BUREAU'S

HIGHER SECONDARY (+2)

ECONOMICS

PART-I

(Written as per the New Syllabus Prescribed by the Council of Higher Secondary Education, Odisha, Bhubaneswar for Higher Secondary (+2) Examination 2016 and onwards)

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FOREWORD

The Council of Higher Secondary Education, Odisha has restructured the syllabus in Economics for its H.S. Examination 2017 and onwards. As usual, the Odisha State Bureau of Textbook Preparation and Production, Bhubaneswar is going to publish Textbook in Economics titled "Bureau's Higher Secondary (+2) Economics" in two parts in conformity with the new syllabus. The book has been written in very simple and lucid language for the students of Odisha. Summary alongwith large number of objective, very short, short and long type questions have been incorporated at the end of each chapter of the book. It has been prepared by a team of experienced and eminent teachers of the State selected by the Council.

At the outset, I acknowledge with thanks the contribution of writers, Dr. Purusotam Nath, Dr. R.N. Patra, Dr. Sujata Pati, Dr. Niranjan Rana and Dr. Kartik C. Dash. I also record my grateful thanks to the authorities of Department of Higher Education and Council of Higher Secondary Education, Odisha for authorising the Bureau to publish this textbook.

It is hoped that this book will fulfil the aspirations and cater to the needs of the students and teachers of the State. Comments and suggestions on any aspect of the book will be welcome by the Bureau.

Sri Umakanta Tripathy
Director
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PREFACE

It is our immense pleasure to bring out this Textbook on Economics for Higher Secondary students (Arts, Science and Commerce) on behalf of the Odisha State Bureau of Textbook Preparation and Production. Part one of this Textbook is meant for Arts and Science students and part two is meant for Arts, Science and Commerce students. This book has been written in accordance with the latest syllabus of the CHSE, Odisha. All possible steps have been taken to make the book enlightening, meaningful, compact, complete and comprehensive. Relevant current statistical information have been incorporated in explaining various economic problems. The implications of various topics have been analysed with illustrations, tables and diagrams as extensively as possible. The subject matter has been presented in a simple, clear and intelligible manner. A brief summary of each topic has been incorporated at the end of each chapter. In view of the changes in question pattern of CHSE Examination, objective, very short, short and long answer type questions relating to each topic have also been given at the end of each chapter.

A textbook like this claims no originality except for redefining or reorienting the mode of presentation of the materials. We unhesitatingly express our gratitude to the authors of standard textbooks and reference books on the subject which have been consulted in writing this book.

We will consider our efforts amply rewarded if the book is read, understood, enjoyed and appreciated and the needs of the students for whom it is intended are met.

In the end, we record our sincere thanks to the officers and staff of the Odisha State Bureau of Textbook Preparation and Production for their constant encouragement, unfailing courtesy, inspiration and wholehearted cooperation in this regard. Suggestions for further improvement of the book will be gratefully welcome by the authors.

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SYLLABUS

Paper - I

Indian Economy and Statistics

A.	**INDIAN ECONOMY**	
I.	Status of Indian Economy	08 Periods 12 Marks
	• Basic characteristics of contemporary Indian economy. • Structural changes in the Indian economy and the present state of relative contributions of primary, secondary and tertiary sectors. • Demographic features, Adverse effects of population growth and Population Policy of India.	
II.	Sectoral Development	10 Periods 15 Marks
	• Agriculture- Importance, low productivity and its causes; Green Revolution, present agricultural situation . • Industry - Importance, Industrial Policies - 1948, 1956, 1991. • Infrastructure -Role, Economic Infrastructure (Energy, Transport and Communications) and Social Infrastructure (Education and Health). • Foreign Trade - Role, Composition, Direction.	
III.	Economic Planning and Economic Reforms	07 Periods 13 Marks
	• Planning -Meaning,Need, Objectives and Achievements, Niti Ayog. • Economic Reforms Since 1991- need and main features of Liberalisation, Privatisation and Globalisation.	
IV.	Current Challenges Facing the Indian Economy	15 Periods 20 Marks
	• Poverty - absolute and relative poverty, causes of poverty, important poverty alleviation programmes currently in place . • Unemployment and underemployment - causes, dimensions and government programmes currently in place. • Inflation - causes and anti-inflationary measures in place. • Sustainable economic development - Meaning of sustainable development, Economic growth and its adverse impact on Environment, Problems of global warming and climate change .	

B.	**STATISTICS FOR ECONOMICS**	
V.	Introductory Statistics	06 Periods 07 Marks
	• Meaning, scope, importance, uses and limitations of statistics in economics. • Sources of statistical data- primary and secondary sources, NSSO and Census of India as sources of secondary data in India. • Methods of collection of primary data - census and sampling methods and their relative merits and demerits.	
VI.	Frequency Distribution	06 Periods 08 Marks
	• Meaning and types of variables and frequency distribution. • Organisation of Data-Basics; Presentation of data - Tabular and diagrammatic presentation, Bar diagram, Pie diagram, Histogram, Frequency Polygon, Ogives, line graphs, Historigrams.	
VII.	Statistical Methods -I	14 Periods 15 Marks
	• Measures of Central Tendency- Simple and Weighted Arithmetic Mean, Median, Mode, Concepts of Geometric Mean and Harmonic Mean • Measures of Dispersion Absolute Measures - Range, Quartile Deviation, Mean Deviation and Standard Deviation. Relative Measures - Coefficients of Range, Quartile Deviation, Mean Deviation and Standard Deviation. • Merits and Demerits of different Measures of Dispersion.	
VIII.	Statistical Methods - II	14 Periods 10 Marks
	• Correlation- Meaning, Correlation and Causation, Types of Correlation, Scatter diagram Method of measuring correlation, uses of correlation in Economics. • Regression - Meaning, Difference between Correlation and Regression, Uses of Regression in Economics. • Index Numbers-Meaning, Importance, Uses; Consumer and Wholesale Price Index Number. • Time Series-Meaning, Uses and Components.	

CONTENTS

CHAPTER - 1

STATUS AND STRUCTURE OF INDIAN ECONOMY

- Status of Indian Economy on the Eve of Independence
- Basic Characteristics of Contemporary Indian Economy
- Structural Changes in the Indian Economy and the Relative Contributions of Primay, Secondary and Tertiary Sectors
- Occupational Structure
- Demographic Features, Population Explosion, Adverse Effects of Population Growth and Population Policy of India.

1.1 STATUS OF THE INDIAN ECONOMY ON THE EVE OF INDEPENDENCE

Introduction

In the recent years India is one of the fastest growing economies in the world. The country has made tremendous progress in several fields in the past seven decades since independence as a result of sincere and sustained efforts of the government. But during the period of about 200 years (1757-1947) of British rule Indian economy was subject to great exploitation. The main purpose of the British rule in India was to use the Indian economy as a source of cheap raw-materials and a market for the goods manufactured by the British industries. Therefore, the British rulers did not pay any attention for development of the Indian economy. Consequently, on the eve of independence, the Indian economy was in a state of underdevelopment, backwardness and stagnation. Besides, it was dependent on the rest of the world. It exhibited all the marks of colonialism and imperialism. There was colossal poverty, mass unemployment, large inequalities, mass illiteracy and widespread malnutrition in the country. In this section an attempt is made to present a brief profile of the status of the Indian economy on the eve of independence.

1. State of Agriculture

On the eve of independence agriculture was the most dominant sector of the Indian economy. About 72 per cent of labour force were engaged in agriculture. Contribution of agriculture to the country's national income was more than 50 per cent. Food crops accounted for about 80 per cent of the total cultivated area. India produced about 32 per cent of the world's output of groundnuts, 41 per cent of jute, 27 per cent of rice and was the second largest producer of cotton. Notwithstanding this predominant position, productivity of Indian agriculture was very low. The economic condition of peasantry was poor.

2. State of Indian Industry

On the eve of independence, industrial development of India was insufficient and lop-sided. Only 11 per cent of total work force were employed in industrial sector. Contribution of industrial sector to the country's national income was only 6.6 per cent. Per capita industrial output was very low. Thus industrial sector was extremely backward.

In the field of industrial development, major emphasis was given on consumer goods industries, while the development of basic capital goods industries such as iron and steel, aluminium, ferro-alloys, and other metal making industries and chemical industries were neglected. The country was completely dependent on the rest of the world for imports of plant and machines, defence equipment as well as spares.

3. State of Infrastructure

On the eve of independence, except for a well laid-down irrigation network in the form of canals, there was nothing in the field of infrastructure that India could be proud of. Communication facilities were outdated. Power generation was negligible. Railway system was so designed that it facilitated the movement of manufactured goods and raw materials from and to port towns and not within the country itself. This encouraged export of raw materials rather than their domestic use and import of industrial products rather than their domestic manufacture. Inadequacy in infrastructure was largely responsible for the slow and lop-sided growth of the Indian industry at the time of independence.

4. Low Per-capita Income

Per capita income refers to the income per head of the population. It is obtained by dividing the country's national income by its population. India's per capita income was estimated at Rs. 238 in the year 1950-51. This means that average monthly income of an individual in India was less than Rs. 20 and the per day average income was almost 65 paise. Low per capita income indicates the underdeveloped state of the Indian economy at the time of independence.

5. Widespread Poverty and Low Standard of Living

Because of low per capita income, the vast majority of the people were living in extreme poverty. Inadequate and unbalanced diet, primitive and insufficient housing, scanty clothing, bare feet, lack of education and poor healthcare facilities were responsible for low standard of living and miserable life style of the people.

6. Stagnation in the Indian Economy

Indian economy was in a state of stagnation at the time of independence because of the slow annual compound rate of growth in average per capita income during the British rule. Whereas annual compound rate of growth in average per capita income was 0.64 per cent during 1860-1890, it came down to 0.16 per cent during 1920-1940 and became negative (- 0.13 per cent) during 1940-1950. Stagnation in the economy was mainly due to slow growth of agricultural output. Total output in agriculture increased by only 10 per cent during the 52 year period (1983-84 to 1945-46). Per capita output of food grains declined by 32 per cent during this period. A stagnant agriculture resulted in poverty and backwardness. Frequent famines, increasing indebtedness of the cultivators, transfer of land from the cultivating peasants to non-cultivating landlords etc. bear testimony to the fact that poverty was growing in India during the British rule.

7. Massive Unemployment

There was widespread unemployment and underemployment in the country at the time of independence due to inadequate industrialisation and poor state of agriculture.

8. Mass Illiteracy

On the eve of independence, only 17 per cent of the population, excluding children below 10 years, were literate. The percentage was, however, still lower for the rural areas and in the case of women. Thus illiteracy was massive in the country at the time of independence.

9. High Birth Rate and High Mortality Rate

The birth rate was high all through the British period. During 1931-41, birth rate was 45.2 and death rate was 31. Therefore, growth rate of population was quite high by the time India achieved independence. Rapid population growth stood as an impediment in the path of economic development.

10. Low level of Urbanisation

On the eve of independence India was overwhelmingly a country of villages. About 85.8 per cent of the country's population were living in villages and only 14.2 per cent were living in urban areas. The level of urbanization in the country was low.

11. Semi-Feudal Economy

At the time of independence, Indian economy was a semi-feudal economy. This was true both of agricultural and non-agricultural sectors. Capitalism had penetrated the agricultural sector. The process was reflected in the emergence and growth of a class of capitalist farmers who carried on cultivation largely by employing hired labour. On the other hand there was a rise and multiplication of a large class of agricultural workers who earned their living mainly by working in the land of capitalist farmers.

By the end of British rule, capitalism had also taken firm root in a sizeable portion of the non-agricultural segment of the economy. Goods were produced by the capitalist producers with a view to earning maximum profit.

12. Lop-sided Occupational Structure

At the time of independence occupational structure in India was lop-sided. About 72 per cent of work force were dependent on agriculture, only 11 per cent on industry, and the rest 17 per cent were engaged in service sector.

13. State of the Social Institutions

At the time of independence, the old social institutions of India such as the self-sufficient village, the caste system and the joint family system were languishing. The

village community as an isolated, autonomous, self-sufficient unit had almost disappeared. The caste system was being increasingly challenged by economic pressure on the one hand, and by the influence of western thoughts and culture on the other. The joint family system, though prevalent in rural areas, was fast disappearing in the towns and cities. In short, the social organisation, on the eve of independence, was in for a change.

14. A Dependent Economy

India continued to be a dependent economy, marked by the following features:

(i) Composition and Direction of India's Foreign Trade

Underdeveloped nature of the Indian economy was also reflected in the composition of its exports and imports. Its exports consisted of low priced agricultural goods such as raw jute, cotton, oil seeds, foodstuffs and other items such as hides and skin, tobacco and gold. Imports composed of high priced cotton manufactures and sugar which India used to export in pre-British period. This shows a clear colonial character of India.

Further, on the eve of independence, England accounted for a large share of India's foreign trade though other countries like Japan, America and Germany began to enter into India's trade.

(ii) Dominance of Foreign Capital

Another manifestation of the colonial character of the economy was that foreign (mostly British) capital had entrenched itself in important segments of the modern sector of the economy, viz.

(a) Economic overheads like railways, ports, merchant shipping and public utilities like electricity generation and waterworks.

(b) Primary production or light manufactures for export mainly tea, coffee and rubber plantations, jute mills and tanneries.

(c) Coal and gold mining.

(d) Banking, finance, insurance and trade.

(e) A few manufacturing industries such as cotton and woolen textiles, tobacco, paper and printing industries, engineering workshops and construction firms, to a limited extent.

It would be seen that the British capital investment concentrated in those industries that performed a complementary role to the industries in England. World War II had somewhat weakened the hold of foreign capital. But at the time of independence the Indian economy had by no means freed itself from exploitation by, and influence of foreign capital.

(iii) Dependence for Capital Goods

On account of its backward economy, the country was almost completely dependent on the rest of the world for plant and machinery and spare parts for their maintenance, many essential items and even modern defence equipment.

15. Problems Due to Partition

Partition of India into Indian Union and Pakistan at the time of independence brought with itself food shortage, raw material shortage and dislocation of Indian industry.

Conclusion

The foregoing analysis reveals that Indian economy was in a state of stagnation, backwardness, and underdevelopment and was dependent on rest of the world on the eve of independence mainly due to anti-growth attitude and colonial policy of the British government, drain of resources from India to England during British rule, non-exploitation of natural resources of the country, rigid social institutions, poor infrastructure facilities etc.

1.2 BASIC CHARACTERISTICS OF CONTEMPORARY INDIAN ECONOMY

Countries of the world can be broadly divided into two categories on the basis of per capita income, viz, developed and underdeveloped countries. Underdeveloped or

less developed countries are those whose per capita income is much lower compared to that of the developed countries like Canada, USA, France and Western Europe. In its present stage of development, the Indian economy exhibits the characteristic of backwardness and progressiveness as well. As a matter of fact, it has become possible to overcome some of the impediments of economic development in course of planning and presently India is marching ahead in the path of development. In this sense, Indian economy is regarded as a developing economy. Nonetheless, there are many fields where achievements are very low for which Indian economy may be called as a less developed economy.

Underdeveloped Nature of the Indian Economy

The following features of the Indian economy indicate the state of its underdevelopment.

(1) **Very low Per Capita Income:** The per capita income is a very important indicator of a country's development. India is regarded underdeveloped since its per capita income is very small. It is estimated at $ 1581.5 in the year 2014-15 which is much lower than that of the developed countries, as well as emerging economies. For example as shown in Table-11, it is $ 54629.5 in USA, $50235.4 in Canada, $ 47871.9 in Germany, $ 11334.4 in Brazil and $ 7590 in China in the same year. Low per capita income gets reflected in low standard of living and acute poverty.

(2) **Low Quality of Life:** Another indicator of economic development of a country is the physical quality of life index which is based upon life expectancy, infant mortality rate and literacy rate. In India, life expectancy is 64 years (2011) which is much lower than that of the developed countries at over 78 years. The infant mortality rate at 52 in 2011 is much higher than that of the developed countries at 6. Illiteracy rate is also very high. It is 25.96 per cent for the population. This implies that literacy rate in India is lower (74.04 per cent) than that of the developed countries. In view of low life expectancy, high infant morality rate and low literacy rate, quality of life of the people in the country is quite low. According

to HDI Report of the World Bank (2014), India's rank in Human Development Index (HDI) is 135 among 187 countries of the World, whereas China's rank is 91, Brazil's rank is 79 and that of South Africa is 118.

Table-1.1 : Percapita Income of Different Countries of the World

Sl.No.	Name of th Country	Percapita Income (in US$)
1	USA	54629.5
2	Canada	50235.4
3	Germany	47871.9
4	UK	46332
5	Japan	36194
6	Brazil	11334.4
7	China	7590
8	India	1581.5

Source : Economic Survey of Government of India (2014-15)

(3) Extreme Inequality in the Distribution of Income: The distribution of income in the economy is highly inequitable. According to a recent study made by the National Council of Applied Economic Research (NCAER), 20 per cent of the households at the lowest rung of the income ladder received only 6.1 per cent of the national income in 2009-10 down from7.3 per cent in 1993-94. At the other end, 20 per cent of the households at the highest rung of the income-ladder received as much as 53.3 per cent of the national income in 2009-10, up from 36.7 per cent in 1993-94. Thus income distribution profile in the country is highly unsatisfactory. Because of such larger inequality, per capita income of people in the bottom group is extremely low and their standard of living is very low.

(4) Heavy Population Pressure: Population of a country is regarded as the means as well as the end of economic development. It is looked upon as the means of

development because labour force comes from population. India has been facing heavy population pressure since1951. India's population is not only very large but also is becoming larger day by day due to high growth rate of population. According to 2011 census, its population stands at the order of 121.02 crore. It constitutes 17.31 per cent of the world population, whereas its land area is only 2.4 per cent of the land area of the whole world. Rate of population growth in the country (about 1.58 per cent during 2001-2011) is much higher than that of the developed countries (around 1 per cent). Such a rapidly growing population in the country has stood as a great impediment in the path of its economic development.

(5) Predominance of Agriculture: Indian economy is primarily an agrarian economy. At present (2015) about 49 per cent of population of the country depend upon agriculture for their livelihood whereas only 2 to 5 per cent of population depend upon agriculture in developed countries like USA, UK, France, Germany etc. Similarly, about 17.4 per cent of GDP is derived from agriculture in India whereas this figure is much lower (around 2 per cent) in developed countries. Such preponderance of agriculture is an indicator of economic backwardness of the Indian economy. Further, it is a matter of great concern that although agriculture constitutes the most dominant sector of the Indian economy, its productivity (both land and labour) is quite low compared to that of the developed countries.

(6) Large Unutilised Resources: India is endowed with large amount of natural resources, such as mineral resources, forest resources, water resources, and marine resources. In respect of some of the minerals, Indian economy occupies a leading position in the world. For example, India's rank is fourth in respect of iron ore, and third in manganese. There are also large deposits of ilmenite, keyamite, bauxite and non-ferrous minerals like copper, lead, zinc etc. in the country. There is a large potential of oil-resources too. Had those resources been exploited and fully tapped the country would have been very rich. But it is a matter of great concern that these resources have not been fully used for production of larger

amount of final goods and services. It is, therefore, said that India is a rich country where poor people live.

(7) **Widespread Unemployment:** India is facing massive unemployment problem. It is caused mainly due to rapid growth of population on the one hand and lack of job opportunities on the other. Job opportunities do not expand in keeping pace with increase is supply of labour force because of slow pace of industrialization and slow growth of tertiary sector. Consequently large number of people are forced to depend upon agriculture. This causes the problem of disguised unemployment. Besides, there are other forms of unemployment such as, seasonal unemployment, underemployment, open unemployment and educated unemployment. Rural unemployment is more colossal than urban unemployment in the country. Main causes of massive educated unemployment problem in the country are lack of man-power planning and inappropriate educational system.

(8) **Massive Poverty:** Massive poverty is the most serious problem which the Indian economy has been facing since long time. According to the estimate made by Planning Commission on the basis of Suresh Tendulkar methodology, 29.8 per cent of population in the country were living below poverty line in 2009-10 which came down to 21.9 per cent in 2011-12. It is much higher compared to many Asian countries like China (10 per cent), Korea (5 per cent) and Malaysia (2 per cent).

(9) **Paucity of Capital :** Adequate stock of capital is the most essential pre-requisite for economic development. Unfortunately, India is underequipped with both physical capital and human capital. Physical capital such as machines, tools, equipment, factory buildings etc. are grossly inadequate in relation to the vast labour-force and huge natural resources in the country. Further, quite a large part of such capital is of low quality consisting of traditional variety. Paucity of capital is the main cause of underutilization of natural resources and labour force leading to slow growth of output in the country.

In respect of human capital such as knowledge, skill and efficiency of the people India's position is still worse. This is mainly because of low level of education and inadequate health care facilities in the country. Here, about 25.96 per cent of the population are illiterate. Quality of higher education is poor. There is dearth of high quality institutes for imparting technical education, medical education, management education, research and training. Although in recent years India has made rapid progress in the field of information technology, its use is limited to a few areas. In comparison to advanced countries like USA, Canada, UK, Australia and Sweden human capital formation in India is too small due to low investment in education, research and health care facilities. Government expediture on education and research constitutes only 3.3 per cent of GDP. The corresponding figure in USA is about 6 per cent of GDP. Some of our best brains are migrating to foreign countries where opportunities are available.

(10) Backward Technology: Economic development of a country greatly depends upon the type of technology used in production of output in different sectors. One important cause of India's underdevelopment is the use of traditional and primitive technology particularly in the unorganized sector, viz agriculture and allied activities, small scale, cottage and village industries. The use of such backward technology has caused low productivity in these sectors and thus acts as an impediment to rapid growth of output and income.

(11) Unfavourable Socio-cultural and Religious framework: In the Indian economy, to a considerable extent, social system is governed by rigid caste system, religious system, traditional attitude and custom. Here many people believe in fate, not in action. Many people spend most of their time in meditation and prayers and have apathy for hard work. Lack of desire for achieving material progress on part of many people is also an important cause of India's backwardness.

(12) Poor Economic Organisations: Economic organisations in India are very weak. Paucity of developed financial institutions in the country is greatly responsible for India's backwardness.

(13) Predominantly Rural: Indian economy is predominantly a rural economy. According to 2011 census, 72.2 per cent of India's population live in some 638,000 villages. The rest 27.8 per cent live in about 5480 towns and urban agglomerations.

Progressive Features

While recognizing the underdeveloped nature of the Indian economy in view of the above characteristics, one should not lose sight of the remarkable achievements which it has made since inception of planning. Now it is claimed that India is shining because of rapid rise in GDP, increase in productive capacity, development of infrastructure, boost in exports, record foreign exchange reserve, improvement in human capital, structural change etc. These indicators of the developing nature of the Indian economy are explained below.

(1) Rising trend in GDP: Gross Domestic product (GDP) which is an important indicator of economic growth is showing a rising trend in the country. However, upto the end of Fifth Five Year Plan, i.e., till 1980 growth of GDP was not encouraging. The average annual growth rate of GDP was 3.7 per cent during the period 1951-1980. But during the Sixth Five Year Plan and Seventh Five Year Plan periods (1980-1990), average annual growth rate of GDP increased to 5.4 per cent. During the post-reform decade (1991-2001) GDP has recorded an increase of 5.8 per cent and thereafter growth rate accelerated. During the period 2003-04 to 2008-09, average GDP growth per annum was 8.6 per cent and it reduced to 7.5 per cent in 2015-16 which was much higher than that of other emerging economies such as Brazil (3.9 per cent), Russia (4.6 per cent) and China (6.9 per cent). However, growth rate of GDP per annum during the entire plan period (1951 to 2016) is around 5 per cent. Since the Indian economy at the time of independence was almost stagnant, such rise in GDP during plan period is considered impressive.

The remarkable rising trend in the GDP has become possible due to growth of output in agriculture, industry and service sectors. In the case of agriculture, annual average growth rate is 2.7 per cent since 1951. It is significantly higher than 0.3 per cent growth before independence. The average annual rise in industrial output is over 6 per cent since 1951. Before independence, it was mere 2 per cent.

(2) Some Success in the Field of Self-reliance: India has achieved self-reliance in a number of fields due to its planned economic development started in 1950-51. By the end of the Fifth five year plan India became self sufficient in food grain production. In 1999- 2000 food grain production in the country reached a record 206 million tons, which increased to 257.07 million tons in 2014-15. In the field of industrialization, there has been substantial increase in capacity to manufacture machinery and equipment for the capital goods sector. The proportion of foreign aid in plan outlay has declined to a great extent. After adoption of the policy of liberalization and globalization in 1991-92, exports have gone up. Presently, India's foreign exchange reserve has touched a record level of US $ 361 billion on May 2016.

(3) Some Modernisation: Trend towards modernisation of the Indian economy is also a significant achievement. This is indicated by a variety of structural and institutional changes that have taken place in the economy. Structural changes that have taken place in the economy include the following:

(i) The share of agriculture and allied activities (Primary sector) in the country's GDP has declined from 57.7 per cent in 1950-51 to 17.4 per cent in 2014-15. On the other hand, the share of secondary sector has gone up from about 14.8 per cent in 1950-51 to 29.7 per cent in 2014-15. The share of the service sector has gone up from about 27.5 per cent to 52.9 per cent during the same period. This is seen from Table 1.4.

(ii) There has been diversification in industrilisation. In industrial production, the relative share of the traditional manufactures like food and textiles had declined and that of the new industries like chemical and engineering has substantially increased.

(iii) There is considerable progress in the use of modern and capital intensive technology in industrial sector.

(iv) In the field of agriculture too there is spread of modernisation under green revolution though limited to a few regions and to a few crops.

Institutional changes that incorporate elements of modernisation include the following:

(i) A lot of support is being provided to the private sector through establishment of financial institutions and infrastructure facilities like roads, railways, generation and supply of power etc. Besides, price-support schemes as well as marketing facilities are provided to boost agricultural production.

(ii) A large number of institutions have been set up to promote general, technical and management education, research and training for skill formation. Establishment of University Grants Commission (UGC), All India Council of Technical Education (AICTE), Indian Council of Agricultural Research (ICAR), Council of Scientific and Industrial Research (CSIR) is an important step in this direction.

(4) Increase in Capital Formation: The progress in respect of capital formation (or investment), a key element of economic development has been commendable. Gross Domestic Saving which was only 10.1 per cent of GDP in 1951 increased to 32.3 per cent in 2010-11 but slightly declined to 30.6 per cent in 2013-14. Gross Domestic Fixed Capital Formation (GDFCF) or investment which was only 8.4 per cent of GDP in 1951 has gone up to around 35.1 per cent in 2010-11 but slightly declined to 32.3 per cent in 2013-14. However, rate of growth of national income is much smaller compared to increase in investment in view of the high capital output ratio.

There has been substantial rise in physical capital formation in the country. This includes factory buildings, machines, irrigation projects, power plants for electricity generation, transport facilities such as highways, other roads, railway tracks, air ports and the manufacturing capacity of different factories etc. There has also been some rise in human capital formation as a result of growing expenditure on education, research, training, health care facilities etc.

(5) Rising Trend in Per capita Income: It has been stated earlier that per capita income in India is low and is showing a rising trend. For example, in 2006-07, nominal per capita GDP in the country was only $ 807, but it increased to $ 950 in 2007-08 and further to $ 1527 in 2010-11 and $ 1581.5 in 2014-15. Similarly per capita income at factor cost has gone up from $ 648 in 2006-07 to $ 1142 in 2010-11 and 1581.5 in 2013-14 showing compound annual growth rate (CAGR) of 15.3 per cent during the period (Economic Survey 2011-12 and 2015-16, Government of India).

(6) Significant Improvement in Quality of Consumption: Rise in per capita income has brought about significant improvement in quality of consumption of the people in the country. For example, it has pushed demand away from cereals to milk products and vegetables. In other words, demand for cereals has come down and that of high value food items (such as milk and vegetables) has gone up. This is evident from Table 1.2.

Table 1.2 : Percentage Share of Expenditure on Cereals and other Food Items in Total Food Expenditure in India

	1987-88	**2009-10**
RURAL		
1. Cereals	41.1	29.1
2. Milk and Products	13.4	16
3. Vegetables	8.1	11.6
URBAN		
1. Cereals	26.6	22.4
2. Milk and Products	16.8	19.2
3. Vegetables	9.4	10.6

Source: Economic Survey (2011-12), Government of India.

Further, percentage share of food expenditure of the people in the total consumption expenditure is coming down, and that of furniture and appliances, and health, education, recreation and cultural services is going up as evident from Table 1.3.

Table 1.3 : Percentage Share of Expenditure on Food and Non-food Items in Total Consumption Expenditure in India

Item	1999-2000	2009-10
1. Food	40.1	26.9
2. Furniture and Appliances	3.1	4.4
3. Health, education, recreation and cultural services	6.2	7.8

Source: Economic Survey (2011-12), Government of India.

All these achievements reveal that the Indian economy, despite being underdeveloped in several respects is doing very well and heading in the path of rapid economic development. The present government expects India to be a fully developed nation by 2020.

1.3 STRUCTURAL CHANGES IN THE INDIAN ECONOMY

1.3.1 Introduction

India was under British rule for a period of nearly two hundred years (1757 to 1947). Indian economy which had the potential to become a developed economy before 1757 suffered a great set back during this period. Agrarian policies adopted by the British government made Indian agriculture stagnant and brought unparallel misery to peasants and farm labourers in the country. Indian industries also suffered a lot. Under the impact of Industrial revolution, Indian cottage and handicraft industries could not withstand competition with British manufacturing industries and thus were about to meet their decay. British government developed roads, railways and ports for the export of raw materials from India to England and for the import of British manufactured goods to India. This helped in expanding markets for English products in India and ruining the Indian economy. Thus the policies formulated by the British government for protecting the interest of the Britishers made the Indian economy backward and poor.

After independence, the government of India adopted planning as the chief means of lifting the economy out of stagnation and initiating and accelerating the pace of economic development of the country. By now, eleven five year plans and five annual plans have been completed. The Twelveth Five Year Plan is in progress. Although during the first three decades of planning (1951-1980) the rate of growth of GDP was very low (3.7 per cent per annum), since 1981 there has been considerable progress in the Indian economy. However, annual growth rate of GDP during the entire plan period (1951 to 2015) is around 5 per cent and annual growth rate of GDP per capita is around 3 per cent. This is not a small achievement. A somewhat remarkable achievement of the Indian economy during the planning era is the change in structure (or composition) of its total output. This clearly indicates that Indian economy is in the process of transformation from a traditional agrarian economy into an advanced industrial economy. Therefore, it is pertinent to know the meaning of structural change and to show the extent of such change that has taken place in the Indian economy since inception of planning in 1951.

1.3.1 Meaning of Structural Change

Economic growth of a country is usually measured in terms of rise in national income. But sometimes economic growth is measured by GDP because it is easier to compute GDP than national income. GDP is the money value of all final goods and services produced inside the country during a given year by all the sectors. Sectoral contribution to GDP (i.e., share of different producing sectors of an economy in GDP) gives a clear picture of the composition or structure of production in the economy. Change in the structure of production in the economy over time in the process of development is called structural change. To study the structural change in the Indian economy, it is necessary to analyse the contribution of different sectors to the Gross Domestic Product. Change in the contribution of different sectors of the Indian economy to its GDP over time shows the extent of structural change.

1.3.2 Division of The Economy

From the point of view of economic activities, the economy of any country can be divided into three sectors, i.e.,

- Primary Sector
- Secondary Sector
- Tertiary Sector

1. **Primary Sector:** Primary sector refers to that sector of the economy which exploits natural resources to produce goods. Agriculture and allied activities like animal husbandry, fishery, forestry, diary, poultry etc. are included in this sector.

2. **Secondary Sector:** The manufacturing sector which transforms one physical good to another is called the secondary sector. Secondary sector includes mining, manufacturing, electricity, gas, water supply and construction. Secondary sector is also called industrial sector.

3. **Tertiary Sector:** Tertiary sector is also called service sector. Services of various kinds like trade, transport, communication, banking, insurance, education, health services etc. are included in the tertiary sector.

The primary and secondary sectors are concerned with the production of goods while the tertiary sector is concerned with the production of services.

While estimating national income, the Central Statistical Organisation (CSO) divides the Indian economy into six sectors. These are: (1) Primary Sector, (2) Secondary Sector, (3) Trade, Transport and Communication, (4) Banking, insurance and real estates, (5) Community and personal services and (6) Foreign trade. To calculate GDP, the rest-of-the world sector (external sector) is excluded. For simplicity, trade, transport, communication, banking, insurance, real estates, community and personal services are put under tertiary sector or service sector.

1.3.3 Relative Contributions of Different Sectors to GDP

To study the structural change in the Indian economy, it is worthwhile to examine the change in the contribution of Primary, Secondary and Tertiary sectors to the Gross Domestic Product over time. Table-1.4 presents data relating to sectoral contribution to the GDP at 1993-94 prices from 1950-51 to 2001-02, and at 2011-12 prices for the year 2014-15..

Table 1.4 : Share of GDP by Industry of origin (at 1993-94 and 2011-12 prices) (in per cent)

Sl. No.	Producing Sector	1950-51	1980-81	2001-02	2014-15*
I	Primary sector	57.7	39.8	24	17.4
	1. Agriculture	50.2	35.7	21.9	NA
	2. Forestry	6.7	3	1.1	NA
	3. Fishery	0.8	1	1	NA
II	Secondary sector	14.8	23.7	26.5	29.7
	1. Mining and Quarrying	2.1	2.1	2.2	2.88
	2. Manufacturing	8.9	13.8	16.8	18.08
	3. Electricity, Gas and Water supply	0.3	1.7	2.5	2.32
	4. Construction	4.1	6.1	5.0	8.09
III	Tertiary Sector / Service Sector	27.5	36.6	49.5	52.9
	1. Transport, Communication and trade	11.4	18.4	23.6	19.38
	2. Finance and Real Estate	6.7	6.5	12.5	20.51
	3. Community and personal service	9.4	11.7	13.5	12.63
A	Commodity Sector (I & II)	72.5	63.4	50.5	47.1
B	Service Sector (III)	27.5	36.6	49.5	52.9
	Total	**100**	**100**	**100**	**100**

Source: 1. Central Statistical Organization, National Accounts Statistics (2003)

2. Economic Survey (2015-16), Government of India

*At 2011-12 price level

N.A.- Not Available

Table-1.4 reveals that there has been significant structural transformation in Indian economy during the planning era. Such structural changes are explained below.

1. **Decline in the Share of Primary Sector:** It is found that the share of the primary sector in GDP has been steadily declining since 1950-51. Its share in GDP was 57.7 per cent in 1950-51 which declined to 39.8 per cent in 1980-81 and further to 24.0 per cent in 2001-02. In 2014-15, share of the primary sector (agriculture) has been reduced to 17.4 per cent. As agriculture constitutes the most important component of the primary sector it would be of interest to examine the trend of its contribution to GDP. The contribution of agriculture to GDP stood at the order of 50.2 per cent in 1950-51; it came down to 35.7 per cent in 1980-81 and again declined to 21.9 per cent in 2001-02 and to about 15 per cent in 2014-15. Such declining trend in the percentage contribution of agriculture to the GDP in India is consistent with the declining tendency of the share of agricultural sector in national product in advanced countries as development proceeds. This shows that the Indian economy is marching ahead in the path of development.

   Though the contribution of agriculture to GDP in India is declining, it is still high in comparison to developed countries. In advanced countries like USA, UK, Germany and Canada the share of agricultural sector in national income is only 2 to 3 per cent.

2. **Rise in the Share of Secondary Sector:** The share of the secondary sector in GDP has been steadily increasing since 1950-51. Its share in GDP was 14.8 per cent in 1950-51 which increased to 23.7 per cent 1980-81 and again to 26.5 per cent in 2001-02 and to 29.7 per cent in 2014-15. Two major components of the secondary sector are manufacturing industries and construction. The share of manufacturing in GDP increased from 8.9 per cent in 1950-51 to 16.8 per cent in 2001-02 and 18.08 per cent in 2014-15. But, the share of construction modestly increased from 4.1 per cent in 1950-51 to 5.0 per cent in 2001-02 and 8.09 per cent in 2014-15. Such rising trend of the contribution of secondary sector to the

GDP in India is consistent with the rising trend of the share of the secondary sector in national product in advanced countries. This indicates the structural change in the Indian Economy in the process of development.

Though the contribution of secondary sector to GDP in India is increasing, it is very low in comparison to developed countries. According to World Development Report (1995), the contribution of industrial sector to national income was 33 per cent each in U.K. and U.S.A. and 41 per cent in Japan.

3. **Rise in the Share of Tertiary Sector / Service Sector :** The share of the tertiary sector (service sector) in GDP has also been steadily increasing since 1950-51. Its share in GDP was only 27.5 per cent in 1950-51 which increased to 36.6 per cent in 1980-81 and further to 49.5 per cent in 2001-02, and to 52.9 per cent in 2014-15. Transport, communication and trade which constitute the most important segment of the service sector increased from 11.4 per cent in 1950-51 to 23.6 per cent in 2001-02 and 19.38 per cent in 2014-15. It signifies the development of infrastructure in Indian economy. The service sector has now become the most important sector in the Indian economy. In fact, at present, the share of service sector in GDP (52.9 per cent) is more than that of the two commodity producing sectors (agriculture and industry) put together (47.1 per cent).

Though the contribution of the service sector to GDP in India is rising rapidly, such contribution is low in comparison to developed countries (in U.K. and U.S.A. 65 per cent each).

Sectorwise Rates of Growth of GDP

The structural change in the composition of national income by industrial origin is the consequence of the process of economic growth initiated during the plan period. Since the growth process involved a rapid expansion of manufacturing in the organized sector, the share of manufacturing was bound to indicate a relatively sharp increase. Share of agriculture registered a decline because of falling trend in its rate of growth.

Table-1.5 presents data relating to compound annual growth rate of India's GDP at factor cost by industry of origin from 1950-51 to 2001-02 and also for the year 2012-13, 2013-14 and 2014-15 (at 2011-12 price level). An analysis of this table gives a clear picture about the sectorwise rates of growth in the Indian economy.

Table 1.5 : Compound Annual Rate of Growth of GDP by industrial origin at Factor Cost (per cent per annum at 1993-94 prices upto 2011-12 and at 2011-12 price in 2012-13, 2013-14 and 2014-15)

Sl. No.	Sector	1950-51 to 1960-61	1960-61 to 1970-71	1970-71 to 1980-81	1980-81 to 1990-91	1950-51 to 1990-91	1990-91 to 2000-01	2012-13*	2013-14*	** 2014-15
I	Agriculture and Allied Activities (Primary Sector)	3	2.3	1.5	3.4	2.6	2.7	1.2	3.7	1.1
II	Mining and Manufacturing etc. (Secondary Sector)	6.2	5.4	4	6.7	5.6	6.8	2.3	4.5	5.9
III	Service Sector	4.3	4.8	4.4	6.7	5.1	7.5	8.0	9.1	10.6
	GDP at Factor Cost	3.9	3.7	3.1	5.6	4.1	5.6	5.1	6.9	7.4

Source: 1. C.S.O., National Accounts Statistics (1950-51 to 2001-02)
2. Economic Survey (2014-15), Government of India.

Growth Rate of Primary Sector

It is found that agriculture and allied activities register a slow rate of growth. Annual growth rate of primary sector showed a declining trend from 1950-51 till 1980-81 and then picked up to 3.4 per cent per annum during 1980-81 to 1990-91. However, the average annual growth rate of agriculture and allied activities in the first four decades of planning (1950-51 to 1990-91) was 2.6 per cent. In the first decade of post reform period (1991 to 2001), growth rate of agricultural sector remained more or less the same, i.e., 2.7 per cent. In the year 2012-13, growth of agriculture sector was 1.2 per cent, but increased to 2.7 per cent in 2013-14 but declined to 1.1 per cent at 2014-15. This shows that growth rate of agriculture is slowing down in the post reform period. A low growth rate of agriculture and allied activities has pulled down the contribution of

this sector to GDP. A high growth rate of primary sector is very much needed to raise the growth rate of the economy. There is also large scope in raising output from activities allied to agriculture. What is needed is a multipronged strategy for boosting production and productivity of agriculture. Several measures - institutional (land reforms) and technological (green revolution or the new agricultural strategy) have been introduced after independence for increasing productivity and production in agriculture. The green revolution initiated during the late 1960s has immensely benefited the farmers and the economy at large as it generated wealth and brought about self-reliance in food production. However, that success story has run its course. In the interest of food and nutritional security, we have to move to the second green revolution, popularly called as gene revolution.

Growth Rate of Secondary Sector

It is also found that annual growth rate of the secondary sector showed a declining trend from 1950-51 to 1980-81 and then picked upto 6.7 per cent per annum during 1980-81 to 1990-91. However, the average annual growth rate of the secondary sector was 5.6 per cent in the first four decades of planning (1950-51 to 1990-91) which was more than double the annual growth rate of primary sector (2.6 per cent) during the same period. In the first decade of post - reform period (1991-2001), the annual growth rate of the secondary sector was somewhat encouraging (6.8 per cent). Although, in the financial year 2012-13, growth of secondary sector declined to 2.3 per cent, it increased to 4.5 per cent in 2013-14 and further to 5.9 per cent in 2014-15 at 2011-12 prices. However, the present growth rate of industrial production in India is much less in comparison to that of the developed countries. The slow rate of growth of output in industrial sector is responsible for its inability to increase its share in the gross domestic product significantly. It is due to the following reasons:

(i) First, infrastructure facilities are inadequate.

(ii) Second, the strategy of development remained focused on the heavy and capital intensive industries for many years. These industries have a high capital output ratio and involve long gestation period. Therefore, the output flows have been slow.

(iii) Besides, restrictive environment for investment, unsuitable macroeconomic policy and inability of the government to push reforms are responsible for slow growth of output in industrial sector.

Growth Rate of Service Sector

The growth rate of the service sector has been showing consistently a rising trend since 1950-51. The average annual growth rate of this sector which was around 5.1 per cent during the first four decades of planning (1950-51 to 1990-91), has shown a sharp increase to 7.5 per cent in the first decade of post - reform period (1990-91 to 2000-01). In the year 2012-13 growth rate of service sector was 8 per cent, which increased to 9.1 per cent in 2013-14 and again to 10.6 per cent in 2014-15 at 2011-12 prices. The growth rate in the service sector has been quite significant to raise its share in the gross domestic product. It has taken place in a relatively short period of time compared to the developed countries of the world.

1.3.4 An Assessment of Structural Change

The foregoing discussion on the dynamics of sectoral contribution to GDP in the Indian economy gives a fair idea as to the extent of change in the structure of production in the process of development. The gist is that in India the contribution of agriculture has declined and that of industry and service sectors has increased though the extent of increase in the contribution of service sector is greater. Such tendency is consistent with the change in the composition of national product taking place in developed countries. However, in developed countries the contribution of agriculture to national product is much smaller and that of industry and service sector is much higher than in case of the Indian economy. Thus, in India structural change is taking place, but at a slow pace. Such structural change brings forth the following inferences:

(i) The growth of the economy is no longer primarily dependent on agriculture. Therefore, economic growth will not be subject to the ups and downs so much as before. On the contrary, the growth of the economy will be more stable since it is now being led by two dynamic sectors viz industry and service.

(ii) The economy has undergone a pro - growth structural transformation. It is in the process of transformation from a traditional agrarian economy into an advanced

industrial economy. It is expected that in future the economy will be a developed economy.

(iii) The structural changes in Indian economy also indicate that the growth has been a broad - based one.

Above discussion makes it clear that economic development leads to structural change. As economic development proceeds, percentage contribution of agriculture sector to GDP declines and that of industrial and service sectors increases. Along with structural change there is also change in occupational structure. Thus structural change and change in occupational structure are the effects of economic development and are interrelated.

Here, an attempt is made to explain the meaning of occupational structure and how there is change in occupational structure (or occupational pattern) in India over the years along with economic development and changes in structure of production.

1.3.5 Occupational Structure

Occupational structure of a country refers to the distribution of its workforce among different sectors or occupations. An economy is usually divided into three sectors or occupations - primary, secondary and tertiary. In this sense the occupational structure of a country shows how many of the total working population are engaged in primary sector and how many of them are engaged in secondary and tertiary sectors.

Occupational Structure (or Occupational Pattern) in India

Labour is the primary factor of production. It is considered to be important not only because it is productive but also because it activates other factors of production and makes them useful for productive purposes.

Therefore, the size of labour force in a country is of crucial importance for the level of economic activity. In India, labour force is defined as those able-bodied workers in the age group of 15 to 59 years. The proportion of working population to total population is called work participation rate. In underdeveloped countries like India work participation rate is very low. In India, work participation rate was only 36.7 per cent in 1981, which increased to 37.7 per cent in 1991 and further to about 40 per cent in 2011. That means, of the total population of 121 crore, around 48 crore people constitute the

work force. Occupational pattern in India indicates distribution of its work force among three occupations or sectors. In other words it shows how many of total workers in the country are engaged in agriculture, how many are engaged in industry and in services.

Occupational structure in India and changes therein during plan period are presented in Table-1.6.

Table 1.6 : Distribution of Work force among different Occupations (in per cent)

SECTOR	1951	1961	1971	1981	1991	1999	2011-12	2013-14
I. Primary Sector (Agriculture and Allied Activities)	72.1	71.8	72.2	68.8	66.8	64	58	49
II. Secondary Sector (Mining, manufacturing, gas, electricity, water supply and construction)	10.7	12.2	11.2	13.5	12.7	15	18	20
III. Service sector (Trade, transport, communication, banking, insurance etc.)	17.2	16.0	16.7	17.7	20.5	21	24	31
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.00**

Source: 1. Complied from CMIE, Basic Statistics relating to the Indian Economy, Vol. I, All India, August, 1993.

2. Economic Survey (2014-15), Government of India.

An analysis of the data given in Table 1.6 brings forth the following features of occupational structure in India.

(i) Lopsided: India's occupational structure is lopsided. According to Economic Survey, Government of India (2014-15), here too many workers (49 per cent) depend on primary sector, but too few workers depend on secondary sector (20 per cent) and tertiary sector (31 per cent). It is obvious that Indian economy is predominantly agrarian. This is mainly because India is facing heavy population

pressure and work is not available so much outside agriculture. Although a large proportion of the country's work force depends on agriculture, its productivity is low. This is clear from the fact that contribution of agriculture to the country's GDP is meagre (17.4 per cent at 2011-12 price level). Predominance of agriculture in the Indian economy reflects India's backwardness.

(ii) **More or less Static up to 1991:** From the beginning of the 20th century till 1991 there has been a slight decline in the proportion of work force in agriculture and allied activities. 72.1 per cent of labour force were engaged in primary sector in 1951. This has come down to 66.8 per cent in 1991. Such decline is very small. Similarly, there is small rise in proportion of labour force engaged in secondary sector and tertiary sector. Whereas in 1951, 10.7 per cent of work force were engaged in secondary sector and 17.2 per cent in tertiary sector, in 1991 these figures have slightly gone upto 12.7 per cent and 20.5 per cent respectively. Thus the change in occupational structure in India from the beginning of the 20th century upto 1991 was not significant. In other words, occupational structure in India was more or less static upto 1991.

(iii) **Some Shift in Occupational Pattern after 1991:** After 1991, there has been somewhat greater fall in the share of primary sector in total employment. Whereas share of primary sector in total employment was 66.8 per cent in 1991 it came down to 58 per cent in 2011-12 and again to 49 per cent in 2013-14. Similarly, the share of secondary sector has gone up from 12.7 per cent to 20 per cent and that of the tertiary sector has gone up from 12.7 per cent to 31 per cent during the same period. Though there has been some shift in the workforce from the primary to the secondary and teritary sectors in the Indian Economy after 1991, it is much less compared to developed countries. Even today in India about 49 per cent of the workfore depend on primary sector whereas in developed countries like UK, USA and Japan this proportion varies from 2 per cent to 7 per cent.

The following factors are mainly responsible for the heavy dependence of labour force on primary sector in the Indian economy.

(1) **Slow Growth of Industrial Sector:** In India, the average annual industrial growth has been around 6 per cent since the inception of planning till now. This is much less compared to that of the developed countries. Such slow growth of industrial sector is responsible for a very small change in occupational pattern in India.

(2) **No Adequate Attention to Small Scale and Cottage Industries:** Small scale and cottage industries are labour using or capital saving. These industries are suitable to Indian condition. But adequate attention was not accorded to small scale and cottage industries in Indian planning until the formulation of the Industrial policy of 1977. Although this industrial policy made sufficient provision for expansion of these industries, in 1980 the situation was reversed and heavy industries dominated the scene. As a result, shift in labour force from the agricultural sector to industrial sector has not become possible in large scale as in the case of developed countries.

1.4 THE POPULATION PROBLEM

Introduction

Population of a country is regarded as both the means and end of economic development. Population is the main source of labour force which plays a critical role in accelerating the pace of the country's economic development. Human beings are also the beneficiaries of development. The ultimate goal of development is to maximize welfare of the population. Thus, while planning for overall development and for providing services to the people, the study of demographic features of the economy, i.e., the size, growth, composition and quality of population is of immense importance.

Here an attempt is made to present an overview of the population in India so that one can have a reasonable idea about its size, composition and growth as well as the causes and impact of such growth. Measures to control population growth are discussed at the end.

1.4.1 Demographic Features of the Indian Economy

Demographic features include the size and trend of growth of population, its density, age structure, distribution of population between rural and urban areas, sex composition, level of literacy, life expectancy and infant mortality etc. These aspects of Indian population are discussed below.

1. Large Size of Population:

India is the second most populous country in the world while China is on the top. According to 2011 census, India's population stands at the order of 121.02 crore (1.21

billion), whereas Chain's population stands at 135 crore (1.35 billion). India with 2.4 per cent of world's land area accounts for almost 17.31 per cent of the world's population which means that every sixth person on the planet is an Indian.

2. High Growth Rate of Population

Size of India's population is not only large, but also it is becoming larger day by day due to its high growth rate. With the present population growth rate of 1.58 percent per annum India is predicted to have more than 153 crore (1.53 billion) people by the end of 2030 and to take the number one position in the world. Table 1.7 presents data relating to population of India since the beginning of the 20th century till 2011. It shows that population growth in India is showing a rising trend. But the rate of growth of population is declining since 1971.

Table 1.7 : India's Population Growth (1901-2011)

Census year	Population (Cr)	Decennial Increase or Decrease (Cr)	Annual Average Growth Rate (%)
(1)	(2)	(3)	(4)
1901	23.84	-	-
1911	25.21	1.37	0.57
1921	25.13	-0.08	-0.03
1931	27.90	2.77	1.10
1941	31.87	3.97	1.42
1951	36.11	4.24	1.33
1961	43.92	7.81	3.16
1971	54.82	10.90	2.48
1981	68.33	13.51	2.46
1991	84.63	16.30	2.38
2001	102.70	18.07	2.13
2011	121.02	18.32	1.58

Source: Census of India (1901 to 2011).

From Table 1.7 it is observed that there are four distinct phases of population growth in India from 1901 to 2011.

(i)	Phase I:	1901 - 1921	Very slow and erratic growth
(ii)	Phase II :	1921 - 1951	Steady growth
(iii)	Phase II :	1951 - 1971	Rapid and high growth
(iv)	Phase II :	1971 - 2011	High growth with definite sign of slowing down.

From the country's population point of view, the year 1921 is known as the year of the 'Great Divide', since from 1921 the rate of growth of population picked up. Since 1951 India experienced the problem of 'population explosion'.

3. High Density of Population

Density of population refers to the number of persons living per square km. of the land area. It is calculated by dividing the total population of the country by its total land area. Density of population indicates the man land ratio in a country and the magnitude of burden that a unit of land has to carry. The density of population in India was 117 in 1951 which increased to 382 in 2011.

Table-1.8 reflects data relating to density of population in India since 1951.

Table 1.8 : Density of Population in India Since 1951

Census Year	Density of Population
1951	117
1961	142
1971	177
1981	216
1991	274
2001	324
2011	382

Source: Census of India (1951-2011)

The overall increase in the density of population is a matter of great concern as it puts immense pressure on the country's natural resources.

4. Age Composition of Population

Age composition refers to the division of total population of a country into different age groups, such as 0 to 14 years, 15 to 59 years and 60 years and above. While the first group and the third group, i.e., the children and old persons constitute the non-working population, people belonging to the second group are the working population (or the work force) of a country. Thus age composition shows the division of population into working population and non-working population. Table 1.9 shows the age-composition of India's population.

Table 1.9 : Age Composition of India's Population (in per cent)

Year	Age Group (in years)		
	0 - 14	15 - 59	60 and Above
1921	39.2	59.6	1.2
1951	37.4	56.9	5.7
1971	42.0	52.0	6.0
1991	36.5	57.1	6.4
2001	32.3	59.4	8.3
2011	29.5	62.5	8.0 (65 above)

Source: Census of India (1921 to 2011)

From Table 1.9, it is observed that the percentage of working population (Age group: 15-59 years) has become almost stagnant over the years. While it was 59.6 in 1921 and 56.9 in 1951, in 2001 it was 59.4 and 62.5 in 2011. According to 2011 census, more than 50 per cent of India's population is below the age 25 years and over 65 per cent below the age 35 years. Thus only 35 per cent of population of India have age more than 35 years. This shows that most of the people of India are young. This is why India is said to possess a demographic dividend.

5. Heavy Concentration of Population in Rural Areas

It is said that India lives in villages in the sense that more than 70 per cent of total population in the country inhabit the countryside. From Table 1.10 it is observed that, 82.7 per cent of population in India were living in rural areas (villages) in 1951 which has gradually declined to 72.6 per cent in 2001 due to growth of urban areas like cities and towns. According to 2011 census, 72.2 per cent of Indian population live in 638691 villages and the rest 27.8 per cent in about 5480 towns and urban agglomerations.

Eventhough proportion of people living in rural areas is declining, now significant proportion of Indians live in and derive livelihood from villages.

Table 1.10 Distribution of Population in Rural and Urban Areas

Year	Percentage of Rural Population	Percentage of Urban Population
1951	82.7	17.3
1961	81.9	18.1
1971	80.7	19.3
1981	76.7	23.3
1991	74.0	26.0
2001	72.6	27.4
2011	72.2	27.8

Source: Census of India (1951 to 2011)

6. Sex Composition

The most significant aspect of demographic dynamics is the sex ratio. It is an important social indicator and shows the number of females per 1000 males. In India sex ratio was gradually declining up to 1991 (Table 1.11). Whereas sex ratio was 972 in 1901, it declined to 946 in 1951 and further to 927 in 1991. However, the sex ratio

in India is showing an improvement since 1991. The sex ratio was 927 in 1991, it increased to 933 in 2001 and further to 940 in 2011. Though it has been improving since 2001, it continues to be the lowest in the world. Among the Indian states, Kerala has the highest sex ratio (1084) and Jammu and Kashmir has the lowest sex-ratio (883). Low sex-ratio highlights the low status of woman in the society.

Table 1.11 : Sex Composition in India

Year	Female per 1000 male (Sex ratio)
1901	972
1951	946
1971	930
1991	927
2001	933
2011	940

Source: Census of India (1901 to 2011)

7. Occupational Structure:

Occupational structure shows the distribution of working population of the country in different occupations (or sectors). Generally there are three sectors in an economy such as primary, secondary and tertiary sector, in which the working population are engaged. The primary sector is composed of agriculture, livestock, forestry, fisheries etc. Mining, manufacturing and construction constitute the secondary sector of economy. The tertiary sector includes trade and commerce, transport, communication, banking, insurance and other services. While in a developing country primary sector accommodates maximum number of labour force, in a developed economy workers concentrate in secondary and tertiary sectors. In India, due to heavy concentration of population in the rural areas, more than 50 per cent of the total working population are engaged in the primary sector. Though the secondary and tertiary sectors are gradually expanding, they are not able to transfer a sizeable section of the

labour force from the primary sector. Table 1.12 shows the occupational structure of India since 1951.

Table 1.12 : Occupational Distribution of Working Population in India (per cent)

Sectors	**1951**	**1961**	**1971**	**1981**	**1991**	**1999-2000**	**2011-12**	**2013-14**
Primary Sector	72.1	71.8	72.1	68.7	66.8	64	58	49
Secondary Sector	10.6	11.7	11.2	13.5	12.7	15	18	20
Tertiary Sector	17.3	16.5	16.7	17.8	20.5	21	24	31
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Source: 1. CMIE, Basic Statistics Relating to Indian Economy

2. Economic Survey (2014-15), Government of India

Table 1.12 shows that in 1951, 72.1 per cent of working population were engaged in the primary sector, which has declined to 49 per cent in 2013-14. On the other hand, employment in secondary sector and tertiary sector has gradually increased from 10.6 per cent to 20 per cent and from 17.3 per cent to 31 per cent respectively during the same period. The heavy concentration of work force in the primary sector shows the unbalanced occupational structure in the Indian economy.

8. Low Quality of Population

The quality of population can be judged on the basis of life expectancy, the level of literacy and the level of technical training attained by the people of a country. On the basis of these parameters, quality of population in India is low.

(a) Low Life Expectancy

Life expectancy of the people of a country refers to the average number of years for which people are expected to live at the time of birth. It depends mainly on the death rate and age at the time of death. If the death rate is high and / or death occurs at an early age, life expectancy becomes low. On the other hand, if the death rate is low and/ or death occurs at a later stage, the life expectancy or longevity becomes high. Life

expectancy of a country shows the quality of life, productivity in the economy and the size of family. The expectancy of life in India was low for a quite long period of time. However, due to a sharp decline in death rate and an increase in the age at the time of death, it has increased significantly. Table 1.13 shows the life expectancy in India and indicates that life expectancy has increased form 33 years in 1951 to 68.4 years in 2011. However it is much lower compared to that of the developed countries. In Japan, life expectancy is 82.7 years, in Norway it is 78 years, in South Korea it is 79.9 years, and in China it is 73.1 years.

Table 1.13 Life Expectancy in India (in years)

Year	Life Expectancy
1951	33.0
1961	41.0
1971	52.0
1981	54.0
1991	59.0
2001	63.9
2011	68.4

Source: Economic Survey (2013-14), Government of India.

(b) Low Level of Literacy

There is a positive relationship between the level of literacy and the level of economic development. Developed countries with higher level of literacy have tended to grow at a faster rate. In India, the level of literacy was very low and stood at only 16.7 per cent in 1951. However, with the passage of time, level of literacy has significantly increased to 74.04 per cent in 2011 as found from Table 1.14. Though literacy rate is showing an improvement, it is much lower compared to that of the developed countries.

Table 1.14 : Literacy Rate in India (in per cent)

Year	Male	Female	Persons
1951	25.0	7.9	16.7
1961	35.4	13.0	24.0
1971	39.5	18.7	29.5
1981	46.9	24.8	36.2
1991	64.1	39.3	52.2
2001	75.85	54.16	65.38
2011	82.14	65.46	74.04

Source: Census of India (1951-2011)

Table 1.14 shows that level of literacy is comparatively lower for the female than for the male. For example, literacy rate was only 7.9 per cent for female in 1951, whereas 25.0 per cent for male. At present (2011),the literacy rate stands at 65.46 per cent for female whereas it is 82.14 per cent for male. The literacy rate varies considerably across the States. Kerala continues to remain at the top in respect of literacy rate. On the other hand, Bihar has recorded the lowest literacy rate.

(c) High Infant Mortality Rate (IMR)

The infant mortality rate is expressed as a ratio of the number of deaths among one thousand children, before they complete one year of age. High infant mortality reduces the average expectancy of life and is treated as an indicator of underdevelopment. In India, the infant mortality rate has been quite high. The infant mortality rate was as high as 218 in 1921. However, it started declining thereafter with the development in the field of medical sciences and practices. The infant morality rate stood at 129 in 1971, further declined to 110 in 1981, 66 in 2001, 52 in 2008 and to 41.8 in 2015. Though the infant morality rate is declining in India, it is still much higher in comparison to the developed countries of the world. Infant morality rate is less than 10 in countries like Japan (3), South Korea (8), Australia (4) etc. In Sri Lanka, it is 13 and in China it is 18.

1.4.2 Population Exploision

Demographers are of the opinion that if the population of a country increases at a rate of one per cent per annum, it will take hundred years to double itself. But if the rise is two per cent or more per annum, it will take less than fifty years to double itself. In India, the population which started growing consistently since 1921, showed a sudden and large upward spurt after 1951. The annual growth rate which was below one per cent before 1921 and just above one per cent till 1951, more than doubled itself to over two per cent thereafter. This historically unprecedented massive increase in population is truly described as population explosion. Due to such high rate of growth, the population which was 36.11 crore is 1951, became more than three times (121.02 crore) in 2011.

1.4.2.1 Causes of Population Explosion (or Causes of Rapid Population Growth)

The growth of population in a country basically depends on its birth rate and death rate. Birth rate refers to the number of live births per 1000 population of a country in a year. Death rate refers to number of deaths per 1000 population of a country in a year. It is the excess of birth rate over death rate that leads to population growth. In India, the rapid growth of population has been the outcome of a sharp decline in death rate but a slow decline in the birth rate as is found from Table 1.15.

Here it is observed that in India, while the birth rate declined from 46.4 in 1921 to 22.22 in 2009 and 20.22 in 2013, death rate declined from 36.6 to 7.4 during the same period. Thus the explosive rise in India's population is due to a sharp decline in death rate in comparison to fall in birth rate. During the last decade (2001 to 2011) the rate of growth of population in India has been 1.58 per cent per annum, and during the last 12 years (2001 to 2013), the rate of growth of population has been 1.28 per cent per annum.

Table 1.15 : Average Birth Rate and Death Rate in India

Period	Annual Birth Rate (per 1000 population)	Annual Death Rate (per 1000 population)	Decennial Increase in Growth Rate of population
1901	49.2	42.6	6.6
1911	48.1	48.6	-0.5
1921	46.4	36.6	10.1
1931	45.2	31.2	14.0
1941	39.9	27.4	12.5
1951	41.7	22.8	18.9
1961	41.2	19.0	22.0
1971	37.2	15.0	22.2
1981	33.2	12.2	21.0
1991	30.9	10.8	20.1
2001	27.5	8.4	19.1
2009*	22.22	6.4	15.82
2013	20.22	7.4	12.82

Source: Census Data

* SRS Bulletin, Registrar General, India, April - 2009 & Estimate in 2013.

Causes of Rapid Decline in Death Rate

The death rate in India has significantly declined from 22.8 in 1951 to 7.4 in 2013. This decline in death rate is the outcome of the following factors.

1. Control over Famines

In early years, the high death rate was caused by frequent occurrence of famines. During these days, there was lack of proper transport and communication

facilities, for which foodgrains could not be transported to the famine stricken areas. However, after 1921, particularly after independence, expansion of transport facilities to rural areas, proper mobilization of foodgrains and import of foodgrains to meet the domestic demand, led to reduction in the occurrence of famines.

2. Expansion of Medical Facilities

In recent years, rapid advancement has been made in the field of medical science. As a result of expansion of medical facilities and public health services various diseases have been controlled. Further, the use of medicines has controlled the deadly epidemics like cholera, plague, malaria and influenza. Consequently, the death rate has significantly declined during these days.

3. Decline in Infant Mortality

Another important factor contributing to low death rate is decline in infant mortality. The infant mortality rate which was 218 per thousand in 1921 had come down to 66 in 2001 and further to 57 in 2011. Expansion of medical facilities and better child care at maternity centers have resulted in decline in infant mortality. All these factors have significantly lowered the death rate in India.

Causes of Slow Decline in Birth Rate

Though birth rate is falling in India, the rate of fall is slow. Further, despite fall in birth rate, it is still very high. The factors responsible for high birth rate are discussed below:

1. Climatic Factor

India is a hot country. In the hot climate, girls get puberty at an early age which lengthens the fertility period. In the cold countries, girls get puberty late which reduces their effective period to produce children. In India such climatic factor along with other socio-economic factors has resulted in a high birth rate.

2. Socio-Cultural Factors

(i) **Universal and Early Marriage:** In India universal marriage is a social custom. 76 per cent of girls in the age group 15-44 years get married. Since marriage among

women is almost universal, birth rate is higher. Further, Indian women marry comparatively at an early age. The average marriage age of women is about 16 years. As the child bearing capacity is more at an early age, birth rate tends to be higher.

(ii) **Craze for a Male Child:** In Indian society, more importance is given to the male child as certain religious duties have to be performed only by sons and further sons take care of their parents in their old age. If the first child is a daughter and second is also a daughter, they go for more and more children expecting a son to come. This leads to a high birth rate.

(iii) **Joint-family System:** In India joint family system is still prevalent. Such joint family system induces the young couples to have more children since burden of larger number of children falls upon the family head. An additional child brings no immediate hardship to parents. This is an important factor responsible for high birth rate.

3. Economic Factors

(i) **Poverty:** Some demographers establish a direct relationship between poverty and high birth rate. In poor families children are considered as an asset as they add to family income from an early age. Further, a large family acts as a social security for the old age. Besides, it is believed that the reproductive capacity of the poor is intense as sex is the only form of entertainment for them. Thus a high birth rate is always associated with poverty of the people.

(ii) **Illiteracy and Unemployment:** In India people are illiterate and ignorant. According to 2011 census, nearly 35 per cent of Indian women are illiterate. Further, 68 per cent of women are unemployed and they are confined to four walls of the house. They do not know the benefit of family planning measures. This results in high birth rate.

(iii) **Partial Success of Birth Control Measures:** Birth control measures have not been fully successful in India. This is evident from the fact that in 2009, every

Indian woman in the age group of 15-49 years gave birth to 2.72 children on an average. This partial success of birth control measures is regarded as one of the causes of high birth rate.

1.4.2.2 Adverse Effects of Population Explosion

Rapid growth of population has stood as great obstacle in the path of rapid economic development of India. It has adversely affected the growth of per-capita income, per-capita availability of land and other productive resources, level of saving and capital formation in India. Further, population explosion has brought an upward movement in the demand for goods and services resulting in an inflationary situation. It has also aggravated the unemployment problem and polluted the environment. The wide ranging effects of population explosion on different fronts of the Indian economy are discussed below.

1. **Slow Rise in Per-capita Income:** High growth of population reduces the per capita income, as the per capita income is found by dividing the national income by total population. The per capita income is considered an important indicator of economic growth and standard of living of the people. Though national income has increased significantly in India after independence, the per capita income has not gone up proportionately due to rapid growth of population. While the national income in India has gone up at a rate of approximately 5 per cent per annum between 1951 to 2015, the per capita income increased at a rate of 3 per cent per annum during the same period. This reveals that unless rapid growth of population is controlled, the gains from increase in national income will be eaten away by the growing population.

2. **Low Per-capita Availability of Land:** Land is limited in supply. With increase in population, per capita availability of land is bound to decline. In India, due to rapid growth of population, per capita availability of cultivable land has declined from 0.9 hectare in 1951 to 0.38 hectare in 2014-15. This has also resulted in sub-division and fragmentation of land holding which adversely affects the agricultural productivity Land is the only productive asset in the rural sector and due to

population growth it has gradually become over-crowded. While in 1951, only 102 million were engaged in the agricultural sector, the number of people engaged in agriculture increased to 263 million in 2011 and over half of them are agricultural labourers. The consequence is the disguised unemployment in the agricultural sector and low productivity of Indian agriculture.

3. **Low Saving and Low Capital Formation:** A high rate of capital formation is crucial for the development of an economy. Capital formation depends on the level of saving and investment. But due to rapid growth of population in India major proportion of the national income is spent for consumption and less is saved. As a result, smaller amount of resources are available for investment. Hence capital formation is low in India due to rapid growth of population. Further, due to rapid population growth available resources are to be diverted from directly productive activities to social overhead capital like education, health, housing etc, where the returns come slowly in the long-run.

4. **Marginal increase in the Per-capita Availability of Foodgrains:** Rapid growth of population adversely affects consumption. The reason is that more mouths are added without a corresponding increase in the number of hands that work. Due to rapid growth of population, demand for foodgrains has significantly increased in India. After adoption of HYV technology, foodgrain production has significantly increased from 51 million tonnes in 1950-51 to 252 million tonnes in 2011-12 and 257.1 million tonnes in 2014-15. But this increase in foodgrain production has been almost neutralized by rapid growth of population. Consequently, the per capita availability of foodgrains such as rice and wheat has increased only marginally. Net per capita availability of rice has gone up by only 20 per cent (from 58 kg / year to 70 kg / year) while in the case of wheat it has gone up by two times (from 24 kg/year to 49.5 kg / year) during the same period. But there is consistent decline in availability of pulses during the period (from 22 kg / year to 11 kg (year). Further, a large number of people in the country are underfed and suffer from malnutrition. This situation has emerged due to rapid growth of population in the country.

5. **Massive Unemployment Problem:** Population is the source of supply of labour. When population increases at a higher rate than increase in employment opportunities it leads to unemployment problem. In India, due to rapid growth of population there is excess of supply of labour in relation to demand and the number of the unemployed both in the rural and urban areas has gone up significantly. While the total number of the unemployed was 20.7 million in 1980, it has increased to 28 million in 1990 and 44 million in the year 2012. Further, due to rapid growth of population, agriculture has been over-crowded and disguised unemployment is found in this sector.

6. **Rise in Price Level:** Modern economy is a monetary economy where money helps in the purchase of goods and services. Money value of a commodity is known as price. Price, in turn, depends on demand and supply forces. Increase in price is the outcome of excess of demand over supply. The rapid growth of population has led to an increase in the demand for goods and services. Since the supply of goods and services does not increase in accordance with the rise in demand the price level rises. Continuous and rapid rise in the price level is termed as inflation. Such inflation reduces the value of money and hits common people very hard. It also adversely affects economic growth. Inflationary situation in India is mainly caused due to rapid growth of population.

7. **Heavy Pressure on Infrastructure:** Rapid growth of population exerts heavy pressure on existing infrastructure. Education, health, housing, transport and communication facilities constitute the infrastructure which are generally provided by the government. When population increases at a fast rate, more schools, more hospitals, more houses, and more roads are required to meet the demand of the people. Hence available infrastructure facilities become inadequate and as such the government finds itself in a tight financial position to provide these services to the people.

8. **Adverse Effect on Quality of Life:** Growing population adversely affects the quality of life of its people. Quality of life depends on the volume and pattern of

consumption, availability of education and health care facilities, longevity etc. As rapid growth of population adversely affects these variables, quality of life deteriorates.

9. **Adverse Effect on Environment:** Environment is a combination of biological, physical and social resources available to the people for satisfying their wants at a given time. Human and animal survival is possible only if the environmental balance is maintained. The rapid growth of population in India leads to increasing exploitation of natural resources and growing pollution of air, water, sound and the like and thus is a contributory factor for environmental degradation in the country. Due to over-crowding the urban city centres have become extremely polluted. The industrial wastes of Kanpur and Allahabad have polluted the river 'Ganga'. The rural areas are also getting polluted as resources are getting depleted very quickly and forests are being destroyed because of population pressure. Further, majority of rural people are not getting pure water to drink. Use of pesticides and insecticides for increasing agricultural production has contaminated the water and destroyed the ecological balance. Thus the problem of environmental degradation is the outcome of rapid growth of population.

10. **Effect on Social Life:** Indian society is peaceful from time immemorial. Here, people believe in plain living and high thinking. They believe in 'truth', 'honesty' and 'integrity'. However, due to excess growth of population, a commercial attitude has developed in their mind. Further, massive unemployment in India has resulted in crimes, strikes and social unrest. People are gradually becoming corrupt to maintain their big family size. Thus the rapid growth of population has brought a degradation is social values and social life in the country.

1.4.3 Population Control Measures

Population explosion is the main obstacle in the path of rapid economic development of the Indian economy. Since this problem is getting intense day by day, there is need to adopt appropriate measures to effectively arrest rapid population growth through a suitable population policy.

Population Policy

Population policy refers to the measures and programmes which are designed to reduce the rate of growth of population by bringing down birth rate and to stabilise population at a reasonable level.

Policy Option:

Measures which can lower the birth rate can be broadly divided in to two groups: (1) Autonomous Measures and (2) Deliberate Measures.

(1) Autonomous Measures

Autonomous measures include the following:

(i) **Rise in Per-capita Income:** Demographic history of various advanced countries like U.S and Japan shows that there is an inverse relationship between per-capita income and a country's birth rate. When per-capita income increases, people do not desire more children in order to supplement their income. In other words, with increase in per-capita income, people feel more secure and do not want to depend on their children. Dumont, a noted demographer has developed the 'social capillarity thesis' to explain this relationship between birth rate and per-capita income. Therefore, a rise in per-capita income is very much essential to control the already high birth rate for which the government has to undertake developmental programmes. Therefore, it is said that economic development is the best contraceptive. However, economic development or the increase in per-capita income will have positive impact on birth rate after a long period of time.

(ii) **Urbanisation and Industrialisation:** In the Indian society, there is prevalence of joint family system which encourages the younger people to have more children. A nucleus family is generally found in an urbanized and industrialized economy. Urbanisation and industrialisation encourage nucleus family system thrugh migration and urban employment opportunities. They also tend to induce couples to have small families with less children.

(iii) **Late Marriage:** When girls marry at an early age, they get a longer span of time to reproduce children. With economic growth and spread of education girls are induced to marry late in order to control the birth rate. A UN report has pointed out, there would be a significant decline in birth rate to seven per thousand, if the average age of marriage of female will rise from 16 to 20 years.

However, economic development, urbanisation and industrialisation are only possible in the long run, not in the short run.

(2) Deliberate Measures

Since economic development is a long run process, population growth cannot be checked automatically in the short run. Therefore, the following deliberate measures should be taken to get the quick results.

(i) **Lowering Infant Morality Rate:** In India, infant morality rate is very high and stands at around 42 in the year 2015. Poor people, in order to ensure that some children do survive, reproduce more. Therefore, widespread vaccination and proper child care should be undertaken to reduce the infant mortality rate and hence the birth rate.

(ii) **Spread of Education:** In India, 26 per cent of total population are illiterate. They regard children as the gift of God and are not conscious of the evils of population growth and virtues of a small family. To remove illiteracy and blind belief, spread of education is very much essential. An educated man can rightly understand the benefits of a small family and the vices of a large family.

(iii) **Women Education and Employment:** In India, about 35 per cent of women are illiterate and 68 per cent are unemployed. The Government, therefore, should take effective steps to spread women education and create employment opportunities for them so that they can understand the evils of large family size and come forward to use birth control devices for arresting population growth.

(iv) **Family Planning Infrastructure Facilities:** In India, family planning infrastructure facilities are available mostly in the urban centres and semi-urban areas. Poor

people of rural areas do not get these facilities easily. Therefore, family planning centres with trained personnel should be set up in rural areas so that people can come forward to adopt family planning measures such as sterilization and use of contraceptive pills to control birth.

(v) Incentives: The government should provide both monetary and non-monetary incentives to motivate people for adopting family planning measures. The funds for the purpose should be properly utilised.

(vi) Publicity: The massage of family planning should reach the people of rural areas. For this there should be widespread publicity in the newspaper, radio and T.V People should be convinced that no birth control device is harmful and small family is a happy family.

(vii) Legislation: Family planning measures should be voluntary. However, Government should enact laws for lowering the birth rate. The Government can make laws in this field for raising the minimum age of marriage, compulsory education up to high school level, termination of pregnancy and abolition of child labour. In fact, the government of India has already enacted laws in these respects.

Population Policy of the Government of India

While formulating the First Five Year Plan (1951-56) the Planning Commission recognised the need of a population policy in order to control the rapid growth of population. India became the first country in the world to adopt deliberate policy measures to control the high birth rate in 1952. Initially the programme undertaken by the government for reducing population growth was known as Family Planning Programme. The objectives of such programme were:

(i) to limit the size of the family within 2 to 3 children,

(ii) to have children by choice and not by chance, and

(iii) to have proper spacing of children and safe motherhood.

Government of India's programme for arresting population growth since 1952 till the present day can be discussed under two heads:

(A) Clinical Approach

(B) Family Welfare Approach

(A) Clinical Approach to Population Control

During the First Four Five Year Plans (I-IV) the approach to population control was clinic-based. In the First Five Year Plan a sum of Rs. 65 lakh was earmarked for the purpose and the amount increased to Rs. 3 crore during the 2nd plan period. During the 3rd plan emphasis was given on mass propaganda and motivation programme in order to make people conscious about the adverse effects of population growth. Rs. 25 crore were allotted for the purpose during this plan period. Different methods of contraception were introduced to check the high birth rate and a pill factory was set up in India during 1966-69. A "Cafeteria Approach" meaning 'choose whatever method of contraception you like' was introduced by the Health and Family Welfare Minister Prof. Chandrasekhar. During the Fourth Plan period a time bound target oriented approach was adopted to reduce the birth rate from 39 per thousand to 32 per thousand. But nothing remarkable could be achieved in this direction. By 1971, population of the country increased to 548 million.

In 1972, the Indian Parliament passed the Medical Termination of Pregnancy (MTP) Act legalising abortion on demand. Mass vasectomy camps were organised in the country. The Family Planning Programme was widened to cover nutrition, maternity and child care. In 1976, the government of India announced a comprehensive National Population Policy. The objective was to reduce the fertility period of reproductive couples. The policy discouraged the child marriages and increased the minimum age of marriage to 18 for girls and 21 for boys. The family planning programme was started on a war-footing during the emergency period (1975-77). Compulsory sterilization was introduced and 8.4 million people were sterilised against the target of 4.3 million. Financial incentives were given to the people for attracting them for sterilization. However, the programme was virtually rejected by the people and its progress received a serious set-back during two yours after 1976.

(B) Family Welfare Approach

The Janata Government in 1977 renamed the Family Planning Programme as Family Welfare Programme and put emphasis on the welfare of the family as a whole apart from adoption of contraceptives for population control. The method of persuasion replaced the earlier method of compulsion in the field of sterilization. The policy targeted to reduce the birth rate to 30 per thousand by 1979 and 25 per thousand by 1989. However, during the brief tenure of Janata government the policy could not achieve much.

From the Sixth Plan onwards, long term strategy of limiting population growth started in the country. The objective was to reduce the birth rate from 33 to 21 and mortality from 14 to 9 during the Sixth Plan period. But the objective of this ambitious plan could not be achieved. Hence the Seventh Plan adopted a practical target for the purpose. The plan aimed at reducing the birth rate to 29 per thousand. During the Eighth Plan, emphasis was given on decentralised planning to check population growth. The local conditions, regional variations and diversities needed to be considered while planning and implementing the family welfare programme. The Eighth Plan reduced the target of birth rate to 26. The Ninth Plan aimed at limiting the population growth to 1.6 per cent by 2001 and 1.5 per cent by 2011. The plan emphasised to increase the supply of contraceptives to meet the demand and reduce the infant and maternity morbidity and mortality to reduce fertility.

New Population Policy (2000)

The N.D.A. government at the centre announced its New Population Policy in February, 2000. The objective of the policy is to meet the urgent needs for contraception, health care infrastructure, health personnel and integrated service delivery. The policy aims at achieving the target of two children per couple by 2010. The main provisions of the New Policy are:

(i) Freezing of the number of seats in legislatures (Parliament and Assemblies) at the current level based on the 1971 census will be extended from 2001 to 2026.

(ii) Setting up a commission with the Prime Minister as the Chairman to monitor the progress of the State governments in controlling population growth.

(iii) 16 promotional and motivational measures have been cleared for adopting small family norm

(iv) To achieve population stability by 2045.

(v) Reduction of infant mortality rate (IMR) below 30 and maternity mortality rate (MMR) below 100 per 1 lakh live births.

(vi) Universal immunization.

(vii) Incentive for adopting two-child small family norm.

(viii) To achieve 80 per cent delivery in dispensaries, hospitals and medical institutions.

(ix) Facilities for safe abortions be increased.

(x) Strict enforcement of Child Marriage Restraint Act and Pre-Natal Diagnostic Techniques Act.

(xi) A special reward for women who marry after 21 and opt for a terminal method of contraception after the second child.

(xii) Health insurance cover for those who live below poverty line and undergo sterilisation after having 2 children.

However, critics feel that the new population policy puts the entire burden of family limitation on 'women'. They argue that the policy provides incentives only to women for undergoing sterilisation (tubectomy) after two children. The same incentive should also be provided to 'men' if they undergo sterilisation (vasectomy) after two children. It is a matter of pity that vasectomy accounts for only 6 per cent of contractive use. In order to reduce population growth male should come forward to undergo vasectomy.

Asessment of Population Policy

In spite of the massive efforts by the government, the performance of the family welfare programme has not been satisfactory. Right from the First Five Year Plan the set goals have not been realised in time. This has resulted in resetting of goals again and again.

Following are the main reasons for the poor performance of family welfare programme.

(1) The programme has remained a government programme, the community's involvement and participation being marginal.

(2) Health infrastructure is not evenly distributed across the country.

(3) There is shortage of contraceptive devices in the country.

(4) There is also lack of awareness among poor in backward areas.

(5) The monitoring mechanism under the programme has been reduced to a routine target reporting by officials.

Conclusion:

In order to make the family welfare programme a success there should be involvement of the community in the programme and besides, the policy makers and the administration must have strong will power in monitoring the programme.

SUMMARY

1.1 STATUS OF THE INDIAN ECONOMY ON THE EVE OF INDEPENDENCE

(A) On the eve of independence the Indian economy was underdeveloped, stagnant and dependent in view of the following:

(i) Agriculture was overcrowded. Its productivity was one of the lowest in the world.

(ii) Industrial development of the country was insufficient and lopsided. Per capita industrial output was very low.

(iii) There was no industrial infrastructure worth the name.

(iv) There was widespread poverty and massive unemployment.

(v) Urbanisation was at a low level.

(vi) There was mass illiteracy and high growth rate of population.

(vii) There was very slow growth of per capita income.

(viii) It was a semifeudal economy.

(ix) Its exports consisted of agricultural goods and imports consisted of textiles and sugar. Further England accounted for a large share of India's foreign trade.

(B) At the time of India's independence, partition of the country brought with itself food shortage, raw material shortage and dislocation of the Indian industry.

1.2 BASIC CHARACTERISTICS OF CONTEMPORARY INDIAN ECONOMY

The Indian economy exhibits the characteristics of backwardness and progressiveness as well.

The following features indicate the state of its backwardness.

(i) Low per capita income

(ii) Low quality of life

(iii) Extreme inequality in the distribution of income

(iv) Heavy population pressure

(v) Predominance of agriculture

(vi) Large unutilized resources

(vii) Widespread unemployment

(viii) Massive poverty

(ix) Paucity of capital

(x) Backward technology

(xi) Unfavourable socio-cultural framework

(xii) Predominantly rural

Indicators of the developing nature of the Indian economy include:

(i) Rising trend of GDP

(ii) Rising trend of per capita income

(iii) Some success in the field of self-reliance

(iv) Some modernization

(v) Increase in capital formation

1.3 STRUCTURAL CHANGES IN THE INDIAN ECONOMY

Change in the structure of production and employment in the economy over time in the process of development is called structural change.

1.3.1 Structural Changes in the Indian Economy

There has been significant structural transformation in the Indian economy during the planning era which include the following:

(a) Decline in the share of primary sector in GDP from 57.7 per cent in 1950-51 to 24 per cent in 2001-02, and further to 17.4 per cent in 2014-15.

(b) Rise in the share of secondary sector in GDP from 14.8 per cent in 1950-51 to 26.5 per cent in 2001-02, and further to 29.7 per cent in 2014-15.

(c) Rise in the share of services sector in GDP from 27.5 per cent in 1950-51 to 49.5 per cent in 2001-02, and further to 52.9 per cent in 2014-15.

Such tendency is consistent with the change in the composition of national product taking place in developed countries. However, the extent of structural change taking place in Indian economy is much slower than in case of developed countries.

1.3.2 Occupational Structure

Occupational structure of a country refers to the distribution of its work force among different sectors or occupations.

1.3.2.1 Occupational Structure in India

Of the total population of 121.02 crore in India, 39.2 per cent (around 40 crore) constitute work force. Change in occupational pattern in India from the beginning of the 20th century upto 1991 was not significant. However, there has been substantial change in occupational pattern during 1991-2001 decade. But it is much less compared to that of developed countries. Even today about 49 per cent of the work force in India depend on the primary sector whereas in developed countries like U.K., U.S.A. and Japan this proportion varies between 2 and 7 per cent.

1.3.3 Causes of Heavy Dependence on Primary Sector

- Lack of emphasis on employment expansion as a distinct plan objective.
- Slow growth of industrial sector.
- In adequate attention to small scale and cottage industries.

1.4 THE POPULATION PROBLEM

1. India is the second most populous country in the world, next to China.
2. Demographic features of Indian population include the following:

(a) Large Size: According to 2011 Census, population of India stands at 121.02 crore which is almost 17.31 per cent of the global population.

(b) High Growth Rate of Population: Upto the year 1921, rate of growth of population in India was very small and highly unstable erratic. From 1921 to 1951 rate of growth was small and steady. Since 1951 India has been experiencing population explosion. Population growth during 2001 to 2011 is 1.58 per cent per annum.

(c) High Density of Population: Density of population refers to the number of persons living per square kilometer of land area. According to 2011 Census, density of population in India is 382.

(d) Age Composition: Division of total population into different age groups (0-14 years, 15-59 years, 60 and above) is known as age composition. Percentage of working population (those belonging to the age group 15-59 years) in India has remained almost stagnant since 1921.

(e) Heavy Concentration of Population in Rural Areas: According to 2011 Census 72.2 per cent of India's population live in rural areas and 27.8 per cent in urban areas.

(f) Sex Composition: Sex ratio refers to the number of female per 1000 male. According to 2011 census, sex ratio in India is 940, up from 933 in 2001 census.

(g) Occupational structure: Occupational structure of India shows the distribution of its working population in different occupations (or sectors). In India, but half of the population depend on primary sector.

(h) Low level of life expectancy: Life expectancy refers to the average number of years for which people of a country are expected to live at the time of birth. Life expectancy in India has increased from 33 years in 1951 to 63.9 years in 2001, and to 68.4 years in 2011. However, it is much lower compared to the developed countries.

(i) Low Level of Literacy: Literacy rate in India has improved from 16.7 per cent in 1951 to 74.04 per cent in 2011. But it is lower compared to the developed

countries. Literacy rate for women are significantly lower compared to males.

(j) High Level Infant Mortality Rate (IMR): The infant mortality rate is expressed as a ratio of the number of deaths among 1000 children before they complete one year of age. IMR in India has declined from 218 in 1921 to 52 in 2008, and to 42 in 2015.

3. Causes of Rapid Population Growth:

Rapid population in India is mainly caused due to (a) High Birth Rate and (b) Low Death Rate or the excess of birth rate over death rate.

(a) High Birth Rate: Birth rate refers to the number of live births per 1000 population of a country in a year. In India birth rate was 20.22 in 2013 down from 46.4 in 1921. Though birth rate is falling, rate of fall is very slow.

(b) Low Death Rate: Death rate refers to the number of persons who die per 1000 population of a country in a year. In 2013, death rate in India was 7.4, down from 36.6 in 1921. Death rate in India in falling rapidly.

4. Adverse Effects of Rapid Growth of Population: Rapid population growth in India has produced adverse effects in the following manner.

(a) Slow rise in per capita income

(b) Low per-capita availability of land

(c) Low saving and low capital formation

(d) Small increase in the per capita availability of foodgrains.

(e) Massive unemployment problem

(f) Rapid rise in price level

(g) Heavy pressure on infrastructure

(h) Adverse effect on quality of life

(i) Degradation in social values and social life

(j) Adverse effect on environment

5. Measures to Control Rapid Population Growth:

For controlling rapid population growth in India, there is need to lower birth rate. Measure which can lower birth rate can be broadly divided into two groups: (a) Autonomous Measures, and (b) Deliberate Measures

India is the first country to adopt population policy as an official programme where deliberate measures are adopted to control the high birth rate.

Initially, the programme undertaken by the government for reducing population growth was known as family planning programme.

In 1977 the family planning programme was renamed as family welfare programme.

Family welfare programme in India has achieved limited success.

MODEL QUESTIONS

1.1 STATUS OF THE INDIAN ECONOMY ON THE EVE OF INDEPENDENCE

Group - A: Objective Type (Compulsory 1 mark each)

I. Write the correct answer choosing from the alternatives given in each question:

(i) On the eve of independence, Indian economy was predominantly

(a) An industrialised economy (b) A developed economy

(c) An agrarian economy (d) An urban economy

(ii) On the eve of independence, contribution of agriculture to India's national product was

(a) About 50 per cent (b) Less than 50 per cent

(c) More than 60 per cent (d) About 70 per cent

(iii) On the eve of independence, dependence of labour force in India on agricultural sector was approximately

(a) 72 per cent (b) 58 per cent

(c) 60 per cent (d) 65 per cent

(iv) On the eve of India's independence industrial sector accounted for

(a) 6.6 per cent of national product (b) 10.6 per cent of national product

(c) 15 per cent of national product (d) 20 per cent of national product

(v) On the eve of India's independence, the major emphasis on industrial development was given on

(a) Consumer goods industries (b) Basic capital goods industries

(c) Engineering goods industries (d) Power sector

(vi) On the eve of independence, industrial structure in India was dependent on

(a) Import of plant and equipment (b) Import of raw materials

(c) Import of spares (d) Import of all of the above

(vii) Per capita income in India per month at the time of independence, was

(a) Less than Rs. 20 (b) Approximately Rs. 25

(c) Rs. 30 (d) More than Rs. 30

(viii) The country which accounted for a larger share of India's foreign trade at the time of independence was

(a) England (b) USA

(c) Japan (d) Germany

2. Express each of the following statements in one word:

(i) National income divided by the population of the country

(ii) A state of slow growth or no growth in national income or per capita income

3. Answer the following questions in one sentence:

(i) Which sector of the Indian economy had the largest contribution to the national income at the time of independence ?

(ii) Which sector of the Indian economy provided largest employment opportunity at the time of independence ?

(iii) In which field of infrastructure India made some achievement at the time of independence ?

(iv) What was the main item of imports of India at the time of independence ?

(v) What was the main item of exports of India at the time of independence ?

(vi) What proportion of cultivated land was used for producing foodgrains at the time of independence ?

4. Are the following sentences incorrect ? Correct them, if necessary, without changing the portions underlined:

(i) Indian economy was highly industrialised at the time of independence.

(ii) Indian economy was self sufficient in production of plant and machinery and

modern defence equipment at the time of independence.

(iii) Contribution of agriculture sector to national product was maximum at the time of India's independence.

(iv) At the time of independence, India's exports mainly consisted of industrial goods.

(v) At the time of independence India's imports mainly consisted of cotton manufactures.

(vi) USA accounted for a larger share in India's foreign trade at the time of independence.

(vii) At the time of independence, irrigation network was the major infrastructure facility that India could be proud of.

(viii) The major emphasis in industrial development in India was basic capital goods industries at the time of independence.

5. Fill in the blanks:

(i) Food crops accounted for about _____ per cent of the total cultivated area under cultivation at the time of independence.

(ii) At the time of India's independence, contribution of industrial sector to the country's national income was _____ per cent.

(iii) At the time of independence, major emphasis was given on _____ industries in India.

(iv) At the time of independence, stagnation in the Indian economy was mainly due to slow growth of _____ output.

(v) On the eve of independence, only _____ per cent of India's population were literate.

(vi) On the eve of independence about _____ per cent of India's population were living in villages.

(vii) At the time of independence about _____ per cent of work force in India were dependent on agriculture.

(viii) At the time of independence India's exports consisted of mainly _____ goods.

(ix) At the time of independence India's imports composed of mainly _____ goods.

(x) On the eve of independence _____ accounted for a larger share of India's foreign trade.

Group - B (Short Type Answer)

3. Answer the following questions within two / three sentences in each case: (2 marks each).

(i) Give a picture on the state of Indian industry on the eve of independence.

(ii) What was the state of industrial infrastructure in India on the eve of independence ?

(iii) What was the state of Indian agriculture at the time of independence ?

4. Explain the following statements within six sentences in each case: (3 marks each)

(i) Indian economy was in a state of stagnation at the time of independence.

(ii) Indian economy was a dependent economy at the time independence.

Group - C (Long Type Answer: 7.5 marks each)

5. Discuss the status of the Indian economy on the eve of independence.

6. "On the eve of independence, Indian economy was underdeveloped and dependent." Explain.

MODEL QUESTIONS

1.2 BASIC CHARACTERISTICS OF CONTEMPORARY INDIAN ECONOMY

Group - A: Objective Type (Compulsory) (1 mark each)

I. Write the correct answer choosing from the alternatives given in each question:

(i) Indian economy is a

(a) Developed economy
(b) Developing economy
(c) Underdeveloped economy
(d) Stagnant economy

(ii) Contribution of agriculture to India's GDP at present is

(a) 13.9 per cent
(b) 15 per cent
(c) 18 per cent
(d) 17.4 per cent

(iii) According to HDI Report of the World Bank (2014), India's rank in Human Development Index is:

(a) 174
(b) 164
(c) 139
(d) 135

(iv) According to a study by National Council of Applied Economic Research (NCAER) in 2009-10, 20 per cent of the households at the highest rung receive:

(a) 53.3 per cent of GDP
(b) 55 per cent of GDP
(c) 50 per cent of GDP
(d) 48 per cent of GDP

(v) Presently, dependence of labour force on agricultural sector is:

(a) 58 per cent
(b) 70 per cent
(c) 49 per cent
(d) 72 per cent

(vi) India is regarded less developed, because of

(a) Low per capita income
(b) Low quality of life
(c) Predominance of agriculture
(d) All of the above

(vii) India achieved self-sufficiency in food grain production at the end of

(a) Fourth Plan
(b) Third Plan
(c) Fifth Plan
(d) Eighth Plan

2 I. Answer the following questions in one word:

(a) A state of slow growth or no growth of National income or per capita income.

(b) An economy which is not fully developed but marching ahead in the path of development.

(c) An economy where people mainly depend on agriculture for their livelihood.

(d) An economy where per capita income is very low.

(e) Persons living below the poverty line.

2.II Answer the following questions in one sentence:

(a) What is per capita income ?

(b) Why is Indian economy primarily an agrarian economy ?

(c) What was India's rank in Human Development Index (HDI) Report in 2014 ?

(d) Why in Indian economy predominantly a rural economy ?

(e) What is the trend of growth of GDP in India since independence ?

2.III Are the following statements correct ? Correct them, if necessary, without changing the portions underlined:

(a) Indian economy is a developed economy.

(b) In India per capita income is showing a rising trend.

(c) In India rate of growth of GDP is showing a falling trend.

(d) Indian economy is an urban economy.

2.IV Fill up the blanks:

(a) India's rank in Human Development Index according to World Bank's HDI Report 2014 is _____.

(b) _____ per cent of population in India are living below the poverty line in 2010-11.

(c) Government of India's expenditure on education and research constitutes only _____ per cent of GDP.

(d) Annual growth rate of GDP during the entire plan period is approximately _____ per cent.

Group - B (Short Type Questions)

3. Write short notes on following within three to four sentences in each case:

(a) Per capita income (c) Developing economy

(b) Quality of life (d) Backward technology

4. Explain the following statements within six sentences in each case: (3 marks each)

(a) Quality of life of the people in India is low.

(b) Distribution of income in India is inequitable.

(c) There is shortage of capital in India.

Group - C (Long Type Questions: 7.5 marks each)

5. Describe the basic features of Indian economy.

6. 'Indian economy is a developing economy.' Explain.

STRUCTURAL CHANGES IN THE INDIAN ECONOMY

Group - A: Objective Type (Compulsory) (1 mark each)

I. Write the correct answer choosing from the alternatives given in each question:

(i) For estimating national income, the Central Statistical Organisation (CSO) divides the Indian economy into

(a) Three Sectors (b) Four Sectors

(c) Five Sectors (d) Six Sectors

(ii) Primary sector includes:

(a) Agriculture, forestry and fishery

(b) Agriculture, manufacturing, electricity, gas and water supply

(c) Agriculture, transport and communication

(d) Finance and real estate

(iii) Secondary sector includes:

(a) Agriculture and allied activities

(b) Mining, manufacturing, electricity, gas and water supply, construction

(c) Transport, communication and trade, finance and real estate

(d) Forestry, fishery and transport

2. I Answer each of the following questions in one word:

(a) Change in the share of different sectors of an economy to GDP over time.

(b) Money value of final goods produced in a country during an accounting year.

(c) The sector of the economy which exploits natural resources to produce goods.

(d) The sector which transforms one physical good to another.

(e) The sector of the Indian economy which is concerned with the production of services.

(f) Distribution of work force of a country among different occupations.

2. II Answer the following questions in one sentence in each case:

(a) What is meant by structural change ?

(b) Which sector's contribution to India's GDP is declining ?

(c) What is meant by occupational structure ?

(d) What is primary sector ?

(e) What is secondary sector ?

(f) What is tertiary sector ?

2. III Are the following statements correct ? Correct them, if necessary, without changing the portions underlined:

(a) The contribution of tertiary sector to India's GDP is declining.

(b) The share of agriculture in India's GDP is increasing.

(c) The share of agriculture in India's GDP is the highest.

(d) In the process of economic development there is increase in the share of industry and services in India's GDP.

(e) In the process of economic development there is large shift of work force from non-agricultural sector to agricultural sector.

(f) Banking and insurance are included in secondary sector.

(g) Transport and communication are included in primary sector.

(h) Structural change in India indicates underdeveloped nature of its economy.

2. IV Fill up the blanks:

(a) Banking, insurance, trade, transport and communication constitute _____ sector.

(b) Change in the structure of production in the process of development is called _____.

(c) _____ sector makes the largest contribution to India's GDP.

(d) Primary sector includes _____.

(e) Indian economy is divided into _____ sectors.

(f) For computation of National Income, CSO divides the Indian economy into _____ sectors.

Group B (Short Type Questions)

3. Write short notes on the following within three/four sentences:

(a) Primary Sector

(b) Secondary Sector

(c) Tertiary Sector

(d) Structural Change

(e) Occupational Structure

4. Explain the following statements with in six sentences in each case: (3 marks each)

(a) There is a direct relation between economic development and structural change.

(b) Indian economy has undergone a pro-growth structural transformation.

Group - C (Long Type Questions) (7.5 marks each)

5. What is structural change ? Explain structural changes that have taken place in India since independence.

6. What is occupational structure? What changes do you find in India's occupational structure during the planning era ?

1.4 THE POPULATION PROBLEM

Group - A: Objective Type (Compulsory) (1 mark each)

1. Write the correct answer choosing from the alternatives given in each question:

(a) What is the size of India's population according to 2011 census ?

(i) 102.4 cr (ii) 112.3 cr (iii) 121.02 cr (iv) 125 cr

(b) What is the annual rate of growth of India's population over the period 2001 to 2011?

(i) 2.13 per cent (ii) 2.5 per cent

(iii) 1.9 per cent (iv) 1.58 per cent

(c) Which year is known as the year of the 'Great Divide' from India's population point of view ?

(i) 1951 (ii) 1971 (iii) 1921 (iv) 1961

(d) From which year India has been experiencing population explosion?

(i) 1921 (ii) 1951 (iii) 1961 (iv) 1981

(e) What is the percentage of population in India living in rural areas according to 2011 census ?

(i) 70 per cent (ii) 75 per cent

(iii) 72.2 per cent (iv) 74 per cent

(f) In which State in India sex ratio is the highest ?

(i) Odisha (ii) Bihar

(iii) Kerala (iv) Jammu and Kashmir

(g) In which State in India sex ratio is the lowest ?

(i) Bihar (ii) Odisha

(iii) West Bengal (iv) Jammu and Kashmir

(h) What is female literacy rate in India as per 2011 census ?

(i) 65.46 (ii) 74.04 (iii) 82.14 (iv) 54.16

(i) What is the literacy rate in India?

(i) 82.14 (ii) 65.46 (iii) 65.38 (iv) 74.04

(j) Which of the following is not an autonomous measure for controlling population growth ?

(i) Family welfare (ii) Economic development

(iii) Urbanisation (iv) Late marriage

(k) What is the name of the population control programme adopted in India upto 1977 ?

(i) Family Welfare Programme

(ii) Family Planning Programme

(iii) Birth Control Programme

(iv) Deliberate Population Control Programme

(l) What is the name of the population control programme adopted in India after 1977 ?

(i) Family Planning Programme

(ii) Family Welfare Programme

(iii) Birth Control Programme

(iv) Deliberate Population Control Programme

(m) What is the minimum age of marriage for girls in India ?

(i) 15 years (ii) 16 years (iii) 18 years (iv) 21 years

(n) What is the minimum age of marriage for boys in India ?

(i) 18 years (ii) 20 years (iii) 21 years (iv) 25 years

(o) What is the name of female sterilisation ?

(i) Vasectomy (ii) Abortion

(iii) Condom (iv) Tubectomy

2. I Express each of the following statements in one word.

(a) Number of persons living per square kilometer of area.

(b) Number of females per 1000 males.

(c) Average number of years for which people are expected to live at the time of birth.

(d) The terminal method of controlling birth in the case of male.

(e) The terminal method of controlling birth in the case of female.

(f) Measures and programmes designed to reduce the rate of growth of population and to stabilise at a reasonable level.

2.II Answer the following questions in one sentence in each case:

(a) What is meant by density of population ?

(b) In which year the last census of India was held ?

(c) What is sex-ratio ?

(d) What is infant-mortality rate ?

(e) What is birth rate ?

(f) What is death rate ?

(g) What is literacy rate ?

(h) What is meant by life expectancy ?

(i) What is meant by family planning ?

(j) What is the percentage of urban population in India ?

(k) What do you mean by autonomous measures for controlling population ?

(l) What do you mean by age composition ?

(m) What is meant by family welfare programme ?

(n) What is 'population policy' ?

3.III Examine the correctness of the following statements. Correct them, if necessary, without changing the portions underlined:

(a) India is the most populous country in the world.

(b) Rate of growth of population in India is showing an increasing trend.

(c) Birth rate in India is showing a rising trend.

(d) Death rate in India is showing a rising trend.

(e) There is a positive relation between the level of education and population growth.

(f) India is experiencing population explosion since 1921.

(g) Indian economy is primarily an urban economy.

(h) Odisha has the highest sex-ratio in India.

(i) Vasectomy is the name of female sterilisation.

(j) Tubectomy is the name of male sterilisation.

(k) There is a direct relationship between poverty and high birth rate.

2.IV Fill up the blanks:

(a) India's land area constitutes _____ per cent of world's land area.

(b) India's population constitutes _____ per cent of world's population.

(c) _____ is known as the year of 'Great Divide'.

(d) According to 2011 census, _____ per cent of India's population is below the age 14.

(e) In _____ state sex ratio is the highest in India.

(f) Sex ratio in India is _____ according to 2011 census.

(g) Economic development, urbanization and late marriage constitute _____ measures of population control.

(h) Government of India adopted population policy since _____.

(i) According to the new population policy India has to stabilise population by the year _____.

(j) When per capita income rises, people desire _____ number of children.

Group - B (Short-Type) Questions

3. Answer the following questions within three to four sentences in each case: (2 marks each)

(a) Density of population in India

(b) Sex-ratio in India

(c) Infant-mortality in India

(d) Age composition of population in India

(e) Trend of population growth in India

(f) Family welfare programme

(g) Family planning programme in India

4. I Answer the following within six sentences in each case: (3 marks each)

(a) How is poverty responsible for high birth rate in India ?

(b) How is the joint-family system responsible for high birth rate in India ?

(c) How does a decline in infant mortality rate contribute to low death rate in India ?

(d) How is illiteracy responsible for high birth rate in India ?

(e) How does rapid population growth in India lead to slow rise in per capita income ?

(f) How does population growth lead to low saving and low capital formation in India ?

(g) Why should family welfare programme be a people's programme ?

(h) Why it is said that 'economic development is the best contraceptive' ?

4. II Distinguish between the following restricting your answer within six sentences in each case:

(a) Autonomous measures and Deliberate measures for population control.

(b) Family planning programme and Family welfare programme.

(c) Vasectomy and Tubectomy.

Group - C (Long Type questions) (7.5 marks each)

5. Discuss the demographic features of the Indian economy.
6. Discuss the causes of rapid growth of population in India.
7. Explain the effects of rapid population growth on Indian economy.
8. "A rapidly growing population is a retarding factor of India's economic development." Elucidate.
9. Discuss the measures for controlling population growth in India.
10. Explain the population policy of government of India.

CHAPTER - 2

SECTORAL DEVELOPMENT

- Agriculture - Its importance, Low Productivity and Causes, Green Revolution, Present Agricultural Situation
- Industry - Its importance, Industrial Policy of 1948, 1956 and 1991

  Infrastructure- Its Role, Economic Infrastructure (Energy, Transport and Communication), Social Infrastructure (Education and Health)
- Foreign Trade - Its Role, Composition and Direction

2.1 AGRICULTURE

Introduction

Agriculture constitutes the most dominant sector of the Indian economy in the sense that about half of the population of the country is dependent on agriculture for their livelihood. The social customs, traditions and culture of the Indian society are greatly moulded by agriculture. Agriculture in India is not merely a source of income, but a way of life.

2.1.1 Importance of Agriculture in Indian Economy

Agriculture plays a vital role in stimulating the development of other economic activities like industry, trade, commerce and transport. So agriculture is regarded as the foundation of economic development of India. The following analysis highlights the importance of agriculture in the Indian economy.

1. Significant Contribution to Gross Domestic Product (GDP)

Agriculture and allied activities contribute a significant portion to India's GDP. In 1950-51, the share of agriculture in the country's GDP was 57.7 per cent. However, the share of agriculture in GDP of the country is gradually declining. It was 35.7 per cent in 1980-81 and 21.9 per cent in 2000-01. It further declined to 18.5 per cent in 2011-12, and 17.4 per cent in 2014-15. Though, share of agriculture in GDP of the country is declining steadily, it is still much higher than that of the developed countries like UK, USA and Canada where the corresponding figures are 2 per cent, 3 per cent and 4 per cent respectively.

2. Main Source of Employment

Agriculture has been and is a major source of employment in India. In 1950-51, about 72 per cent of work force in the country were engaged in agriculture. In 2000-01 the share of agriculture in total employment came down to 59 per cent. According to an estimate made by National Sample Survey Organisation (NSSO) the share of agriculture in total employment has come down to 48.9 percent in 2011-12. Rapid growth of population and the slow growth of industrial sector are responsible for the

heavy dependence on agriculture. But in developed countries like USA and UK only 2 to 3 percent of working population find employment in agriculture.

3. Main Source of Food, Fodder and Fuel

Agriculture is the main source of food for the entire population, fodder for the entire livestock and fuel for the majority of people living in rural areas of the country. Around 75 per cent of the total consumer expenditure is incurred on agricultural products and around 60 per cent of the consumer expenditure is incurred on food items. India had to face a serious food problem in the 1950s and 1960s due to short-fall in agricultural production. However, by the end of Fifth Five Year Plan it has become more or less self-sufficient in the production of food grains. The green revolution in Indian agriculture has made this possible.

4. Stimulates Industrial Development

Agriculture plays a very important role in stimulating industrial development of India in the following ways:

(i) Factor Contribution: Development of agriculture releases surplus labour force to work in industrial sector.

(ii) Product Contribution: Agriculture sector supplies several products which are used as raw materials in leading industries like paper, cotton textiles, jute, sugar, tea, vegetable oil, etc. Many small scale and cottage industries like handloom, edible oil, food processing, rice husking, coir industry etc. also depend on agriculture for their raw materials.

(iii) Market Contribution: Agricultural development results in an increase in income of the people working in farm sector. Such increase in income leads to an increase in demand for industrial products. Agriculture uses chemical fertiliser, pesticides, insecticides, tools, equipment and machinery produced by the industrial sector. Thus agriculture provides market for industrial products.

(iv) Supply of Food grains: Agriculture supplies food grains to the people engaged in industries.

5. Contribution to International Trade

Agriculture also plays an important role in the field of India's international trade. At the time of independence, Indian exports consisted of mainly agricultural products. Only textiles, tea and jute constituted 50 per cent of export earnings of the country. However, the share of agricultural products in India's exports is showing a decline during the plan period. In 1960-61, the share of agricultural products in the total exports was 41 per cent, which declined to 31 per cent in 1980-81 and further to 14.7 per cent during tenth plan (2002-07). In 2003-14, the share of agricultural products in the total exports declined to 12 per cent due to diversification of exports. Despite its declining share in the country's exports, agriculture is a very important source of earning foreign exchange which are utilised for the import of machinery and raw materials.

6. Maintenance of Price Stability

Stability in the price level in India greatly depends on the success of agricultural production. Failure to increase agricultural production in keeping pace with rise in demand leads to an increase in prices of food articles which further causes the general price level to rise. This is because, in India 75 per cent of the total consumption expenditure is incurred on agricultural products and 60 per cent of consumer expenditure is incurred on food items. Thus fluctuations in the price level in the country are mainly caused due to fluctuations in agricultural production. This makes it clear that increase in production of agricultural goods is the sine qua non for maintenance of price stability.

7. Source of Government Revenue

Indian railways are earning huge amount revenue for transporting agricultural products. State government also earns land revenue and registraion fee at the time of sale and purchase of land. Such revenue is called commercial revenue of the government.

8. A Source of Capital Formation

Development of agriculture results in an increase in income of the farm sector. Consequently, saving of the people engaged in farm sector rises. Such saving can be used for augmenting capital formation in the country. Besides, Indian agriculture is characterised by the presence of disguised unemployment. It is a situation where the marginal product of labour over a wide range is zero or close to zero. Therefore, a large number of workers whose marginal product is close to zero can be withdrawn from agriculture without reducing total agricultural output. Such workers are called disguisedly unemployed workers. If these workers are withdrawn from agriculture and are given work outside agriculture such as road construction, irrigation projects, soil conservation and land reclamation activities, social and economic overhead capital (SOC) can be created. Thus, disguised unemployment in agriculture is an important source of capital formation in the country.

Agriculture makes a significant contribution to the gross capital formation in the country. The share of agriculture and allied activities in the gross capital formation in India was 8.6 per cent in 2013-14. However, it has come down to 7.7 per cent in 2014-15.

Above analysis reveals that agriculture occupies an important place in the Indian economy and plays a very crucial role in accelerating the pace of country's economic development.

2.1.2 Growth of Agricultural Output

Growth of agricultural output is an important index of agricultural development in an economy. Agricultural output can be divided into two categories.

(i) Foodgrains which include cereals (rice, wheat, maize, bajra, etc.) and pulses (black gram, green gram, arhar, etc.)

(ii) Non-foodgrains which include oil seeds, cotton, jute, sugar cane etc.

Foodgrains cover about 70 per cent and non-food grains cover about 30 per cent of land under cultivation in India.

Agricultural GDP in the country is showing a rising trend since the inception of planning (1951). Rate of growth of agricultural GDP since 1951-52 till now is approximately 2.7 per cent per annum. Production of foodgrains has registered a rise from 51 million tonnes in 1951-52 to 231 million tonnes in 2007-08 which further increased to 257.1 million tonnes in 2014-15. This means that production of food grains has increased by more than 5 times during the last six and half decades. Among the food grains, performance of wheat is the most spectacular. Its production has gone up by around 12 times and that of pulses by 1.5 times during the same period. Production of rice has gone up by 4 times and sugar cane by 5 times and that of oil seeds by 4 times during the same period.

A comparative study of growth of food crops and non-food crops shows that the growth of non-food crops is more prominent than that of food crops.

Although several factors are responsible for growth of agricultural output in India, the most important one is the rise in agricultural productivity.

2.1.3 Agricultural Productivity

Agricultural productivity can be viewed from two perspectives, viz.,

(i) Land productivity, and

(ii) Labour productivity

Land Productivity

Land productivity refers to the amount of output produced for hectare (or per acre) of cultivated land.

$$\text{Thus, Land productivity} = \frac{\text{Total output}}{\text{Total cultivated land area}}$$

Labour Productivity

Labour productivity refers to the amount of output produced per worker engaged in agriculture.

$$\text{Thus, Labour productivity} = \frac{\text{Total output}}{\text{Total number of persons engaged in agriculture}}$$

In India, both land productivity and labour productivity are low. However, while considering the productivity of agriculture we mean land productivity. Thus in the present case, agricultural productivity means land productivity. During the post-green revolution period (1967-2015) agricultural productivity has increased by approximately 2 per cent per annum. During this period, the most spectacular growth has been recorded by wheat (2.60 per cent per annum).

Despite impressive growth in productivity of some crops in India during the post green revolution period, it is much lower compared to other countries of the world. Table - 2.1 presents data relating to actual yield of some principal crops in India, and world's highest yield of these crops.

Table - 2.1 : Actual Yield per Hectare (Qtl) in 2014-15

Crops	Actual yield in India	World's highest yield
Food Crops		
Rice	23.9	66.61 (China)
Wheat	28.72	73.60 (UK)
Maize	25.57	88.58 (USA)
Non-food Crops		
Cotton	5.1	19.20 (Australia)
Sugar cane	705	939 (Egypt)
Groundnuts	17.64	312 (China)
Mustard seed	11.85	35.88 (UK)

Source: Agricultural Statistics at a Glance (2015) and Economic Survey (2015-16), Goverment of India.

From Table 2.1 it is observed that actual yield of rice in India was 23.9 quintals in 2014-15, whereas it was 66.61 quintals in China which is the world's highest yield. In the case of wheat, actual yield in India was 28.72 quintals, whereas it was 73.60 quintals (highest yield) in UK. In the case of other food crop (maize) and non-food crops

(cotton, sugar cane, groundnut and mustard seed) productivity in India is much lower compared to other countries.

2.1.4 Causes of Low Productivity

Several factors are responsible for low agricultural productivity in India. These factors can be grouped under four heads:

(A) General Factors
(B) Institutional Factors
(C) Technological Factors
(D) Miscellaneous Factors

(A) General Factors

(1) Natural Factors: Nature plays an important role in the performance of agriculture in India. More than 50 per cent of total cultivated land in India depend on rainfall. In such years when monsoon is favourable, i.e., when rainfall is adequate and timely, agricultural production and productivity are higher. But in the years of irregular and inadequate rainfall, production and productivity become low. It is correctly said that Indian agriculture is a gamble of monsoon. Besides, frequent occurrence of natural calamities such as flood, drought and cyclone also adversely affect agricultural productivity.

(2) Over-crowding in Agriculture: In view of the rapid growth of population on the one hand and inadequate employment opportunities in secondary and tertiary sectors on the other, about 48.9 per cent of the population of India depend on agriculture. As a result, land-man ratio in the country is low and further there is sub-division and fragmentation of land holdings. The per capita availability of land was 0.43 hectare in 1901. But now it is about 0.2 hectare. Smallness in the size of land holding and sub-division and fragmentation of such holdings are not conducive for application of modern technology in agriculture and consequently productivity of agriculture is low. Although different state governments in India have implemented land reform measures, such measures have little impact on productivity.

(3) **Depressed Rural Atmosphere:** In the rural sector people are conservative, illiterate, superstitious and tradition bound. They are not prepared to accept anything new to them. For this traditional outlook it is not possible to adopt modern technology in the rural sector. Further, due to ignorance rural people are also not able to take advantage of various rural and agricultural development programmes that the governments have implemented for the benefit of the farm sector. For this reason also the productivity of agriculture is low.

(B) Institutional Factors

(1) **Defective Land Tenurial System:** Distribution of land in India is extremely unequal. Majority of people in the country are either land-less or possess very small amount of land. About 80 per cent land holdings in India are marginal and small. Such people who are either landless or possess very small amount of land actually cultivate the land owned by big land lords and as such they are tenant cultivators. Since there is no security of tenure, the tenant cultivators do not have incentive to raise productivity by bringing about permanent improvement in land. Hence, the land tenurial system is India is responsible for low productivity.

(2) **Inadequate Availability of Institutional Credit:** Since most of the farmers do not have their own resources, they depend on credit for undertaking agricultural operations. Main source of agricultural credit in the country is village money lender. Farmers are greatly exploited by the village money lenders since they charge very high interest rate. Eventhough government of India has taken a number of measures, such as the nationalisation of commercial banks in 1969 and 1980, establishment of RRBs in 1975 and NABARD in 1982 and setting up of many co-operative banks and cooperative societies, all the credit requirements of the farmers are not met by these financial institutions. According to a recent NSSO report for the year 2013, only 56 per cent of credit needs are met by institutional agencies.

(C) Technological Factors

(1) Dominance of Traditional Technique of Production: Modern technology includes application of HYV seeds, chemical fertilisers, pesticides, and use of modern agricultural implements like tractors, pump sets, harvestors, sowing machine etc. In India about 50 per cent of the total land are cultivated in traditional lines. In such land only traditional crops are grown; farm-seeds and animal manure are used. Old agricultural practices in respect of tilling, sowing, harvesting, storage etc. are also adopted.

(2) Inadequate Spread of Modern Agriculture: Inadequate spread of modern agriculture in India is evident from the following:

(i) Only 53 per cent of total land in the country are under the use of HYV seeds.

(ii) The animal power is still very much in vogue for many agricultural operations and in large many areas. Modern farm implements like tractors, power tillers, pump sets, sowing machine and harvestor etc. are not extensively used by the farmers.

(iii) The consumption of fertiliser is one of the lowest in the world. On an average, Indian farmers apply 105 kg of fertilizer per hectare while the corresponding figure stands at 395 kg in Japan, 465 kg in Korea, 300 kg in China and 320 kg in U.K.

(iv) Irrigation water is the most critical input of agricultural output. Despite expansion of irrigation facilities during planning era, only 49.8 per cent of total cultivated land are in receipt of irrigation water. In view of inadequate irrigation facilities, proportion of cultivated area under multiple crops is very small and as such cropping intensity is low.

(3) Poor Extension Services

Although a lot of research are done in the field of agriculture, the messages relating to outcome of these researches do not reach the poor farmers in the field because of inefficiency and lack of commitment on part of the extension workers such as Agricultural Extension Officers, Village Agricultural Workers, Village Level

Workers (Grama Sevakas) etc. Illiteracy of the farmers is also responsible for their ignorance about modern methods.

(D) Miscellaneous Factors

(1) **Lack of Storage Facilities:** The storage facilities with the individual farmers are normally very primitive in the form of dug-holes and pits. As a result 10 to 15 per cent of agricultural produce gets spoiled or eaten by rats and insects.

(2) **Lack of Organisation of Farmers:** Farmers in India are not organised. Due to lack of their organisation, they do not get fair price for their produce. They even do not get the minimum support price (MSP) fixed by the government.

(3) **Poor Marketing Facilities:** Farmers do not have incentive to produce more since they are not able to sell their produce at remunerative prices in view of the inadequate marketing facilities. To boost agricultural production, there is need for a marketing revolution, where farmers get a reasonable price, and yet consumers pay an affordable price.

(4) **Low Public Investment in Agriculture:** In all the earlier plans, public investment in agriculture has been low. During the Ninth Five Year Plan (1997-2002) only 4 per cent of total plan outlay was invested in agriculture. During the Tenth Five Year Plan 3.9 per cent of total plan outlay and during Eleventh Five Year Plan 3.7 per cent of total plan outlay were invested in agriculture. Because of such low public investment in agriculture, infrastructure facilities such as irrigation and research have not made considerable progress.

On the basis of the above discussion it can be said that for enhancing agricultural productivity in India there is need for increase in the use of fertiliser, expansion of irrigation facilities, extensive use of modern method of cultivation, effective implementation of land reform measures, improvement in agricultural marketing and change in outlook and awareness of rural population. There is also need for formulation of effective agricultural policy and larger public investment in the field of agriculture.

2.1.5 Green Revolution

The impressive growth of agricultural sector in the Indian economy in the post independence period especially since the 1970s, is primarily due to the adoption of a new agricultural strategy called Green Revolution. It is pertinent to know the meaning of green revolution and its impact.

Meaning

Green revolution is a new agricultural strategy adopted in the late-1960s in Indian agriculture for augmenting production of foodgrains through application of new technology. New technology consisted of a package of inputs such as high yielding varieties (HYV) of seeds, chemical fertilisers and pesticides which are to be used in combination along with an assured water supply for enhancing agricultural output in the country. Since this new agricultural strategy could spread very quickly and was able to bring about substantial increase in production of foodgrains within a very short time it is called 'green revolution'.

The Background: The background in which the new agricultural strategy was introduced during the late-1960s is as follows:

(1) In the period from 1950 to 1965, productivity of Indian agriculture was abysmally low.

(2) State investment in agriculture was limited. By the end of Third Five Year Plan, only 17 per cent of the total cultivated area in the country was irrigated.

(3) There was no further scope for expanding cultivated area. It was believed that future increase in output would be possible only by increasing yield from the available cultivated area.

(4) India experienced two consecutive bad monsoons in 1965-66 and 1966-67. There was dramatic fall in output for which India had to make large import of foodgrains from USA and other countries of the world. The country had a ship-to-mouth

existence. The poor agricultural performance also had a negative impact on industries.

In view of the above, there was a crucial need for increasing productivity of agriculture which forced the government to play a positive role in improving the technical conditions of agricultural production.

Elements of New Technology

It has already been stated that green revolution is a new agricultural strategy for increasing foodgrains production through application of new technology. New technology consists of a package of inputs such as HYV seeds, chemical fertilizers, pesticides and assured water supply. Use of these inputs by the farmers facilitated green revolution and resulted in spectacular growth of agricultural output.

(i) Application of HYV Seeds

The use of HYV wheat seeds such as Kalyan Sona, Sonalika, Safed Lerma and Chhoti Lerma and HYV paddy seeds like IR-8, Jaya, Ratna, Padma, Parijat, Swarna, 1009, 1018 etc. by Punjab and Haryana farmers in the late 1960s facilitated green revolution. Government of India set up ICAR and Agricultural Universities in different States and encouraged scientists to invent improved seeds for use by the farmers. National Seeds Corporation of India was set up in 1969 to produce and distribute quality seeds.

(ii) Use of larger Amount of Chemical Fertilisers

Since HYV seeds were much responsive to fertiliser intake, the farmers had to use larger amount of fertilisers (Nitrate, Phosphate and Potassium compounds) to increase agricultural productivity. The massive subsidies on fertiliser given by government has made possible the cheap availability of fertiliser and increase in its use by the farmers.

(iii) Use of Pesticides

Since HYV seeds were highly prone to pests and weed, larger amount of pesticides and weed killers were used for the success of green revolution.

(iv) Expansion of Irrigation Facilities

The most crucial element of the new technology being water, emphasis was laid on the extension of irrigation facility (ground water as well as surface water) throughout the country. Expansion of irrigation facilities gave a boost to green revolution.

(v) Use of Modern Agricultural Implements

Use of modern farm implements like tractor, power tiller, pump set, sowing machine, harvestor, threshing machine etc. by the farmers led to the growth of agricultural productivity and thus facilitated green revolution.

(vi) Improvement in Agricultural Practices

The government and the agricultural universities have taken up extension programmes. As a result farmers gained the knowledge of making an optimal use of HYV seeds, fertiliser, pesticide and water to raise productivity.

(vii) Availability of Institutional Credit

Establishment of co-operative credit societies, co-operative banks, nationalisation of the commercial banks, establishment of Regional Rural Banks etc. in the country have facilitated the availability of cheap credit to the farmers. Easy and cheap institutional credit have encouraged the farmers to invest more in agriculture resulting in higher productivity.

(viii) Price Support Policy

In order to encourage the farmers to produce more output, government of India introduced fixing of minimum support price of foodgrains throughout the country in 1964. Since then the FCI and other government agencies are purchasing foodgrains from the farmers at the government determined prices.

Impact of Green Revolution

Contribution of green revolution to the Indian economy is immense. India owes its present position of self sufficiency in foodgrains to green revolution. States like Punjab and Haryana have become prosperous due to green revolution.

Favourable Impact: Green revolution produced remarked impact on the agricultural economy through out the country.

(i) Use of New and Modern Inputs

One very important consequence of green revolution is that traditional inputs have given way to new and modern inputs such as HYV seeds and chemical fertilisers. The amount of land put to HYV cultivation in 1951 was negligible, but in 2014-15 more than 53 per cent of total cultivated land were put to HYV cultivation. Similarly in 1950-51, only 0.5kg of fertilizer per hectare was used, but consumption of fertilizer increased to 105kg per hectare in 2014-15.

(ii) Spectacular Increase in Productivity in respect of some Food grains

The new technology has brought about an impressive increase in productivity of land in respect of food grains, particularly rice and wheat. In 1967-68 yield of rice per hectare was only 7.83 quintals, but in 2014-15 it has gone up to 23.9 quintals. This implies that yield of rice has gone up by about 3 times in the post-green revolution period. Similarly, yield of wheat per hectare has gone up from 8.3 quintals to 28.72 quintals during the same period. Thus, yield of wheat has gone up by about 3.5 times in the post-green revolution period. Total food grain production as well as yield of different food grains per hectare from 1965-66 to 2014-15 are shown in Table - 2.2.

(iii) Significant Increase in Production of Foodgrains

The major achievement of the green revolution is the significant increase in production of foodgrains, particularly wheat. Total foodgrains production increased from 72.4 million tonnes in 1965-66 to 257.1 million tonnes in 2014-15. The contribution of wheat to this increase was significant. Production of wheat increased by about 9 times

from 10.4 million tonnes in 1965-66 to 88.9 million tonnes in 2014-15. Production of rice also registered a rise by about 3 times from 35 million tonnes in 1965-66 to 104.8 million tonnes in 2014-15. This shows that even though rice continues to be the most dominant cereal in the country, wheat is catching up fast. Data relating to output of food grains and commercial crops are shown in Table - 2.2.

(iv) Increase In the Production of Commercial Crops

Although in the initial years of green revolution there was not significant improvement in production of commercial crops, after 1973-74 improvement in output was considerable in case of sugar cane and oil seeds, as seen from Table - 2.2.

Table-2.2: Production of Food Grains and Commercial Crops (in million tonnes)

Crops	1965-66	2014-15
Rice	35	104.8
Wheat	10.4	88.9
Total Food grains	72.4	257.1
Sugar cane	110	359.3
Oil Seeds	7	27.7

Source: Economic Survey (2015-16), Government of India

In 1965-66, sugar cane output was only 110 million tonnes, but in 2014-15 it rose to 359.3 million tonnes. Similarly production of oil seeds increased from 7 million tonnes to 27.7 million tonnes during the same period.

(v) Significant Changes in Cropping Pattern

Cropping pattern refers to the distribution of total cultivated land among different crops in a year. At the time of independence cropping pattern was traditional. A larger proportion of total land was used for growing food crops and smaller proportion for non-food crops. After green revolution, there has been diversification of cropping pattern.

Proportion of total land put to non-food crops is showing a rising trend after green revolution.

(vi) Increase in Cropping Intensity

Cropping Intensity refers to the number of times by which a unit of land is put to cultivation in a single year.

$$\text{Index of cropping Intensity} = \frac{GCA}{NSA} \times 100$$

Here, GCA = Gross Cultivated Area

NSA = Net Sown Area

In view of the introduction of short duration crops and extension of irrigation facilities, now the same piece of land is cultivated more than once during a single year leading to increase in cropping intensity. Although total land area has remained more or less constant, due to increase in cropping intensity there has been remarkable growth of agricultural production during the post-green revolution period.

(vii) Increase in Marketed Surplus and Foodgrain Consumption

Marketed surplus of foodgrains is showing a rising trend due to increase in their production during the post-green revolution period. Per capita consumption of certain food grains is also increasing.

(viii) Increase in Employment

The adoption of new technology has given a boost to employment in agriculture because of diverse job opportunities created due to multiple cropping and consequent increase in cropping intensity.

Unfavourable Impact

Despite its spectacular achievements in respect of growth of output and yield, the green revolution has several weaknesses which need to be looked into.

(i) Confined to Limited Area

One of the major areas of concern is that the green revolution has not spread widely region-wise as well as crop-wise. Region-wise, it is confined to north-western states like Punjab, Haryana, Western U.P and some pockets of south. In eastern and north eastern states with negligible irrigation facilities, the impact of green revolution is yet to be felt.

(ii) Confined to a Few Crops

The green revolution is confined to a few crops like wheat and rice. Rice production has increased 3 times and, wheat production has increased by 9 times during the post-green revolution period. Wheat is the only crop which has benefited the most due to green revolution. So green revolution is called 'wheat revolution'. Cash crops, particularly pulses, are not covered extensively under green revolution. Vegetables are not produced in sufficient quantities to meet the growing demand in the country.

(iii) Instability in Growth of Agricultural Output

Although production of foodgrains in India is showing a rising trend during post-green revolution period, such growth is not stable. Growth is unstable due to the fact that even today more than 50 per cent of land in our country are rain-fed. Due to the irregular and erratic monsoon, there is year-to-year fluctuation in agricultural output which affects income of the poor.

(iv) Increase in Inequality

Green revolution has led to accentuation of inequalities in the distribution of income both region-wise and farmer class-wise. Income of north-western states like Punjab, Haryana, Western U.P. and some southern states like Andhra Pradesh and Tamil Nadu increased due to adoption of new technology, but income of other States has remained more or less constant. Similarly, income of the rich farmers who were able to adopt the new technological package early experienced rapid growth of income. But income of the small and marginal farmers has not gone up much.

(v) Growth of Capitalist Farming

The new agricultural strategy necessitated heavy investment in HYV seeds, fertilisers, pesticides and irrigation facilities. These heavy investments are beyond the reach of small and marginal farmers. Only the big farm households which constitute 6 per cent of the total households and own 40 per cent of total cultivated land in the country are making large investment in irrigation, purchase of HYV seeds, fertilisers and pesticides. Thus the new technology has helped the growth of capitalist farming in India and has led to concentration of wealth in a few hands.

(vi) Innovation

Green revolution has involved in two types of innovations:

(a) Biological innovation

(b) Mechanical innovation

Biological innovation which shortened the crop maturity period had the potential for increasing farm employment because of double and multiple cropping. But mechanical innovation, i.e., the use of tractors, harvestors, threshers, pumpsets etc. resulted in displacement of labour and thus stood on the way of increasing the prospect of labour employment.

An examination of the strengths and weaknesses of green revolution leads to the conclusion that though it has led to a spectacular growth of food grain production and has enabled the country to achieve self-sufficiency in foodgrains, particularly in cereals, it has failed to meet the pulses requirements in the country as well as to achieve equity which is the avowed goal of public policy.

2.1.6 Present Agricultural Situation

Agriculture provides much more than food. It is the source of livelihood for majority of Indians. It is the engine of growth for the larger economy.

In view of the importance of agriculture in the Indian economy, it is worthwhile to know the present agricultural situation and identify the challenges which the sector is presently facing and to find the solution.

To start with, a brief profile of the present state of Indian agriculture is depicted below:

(1) **Heavy Dependence on Agriculture:** According to an estimate made by National Sample Survey Organisation (NSSO), 48.9 per cent of labour force in the country are depending on agriculture for earning their livelihood through employment. Since dependence on agriculture is much higher compared to industrial sector (24.3 per cent) and sevices sector (26.9 per cent) agriculture is regarded as the most dominant sector in the Indian economy.

(2) **Contribution to GDP:** Although about half of the labour force of the country depend on agriculture, its share in the country's GDP is only 17.4 per cent in 2014-15. Therefore, per capita income of the people depending on agriculture is low and they are very poor.

(3) **Low Growth Rate:** The experience of the last one and a half decades in the field of growth of agricultural output is not encouraging. Agricultural GDP growth rate was 2.5 per cent in the Ninth Plan, 2.4 per cent in the Tenth Plan and 3.2 per cent in he Eleventh Plan against target annual average growth rate of 4 per cent. In 2012-13, 2013-14 and 2014-15 rates of growth of agricultural GDP have been 1.2 per cent, 3.7 per cent and 1.1 per cent. Such lukelustre growth in agricultural output is due to low capital investment, obsolete technology, and shortage of basic inputs such as water, fertiliser, seed and energy.

(4) **Volume of Production:** There has been massive increase in food grain production in the country because of green revolution. Food grain production in the country was at a record level (264.8 million tonnes) in 2013-14. However it came down to 257.1 million tonnes in 2014-15.

Table-2.3 presents data relating to the ten most important agricultural produce in India by economic value in 2010. Average productivity of India's farms for each produce is also given in the table. For the sake of comparison, the yield of the most productive farms in the world and name of the country where the most productive farms existed in 2010 have also been shown.

Table-2.3: Agriculture in India - Largest Crops by Economic Value

Rank	Produce	Economic value in terms of US$ billion (at 2009 prices)	Unit Price (US$/Kg)	Average Yield in India (tons/Ha)	World's Most Productive Farms	
					Yield	Country
1	Rice	35.74	0.27	3.3	10.8	Australia
2	Buffallo Milk	25.07	0.4	1.7	1.9	Pakistan
3	Cow Milk	14.09	0.31	1.2	10.3	Israel
4	Wheat	12.13	0.15	2.8	8.9	Natherland
5	Sugar cane	8.16	0.03	66	125	Peru
6	Mangoes	8.12	0.6	6.3	40.6	Cape Verde
7	Bananas	7.60	0.28	37.8	59.3	Indonesia
8	Cotton	5.81	1.43	1.6	4.6	Israel
9	Potato	5.31	0.5	19.9	44.3	USA
10	Fresh Vegetables	5.28	0.19	13.4	76.8	USA

Source: FAO, United Nations Organisation

According to Food and Agricultural organisation (FAO), India is the largest producer of fresh fruit, lemons and limes, buffalo milk, castor oil seed, sunflower seed, millet, spices, jute, mangoes, guavas, pulses, indigenous buffalo meat, fruit, ginger, chick peas, papayas, chillies, peppers and goat milk.

(5) Slow Increase in Productivity of Commercial Crops : It has been stated earlier that green revolution has brought about an impressive increase in productivity in respect of some food grains, particularly wheat and paddy. But in case of some important crops such as pulses, sugar cane and cotton, production per hectare is increasing very slowly. Table - 2.4 makes this point clear.

Table-2.4 : Productivity of some important crops (Qtl. per hectare)

Sl. No.	Crop	1970-71 to 1979-80	1980-81 to 1989-90	1990-91 to 1999-2000	2000-01 to 2009-10	2010-11	2013-14	2014-15
1	Paddy	11.33	13.36	17.40	19.01	22.39	24.24	23.9
2	Wheat	13.07	16.30	22.81	27.08	29.89	30.75	28.72
3	Pulses	5.24	4.73	5.28	5.44	6.91	7.64	7.44
4	Sugar cane (Ton/Hectare)	48	58	65	69	70	71	70
5	Tea	11.82	14.92	17.94	16.73	17.12	21.70	21.70
6	Cotton	1.6	1.52	2.25	1.9	4.99	5.1	4.61

Source : Economic Survey (2015-16), Government of India.

Similarly, increase in yield in case of vegetables, root and tuber, fruit and nut etc. over the years is very small. In view of the slow rise in production of these food crops in relation to demand, their prices are rising.

(6) Low Capital Formation and Low Investment in Agriculture: Gross capital formation in agriculture as percentage of total agricultural output is very low. For example, in 2004-05 gross capital formation in agriculture was only 13.5 per cent of agri-GDP. Although in 2010-11, it went up to 20.1 per cent, it came down to 14.8 per cent in 2013-14. Similarly, investment in agriculture as percentage of GDP is quite small in India. During the Ninth Five Year Plan (1997-2002) only 4 per cent of the plan outlay was earmarked for investment in agriculture. During the Tenth Five Year Plan 3.9 per cent and during the Eleventh Five Year Plan only 3.7 per cent of total plan outlay was earmarked for investment in agriculture.

This is an important cause of slow growth of agricultural production.

(7) Inadequate Spread of Modern Agriculture: Only 53 per cent of total cultivated land in the country is under the use of HYV seeds. Indian farmers apply only 105 kg of fertiliser per hectare which is much less compared to the developed

countries. Only 49.8 per cent of total cultivated land in India are irrigated. Therefore, cropping intensity in India is very low.

(8) Total Land Area and Area under Food grain Cultivation: India's arable land area of 159.7 million hectares is the second largest in the world, after USA. Food grains cover about 70 per cent and non foodgrains about 30 per cent of total land under cultivation. Table - 2.5 shows data relating to area under food grain cultivation in India from 2006-07 to 2014-15.

Table-2.5: Area Under Food grain Cultivation (Million hectares)

Year	Area under Foodgrain cultivation
2006-07	123.7
2007-08	124.1
2008-09	122.8
2009-10	121.3
2010-11	126.7
2011-12	124.8
2012-13	120.8
2013-14	126.1
2014-15	122.1

Source: Economic Survey (2015-16), Government of India.

It may be seen from the table that upto 2009-10, except 2007-08, area under food grain cultivation in the country was falling. In 2010-11, it increased to 126.7 million hectares but again it came down thereafter. In 2014-15, 122.1 million hectares of land were put to food grain production.

(9) Irrigated Area: India's gross irrigated area of 82.6 million hectares is the largest in the world. At present about 49.8 per cent of total land under cultivation are irrigated.

(10) Contribution to Exports: Agriculture's contribution to export earning of India is approximately 12 per cent.

Challanges before the Government

Addressing welfare of agricultural producers and consumers simultaneously is a big challenge before the government. On one hand, it is necessary to ensure that 'right quantities of food items' are there in the common man's food basket for nutritional security. On the other hand, the government has to ensure that farmers realize better returns. It is felt that inclusive growth and nutritional security can not be achieved unless growth in agriculture is increased to 4 per cent per annum. To achieve this target the following steps need to be taken at the right earnest.

(i) Incentives must be given to the farmers in terms of better prices for their produce to encourage them for producing more. In most of the eastern states like UP, Bihar, Jharkhand, West Bengal, Assam and Odisha, where there is record crop production, paddy is being sold away below the minimum support price (MSP). Farmers feel frustrated and complain of slow or no procurement, and collusion between procurement agencies and rice millers/traders. Government must take steps to create sufficient infrastructure to reach farmers, and create adequate marketing network that can ensure at least MSP to farmers. A marketing revolution needs to precede the second green revolution.

(ii) Sufficient investment in agriculture must be made. When farmers get better returns for their produce, they will like to produce more and thus there will be increase in private investment in agriculture. But there are critical areas where government has to take a lead: rural roads, public irrigation and marketing infrastructure including storage facilities. Gujarat has done much of this, for which it has achieved almost 9 percent agricultural growth per annum.

(iii) There must be formation of producers' (farmers') organisations. Institutional reforms such as free movement of agri-commodities across India, uniform and low taxation on primary commodities, reforms in Agricultural Procurement and Marketing of Commodities are some of the reforms needed to get Indian agriculture past the 4 per cent growth barrier.

(iv) There must be expansion of acrage under irrigation along with adoption of appropriate technology for efficient utilisation of water. According to the Task Force on Agriculture (NITI Aayog, 2015) conventional system of irrigation results in wastage of water. Therefore, introduction of microirrigation technology, sprinkler irrigation and drip irrigation is essential for efficient use of water.

(v) There must be increase in production and use of appropriate farm equipment for extensive farm mechanisation.

(vi) There must be increase in production and supply of quality seeds (resistant to pests, moisture variation, drought etc.) through Seed Development Corporation.

(vii) Instead of using huge amount of urea, farmers should be encouraged to use larger amount of bio-fertiliser.

(viii) 40 per cent of credit to agriculture comes from private sources. Government should take steps for improvement of the credit flow to agriculture from institutional sources at lower interest rate.

2.2 INDUSTRY

Introduction

Industries play a vital role in stimulating the pace of economic development of a country. It is noticed that countries which are industrially developed are economically developed and countries which are industrially backward are economically underdeveloped. Thus there is a high degree of correlation between industrial development and economic development of a country.

2.2.1 Importance of Industrialisation

Industrialisation is the process of setting up of large number of different kinds of industries in different parts of the country. As in the case of developed countries, rapid industrialisation is the sine qua non for rapid economic progress of the Indian economy. The following discussion makes this point clear:

1. **Utilisation of the Available Natural Resources:** India is endowed with huge amount of natural resources such as land, water, minerals like iron ore, manganese, bauxite, coal, mica etc., and forest resources. Unfortunately, these resources remain either unutilized or underutilised. Development of industrial sector can play a very important role in utilisation of these resources and help in increasing national product and per capita output.

2. **Significant Contribution to Country's GDP:** Industrial development provides a strong and sustainable infrastructure for rapid increase in income. Higher level of income and rapid economic development are found to be strongly correlated. Contribution of industrial sector to India's GDP is significant. Further, share of industry in GDP is showing a rising trend since the inception of planning in 1951 in the country as can be seen from the contribution of secondary sector. For example, in 1950-51, its share in India's GDP was only 14.8 per cent. It increased to 23.7 per cent in 1980-81 and 26.5 per cent in 2001-02. In 2014-15, contribution of industry to the country's GDP stands at 29.7 per cent. The share of manufacturing in GDP was of the order of 8.9%, 13.8%, 16.8% and 18.8% in 1950-51, 1980-81, 2001-02 and 2014–15 respectively. According to the World Bank, India's industrial mannufacturing GDP in 2015 was the largest in the world in terms of US dollar ($559 billion) Though industry's contribution to GDP is increasing over the years, it is much less compared to that of the developed countries.

3. **Contribution to Employment:** Industry is also a very important source of employment in the Indian economy. Further, contribution of industrial sector to total employment in the country is showing a rising trend. In 1950-51, only 10.7 per cent of the labour force in the country were absorbed in industrial sector, but in 1999-2000 this figure increased to 17.5 per cent. In 2013-14, 24.3 per cent of labour force were found to be engaged in industrial sector. Massive unemployment problem in India is mainly caused due to limited degree of industrialisation. The problems of unemployment, under employment and disguised unemployment can be tackled if large number of labour-intensive industries are set up in the country.

4. **Contribution to Gross Domestic Fixed Capital Formation:** Economic growth of the country depends upon the volume of capital formation or investment. Industrial sector makes a significant contribution to enhancing India's gross domestic fixed capital formation. Share of industrial sector in the gross domestic capital formation of the country was only 22.1 per cent in 1950.51. But in 2011-12 this figure went up to around 37.3 per cent which further increased to 38.4 per cent in 2013-14. Thus, industrial sector is playing an important role in accelerating India's growth rate.

5. **Alleviation of Poverty:** One of the biggest problems which Indian economy is facing today is massive poverty. According to a recent estimate made by the Planning Commission, 21.9 per cent of India's population are living below the poverty line. Although several factors are responsible for such massive poverty in the country, the most dominant one is widespread unemployment. Alleviation of poverty is possible by creating employment opportunities in the industrial sector through establishment of small, medium and cottage industries which are labour-intensive in nature.

6. **Reduction of Inequity in the Distribution of Income:** Indian economy is characterised by the presence of extreme inequality in the distribution of income. Such inequality can be reduced if a large number of small, medium and cottage industries are set up in the country for providing employment and generating income for those who do not have access to employment.

7. **Reduction of Regional Imbalances:** Industrial development in the underdeveloped and backward regions of the country could help in correcting regional imbalances. It is found that many areas of the country are underdeveloped despite the availability of adequate mineral resources, cheap labour and other favourable factors. Establishment of industries in these areas necessitates creation of economic infrastructure facilities such as transport and communication which can help in reduction of regional inequality necessary for stimulating overall development of the country.

8. **Development of Agriculture Sector:** Industrialisation promotes development of agriculture in the following manner:

   (i) Market Contribution: Industry provides market to agriculture sector. Agricultural output such as sugar cane, oil seeds, raw cotton, jute, wheat etc. are used as inputs in sugar, oil, textile, jute and flour mills respectively. Therefore demand for agricultural goods increases due to rapid industrialisation and this helps in agricultural growth.

   (ii) Supply of Modern inputs: Industries provide modern inputs like chemical fertilizer, pesticides, tractors, harvesters, threshers, sowing machines etc. for use in agriculture sector. Through provision of these inputs industrial sector helps in agricultural development of the country.

9. **Self-Sufficiency:** It is not advisable for a country to depend too much on foreign countries for industrial products. Heavy dependence on imports harms autonomy and results in deficit in the country's balance of payments and puts pressure on the foreign exchange reserves. Therefore, the country must be self-sufficient in the field of industrial products by stimulating industrial development.

10. **Contribution to Export:** Industries can also play an important role in augmenting the country's exports. In India, a large part of exports consists of industrial products such as refined petroleum, textiles, jute products, engineering goods, etc.

11. **Strengthening Country's Defence:** Industrialisation enables the country to produce defence equipment inside the country which is very much necessary for ensuring the country's security and safety.

12. **Strengthening the Economy:** Industrialisation has played a vital role in building a strong foundation for the Indian economy. First, it has strengthened the country's economic infrastructure by facilitating the development of railways, roads, dams etc. Second, it has facilitated improvement in productivity through the use of capital intensive technology in production of goods by increasing production of machines, tools, equipment and other capital goods.

2.2.2 Industrial Policy

Realising the importance of industrialisation as the main driver of economic development, soon after independence, government of India decided to formulate industrial policy to stimulate industrial development in the country. Industrial Policy refers to the rules, regulations and principles formulated by the government in respect of ownership, operation and regulation of industries. It defines clearly the extent of participation of the State and area of operation of private sector in the field of industrial development. Industrial policy constitutes an important component of the broad economic policy of the government to realise the desired objectives.

2.2.2.1 Industrial Policy Resolution 1948

The first Industrial Policy Resolution (IPR) was adopted by the government of India on April 6, 1948.

IPR 1948 has the following features:

(1) It contemplated a mixed economy with both public sector and private sector on the industrial front.

(2) Division of the industries: This policy divided the various industries of the country into four broad categories:

Category - I State ownership: In the first category, industries engaged in the manufacture of arms and ammunition, the production and control of atomic energy and ownership and management of railway transport were included. These industries were under the exclusive ownership of the State.

Category - II Basic and Key Industries: The second category included the basic and key industries such as coal, iron and steel, air craft manufacture, ship-building, manufacture of telephone, telegraphs and wireless sets and mineral industries. In this category, the existing units of such industries would continue in the private sector, but the new ones will be set up only by the government.

Category - III Regulated Industries: The third category included 20 important industries which were allowed to continue in the private sector but under strict

supervision of the government. These are the industries which produce salt, automobiles, tractors, heavy chemicals, machine tools, fertilizers, electro-chemicals, heavy engineering, cotton and woolen textiles, sugar, paper, cement, newsprint, air and sea transport, minerals etc.

Category - IV Private Industries: All industries not covered by the above three categories will be allowed to operate in the private sector.

(3) This industrial policy laid emphasis on the development of cottage and small scale industries.

(4) Importance was given on sound industrial relation between management and labour.

(5) The policy recognized the need for participation of foreign capital in Indian industries for enhancing the pace of industrialisation.

But there was a need to formulate a new industrial policy in view of certain developments in the economic and political life of the country during 1948 to 1956. These developments were:

(i) Adoption of the constitution of India in 1950.

(ii) Commencement of the Second Five Year Plan.

(iii) Acceptance of "the socialistic pattern of society" as the goal of the country's socio-economic policy.

In the light of these developments, government of India introduced a new industrial policy in 1956.

2.2.2.2 Industrial Policy Resolution 1956

The IPR-1956 is the systematic approach for rapid industrialisation of the country. This is also referred to as the "economic constitution of India". The main features of the policy are discussed below:

(i) New classification of Industries: The IPR-1956 classified the industries into three broad categories. They are as follows:

(a) Schedule A: It consisted of 17 industries to be under the exclusive control of the State and the State will be responsible for their development. These industries include strategic and basic industries like arms and ammunition, atomic energy, iron and steel, heavy machinery and electrical units, generation and distribution of electricity, coal, mineral oil, railway transport, telephone etc. However, there was no threat of nationalisation to the private enterprises operating in this area.

(b) Schedule B: It included 12 industries which will be progressively State owned. The new undertakings would be established by the State while the existing units under private control would be expected to supplement the efforts of the State. These industries were fertiliser, antibiotics, machine tools, synthetic rubber, machine tools, ferro alloys, road transport and sea transport etc.

(c) Schedule C: It included the residual industries not included in schedule A and B. The present and future development of these industries were left to the initiative of the private sector subject to State regulation and control.

However, the IPR-1956 made it clear that this classification of industries into three categories is not a rigid one. In case of overriding national considerations, the State can establish industries under schedule-C, and the private sector might produce commodities in schedule A.

(ii) Small-scale and Cottage Industries: The IPR-1956 highlighted the role of small-scale and cottage industries in generation of employment, reduction of poverty and inequality. The Policy resolved to provide all types of government assistance to these industries. The State has to support these industries by restricting the volume of production in the large-scale sector, providing direct subsidies to these units and taxing these units at a lower rate.

(iii) Removal of Regional Disparities: The IPR-1956 laid emphasis on reduction of regional disparities in the field of industrial development. The public sector industries have to be developed in the backward areas and these areas were to be provided with cheap power, transport and communication facilities, banking

and insurance facilities, favourable monetary and fiscal policies for the development of industries.

(iv) **Workers' Participation in Management:** The policy emphasised a healthy relationship between trade unions and management. The Government believed that an improvement in the economic condition of the labourers will increase their efficiency and consequently there will be increase in their contribution to industrial production. The management has to take into account the problems of labour force and take steps to solve them. For this, participation of leaders of trade unions in management was emphasised.

(v) **Role of Foreign Capital:** In view of the paucity of domestic capital, the role of foreign capital including foreign technology was duly emphasised. The policy resolved to give fair and non-discriminatory treatment to foreign investors.

(vi) **Reduction of Concentration of Economic Power:** The policy further resolved to reduce the growth of monopoly and concentration of economic power in the field of industrialisation for reduction of inequality. Several laws were enacted in this regard.

(vii) **Fair and Non-discriminatory treatment to Private Sector:** The IPR 1956 made adequate provision for facilitating and encouraging the private sector in accordance with the programmes and policies of the five year plans. The private sector would be provided with transport and communication facilities as well as monetary and fiscal incentives for its expansion and growth. Further, the state would continue to provide fair and non-discriminatory treatment to private sector enterprises.

Inspite of its comprehensive approach, the IPR 1956 suffered from the following shortcomings:

(a) The policy gave too much emphasis on the establishment of capital intensive heavy industries for which the country faced acute shortage of capital.

(b) The small-scale and cottage industries did not receive adequate attention. As a result, problems of unemployment, inequality and regional imbalances aggravated.

(c) The performance of public sector units was far from satisfactory.

(d) Private sector was subject to much of government control. Too much government control and regulation led to corruption and inefficiency.

(e) The problems of poverty and unemployment became acute, so also the balance of payment difficulties.

To address these problems, government of India reformulated the industrial policy in 1977 and again in 1981. However, a new industrial policy resolution was launched in 1991.

2.2.2.3 Industrial Policy Resolution (IPR) 1991

Indian economy experienced significant changes during the 1980s. The efficiency and confidence of private sector increased and the private sector industries were able to adopt the better techniques of production to produce goods at a lower cost, but performance of public sector enterprises, excepting a few was not satisfactory. Therefore, there was need to expand private sector. During the period 1990-91 the country faced a severe crisis both on the internal front and on the external front. There was large fiscal deficit (8.4 percent of GDP) and annual inflation rate was 12 percent. The foreign exchange reserves of the country declined to a record low level and the country was not in a position to honour her external payment obligation and even finance its imports. The country was compelled to mortgage gold in the Bank of England to get foreign exchange. It is in this situation, the Congress party came to power with Mr. P.V. Narasimha Rao as the Prime Minister who selected Dr. Manmohan Singh as the Finance Minister. Under their able guidance and leadership, the country announced a New Economic Policy in 1991. The Industrial Policy 1991, is a part of this New Economic Policy.

Main objectives of IPR 1991

The main objectives of IPR 1991 are the following:

(i) To free the Indian industries from the cobwebs of unnecessary bureaucratic control.

(ii) To remove restrictions on foreign investments and free the domestic investments from monopoly legislation.

(iii) To integrate the domestic economy with the world economy for improving competitiveness of Indian industries.

(iv) To reduce the load of public sector enterprises because their performance was not satisfactory.

To achieve these objectives, government announced several changes in the following fields : (1) Public Sector (2) Industrial Licence, (3) Foreign Investment, (4) Foreign Technology, (5) MRTP Act.

Salient Features: The main features of the IPR 1991 are as follows:

(i) Dereservation of Public Sector Industries: The New Industrial Policy, 1991 dereserved nine out of seventeen industries earmarked for public sector in 1956 Policy to ensure the participation of the private sector in the important segments of the economy. Thus the number of industries reserved for the public sector was reduced from 17 to 8 and subsequently to 6. At present there are only 3 industries which are reserved for public sector. Further, the Government decided to disinvest a part of its huge investment locked in the public sector undertakings. This was expected to increase the capital earning of the state. The policy also emphasised to withdraw investment from all such Public Sector Undertakings (PSUs) which made little use of advanced technology and were becoming socially irrelevant.

(ii) Industrial Licensing: The policy abolished licensing for all excepting 18 industries which were concerned to environmental problems and later on to 15. Consequently 80 per cent of Indian industries were not required to obtain licence.

All restrictions on expansion and modernisation were removed. The objective was to make the private sector free to operate without any State intervention. At present, there are only 6 industries producing alcohol, cigarettes, hazardous chemicals, defence equipment, industrial explosives and chemicals which remain under the purview of industrial licensing.

(iii) **Foreign Investment:** The policy encouraged foreign investment in the Indian industries. It provided automatic approval of direct foreign investment up to 51 per cent of equity in 34 high priority industries. The objective was to make the Indian industries more competitive and to promote exports.

(iv) **Foreign Technology:** The policy provided automatic approval of foreign technology to 34 high priority industries. The intention was to adopt better techniques of production on part of these industries to increase efficiency and produce goods at lower cost. Further no prior clearance would be needed for hiring of foreign techniques and testing of indigenous technology in foreign countries.

(v) **Amendment of MRTP Act:** The Monopoly and Restrictive Trade Practices (MRTP) Act was amended to provide incentive to the industrial houses for further expansion. The policy removed the asset limits of the companies covered under MRTP Act.

(vi) **Location of Industries:** The new policy required no permission for setting up of industries in big cities having less than one million population. For the cities having population more than one million, non-polluting industries have to be set up more than 25 kms away from the city's periphery.

(vii) **Small Scale Industries:** The new policy also emphasised the promotion of small scale industries through financial and marketing support. Government will make provision for supply of raw materials and marketing support to them. The policy allowed other non-SSI units to hold equity up to 24 per cent of the total share holding for providing finance to the small scale units. Small Industries Development Organisation (SIDO) was created to promote the export of small scale units. The investment limit in plant and machinery in the tiny sector units increased from Rs. 5 lakh to Rs. 25 lakh.

(viii) Free Access to Capital Market: Private enterprises can have free access to capital market. The New Industrial Policy, 1991 is based on the principles of liberalization, privatization and globalization (LPG) of the Indian economy. The private sector has been given its due importance in the industrial development and the necessary corrective steps are taken to improve the efficiency of the public sector units.

Assessment of the IPR 1991

Since 25 years have already passed after adoption of IPR 1991, it is worthwhile to make an appraisal of its achievements and failures.

Achievements

(1) There has been significant increase in growth of GDP since 1991. The average annual growth rate of GDP was 5.4 per cent during the period 1980 to 1990-91. It increased to 5.8 per cent during 1990-91 to 2000-01 and further to 7.6 per cent during 2000-01 to 2007-08. Though GDP growth rate declined to 6.7 per cent in 2008-09 due to global slow down, it increased to 8.6 per cent in 2009-10 and to 8.9 per cent in 2010-11. In 2011-12, GDP growth stood at 6.5 per cent which came down to 5.1 per cent in 2012-13 but increased to 6.9 per cent in 2013-14, further to 7.4 per cent in 2014-15, and 7.5 per cent in 2015-16.

(2) There has been improvement in the performance of central sector public enterprises in terms of gross profit as percentage of capital employed, as well as net profit and value-added per unit of capital invested.

(3) There has been an increase in the flow of foreign capital to India. Total FDI inflow to India during 1991-92 to 2006-07 was US$ 136.5 billion which means that average FDI inflow per annum was only US$ 9.1 billion. In 2007-08 FDI inflow increased to US$ 24.58 billion. In 2014-15 it stood at US$ 44.9 billion.

(4) India's balance on current account has been found to be positive during the period 2001-02 to 2005-06. Since 2006-07, however, India has been facing large deficit

in current account of BOP. It was only one per cent of GDP in 2006-07. But such deficit increased to 2.8 per cent in 2009-10 due to global slowdown. It increased further to 4.2 per cent in 2011-12 and 4.7 per cent in 2012-13. However, current account deficit has come down to 1.3 per cent of GDP in 2014-15.

(5) There has been significant increase in per capita income in the country. In 2011-12, per capita income stood at ₹ 63316 which increased to ₹ 88533 in 2014-15. Rate of growth of per capita income in the country was 4.1 per cent during 2014-15.

Failures

In spite of these achievements, there are many areas of concern as stated below:

(1) There is widespread poverty in the country. About 22 per cent of population in India are living below the poverty line.

(2) There is massive unemployment in the country.

(3) Inequality in the distribution of income is widening.

(4) Flow of FDI into the country is much lower compared to other emerging economies.

(5) Rate of growth of industrial production is low. For example, rates of growth of industrial production in 2011-12, 2012-13 and 2013-14 are only 2.3 per cent, 4.5 per cent and 5.9 per cent respectively.

In view of the above failures of IPR 1991, there is need to introduce more reforms both in internal front and external front for acceleration of growth with stability. Recently Government of India has undertaken several programmes like Make in India, Ease of Doing Business, Skill India and Start up India for attracting more investment to ensure higher industrial growth. Make in India and Ease of Doing Business in India are focussing on more and faster industrial growth while start up India will turn Indian youths to job creators. It will encourage entrepreneurship, innovations and creation of revolutionary new products, that will be used by people around the world.

2.3 INFRASTRUCTURE AND ITS ROLE IN THE INDIAN ECONOMY

Introduction

Infrastructure plays a vital role in stimulating the pace of economic development of a country. As a matter of fact, there is a direct link between infrastructure and economic development of an economy. The progress and prosperity of a country is always associated with the progress of its infrastructure facilities. Infrastructure is just like the lubricating oil and wheels of an economy.

2.3.1 Meaning of Infrastructure

Infrastructure is an umbrella term for several activities. It includes public works like transport, communication, irrigation etc, as well as public utilities like power, telecommunication, water supply, sanitation, sewerage etc. It also includes facilities pertaining to health, education, and skill-formation. All these activities are of the nature of facilitating the working of an economy. Infrastructure can also be defined as the basic facilities and services without which primary and secondary sectors of an economy cannot function.

Infrastructure facilities, often referred to as economic and social overheads, consist of

(i) Energy: Coal, electricity, oil and non- conventional sources of energy.
(ii) Irrigation including flood control and command area development.
(iii) Transport: Railways, Roadways, Water ways and Airways.
(iv) Communication: Post and Telegraphs, Telephones and Broadcasting
(v) Banking, finance and insurance
(vi) Social Overheads: Health, hygiene, education and training.

2.3.2 Types of Infrastructure

Broadly, infrastructure can be categorized under two heads such as (i) economic infrastructure (or economic overheads) and (ii) social infrastructure (or social overheads)

(i) Economic Infrastructure

The basic facilities and services which directly promote the economic activity of a country are called economic infrastructure. These overheads directly facilitate the process of production and distribution in an economy. These include transport and communication,irrigation, energy, banking and finance, science and technology etc.

(ii) Social Infrastructure

The facilities and services which facilitate the functioning of an economy in an indirect manner are called social infrastructure. The facilities pertaining to health, education, skill formation etc. come under social infrastructure. These are also called Social Overhead Capital (SOC).

2.3.3 Role of Infrastructure in the Indian Economy

Infrastructure is of great importance for an economy. In the context of Indian economy its significance arises because of the following reasons.

(a) Facilitates Economic Activities

Infrastructure works as the wheels of an economy. The functioning of an economy is determined by the infrastructure facilities it provides. For example, transport and communication moves men and materials from different places to the firms and again from firms to market places and thus facilitate production, consumption and investment. Similarly, different kinds of energy are needed for the functioning of machines and factories. So, larger the infrastructure facilities, bigger are the opportunities for the producers and investors to invest and produce.

(b) Promotes Development

Infrastructure constitutes a part of the stock of capital in an economy. It helps production by linking production points with input supplies. Trade also gets a boost from infrastructure facilities. Thus infrastructure promotes development of an economy.

(c) Expands Employment and Alleviates Poverty

Infrastructure accelerates economic growth of a country and so helps in expansion of employment and alleviation of poverty. For example, in India majority of the poor people live in rural areas. Appropriate infrastructure for rural economy like roads, irrigation facilities, market yards, storage godowns, extension services etc. can help in raising farm productivity. It can also help expanding non-farm rural employment and generating income for the rural households. Thus infrastructure plays an important role in expansion of employment and alleviation of poverty.

2.3.4 Infrastructure Development in India

Infrastructure provides the backbone for both industrial and agricultural development of the country. But there are certain peculiarities of infrastructure facilities for which the private industrialists are not interested to invest in them. These are :

(i) They need huge initial investment.

(ii) These projects usually have long gestation period. So, the returns from these projects usually come after a long period of time.

(iii) They do not guarantee sufficient profits to the investors.

(iv) They have large externalities.

But provision of infrastructure facilities is a pre-condition for initiating and accelerating the process of development. Hence, the government should provide them for creating investment opportunities needed for economic development.

Indian planners are fully aware of the strong direct link between infrastructure facilities and general economic development. Accordingly, they have given high priority for the rapid expansion of these facilities right from the first plan. In each five year plan a sizeable portion of the total plan outlay has been earmarked for the creation of infrastructure facilities. As a result, there has been some increase in infrastructure facilities, which has made the country one of the promising developing economies of the world.

2.3.4.1 Development of Economic Infrastructure

Althogh there are several forms of infrastructure in our country, of these three most important forms of economic infrastructure, i.e., energy, transport and communication and two important forms of social infrastructure, i.e., education and health are very important. They are discussed below.

ENERGY

Energy is considered as an important factor affecting the economic growth of a country. Availability and use of energy is often used as an indicator of economic growth. India is a major producer as well as a consumer of energy. It ranks as the world's seventh largest energy producer and fifth largest energy consumer. But as per the World Development Indicators Report (2010), per capita consumption of commercial energy (like coal, petroleum and electricity) in India is very low compared to developed countries. For example, per capita consumption of energy in India is 13 per cent of that of Japan and only 6.8 per cent of that of U.S.A.

Sources of Energy

Energy can be broadly divided into two categories: conventional and non-conventional.

Sources of Conventional Energy

Conventional energy is of two types - commercial and non- commercial. Sources of commercial energy consist of coal, oil and natural gas and electricity. These are Commercial in the sense that they are available only at a price. Commercial energy accounts for over 50 per cent of total energy consumption in India.

Sources of non-commercial energy, consist of fire-wood, vegetable waste, dried cow-dung etc. Energy is available almost free of cost from these sources. More than 60 per cent of Indian households depend on non- commercial sources for cooking and heating purposes.

Conventional energy - both commercial and non-commercial energy is exhaustible (non renewable) with the exception of hydroelectric power. So conventional energy is called non-renewable energy. But non-conventional energy is renewable.

A brief discussion of the major commercial and non- commercial sources of energy is given below:

Sources of Commercial Energy

1. Coal and Lignite

Coal is an important source of commercial energy in India. It meets major part of commercial energy requirement of the country. It is the major source of producing electricity. Because of its importance it is called Black Diamond. Coal reserves are mainly confined to eastern and central parts of the country. Part of West-Bengal, South Bihar, Odisha, Jharkhand, Madhya Pradesh, eastern part of Maharastra and northern part of Andhra Pradesh account for 99 per cent of the total coal reserves in the country. Jharkhand has the maxmimum share (26.81 per cent) in the total reserves of coal in India (301.05 billion tonnes) followed by Odisha (24.94 per cent) as per the latest estimate made in 2014. The estimated total reserves of lignite in the country is 43.24 billion tonnes.

2. Oil and Natural Gas

Oil and natural gas, like coal, is also an important source of commercial energy in India. A sizeable portion of commercial energy requirement is met from oil and natural gas. In India total output of crude oil was just about 0.3 million tonnes till 1951. The production has considerably increased after the establishment of Oil and Natural Gas Commission (ONGC) in 1955 and Oil India Limited (OIL) in 1959. In 2000-01, crude output in the country was 32.4 million tonnes which increased to 37.2 in 2011-12 and to 168.68 million tonnes in 2014-15.

According to the latest estimate (2014), the total oil reserves in the country stood at 762.74 million tonnes, and that of natural gas at 1427.15 billion cubic meters (BCM). Annual production of crude oil is around 0.57 per cent (2013-14). Presently India is meeting only 40 per cent of its total requirement of oil from domestic sources. It is

importing the rest 60 per cent from foreign countries which involves spending of huge amount of valuable foreign exchange. This is a major factor causing imbalance in the country's balance of payments. Because of its importance petroleum is considered as 'Liquid gold'. Geographical distribution of crude indicates that maximum reserves are in the western offshore (42.91 per cent) followed by Assam (22.69 per cent), whereas the maximum reserve of natural gas are confined to Eastern offshore (37.24 per cent) followed by western offshore (30.17 per cent).

3. Electricity

Electricity is an equally important source of commercial energy like coal and oil. Life and development are hard to imagine without electricity. In general there are three sources of electric power generation in India, viz (i) Hydroelectric power (ii) Thermal power, and (iii) Nuclear power.

(i) Hydro-electric Power

It is produced through multipurpose river-valley projects by constructing dams over fast flowing rivers. Some major river valley projects are Bhakra-Nangal Project, Domodar Valley Project, Hirakud Project etc. Hydroelectricity generation in the country stood at 2.5 billion killo watt in 1950-51 which increased to 74.5 billion killo watt in 2001-02, and 134.85 billion killo watt in 2014-15. There is huge hydroelectric potential in the country. 20 per cent of the hydro-electric potential has been utilized so far and 80 per cent still remains unharnessed.

(ii) Thermal Power

Thermal power is generated by the use of coal, oil, gas as well as atomic energy. It is the major source of electricity generation in our country. Electricity generation from this source has increased from 1.1 billion killo watt in 1950-51 to 418 billion killo watt in 2001-02, and it further increased to 878.32 billion killo watt in 2014-15.

(iii) Nuclear Power

In recent years nuclear power is seen as an alternative source of commercial energy. India has vast reserves of uranium (about 70,000 tonnes) and thorium (about

360,000 tonnes). These minerals are used in captive power plants to produce nuclear energy. India has nuclear power stations at Tarapur, Kota, Kalpakam and Naroura. Electricity generated from nuclear sources stood at 6.1 billions killo watt in 1990-91, which increased to 16.9 billion killo watt in 2001-02 and 56.0 billion killo watt in 2014-15. Due to vast reserves of minerals required to produce nuclear energy, we can reasonably expect to be self-sufficient in commercial energy in near future.

There has been considerable progress in electricity generation in our country since independence. Nonethless, there is persistent shortage of electricity in our country which acts as a constraint on its economic growth. As a matter of fact, India is not really endowed with adequate amount of coal and other natural resources to generate electricity, considering its vast geographical area, growing population and increasing energy needs.

Data relating to the generation of commercial energy in India from 1950-51 to 2014-15 are presented in Table-2.6.

Table - 2.6: Commercial Energy Output from 1950-51 to 2014-15

Sl. No.	Energy Sources	Units	1950-51	1990-91	2010-11	2014-15
1	Coal	Million tonnes	32.3	212	420	494.23
2	Crude Oil	Million tonnes	0.3	13.3	37.7	27.9
3	Electricity	Billion KW	5.1	264.3	811	1048.67

Source: 1. Economic Survey (2011-12), Government of India.

2. Economic survey (2015-16), Government of India.

It is revealed from the table that there is tremendous improvement in the primary sources of commercial energy in India during the plan period. Coal output is found to be increased by 15.3 times during 1950-51 to 2014-15 and crude output by 13 times during the same period. It is also observed from the table that electricity generation from all sources has increased from 5.1 billion killo watt in 1950-51 to 1048.4 billion killo watt

in 2014-15. Nonetheless India is considered as a power deficient country because of its growing population and increasing energy needs.

Sources of Non-Commercial Energy

It has been stated earlier that non-commercial (or traditional) energy is mostly available free of cost. The important sources of non-commercial energy in India are fuel-wood, agricultural wastes and animal dung. Fuel-wood is extensively used for cooking and heating purpose in rural areas. According to the Tenth plan estimate, more than 65 per cent of total rural energy consumption comes from fuel-wood. This is partly responsible for deforestation in our country. Agricultural wastes such as straw are used as feed and fodder, roofing material, organic matter for compost making and as fuel. Similarly dried cow-dung is extensively used as fuel in rural areas. The future of non-commercial sources of energy in India is not bright because of its growing population and rising energy needs.

Sources of Non Conventional Energy / Renewable Energy

India is the first country in the world to set up a ministry named "Ministry of New and Renewable Energy" in 1982 for the promotion of renewable energy.

There is large potential for generation of renewable energy from various sources– wind, solar, biomass, small hydro, tide and wastes. The major forms of renewable energy are– wind power, solar power, biomass power, hydro power and waste to power. Total potential for renewable power genertion in the country is estimated at 896602 MW in 2014-15. This includes solar power potential of 748990 MW and wind power potential of 1,00,000 MW (69.6 per cent), small hydro power (SHP) potential of 20,000 MW (13.38 per cent) and biomass power potential of 26,800 MW (11.88 per cent).

The geographical distribution of the estimated potential of renewable power in 2014-15 reveals that Gujarat has the highest share (25.04 per cent), followed by Karnataka with 13.08 per cent share and Tamil Nadu with 11.17 per cent share mainly on account of wind power potential.

Renewable energy sources are also being used for distributed generation, lighting, pumping and motive power requirement in remote and inaccessible areas.

The different forms of renewable energy are discussed below.

1. **Wind Energy :** Wind energy can be produced by harvesting wind power. It is generally used for operating water pumps for irrigation purposes. The development of wind power in India began in the 1990s and has significantly increased in the last few years. Although a relative new comer to the wind industry compared to Denmark and US, domestic policy support for wind power has led India to become the country with the fifth largest installed wind power capacity in the world. As of 30 November, 2015, installed capacity of wind power in India was 26744 MW mainly spread across Tamil Nadu, Maharastra, Gujarat, Karnataka, Rajastan, Madhya Pradesh, Andhra Pradesh, Karala and West Bengal. Wind power accounts for 6 per cent of India's total installed power capacity and it generates 1.6 per cent of the country's capacity.

2. **Solar Energy :** India is densely populated and has high solar insulation, an ideal situation for using solar power in India.

The following major initiatives have been taken by the Government of India for generation of solar power.

- In pursuance of the Solar Parks scheme, 34 solar parks with capacity of about 22,000 MW have been sanctioned in 22 states.
- In February 2015, the government has approved a scheme for setting up of 15,000 MW of grid-connected solar PV power projects under National Solar Mission (NSM) through NTPC.
- 1,21,524 solar pumps have been sanctioned for irrigation and drinking water. Out of this, 15,500 solar pumps have been installed by January 2016.
- 56 solar city projects have been launched in the country.
- The Surya Mitra Scheme has been launched in May 2015 for creating 50,000 trained personnel within the next five years.

3. **Waste to Energy :** Every year about 55 million tonnes of municipal solid waste (MSW) and 38 billion litres of sewage are generated in the urban ares of India. In addition, large quantities of solid and liquid wastes are generated by industries. Such wastes can be used to generate energy. Waste water treatment plants in India have been installed which produce renewable energy from sewage gas. However there is significant un-tapped potential.

4. **Bio-energy:** Bio-energy is obtained from organic matter. It is of two kinds- Bio-gas and Bio-mass. Bio-gas is obtained from gobar gas plants. Gobar-gas plants not only produce gas which can be used for cooking, lighting and generating electricity, it also converts gobar (cow-dung) into manure. Similarly, bio-mass is a source of producing energy through plants and trees. Bio-mass programme encourages afforestation and so needs special attention. Total installed capacity of bio-energy (biomass and biogas) in India upto 31st November, 2015 was 4550 MW.

Government of India is taking various measures for the promotion of renewable sources of energy. These measures include:

(a) Providing budgetary support for the purpose of demonstration of various non-conventional energy projects.

(b) Extending institutional finance from Indian Renewable Energy Development Agency (IREDA) set up in 1987 and other financial institutions to commercially viable projects.

(c) Promoting private investment in new and renewable energy sources through fiscal incentives.

TRANSPORT

Transport and communication constitute the backbone of economic growth of a country. Transport, to be specific, benefits an economy in a variety of ways. It serves the final consumers by establishing a link between the places of production and markets. It facilitates production by moving raw materials, tools, machines etc. to places of production. It also helps producers by extending the size of the market. Transportation is a key-factor for the planned development of a country. It enables the

use of resources as per the priorities of plans. It spurs economic growth by providing access to remote areas for exploring resources. It helps in the development of all parts of the economy simultaneously.

In a vast country like India, transport provides the life line for social integration. It helps in getting-together of people from different regions resulting in tonning-up of the social make-up of the community. By that, it reduces the evils of caste-system and untochability. It also helps in maintaining political, cultural and administrative homogeneity. Defending the country during war and keeping vigil on its frontiers in peace require the development of all types of transport to keep the army in perpetual alert.

Modes of Transport System in India

Transport system of India can be broadly divided into four categories, viz. (a) Railways (b) Road transport, (c) Water transport and (d) Air transport.

Growth of the transport system in India since the introduction of planned economic development in 1951 is shown in Table - 2.7.

Table - 2.7: Growth of Transport System in India from 1950-51 to 2014-15

Sl. No.	Type	1950-51	1970-71	2005-06	2009-10	2014-15
1.	Railways:					
	(a) Route length (in kms)	53,600	59,800	63,300	64,000	65,808
	(b) Freight traffic in million tonnes	93	196	680	888	1058.8
2.	Roads:					
	Total length (lakh kms.)	4	9.15	27.13	4.236	52.32
3.	Shipping Ports:					
	Cargo Traffic in Million tonnes	19	-	424	562.7	1052.5
4.	Civil aviation-No. of passengers (lakh)	-	26	318	569	N.A.

Source: Economic Survey (2011-12), (2014-15), Govt. of India, Ministry of Shipping of Government of India Annual Report, 2014-15.

Note: N.A. - Not Available.

(a) Railways

Railways constitute the most important transport system in India. The first railway link in India was laid between Bombay and Thane covering a distance of 34 kms. After independence much headway has been made by Indian railways particularly since 1951, the beginning of the first plan.

Today Indian Railways constitute the third largest railway network in the world owned and operated by the Government of India. In 2014-15, it comprises 115,000 kms of track over a route of 65,808 km and 7112 stations. Indian railways holds over 1,04,999 locomotives, 66392 passenger coaches and 245,267 freight wagons. It runs 12617 passenger trains and 7412 freight trains everyday. It carried 8.397 billion passengers and 1058.8 million tons of freight in the year 2014-15 which means that it carries 25 million passengers and 2.9 million tonnes of freight per day.

Indian railways is the world's seventh largest commercial or utility employer which has employed more than 1.376 million people.

In 2014-15, Indian railways earned revenue of Rs.1634.50 billion (US$ 24 billion) which consists of Rs.1069.27 billlion from freight and Rs.402.8 billion from passenger tickets. It made a profit of Rs.157.8 billion (US$ 2.3 billion) in 2013-14.

Along with the expansion of capacity, railways have also been modernised. At present 21614 kms (32.8 per cent) of the total 65,808 kms route length of the Indian railways have been electrified.

In recent years, Indian railways have taken various measures to improve passenger amenities, infrastructure and services, and initiatives under 'Make in India', freight initiative, resource mobilisation initiative etc. High speed Train project has been approved in July 2015 to be implemented in the country with Japanese technical and financial assistance.

(b) Road Transport

Indian economy is still agrarian in character and its settlement pattern is mostly rural oriented. So road transport constitutes a critical element of the transport system.

It is very much essential for country's development, social integration and security. As compared to the railways, the road transport system has certain definite advantages as stated below :

- There is tremendous scope for generating employment through road construction and maintenance.
- Road transport is quicker, more convenient and more flexible. It is particularly good for short distance travel as well as movement of goods where rail transport is inaccessible.
- Roads are a necessary complement to railways. India is a country of villages and only roads connect villages. So road transport acts as feeder to rail transport.
- Road transport is of particular advantage to the farmers. Good roads help the farmers to move their products to mandis and towns. So roads constitute the basis of agricultural and hence rural development.
- Roads are highly significant for the defence of the country. For troops movement in emergency, and for the transport of arms etc. roadways are more important than railways.

India has a road network of 52.32 lakh km in 2014-15, the second largest network in the world. At 0.66 km of road per sq.km. of land, the quantitative density of India's road network is similar to that of USA (0.65) and higher than that of China (0.16) or Brazil (0.20). However, qualitatively India's roads are a mix of modern highways and narrow, unpaved roads which are being improved.

India's road network carries over 65 per cent of its freight and about 85 per cent of passenger traffic.

Indian roads are classified in to four categories– National Highways, State Highways, Major and other District roads, and rural roads.

Data relating to length of these four kinds of roads are shown in Table - 2.8.

Table - 2.8: Length of Different Types of Roads in India (2014)

Sl. No.	Road Type	Length (km)
1	National Highways	92,851 (1.97)
2	State Highways	1,63,898 (3.48)
3	District Roads	17,05,706 (36.20)
4.	Rural Roads	27,49,805 (58.35)
	Total	47,122,60 (100.00)

Source : Economic Survey (2014-15), Govt. of India

Note : Figures in parantheses representage to total

(i) **National High ways :** National Highways constitute the main road transport of the country. These roads connect different state capitals, ports and big cities of the country. National Highways in the country cover a total length of 1,00,475km. in 2014-15, which constitute 1.97 per cent of the length of the total road system. Nearly 40 per cent of goods and passenger traffic are carried by National Highways. Construction and maintenance of these roads are the responsiblity of the Central Government.

(ii) **State High Ways :** These are the main roads of the states, which connect the State Capital with cities and towns of the State. These roads are maintained by the State Government. The state highways account for nearly 1,63,898 kms. which constitute about 3.48 per cent of the total length of roads.

(iii) **District Roads:** These roads connect district head-quarters with different production locations and mandis as well as with state highways or national highways. District roads are maintained by the district authorities out of the state government funds. Length of district roads is 17,05,706 kms which constitute 36.20 per cent of the total road network in the country. These also connect Block headquarters and rural areas to district headquarters in the state of the total road length in the country.

(iv) **Rural Roads:** Rural roads in India form a substantial portion (58.35 per cent) of the total road length of the country. These roads connect different villages, panchayat and block headquarters and district roads. They are in poor shape, affecting the rural population's quality of life and Indian farmers' ability to transfer produce to market after harvest. For development of these rural roads, Pradhan Mantri Gram Sadak Yojana was launched in December 2000 by the Government of India to provide connectivity to unconnected rural habitations. Besides Pradhan Mantri Gram Sadak Yojana, there is another programme called Bharat Nirman Yojana under which all season, single lane, paved asphalted roads are constructed which connect rural and remote areas.

(c) Water Transport

Though not fully developed, water transport in India is still important and has a large potential. At one time in the past, river and canal transport played an important part in the transport system of the country. But gradually, due to the importance given on rail and road transport systems, water transport could not grow to its full potential.

Water transport is considered superior to rail and road transport because of the following:

- The Cheapest : Water transport is considered to be the cheapest mode of transport, because it involves no cost as nature provides ready made routes. Besides, due to the availability of large space in ships, per unit freight charge is much smaller compared to other modes of transport.
- Larger Capacity and Flexibility:

  Water transport has large capacity to carry bulky and heavy goods in comparison to other modes of transport. Besides, there is a lot of flexibility in ships to accommodate a large number of varieties of cargo.
- Long Distance and Large Volumes : For transporting goods over long distance as in the case of international trade, water ways constitute the only mode of transport.
- Special Significance : With large river systems and long coastline, water transport is of special significance in India. India being a capital scarce country, special

attention should be given to develop water transport, compared to rail or road transport.

There are two kinds of water transport - Inland water transport (IWT) or river transport and Coastal or Marine transport.

(i) Inland Water Transport (IWT)

Inland water transport is the cheapest mode of transport for certain kinds of traffic both for long and short distances, provided the points of origin and destination are located on water front. It is the most energy-efficient mode of transport and virtually needs no investment. IWT is also a labour intensive mode of transport and benefits the weaker sections of the society. The only requirement for this mode of transport is navigable water.

Inspite of the merits of IWT, its progress as a mode of transport in India is not upto mark. This is because of the emphasis placed on rail and road transport systems and diversion of river water for irrigation purposes. As a result, IWT forms a very small part of the total transport network of the country. However, in recent years various actions are being taken to develop IWT infrastructure and the focus is on Cargo-related projects. A significant step in creation of IWT infrastructure is implementation of Jal Marg Vikas Project with World Bank assistance.

(ii) Coastal / Marine Transport

India has a long coast line of 7516 kms. with 11 major and 148 minor working ports and a vast hinterland. Before independence Indian shipping companies did not succeed because of severe competition from foreign shipping companies and lack of support from the foreign rulers in India. At the time of independence, there were only 42 ships with only 19 million tonnes of cargo traffic. It is only after independence that Indian shipping became dominant in India's coastal trade. In 2014-15, cargo traffic in both major and non-major ports increased to 1052.5 million tonnes. At present, Indian shipping accounts for only one per cent of the total world fleet.

Government participation in the development of shipping has been remarkable since independence. Now there are 66 shipping companies in the country, of which 16 are exclusively engaged in coastal trade, 43 in the overseas trade and 7 both in coastal and overseas trade. India has four major ship-building yards at Visakhapatanam, Kolkata, Mumbai and Cochin.

Handling of larger amout of cargo requires substantial capacity expansion and augmentation in major and minor ports of the country. Besides, adequate rail-road connectivity of ports with the hinterland is also of crucial importance.

(d) Air Transport

Air transport is the fastest mode of transport. It is usually known as civil aviation and it not only saves time but also helps to optimize technological, managerial and administrative skills of a country. In India, civil aviation is very significant because of the following:

- The country is of very big size. Its major industrial and commercial centres are located far apart from one another. There are large variety of terrains, ranging from high mountains to low planes, marshy lands etc. The climatic conditions too are very diverse. In these conditions, air transport is the most appropriate means of moving men and materials.
- Being the fastest mode of transport, it makes the best use of most scarce resources such as the latest technologies, high profile managerial talent and sophisticated administrative skills. It can bring all of them together in no time at places where they are most needed.
- This fast mode of transport also goes well with the present highly competitive world, where speed matters the most in respect of timely delivery of different services at both national and global levels.
- Airways also earn lot of revenue both in terms of domestic and foreign currencies through movement of passengers and goods. Besides, the cargo traffic also

brings a lot of revenue as almost a quarter of the total foreign trade in value terms is being carried by the airlines at present.

- Air lines also contribute to the economic growth of the country. It works as a facilitator for the timely carriage of men and materials.

Civil Aviation in India

Since its beginning in 1920, the airways have made considerable progress in India. A landmark in the growth profile of civil-aviation in the country took place in 1953. In this year air-transport was nationalized. The government constituted Indian Airlines for domestic services and Air India for international services. A third level of airlines in the name of Vayudoot was set up in 1981 as a subsidiary to serve the north-east region of the country where the surface transport facilities were difficult and inadequate. However, Vayudoot was merged with Indian Airlines in 1993. Besides, provision has been made for helicopter support services since 1985. Since 1994, civil aviation Industry in India is experiencing a new era of expansion, driven by factors such as increasing private participation and pubic private partnership (PPP), development of greenfield airports, restructuring and modernisation of air ports, FDI in domestic airlines, and increase in low cost carriers (LCC) and emphasis on regional connectivity.

A number of agencies are involved in providing civil aviation services in India. In addition to the public and private sector airlines looking after air-traffics, the International Airports Authority of India (IAAI) and Director General of Civil Aviation (DGCA) are providing infrastructure facilities. IAAI looks after the development of the international airports. DGCA is responsible for maintenance and development of civil aerodromes, civil enclaves and aeronautical communication stations.

There has been strong growth in traffic (domestic and international) as well as cargo (domestic and international) at Indian airports in recent years.

COMMUNICATION

Communication is an important form of economic infrastructure of a country. Communication may be formal or informal, written or verbal. Its network establishes

close relationship between different regions, sections, sectors, people and so facilitates the pace of development of an economy.

Modes of Communication System in India

The communication system comprises posts and telegraphs, telecommunication, broadcasting, television and information services. By providing necessary information about the markets and also supplying necessary motivations, the communication system helps in accelerating the growth of the economy.

(a) Postal Services

At present postal network in India is the largest in the world. Postal services in India started in 1837. Department of Posts was set up in 1854. Railway Mail Service (RMS) was introduced in 1907 and the Air Mail Service started in 1911. The PIN Code system was introduced on 15 August, 1972. Since 1950-51 the postal network has been expanded throughout the country. It has laid special emphasis on spreading the services in rural, hilly and remote tribal areas. Presently there are as many as 1,55,015 post offices in the country.

In recent years, there has been healthy growth in many lines of postal activities. There is speed post service and postal life insurance which now covers over 2 million policies with a sum assured of nearly Rs. 500 crore. There is postal savings bank where people of every walk of life deposit their surplus earnings which constitute a major source of domestic savings.

(b) Telegraph Services

Indian Telegraph service is one of the oldest government owned public utility organisations in the world. It was started in 1851. The number of telegraph offices has increased from 8200 in 1951 to more than 4,00,000 at present. The phonogram service for sending and receiving telegram by telephone and telex service to send and receive printed message directly from one centre to another, as well as fax service are also available to general public.

(c) Telecommunication

Telecommunication as an economic infrastructure is vital for the growth and modernisation of an economy. In Indian context not only it has brought the benefits of communication to every corner of the country but also has helped to a great extent in attracting foreign direct investment.

There has been phenomenal growth of the telecommunication sector in India after 1995. The telecommunication network of the public sector (BSNL and MTNL) is one of the largest telecommunication networks in Asia. There has been a shift in importance towards the private sector and the cell phones in recent times. At the time of independence, there were only two phones per ten thousand population in India. By the year 2014-15, there were 81.5 phones per 100 persons and 120.9 million broad band connections in the country. Cellphone has brought a revolution in the telecommunication sector. Cell phone has become the most preferred mode of communication among Indian public as it has become easily affordable.

Bharat Net / National Optical Fibre Network (NOFN) project is planned to connect all Gram panchayats and Blocks and provide broadband services in the country.

The Rural Wireline Broadband scheme has been launched to provide wireline broadband connectivity to rural and remote areas. As on October 31, 2014 a total of 6,35,939 broadband connections have been provided and 14,653 kiosks have been set up under the scheme in rural and remote areas.

(d) Other Communication Systems

Besides postal, telegraph and telephone services, there are also other services in the communication system. Some such important services are:

(i) Internet Services

Internet is considered as the latest in communication technology. It provides the required information at any time through the use of computers and cell-phones.

Department of Telecommunication (DOT) provides internet facilities on local call basis. The private sector also provides this service.

(ii) Radio and Television

Radio and Television are the simplest modes of communication. They have brought significant improvement in trading and commercial activities. The All India Radio (AIR) has its network in almost all parts of the country. The television network 'Doordarshan' at present covers more than 85 per cent of population of the country.

Besides the above modes of communication, there is the use of newspapers, periodicals, fax, e-mails etc. in the communication sector. The satellite is the latest addition to these categories of communication. India receives the communication messages from its satellite (INSAT-2B).

2.3.4.2 Development of Social Infrastructure

Economic development primarily aims at promoting and maximising the wellbeing of the people. This is achieved through sustained development in the quality of life of the people, particularly the poor and vulnerable sections. Government in its policies lays emphasis on development of social infrastructure facilities. They help in developing human resources of a country. A healthy, educated and skilled workforce can contribute significantly to the economic development of a country. So, development of social infrastructure is no less important than that of the economic infrastructure for the overall development of an economy.

Social infrastructure refers to the facilities and services which facilitate the functioning of an economy in an indirect manner. They are also called Social Overhead Capital (SOC). The facilities pertaining to health, education and skill formation are the major forms of social infrastructure. These facilities improve the quality of human capital of a country.

Human capital refers to people as a capital asset that yields a stream of economic benefits over its working life. An improvement in the mental capability, skill

and physical capacity of the people constitutes an increase in human capital. This enables the human factor to produce more. Hence, the use of resources for the increase in human capital is equivalent to investment in physical capital formation.

EDUCATION

Education is a basic human requirement. It helps a person to strengthen the base of his knowledge, approach, value orientation and efficiency. It brings a change in the social, economic, political and cultural development of mankind. A recent World Bank study points out that an increase in the average level of schooling by 3 years in a country leads to a 27 per cent increase in its economic development and an increase in education by 6 years leads to a 39 per cent increase in economic development. As per population census (2011), 74.04 per cent of population in India are literate. In case of male, the literacy rate is 82.14 per cent; in case of female it is 65.46 per cent.

State of Education in 1950-51

At the time of independence, the level of education was very low in India. In 1883, only 18.3 per cent of total population were literate out of which male literacy was 27.2 per cent and female literacy was only 8.9 per cent. The education system was not so productive and biased in favour of general education. The objective of the colonial administration was to create a group of educated people, well versed in English to work as clerks to help their day to day administration. The technical and vocational education was totally neglected. The following discussion gives a clear picture of the state of education in 1950-51.

(i) **State of Primary Education:** In 1950-51, there was hardly one teacher for 34 students and a primary school served an area of 5 square miles. There were only 2,10,000 primary schools in the country. Student enrolment was around 43 lakh and there was large scale drop-outs from the schools. 40 per cent of teachers in the primary schools were untrained and only 15 per cent of them were ladies. This poor state of primary education was responsible for widespread illiteracy in the country.

(ii) **State of Secondary Education:** In 1950-51, there were only 12,900 middle / secondary schools in the country. More than 45 per cent of secondary school teachers were untrained. The student enrolment in the secondary level was around 5.3 per cent in the age group of 14-17 years. On an average, there was only one teacher for 25 students. There was no provision for vocational education at the secondary level.

(iii) **State of Higher Education:** In 1950-51, higher education was biased in favour of general education and technical education was totally neglected. There were 498 colleges and 27 universities in India. There were only 28 medical colleges across the country. The share of women in higher education was very low. Only 0.33 per cent of students in the age group of 17-23 years were studying in the colleges and universities. Library and laboratories were ill-equipped. Only 14 per cent of students were girls.

National Policy on Education 1968

A national policy on education was announced by the Government of India in 1968 on the basis of recommendations of the Education Commission-1964, popularly known as Kothari Commission. The Policy made provision of free and compulsory education for all children up to the age of 14 years. The policy also recommended for adoption of a uniform 10+2+3 pattern of education throughout the country. Further, a three language formula was recommended in the secondary level. The formula says that pupils should study the regional language, Hindi as the national language and English as the inter-national language. The Policy emphasised the development of education for agriculture and industry. Consequently, a number of agricultural universities, engineering colleges and industrial training institutes were established. The Policy further emphasised adult education and literacy and equal opportunity for all in the field of education. The socially backward groups like SC and ST had to be provided incentives like free books for increasing their level of education. Besides, recruitment of good teachers, publication of quality books and improvement in quality of teachers, were also recommended in 1968 Policy.

National Policy on Education 1986

After 18 years of announcement of first education policy, the Government of India announced a New Education Policy in 1986 in order to meet the changing socio-economic requirements of the country. The objective of the New Policy is to develop a pattern of education which will help in achieving democracy, socialism and secularism. The main features of the new policy are discussed below.

(i) **Pattern of Education:** The Policy recommended for adoption of a uniform structure of education throughout the country. The 10+2+3 system was reiterated. However, the 10 years schooling period was divided into five years of primary, three years of higher primary and two years of secondary education.

(ii) **Universalisation of Elementary Education:** The Policy recommended that students up to 14 years of age should receive elementary education free of cost. The elementary education covers five years of primary and three years of higher primary education. The Policy aimed at checking the drop-outs from the school through various incentives like mid-day meal scheme.

(iii) **Emphasis on Vocational Education:** The Policy emphasised on development of vocational education at the higher-secondary level in +2 classes. The objective was to make students self-employed after completion of the course. Vocational subjects like tailoring, typing, carpentry, fishery, poultry and electronics were introduced in +2 classes.

(iv) **Specialization of Higher Education:** The objective of the new Policy was to restrict the entry of students to higher education and to allow limited number of brilliant students to higher education. The quality of higher education was to be improved with the introduction of specialized courses. Subjects like business management, computer science and electronics were proposed to be introduced,

(v) **Adult Education:** The new Policy aimed at spreading adult education in order to eradicate mass illiteracy. The target of the government was to remove illiteracy in the age group of 15-35 years by 1995.

(vi) **Involvement of Voluntary Organisations:** The voluntary organisations were encouraged to involve themselves in the field of elementary, adult and non-formal education to increase enrolment and retention.

(vii) **Women Education:** Women education was given utmost priority in the New Education Policy. The girls up to secondary level were to be given free education. They had to be given preferential treatment in the matter of admission and other facilities in the colleges also.

(viii) **Model Schools:** The new Policy proposed to establish model schools for bright students. The school should be residential, where students live and learn together to promote national integration. Accordingly, Navoday Vidyalayas have been established across the country with around one lakh students of whom 80 per cent are from rural areas.

Further, the Policy also proposed to develop physical education, improve games and sports, modernize the syllabus and reform the examination system. Emphasis is given on vocational education and spread of science and technology education. However, Indian education is biased in favour of general education, which requires further reform and modernisation.

In order to improve the quality of education and to provide opportunity of education to all, Government of India has enacted 'The Right of children to Free and Compulsory Education (RTE) Act' 2009. For implementation of this Act, a National Programme called Sarva Sikhya Aviyan (SSA) has been launched in the country. Consequently enrolment of students in primary schools has increased from 134 million in 2007-08 to 137 million in 2011-12.

But in 2013-14, student enrolment is reduced to 132 million. This decline might have been due to far greater increase in enrolment in English medium schools. However, enrolment in Upper Primary schools has been increased from 51 million in 2007-08 to 67 million in 2013-14.

HEALTH

Health is an important index of standard of living of the people. Good health increases the efficiency of the labour force and makes them more active and productive. In underdeveloped countries the average caloric intake of the people is low resulting in poor health condition, malnutrition and diseases. To improve the quality of manpower, adequate food and health care facilities have to be provided to the people. Health care facilities include hospitals, doctors, nurses, medical equipment and medicines. The quantity and quality of these facilities determine the status of health in the country.

Development of Health Care System in India

At the time of independence, the state of health care system in the country was very low and inadequate. As a result, the average expectancy of life was only 32 years. In 1951, death rate was 27.4 per thousand and infant mortality rate was 183 per thousand. People were suffering from deadly diseases like malaria, tuberculosis (TB), cholera and small pox. Malaria alone was causing 10 lakh deaths each year. TB was killing around 5 lakh people. There was only one doctor for 43,000 persons and there were only 28 medical colleges in the country. This gives us a very poor picture about the state of health care system in the country at the beginning of planning.

After the adoption of planning in 1951, there has been a substantial improvement in the field of health and nutrition. In 2001, there were 167 medical colleges in the country. The number of primary health centres have increased from 725 in 1951 to 38,031 in 2001. The death rate has declined to 6.4 per thousand in 2013 and infant mortality rate to 41.8 per thousand in 2015. The communicable diseases have been controlled. In 1958, the National Malaria Eradication Programme was launched which was again modified in 1977. As a result, the number of deaths due to malaria reduced considerably. Similarly, small pox could be completely eradicated since 1977. To control tuberculosis, the National TB centres are functioning in 446 districts of the country.

India has the highest number of leprosy patients in the world. In 1955, the National Leprosy Control Programme was launched which was renamed as National

Leprosy Eradication Programme in 1983. It is a fully centrally sponsored programme for eradicating leprosy by 2000 AD. The Programme provides door to door service for early detection and treatment of the disease.

Acquired Immune Deficiency Syndrome or AIDS has emerged as the most dangerous disease. The government of India has launched National AIDS Control Programme in 1987.

Besides the above programmes, the following other National Health Programmes are also implemented in the country. These are :

(1) National Cancer Control Programme

(2) National Filaria Control Programme

(3) National Iodine Deficiency Disorders Control Programme

(4) National Mental Health Programme

(5) National Programme for Control of Blindness

(6) National Programme for control of Deafness

(7) National Tobacco Control Programme

(8) National Vector Borne Disese Control Programme

(9) Pilot Programme on Prevention and Control of Diabetes, Cardiovascular disease and Stroke.

(10) Universal Immunisation Programme.

To eradicate polio by the year 2000 the Pulse Polio Programme was started throughout the country. Children below 5 years of age are administered anti-polio drop free of cost in different hospitals to immunize the children from the disease.

In order to provide advanced medical facilities at low cost, the government of India has set up six units of AIIMS (All India Institute of Medical Sciences) at six different regions, out of which one is at Bhubaneswar. Regional cancer centres have been set up for treatment of cancer. These are controlled jointly by the central and state

governments. Government Medical Colleges, District Hospitals and Block level Hospitals have been set up in different states which are owned and controlled by the respective state governments. Besides, some special institutes, e.g. (i) Central Ayurvedic Research Council, (ii) Central Unani Medical Research Council (iii) Central Homoeopathic Council and (iv) Central Yoga and Nature-cure Council have been set up to conduct research in the Indian system of medicines. In 1995, Department of AYUSH has been set up under Health Ministry for the use of Ayurveda, Yoga, Unani, Siddha, Homoepathy and other alternative systems of medicines.

Rural Health Care System

Under the Minimum Needs Programme (MNP), the government of India has developed health care services in the rural areas. The main features of the rural health care system are discussed below.

(i) **Primary Health Centres (PHC) :** Primary Health Centres (PHCs) are the basic units providing health services to the rural people. Each PHC has a medical officer, pharmacist, staff nurse, laboratory technician and other staff. It provides medical facilities free of cost to the people. All the Community Development Blocks have PHC at their headquarters.

(ii) **Sub Centres :** To provide family planning services to the people, the sub-centres have been established in the rural areas. They are functioning by trained auxiliary and multipurpose health workers.

(iii) **Community Health Centres (CHC) :** Community health centres have been established to meet the medical requirement of every one lakh population. It is a 30-bed hospital with specialists in medicine, gynaecology, paediatrics and surgery. Most of the medical facilities like X-ray, sonography, urine, stool and blood testing etc. are available here.

(iv) **Multi Purpose Workers Scheme :** The workers engaged in the control and eradication of infectious diseases are made multi purpose health workers through

a special training. These health workers work at the grassroots level and constitute the backbone of the health service structure in the country. They provide promotive, preventive and basic curative services.

(v) Village Health Guides: The community health workers were renamed as Village Health Guides (VHG) since October, 1977. They have been given basic training regarding health, hygiene, treatment of common infectious diseases and work as a link between people and primary health centre. They are supplied with one medical kit and given a nominal allowance. They promote health consciousness among the rural people.

Inspite of various measures, health care facilities, particularly in rural areas and tribal regions in the country are inadequate. There are PHCs running without doctors, medicine and other equipment. According to World Health Organisation, India's health service has ranked 112th out of 191 countries with a rank even below Bangladesh. The major problems of health services in the country are stated below.

1. **Insuffucient Government Expenditure on Health:** During the Eleventh Five Year Plan, only 1.01 per cent of GDP was spent on health. It should be at least 2.5 per cent of GDP of the country.
2. **Paucity of Hospitals and Medical Personnel:** Number of Hospitals, dispensaries, doctors, nurses and other medical personnel is inadequate compared to huge population in the country. There are only 5.5 doctors per 10,000 population in India against 25 in USA and 20 in China.
3. **Expensive Health Services:** In India, allopathic treatment is very expensive in view of the high prices of essential drugs and high cost of diagnostic services.
4. **Medical Research:** In India medical research is not properly focused.

2.4 FOREIGN TRADE

Introduction

Foreign trade refers to the exchange of goods and services between two or more countries of the world.

The countries participating in international trade or foreign trade import those goods and services from abroad in which they are less efficient to produce or cannot produce at all. Similarly, they export those goods in the production of which they are more efficient due to their geographical conditions and expertise of their labour force. In modern times, there is no country which does not participate in international trade, as no one can afford to be self-reliant.

2.4.1 Role of Foreign Trade

Foreign trade has been given a place of pride in the economic progress of nations beginning from the classical era till modern times. According to D. H. Robertson, "international trade is an engine of economic growth". In the words of Haberler, "International trade has made a tremendous contribution to the development of less developed countries in the 19th and 20th centuries and can be expected to make an equally big contribution in the future".

The role of foreign trade in stimulating economic development and maintaining economic stability of the Indian economy is highlighted below.

1. **Expansion of Production at Lower Cost:** Countries differ in factor endowments, climatic conditions, technological capabilities and managerial and entrepreneurial skills. Given these diversities, no country has the potential to produce all goods in the most efficient manner or at the least cost. For example, India can produce textiles at a lower cost while Japan can produce electronic goods and automobiles cheaply. Therefore, instead of producing all goods, India should produce only such goods which it can produce more economically (i.e., at a lower cost). If all the available factors of production of the country are utilized

for the production of those goods which can be produced at a lower cost, the volume and value of production of the country becomes larger and thus the country becomes richer. Further, if the country exports those goods which it can produce at lower cost and in return imports those products which it cannot produce at lower cost, it gains from such trade in the form of an increase in real income and improvement in the consumption standard of its people.

2. **Optimum Use of Resources:** If trade takes place, India need not produce all goods, but is engaged in the production of only such goods which can be produced most economically. As a result, factors of production available in the country can be put to the best uses or optimal uses. Thus foreign trade helps in optimum allocation and utilization of the productive resources.

3. **Stabilisation of Prices and Overcoming Financial Crisis:** In the absence of foreign trade, the domestic surpluses or shortages in production invariably lead to serious deflationary and inflationary situations in a country. Through the foreign trade, the domestic surpluses in production can be disposed of through exports and shortages can be made up through imports. In this way, the foreign trade can efficiently deal with the problem of inflation and deflation and ensure a greater degree of stability in prices. Government of India increases exports to overcome the problem of surpluses and increases imports of essential goods to address the problem of rising prices in the country. Thus, foreign trade plays an important role in maintaining economic stability. Foreign trade also plays an important role in overcoming the global financial crisis due to over production or under production.

4. **Technological Progress:** International trade enables India to import new machines, equipment and technical knowledge from other countries to bring about technological progress in the country. Technological progress helps in increasing efficiency and productivity.

5. **Promotes Competitiveness:** Foreign trade promotes competition among the participating countries. Each country aims at producing goods of better quality at

lower cost. As a result, people are able to get quality goods at lower prices. Thus, foreign trade plays an important role in augmenting social welfare.

6. **Expansion in Size of the Country's Market:** In the absence of foreign trade, the country produces smaller amount of goods to meet only domestic requirements. But if foreign trade takes place, the country has to produce goods to meet domestic demand as well as foreign demand. Thus foreign trade widens the size of market for home country's goods. As a result, entrepreneurs are encouraged to make larger investment for producing larger output. At present, India has diversified its production to meet foreign demand. Thus, foreign trade plays an important role in expansion of the size of market for goods, increase in investment and diversification of production.

7. **Stimulating Growth:** It has been stated earlier that foreign trade widens the size of the country's market for various goods. Therefore the country is able to expand exports. This spurs investment which brings about expansion of employment and generation of income and improvement in living standards. Export-led growth provides sufficient foreign exchange earnings that can be ploughed back for development programmes. Such export earnings in form of foreign exchange can be utilised for buying raw materials, machinery, equipment and advanced technical know-how from abroad. Thus foreign trade plays a very important role in stimulating economic growth of the Indian economy.

2.4.2 India's Foreign Trade

Discussion on foreign trade in India can be divided into two parts viz.

(A) India's Foreign Trade before Independence
(B) India's Foreign Trade after Independence

(A) India's Foreign Trade before Independence

Before 1947, when India was a colony of the British, its volume of trade was low. Its foreign trade was mainly confined to England and other commonwealth countries.

India was mainly exporting foodgrains and raw materials and importing only finished products. India's foreign trade before independence can be discussed under the following three heads.

(i) Volume of Trade: Before independence volume of India's foreign trade was quite small. In 1939, India was importing goods worth Rs. 152 crore and exporting goods worth Rs. 169 crore. Thus value of total transactions due to trade stood at Rs. 321 crore. On the eve of independence (1947), its imports increased to Rs. 389 crore and exports to Rs. 402 crore and thus value of trade (imports + exports) increased to Rs. 792 crore.

(ii) Composition of Foreign Trade: Composition of India's foreign trade shows the goods and their quantities which India imports from other countries and those which she exports to other countries during a given period of time.

Composition of foreign trade can be discussed under two heads, viz.

(a) Composition of Imports
(b) Composition of Exports

(a) Composition of Imports: Prior to independence India was importing mainly manufactured goods such as consumer goods, machinery, chemicals, iron and steel etc.

(b) Composition of Exports: During the British rule India's exports consisted of primary products such as foodstuffs , cotton, jute, tea, oil seeds and textiles etc.

(iii) Direction of Foreign Trade: Direction of India's foreign trade shows the countries from which it imports and the countries to which it exports over a given period of time.

Direction of foreign trade can be discussed under two heads, viz.

(a) Direction of Imports

(b) Direction of Exports

(a) **Direction of Imports:** Prior to independence imports from England constituted 31 per cent of India's total imports. 10 per cent of total imports of the country was coming from other commonwealth countries such as Burma and Srilanka. However in 1947, share of England in India's total imports declined to 25 per cent and that of USA increased to 30 per cent.

(b) **Direction of Exports:** During the pre-independence period India's exports to England constituted 34 per cent and exports to other commonwealth countries constituted 21 per cent of her total exports.

(B) India's Foreign Trade after Independence

After independence and particularly during the planning era India's foreign trade has undergone significant changes. India's foreign trade and its changes after independence can be discussed under the following three heads:

(i) Volume of Foreign Trade

(ii) Composition of Foreign Trade

(iii) Direction of Foreign Trade

2.4.2.1 Volume of India's Foreign Trade

Since different goods have different units of measurement volume of trade is expressed in terms of their money value. So volume of trade can be otherwise expressed in terms of value of trade. For the study of trend in the volume of trade in the post-independence period, the period from 1947-48 to the present day can be divided into the following three phases.

- Pre-plan period (1947-48 to 1950-51)
- Pre-reform period (1951-52 to 1989-90)
- Post-reform period (1990-91 to 1914-15)

Pre-plan period (From 1947-48 to 1950-51)

On the eve of independence volume of imports was Rs. 389 crore and exports was Rs. 402 crore and thus trade surplus was Rs. 13 crore. In 1950-51 value of imports increased to Rs. 650 crore and that of exports increased to Rs. 600 crore. As a result there was trade deficit to the tune of Rs. 50 crore. Such trade deficit on the eve of planning was mainly due to increase in imports of (a) foodgrains and basic raw-materials, and (b) machinery and equipment to meet the growing demand for hydroelectric and other projects started during that period.

Pre-Reform Period (From 1951-52 to 1990-91)

Value of exports, value of imports and balance of trade in India from 1951-52 to 2014-15 are shown in Table - 2.9.

It can be seen that the annual average value of imports during the First Five Year Plan was Rs.622 crore and that of imports was to the tune of Rs.730 crore. Thus annual average trade deficit during the First Five Year Plan stood at Rs.108 crore. Such deficit occurred mainly due to large imports of capital goods needed for rapid industrialiation.

During the Second Five Year Plan, annual average value of exports declined to Rs.613 crore, but that of imports increased to Rs.1080 crore in view of the establishment of steel plants and expansion, modernisation and renovation of railways. Consequently, trade deficit during the Second Five Year Plan period stood at Rs.467 crore which was higher than the previous plan period.

Table - 2.9: Volume of India's Foreign Trade and Balance of Trade (in Rs. crore)

Plan Period / Year	Exports (Annual Average)	Imports (Annual Average)	Balance of Trade
First Five Year Plan (1951-52 to 1955-56)	622	730	– 108
Second Five Year Plan (1956-57 to 1960-61)	613	1080	– 467
Third Five Year Plan (1961-62 to 1965-66)	747	1224	– 477
Annual Plans (1966-67 to 1968-69)	3708	5775	– 2067
Fourth Five Year Plan (1969-70 to 1973-74)	1810	1972	– 162
Fifth Five Year Plan (1974-75 to 1978-79)	4728	5538	– 810
1979-80	6418	9142	– 2724
Sixth Five Year Plan (1980-81 to 1984-85)	8967	14683	– 5716
Seventh Five Year Plan (1985-86 to 1989-90)	17382	25112	– 7730
1990-91	32558	43193	– 10635
1991-92	44042	47851	– 3809
Eighth Five Year Plan (1992-93 to 1996-97)	86257	97609	– 11352
Ninth Five Year Plan (1997-98 to 2001-02)	168401	204764	– 36363
Tenth Five Year Plan (2002-03 to 2006-07)	390462	531658	– 141196
Eleventh Five Year Plan (2007-08 to 2011-12)	992830	1576036	– 583206
2012-13	1635260	2673110	– 1037850
2013-14	1838536	2671810	– 833274
2014-15	1822206	2685557	– 863351

Source : 1. Ministry of Commerce, Government of India
2. Economic Survey (2014-15), Government of India
3. Reserve Bank of India Bulletin, June 2014

During the Third Five Year Plan, annual average value of both exports and imports increased to Rs. 747 crore and Rs. 1224 crore respectively. Thus there was trade deficit to the tune of Rs. 477 crore which was marginally higher than that of the previous plan period. Such deficit was mainly due to increase in imports of machinery, equipment, industrial raw-materials, technical know-how, defence equipment and food grains.

In view of the persistent trade deficit since 1951 there was need to augment exports and reduce imports for creating a favourable balance of trade. Therefore, Government of India devalued rupee by 36.5 per cent in June, 1966. Although after devaluation of rupee exports increased during 1966-67 and 1967-68, imports also soared for which trade deficit became greater than before. Annual average value of exports was Rs. 3708 crore and that of imports stood at Rs. 5775 crore during the three annual plans (1965-66, 1966-67 and 1967-68) and thus trade deficit came to the tune of Rs. 2067 crore.

As a consequence of the policy of reduction of food grain imports coupled with vigorous measures of export promotion during 1972-73, there was favourable balance of trade for the first time since independence. But during the entire Fourth Plan period (1969-70 to 1973-74) there was trade deficit to the tune of Rs. 162 crore which was much less compared to the periods of Second plan, Third plan and Annual plans.

Due to hike in oil prices in 1973, cost of imports increased during the Fifth Five Year Plan. However, there was significant improvement in exports for which there was trade surplus in 1976-77. But since the average value of imports (Rs. 5578 crore) was higher than that of exports (Rs. 4728 crore) there was trade deficit to the tune of Rs. 810 crore during Fifth Five Year Plan period.

On account of a further increase in the prices of the petroleum products by Organisation of Petroleum Exporting Countries (OPEC), the cost of impots shot up during the Sixth Plan period. Though exports also increased, they fell short of imports causing annual average trade deficit of Rs. 5716 crore during this period.

During the Seventh Plan period (1985-86 to 1989-90), the annual average imports increased to Rs. 25112 crore, but exports averaged Rs. 17382 crore for which annual average trade deficit to the tune of Rs. 7730 crore emerged. Such huge trade deficit compelled the Government of India to approach IMF for a loan of over US$6.7 billion and the Government was forced to introduce economic reforms in 1990-91.

Post-Reform Period (From 1990-91 onwards)

Prior to 1991 volume of exports and imports was low in view of high tariffs and extensive quantitative restrictions on imports. In order to increase the commetitiveness of the Indian industries and integrate the Indian economy with rest of the world, Government of India introduced economic reforms based on liberalisation, privatisation and globalisation (LPG) in 1991. Consequently since 1990-91 value of both exports and imports increased significantly.

An analysis of the Eighth Plan (1992-93 to 1996-97) reveals that although annual average value of exports jumped to Rs. 86257 crore, policy of liberalisation accompanied by reduction of customs duties resulted in an increase of imports to Rs. 97609 crore causing an annual average trade deficit of Rs. 11352 crore.

From the Ninth Five Year Plan (1997-98 to 2001-02) onwards there was continuous rise in both exports and imports, but rise in imports was much sharper than that of exports causing huge deficits in trade. For example, during the Ninth Five Year Plan, annual average trade deficit stood at Rs. 36363 crore which was more than three times the average trade deficit during the Eighth Plan (Rs.11352 crore).

During the Tenth Five Year Plan (2002-03 to 2006-07) the annual average exports and imports increased to Rs. 992830 crore and Rs.1576036 crore respectively. Consequently annual average trade deficit rose to Rs.583206 crore, which was approximately four times the annual average trade deficit during the Tenth Plan.

In 2012-13 there was large increase in the value of both exports (Rs.1635260 crore) and imports (Rs.2673110 core) for which there was all time high track deficit to

the tune of Rs.1037850 crore. In 2013-14, value of exports increased to Rs. 1838536 crore, but value of imports decreased to Rs. 2671810 crore for which trade deficit declined to Rs. 833274 crore. In 2014-15, value of exports was less and value of imports was more compared to that of 2013-14, but the trade deficit was marginally higher. It is observed from Table 2.9 that trade deficit in 2014-15 was of the order of Rs. 863351 crore as against Rs. 833274 crore in 2013-14.

Above analysis reveals that since the inception of planning till the present day both exports and imports are rising, but their rise is more rapid after introduction of reforms.

2.4.2.2 Composition of India's Foreign Trade

As stated above, composition of trade defines the broad types of goods and their value which a country exports and imports during a reference period. It consists of composition of exports and that of imports. A brief account of these is given below.

(a) Composition of India's Exports

The domestic structure of production of a country is generally reflected in its composition of exports. At the time of independence India used to export agricultural products and raw materials like jute, cotton, tea, coffee, oil seeds, leather and mineral products. It also exported manufactured goods like textiles, engineering goods, chemicals etc.

But now its exports consist of mostly manufactured goods like machines, readymade garments, gems and jewellery, tea, jute manufactures, cashew kernels, electronic goods, refined petroleum, etc.

Exports of India can be broadly divided into four categories :

(1) Agriculture and Allied Products : Exports of agricultural and allied products include tea, coffee, oil cakes, tobacco, cashew kernels, spices, sugar, raw cotton, rice, fish and fish preparations, meat and meat preparations, vegetable oils, fruits, vegetables and pulses.

(2) Manufactured Goods : Exports of manufactured goods include textiles, ready-made garments, jute manufactures, leather products including foot wear, chemicals, automobiles, engineering goods, handicrafts including pearls, precious stones, gems and jewellery, iron and steel, electronic goods especially computer hardware and software etc.

(3) Ores and Minerals : Ores and minerals include iron ore, manganese ore and mica.

(4) Petroleum Products and Mineral Fuel : India also exports some amount of petroleum products and mineral fuel.

Composition of India's exports in some selected years after independence is shown in Table - 2.10.

Table - 2.10 : Composition of India's Exports (Rs. in crore)

Sl.No.	Item	1970-71	1980-81	2013-14
1	Agriculture and Allied Products	487 (31.7)	2057 (30.6)	2,60,906 (13.8)
2	Ores and Minerals	164 (10.7)	413 (6.2)	34827 (1.8)
3	Manufactured Goods	772 (50.3)	3747 (55.8)	12,04,072 (63.6)
4	Refined Petroleum and Petroleum Products and Mineral Fuel	13 (0.8)	28 (0.4)	381281 (20.7)
5	Others	99 (0.5)	465 (6.9)	3096 (0.2)
	Total	**1535 (100)**	**6710 (100)**	**1894182 (100)**

Source : Ministry of Commerce, Government of India

Note : Figures in parantheses represent percentage to total.

Before analysing the changes in composition of India's exports it is worthwhile to know the top exports items in the recent years. Total value of the top 15 export items in terms of US dollar, their share in total exports and ranks in 2013-14 and 2014-15 are presented in Table - 2.11.

Table - 2.11 : India's 15 Top Export Items in 2013-14 and 2014-15

Sl. No.	Commodity	2013-14			2014-15		
		Value (US$ billion)	Share (%)	Rank	Value (US$ billion)	Share (%)	Rank
1	Petroleum and Petroleum Products	64.69	20.59	1	57.62	18.54	1
2	Pearls, Precious and semi-precious stones	41.69	13.25	2	41.55	13.39	2
3	Vehicles	12.93	4.12	3	14.47	4.6	3
4	Nuclear reactors Boilers, Machinery	12.07	3.84	4	13.8	4.45	4
5	Organic chemicals	12.02	3.82	5	11.95	3.85	5
6	Pharmaceutical Products	11.14	3	6	11.58	3.73	6
7	Cereals	10.56	3.35	7	9.55	3.08	7
8	Electric Machinery Equipment & parts	10.3	3.28	8	8.7	2.8	9
9	Cotton	9.93	3.17	9	7.72	2.18	11
10	Iron & Steel	9.22	2.94	10	8.68	2	10
11	Apparel & Cloking (Not knitted)	8.34	2.65	11	9.19	2.96	8
12	Articles of Iron	6.81	2.17	12	7.59	2.45	12
13	Plastic	5.63	1.79	13	5.08	1.64	15
14	Fish	4.82	1.54	14	5.29	1.69	14
15	Aircraft, spacecraft, and parts	4.56	1.47	15	6.16	1.99	13
	Total	**303.44**	–	–	**298.22**	–	–

Source : Ministry of Commerce, Government of India

Note : The gigures on the value column do not add up to the figure given in the 'Total' row because there are other export items not shown in the table.

From Table 2.11, it is observed that petroleum and petroleum products occupy the top most position in India's exports followed by pearls, precious and semi-precious stones. Other important items of exports are vehicles, machinery, organic chemicals, pharmaceutical products, cereals and electric machinery, etc.

On the basis of the data depicted in Table - 2.10 we may analysis the dynamics of exports from India. It gives a picture about the changes in the composition of India's exports during the planning era.

(1) Decline the share of Agriculture and Allied Products

The share of agriculture and allied products in total exports has significantly declined, though exports of these items have increased in absolute terms. In 1970-71, the share of these items in India's exports stood at 31.7 per cent, but came down to 30.6 per cent in 1980-81 and further to 13.8 per cent in 2013-14. Among the agriculture products, tea and coffee have occupied an important place in India's exports in recent years and exports of fish and fish preparations, fruits and vegetables are also found to be increasing.

(2) Decline in the share of Ores and Minerals

Like agriculture and allied products, the share of ores and minerals in the total exports has also declined significantly. The share of ores and minerals in the total exports which was 10.7 per cent in 1970-71 came down to 6.2 per cent in 1980-81 and further to 1.8 per cent in 2013-14.

(3) Rise in the share of Manufactured Goods

The share of manufactured goods in the country's total exports has increased significantly during the planning era. In 1970-71, the share of manufactured goods in total exports was 50.3 per cent which increased to 55.8 per cent in 1980-81 and further to 63.6 per cent in 2013-14. In 2013-14 the most important item among the manufactured goods is jems and jewellery which constitute 13.25 per cent of total exports of the country.

(4) Increase in the share of Petroleum and Petroleum Products

The share of refined petroleum and petroleum products has gone up from 0.8 per cent in 1970-71 to 20.7 per cent in 2013-14 in rupee terms, but to 20.59 per cent in dollar terms. At present, petroleum and petroleum product is the top most item in the country's exports.

(5) Decline in the share of other items

The share of other items not included in the above four categories in the total exports has come down from 6.5 per cent in 1970-71 to 0.2 per cent in 2013-14.

On the basis of the above discussion it can be concluded that exports of India have been diversified in favour of manufactured goods. Now the country is exporting about 7500 commoities to the rest of the world as against only 50 commodities at the time of independence.

(b) Composition of India's Imports

At the time of independence India was importing mainly foodgrains and some manufactured consumer goods. But now India's imports consist of large number of goods such as petroleum and petroleum products, pearls and precious stones, chemicals, fertilisers, iron and steel, machinery, edible oil, food grains etc. which can be broadly divided into four categories :

(1) Petroleum and petroleum products
(2) Non-petroleum Items
(3) Capital Goods
(4) Other goods

Non-petroleum items of imports include (i) Pearls, precious and non-precious stones, (ii) Organic chemicals, (iii) Plastic (iv) Edible oils, (v) Iron and steel, (vi) Fertilisers, (vii) Non-ferruws Metals, (viii) Paper and paper boards, (ix) Food grains etc.

Exports of Capital goods consist of (i) Manufacture of metals, (ii) Electrical machinery, Equipment and parts, (iii) Non-electrical machinery, (iv) Transport Equipment etc.

Composition of India's imports in some selected years after independence is shown in Table - 2.12.

Table - 2.12 : Composition of India's Imports (Rs. in crore)

Sl. No.	Commodities	1970-71	1980-81	2013-14
1	Crude Petroleum and Petroleum Products	136 (8.32)	5264 (41.94)	1098311 (41.1)
2.	Non-petroleum Items (i) Pearls, Semi-precious and Precious stones	25 (1.53)	417 (3.32)	345029 (12.92)
	(ii) Organic Chemicals	35 (2.14)	673 (5.36)	103157 (3.86)
	(iii) Fertilisers	86 (5.26)	818 (6.52)	32639 (1.22)
	(iv) Iron and Steel	147 (9.00)	852 (6.79)	54908 (2.02)
	(v) Non-Ferruws Metals	119 (7.28)	477 (3.80)	220258 (8.25)
	(vi) Edible oils	23 (1.41)	677 (5.40)	57152 (2.14)
	(vii) Food grains	213 (13.04)	100 (0.80)	534 (0.02)
3	Capital Goods			
	(i) Manufacture of Metals	9 (0.55)	90 (0.72)	24579 (0.92)
	(ii) Non-electrical Machines	258 (15.79)	1089 (8.68)	155167 (5.81)
	(iii) Electrical Machinery	70 (4.28)	260 (2.07)	213561 (8.00)
	(iv) Transport Equipment	67 (4.1)	472 (3.76)	90915 (3.40)
4	Other Goods	446 (27.30)	1360 (10.84)	275600 (10.32)
	Total	**1634 (100)**	**12,549 (100)**	**2671810 (100)**

Source : Ministry of Commerce, Government of India.
Note : Figures in parantheses represent percentage.

Before analysing the changes in composition of imports, it is worthwhile to know the top import items in recent years. Total value of top 10 import items in terms of US dollar, their share in total imports, ranks and year over year's growth are depicted in Table - 2.13.

Table - 2.13 : India's 10 Top Import Items in 2013-14 and 2014-15

Sl. No.	Commodity	2013-14			2014-15			
		Value (US$ billion)	Share (%)	Rank	Value (US$ billion)	Share (%)	Rank	YoY Growth (%)
1	Crude Petroleum and Petroleum Products	181.38	40.37	1	156.4	34.87	1	–13.77
2	Pearls, Precious & Semi-Precious stones	58.46	12.85	2	62.38	13.93	2	6.7
3	Nuclear Reactors Boilers & Machinery	30.66	6.82	3	31.73	7.09	3	3.46
4	Electrical Machinery and parts	29.15	6.49	4	33.15	7.4	4	13.71
5	Organic Chemicals	17.04	3.79	5	17.74	3.96	5	4.12
6	Plastic	10.1	2.25	6	11.69	2.61	6	15.7
7	Vegetable oils	9.4	2.10	7	10.67	2.38	7	13.09
8	Iron and Steel	8.07	1.8	8	7.47	1.67	8	35.1
9	Ships, Boats & Floating structures	6.72	1.49	9	7.05	1.57	9	4.86
10	Fertilisers	5.35	1.2	10	6.39	1.43	10	19.33

Source : Ministry of Commerce, Govt. of India
YoY : Year over year.

From Table - 2.13, it is observed that crude petroleum and petroleum products stand at the top among the India's import items in both 2013-14 and 2014-15 followed by pearls, precious and semi-precious stones. Other important items of imports are Nuclear reactors & machinery, electrical machinery and parts, organic chemicals, plastic, vegetable oils, iron and steel, ships, boats and floating structures and fertilisers. Values of imports of all the items except crude petroleum are higher in 2014-15 than in 2013-14.

An analysis on the basis of the data presented in Table - 2.12 gives a picture about the changes in the composition of India's imports during the planning era.

(1) There has been increase in the value of imports of all items except food grains from 1970-71 to 2013-14.

(2) Share of crude petroleum and petroleum products in total imports has significantly increased from 8.32 per cent in 1970-71 to 41.9 per cent in 1980-81 and marginally came down to 41.1 per cent in rupee terms in 2013-14.

(3) Share of pearls, precious and semi-precious stones, in total imports has consistently increased from 1970-71 to 2013-14.

(4) Shares of manufacture of metals, non-electrical machinery, electrical machinery and transport equipment in total imports are censistently decreasing over the period (1970-71, 1980-91 and 2013-14), though their values have significantly gone up.

(5) Shares of other imported items presented in Table-2.12 do not show any consistent trend though there is consistent increase in their absolute value.

On the basis of the above analysis the following conclusious can be drawn : (a) rapid growth of industrialisation has necessitated increasing imports of capital goods and raw-materials, (b) declining imports of food grains and industrial consumer goods are due to the country's self-sufficiency in food grains and increase in industrial production and (c) increase in the value imports of crude petroleum and petroleum products is due to rise in their international prices and fast increase in domestic demand.

2.4.2.3 Direction of India's Foreign Trade

It has been stated earlier that direction of India's foreign trade shows the countries from which its imports come and the countries to which its exports go. In other words, direction of India's foreign trade shows the major trading partners of the country both in the field of exports and imports. The countries with which India's foreign trade takes place can be mainly divided into the following five groups:

(1) Organisation of Economic Cooperation and Development (OECD) Countries consisting of (i) European Union (EU) which includes U.K, Germany, Italy, France, Luxemburg, Netherlands, Ireland, Belgium, Denmark, etc.; (ii) North

America which includes USA and Canada and (iii) Ocean countries, i.e., Australia, New Zealand, Japan etc.

(2) Organisation of Petroleum Exporting Countries (OPEC) comprising the middle east countries such as Iraq, Iran, Saudi Arab, Kuwait etc.

(3) Eastern Europe which includes Russia, Bulgaria, Yugoslovia, Romania and Czechoslovakia.

(4) Developing Countries of Asia, Africa, Latin America and the Caribbean.

(5) Other Countries of the world not included in the above four blocks.

Changes in the Direction of India's Foreign Trade

After independence, India's foreign trade has undergone significant change especially after disintegration of USSR. Changes in the direction of India's foreign trade can be discussed under two heads, namely

(a) Changes in the direction of imports, and
(b) Changes in the direction of exports.

Data relating to changes in the direction of India's imports and exports from 1980-81 to 2012-13 are presented in Table - 2.14.

Table - 2.14 : Changes in Direction of India's Foreign Trade (Percentage to total value)

Countries	1980-81		2012-13	
	Imports	Exports	Imports	Exports
1. OECD Countries	45.7	46.6	27.8	34.2
2. OPEC Countries	27.8	11.1	38.6	20.9
3. Eastern Europe	10.3	22.1	1.8	1.3
4. Developing Countries	15.7	19.2	31.3	41.5
5. Other Countries	0.5	2.0	0.5	2.1
Total	**100.0**	**100.00**	**100.0**	**100.0**

Source: (1) Statistical Outline of India (2013-14)
(2) RBI Bulletin, Different Issues.

(a) Change in the Direction of India's Imports

The direction of imports of India has undergone substantial change in the post independence period as discussed below:

(1) **Imports from Organisation for Economic Cooperation and Development (OECD):** Just after independence India was making most of its imports from OECD though its share in total imports has gradually declined. In 1960-61, the share of OECD group in total Indian imports was 78 per cent which declined to 45.7 per cent in 1980-81 and further to 27.8 per cent in 2012-13. Among the OECD group, England's share in to India's total imports is only 1.3 per cent in 2012-13 down from 18.5 per cent in 1950-51. Similarly, USA's share in India's total imports in 2012-13 is only 4.9 per cent down from 18.8 per cent in 1950-51. India's imports from Japan have remained almost the same in terms of percentage. In 1950-51, share of Japan in India's imports was only 2.9 per cent which came down marginally to 2.5 per cent in 2012-13.

(2) **Imports from OPEC:** The share of OPEC in India's total imports is gradually increasing due to huge import of crude oil. OPEC's share in 1960-61 was only 4.6 per cent, which increased to 27.8 per cent in 1980-81 and further to 38.6 per cent in 2012-13.

(3) **Imports from Eastern Europe:** The share of Eastern Europe in India's total imports was only 3.4 per cent in 1960-61 which increased to 10.3 per cent in 1980-81 but significantly declined to 1.8 per cent in 2012-13.

(4) **Imports from Developing Countries:** The share of developing countries in India's total imports has increased from 12 per cent in 1960-61 to 15.7 per cent in 1980-81 and further increased significantly to 31.3 per cent in 2012-13. Among the developing countries India's imports from China are increasing at a very fast rate. In 2012-13 India's imports from China is 11 per cent of total imports. China is now the biggest source of India's imports.

(5) **Imports from other Countries:** The share of other countries in India's imports has decreased marginally from 2 per cent in 1960-61 to 0.5 per cent in 1980-81, but has remained at the same level in 2012-13.

Thus direction of India's imports have diversified during the last six decades.

(b) Changes in Direction of India's Exports: The direction of India's exports has also undergone significant change in the post independence era as discussed below.

(1) Exports to OECD: Just after independence India was making most of its exports to OECD block. In 1960-61, its share was 66 per cent in India's total exports which declined to 46.6 per cent in 1980-81 and further reduced to 34.2 per cent in 2012-13. Among the OECD countries, India's exports to UK have declined from 6.5 per cent in 1987-88 to just 2.9 per cent in 2012-13. India's exports to USA have also gone down. In 1987-88, USA's share in India's total exports was 18.6 per cent, but it came down to 12 per cent in 2012-13. Japan's share in India's exports was around 10.3 per cent in 1987-88, while in 2012-13 it declined to 2.1 per cent.

(2) Exports to OPEC: India's share of exports to OPEC block has increased from 4.1 per cent in 1960-61 to 11.1 per cent in 1980-81 which further went up to 20.9 per cent in 2012-13.

(3) Exports to Eastern Europe: India's export to Eastern Europe has increased from 7 per cent in 1960-61 to 22.1 per cent in 1980-81 but remarkably declined to 1.3 per cent in 2012-13. Among the eastern European countries India's trade with Russia has declined due to disintegration of USSR. In 1980-81 India's exports to USSR was 18.3 per cent, which drastically it came down to 0.5 per cent in 2012-13.

(4) Exports to Developing Countries: The share of developing countries of Asia, Africa and Latin America in India's exports has increased from 15 per cent in 1960-61 to 19.2 per cent in 1980-81 which further increased to 41.5 per cent in 2012-13. Among the developing countries China's share in India's export is quite high, (6.5 per cent).

(5) Exports to other Countries: India's exports to other countries have marginally increased from 2 per cent in 1980-81 to 2.1 per cent in 2012-13.

CHANGES IN DIRECTION OF INDIA'S TRADE IN RECENT YEARS :

In order to study the change in direction of India's exports and imports in recent years say from 2004-05 to 2014-15, it would be appropriate to classify the trading

partners into six groups viz., North America, Latin America and the Caribbean (LAC), Europe, Asia, Africa and Common Wealth of Independent States (C.I.S.)

Changes in Direction of India's Exports between 2004-05 and 2014-15

The dynamics of direction of 2004-05 and 2014-15 are shown in Table-2.15.

Table - 2.15 : Shares of Different Region in India's Exports

Regions	2004-05 (Percentage of Total Exports)	2014-15 (Percentage of Total Exports)
1. North America	17	14
2. Latin America & the Caribbean (LAC)	3	5
3. Europe	24	18
4. Africa	7	11
5. Asia	48	50
6. C.I.S.	1	1
Total	100	100

Source : Ministry of Commerce, Government of India

It is observed from Table - 2.15 that direction of exports is moving towards developing countries of Asia, Africa and Latin America. For example, share of Asia, Africa and LAC regions increased sharply from 58 per cent in 2004-05 to 66 per cent in 2014-15. Of this, share of Asia increased from 48 per cent in 2004-05 to 50 per cent in 2014-15. On the other hand, the share of deveoped countries of North America and Europe declined from 41 per cent to 32 per cent during the same period.

Changes in Direction of India's Imports between 2004-05 and 2014-15

India's Import sources in 2004-05 and 2014-15 are shown in Table - 2.16.

Table - 2.16 : Shares of Different Regions in India's Imports

Regions	**2004-05 (percentage of Total Imports)**	**2014-15 (percentage of Total Imports)**
1. North America	7	6
2. LAC	2	7
3. Europe	23	16
4. Africa	3	8
5. Asia	36	59
6. C.I.S.	2	2
7. Others	27	2
Total	**100**	**100**

Source : Ministry of Commerce, Government of India.

It is observed from Table 2.16 that direction of imports is also moving towards developing countries. For example, share of Asia, Africa and LAC regions increased sharply from 41 per cent in 2004-05 to 74 per cent in 2014-15. Of this, share of countries of Asia rose from 36 per cent to 59 per cent during the same period. On the other hand, the share of developed countries of North America and Europe declined from 30 per cent in 2004-05 to 22 per cent in 2014-15.

India's Major Trading Partners

At present India's top 10 export partners are USA, UAE, Hong kong, China, Saudi Arabia, Singapore, UK, Germany, Sri Lanka and Netherlands. Table 2.17 presents data relating to the value of exports and the shares of these countries in India's total exports in 2014-15.

Table - 2.17 : Top Ten Export Partners of India in 2014-15.

Rank	Countries	Value of Exports (US$ billion)	Share in Total Exports (Per cent)
1	USA	42.4	13.7
2	UAE	23	7.43
3	Hong Kong	13.5	4.36
4	China	12	3.88
5	Saudi Arabia	11.2	3.62
6	Singapore	10.0	3.23
7	UK	9.3	3.00
8	Germany	7.2	2.33
9	Sri Lanka	6.7	2.16
10	Netherland	6.3	2.03
	Total	**141.6**	**45.74**

Source : Ministry of Commerce, Govt. of India.

Note : Value of export to other countries stood at US$ 168 billion or 54.26 per cent of total exports of 309.6 billion US dollars.

It is observed that USA stands at the top among the countries to which India exports at present.

Similarly, at present India's top import sources are China followed by Saudi Arabia, UAE, Switzerland, USA, Indonesia, Quatar, Iraq, Nigeria and South Korea. Table - 2.18 presents data relating to the value of imports and the shares of these countries in India's total imports in 2014-15.

Table - 2.18 : Top Ten Import Sources of India in 2014-15

Rank	Countries	Value of Imports (US$ billion)	Share in Total Imports (Per cent)
1	China	60.4	13.5
2	Soudi Arabia	28.2	6.3
3	UAE	26.2	5.9
4	Switzerland	22.1	4.9
5	USA	21.6	4.8
6	Indonesia	14.6	3.3
7	Quatar	14.6	3.3
8	Iraq	14.2	3.2
9	Niegeria	13.7	3.1
10	South Korea	13.5	3.0
	Total	**229.1**	**51.2**

Source : Ministry of Commerce, Government of India.

Note : Value of imports from other countries stood at 218.4 billion US dollars or 48.8 per cent of total imports of 447.5 billion US dollars.

Table - 2.18 makes it clear that China stands at the top of the import sources of India at present.

Conclusion : In the basis of the above discussion the following inferences can be drawn in respect of changes in direction of India's foreign trade :

(I) New Trading Partners : On the eve of independence, UK was the principal trading partner of India accounting for 34 per cent of India's exports and 18.5 per cent of India's imports. But now India has got new trading partners such as USA, China, LAC, UAE etc.

(ii) Diversification: Now USA has emerged as the biggest source and China as the fourth largest source for export of Indian goods. UK has lost its position of pre-

eminence. China has become the largest source of imports for India. In 2014-15, 10 countries viz. USA, Hong Kong, China, Saudi Arabia, Singapore, UK, Germany, Sri Lanka and Netherland accounted for 49 per cent of India's exports. Similarly, 10 countries viz., China, Saudi Arabia, UAE, Switzerland, USA, Indonesia, Quatar, Iraq, Nigeria and South Korea accounted for 50.94 per cent of India's imports.

Above discussion makes it clear that composition and direction of India's foreign trade have undergone significant changes since independence.

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SUMMARY

2.1 AGRICULTURE

1. Agriculture occupies an important place in the Indian economy because (a) Its contribution to GDP (17.4 per cent) is higher compared to developed countries, (b) An important source of employment (48.9 per cent of labour force) (c) An important source of food supply (d) Its contribution to industrial development is large (e) Significant contribution to foreign trade (f) It plays an useful role in stabilisation of price level (g) An important source of capital formation.

2. Out of total land under cultivation in India, 70 per cent are used for food grain production and the rest for non-foodgrain production.

3. Agricultural GDP in India is showing a rising trend. Annual average agricultural GDP growth in India from 1951-52 to 2014-15 is approximately 2.7 per cent per annum.

4. Production of food grains has registered a rise from 51 million tonnes in 1951-52 to 257.1 million tonnes in 2014-15.

5. Among the foodgrains, spectacular growth has taken place in the case of wheat (2.6 per cent per annum) during the post-green revolution period.

6. Productivity of Indian agriculture is low compared to other countries due to (a) General Factors, (b) Institutional factors, (c) Technological factors, (d) Miscellaneous factors.

7. Green revolution is a new agricultural strategy adopted in the late-1960s in Indian agriculture for augmenting production of food grains though application of new technology.

8. Elements of new technology consist of a package of (i) HYV seeds (ii) Chemical fertilizer, (iii) Pesticides, (iv) Irrigation facility, (v) Modern agricultural Implements, (vi) Improved agricultural practices and (vii) Institutional Credit.

9. Favourable impacts of green revolution include:

   (a) Greater use of modern inputs, (b) Increase in productivity, (c) Increase in production of foodgrains as well as commercial crops, (d) Crop diversification, (e) Increase in cropping intensity, (f) Expansion of employment and (g) Rise in marketed surplus.

10. Unfavorable impacts of green revolution include: (a) It is confined to limited areas, (b) It is confined to a few crops, (c) Increase in inequality, (d) Growth of capitalist farming, (e) Farm mechanisation and unemployment.

2.2 INDUSTRY

1. Industries play a very important role in the Indian economy because of the following reasons: (a) utilisation of the available natural resources, (b) significant contribution to GDP (30.5 per cent), (c) large contribution to gross domestic fixed capital formation (38.4 per cent), (d) alleviation of poverty, (e) reduction of inequality, (f) reduction of regional imbalances, (g) contribution to development of agriculture, (h) achieving self-sufficiency, (i) contribution to export.

2. To stimulate industrial development , government of India has formulated industrial policies in 1948, 1956 and 1991.

2.3 INFRASTRUCTURE AND ITS ROLE IN THE INDIAN ECONOMY

Infrastructure refers to the basic facilities which help in economic development of a country.

There are two types of infrastructure - economic and social. Economic infrastructure includes energy, transport and communication, irrigation, banking, finance and insurance.

Social infrastructure includes education and health services.

Role of Infrastructure

(i) Infrastructure facilitates economic activities

(ii) It promotes development

(iii) It helps in alleviation of poverty

Government of India has been earmarking a sizeable portion of its plan outlay for development of infrastructure since launching of First Five Year Plan in 1951.

2.3.1. Economic Infrastructure

2.3.1.1 Energy: Economic growth greatly depends upon availability and use of energy. Mainly there are two sources of energy - conventional and non-conventional.

Conventional sources of energy are of two types - commercial and non-commercial.

Sources of commercial energy consist of coal, oil and gas and electricity. These sources are commercial in the sense that they are available at a price.

Sources of non-commercial energy consist of fire-wood, vegetable waste, dried cow-dung etc. Energy is available almost free of cost from these sources.

Both commercial and non-commercial sources of energy are non-renewable. Non-conventional sources of energy are renewable. These include solar energy, wind energy, tidal energy and bio-energy. Government of India is taking several measures for the promotion of renewable sources of energy.

2.3.1.2 Transport: Transport benefits an economy in the following ways:

(i) It benefits consumers.

(ii) It facilitates production.

(iii) It expands size of the market and thereby provides incentive for investment.

(iv) It enables the use of resources as per priorities of plans.

(v) It provides access to remote areas for exploring resources.

(vi) It helps in bringing about regional balanced development of the country.

(vii) In a vast country like India transport provides the life line for social integration.

In view of the tremendous importance of transport system in the country, government of India has accorded high priority to its development.

Modes of transport system in India: Broadly speaking, there are four modes of transport system - railway transport, road transport, water transport and air transport.

(a) **Railway Transport:** The route length of railway has gone up from 53,600 kms in 1950-51 to 63300 kms in 2005-06 and further to 65,800 kms in 2014-15. Both freight traffic and number of passengers have increased manifolds during 1950-51 to 2014-15.

(b) **Road Transport:** Indian roads have been classified into four categories - National highways, State highways, District roads and Rural roads. National highways connect different state capitals, ports and big cities of the country. State highways connect the State capital with cities and towns of the state. District roads connect district headquarters with block and sub-division head quarters and different production locations and mandis. Rural roads connect different villages, panchayats and block headquarters and district roads. The length and quality of all these roads have increased significantly during the plan period.

(c) **Water Transport:** There are two kinds of water transport - Inland Water Transport (IWT), and Coastal / Marine Transport. Waterways are rendering important services for movement of long distance and bulky goods.

(d) **Air Transport:** Air transport or civil aviation was launched in India in the year 1920 and later nationalized in 1953. However, since 1994 the monopoly of public sector airlines has ended.

2.3.1.3 Communication: Communication may be formal or informal, written or verbal. Its network establishes close relationship between different people, regions, sections, sectors and thus facilitates the development process of an economy.

Modes of Communication System in India

The communication system in India comprises (a) Postal services, (b) Telegraph services, (c) Telecommunication and (d) Other communication systems such as (i) Internet services, (ii) Radio and Television, (iii) Newspapers, (iv) Periodicals, (v) Fax, (vi) e-mail and (vii) Satellite

2.3.2. Social Infrastructure

Social infrastructure refers to the facilities and services which help in the functioning of an economy in an indirect manner. Social infrastructure includes

education and health services. These facilities improve the quality of human capital of a country.

2.3.2.1 Education: Education helps a person to strengthen the base of his knowledge, approach, value orientation and efficiency. It brings about a change in the social, economic, political and cultural development of mankind.

State of Education in India in 1950-51

(i) State of primary education was poor. There was widespread illiteracy in the country.

(ii) State of secondary education was not satisfactory.

(iii) Higher education was biased in favour of general education.

For development of education, Government of India have implemented one National Policy on Education in 1968 and thereafter another National Policy on Education in 1986 which recommended for introduction and continuation of 10+2+3 pattern, universalisation of elementary education, development of vocational education, allowing only brilliant students in higher education, spread of adult education and women education, establishment of model schools etc.

2.3.2.2 Health: Health is an important indicator of standard of living of the people. Good health increases the efficiency of labour force and makes them more active and productive.

Health care facilities include hospitals, doctors, nurses, medical equipment and medicines.

Development of Health Care System in India

At the time of independence, the state of health care system in the country was very poor and inadequate. As a result, average life expectancy was low and death rate was very high.

After the adoption of planning since 1951, Government of India has implemented the following National Health programmes.

(i) National Malaria Eradication Programme (1958)
(ii) National Leprosy Control Programme (1955) renamed as National Leprosy Eradication Programme (1983)
(iii) AIDS Control Programme (1987)
(iv) Pulse Polio Programme etc.

Rural Health Care System

Under the minimum needs programme, the Government of India has developed health care system in the rural areas which include:

(i) Establishment of PHCs
(ii) Establishment of Sub-Centres
(iii) Establishment of Community Health Centres (CHCs)
(iv) Introduction of Multi Purpose Workers Scheme
(v) Appointment of Village Health Guides (VHG)

Despite adoption of several measures, health care facilities in the country are inadequate.

2.4 FOREIGN TRADE

1. Foreign trade refers to the exchange of goods and services between different countries of the world.

2. Foreign trade plays a vital role in stimulating the pace of economic development of the participating countries through expansion of production, optimal utilisation of resources, stabilisation of price level, expansion in the size of the market and promotion of competition.

3. India's Foreign Trade before Independence

(a) Composition of Foreign Trade: Composition of India's foreign trade shows the type of goods and their quantities which India imports from other countries and those which she exports to other countries during a given period of time.

Prior to independence India was importing mainly manufactured goods such as consumer goods, machinery, chemicals, iron and steel. Similarly, the country was

exporting mainly primary products such as foodstuff, cotton, jute, tea, oil seeds, textiles etc.

(b) Direction of Foreign Trade: Direction of India's foreign trade shows the countries from which it imports and the countries to which it exports over a long period time.

Before independence, England constituted 31 per cent of India's total imports. However in 1947 it came down to 25 per cent and that of USA increased to 30 per cent. Before independence India's exports to England constituted 34 per cent and to other commonwealth countries 21 per cent of total exports.

4. India's Foreign Trade after Independence

(a) Composition of Foreign Trade: India is now importing a large number of goods which can be broadly divided into three groups viz. Petroleum and petroleum products, Non-petroleum products and capital goods. Thus, during planning era India's composition of imports has undergone significant change.

Similarly, India is now exporting large number of goods which can be broadly divided into three categories viz. agricultural and allied products, manufactured goods, minerals and others. Thus India's exports have also undergone significant change during planning era.

(b) Direction of India's Foreign Trade: The countries with which India's foreign trade takes place were broadly divided into five groups such as OECD, OPEC, Eastern Europe, Developing countries and Other countries. For studying the change in direction of India's foreign trade in recent years, world can be divided into six groupings such as North America, Latin America and the Caribbean (LAC), Europe, Asia, Africa and Commonwealth of Independent states (CIS). It is found that direction of India's exports and imports in recent years is moving towards developing countries of Asia, Africa and Latin America. At present India's top 10 export partners are USA, UAE, Hong kong, China, Saudi Arabia, Singapore, UK, Germany, Srilanka and Netherlands. India's top 10 import sources are china followed by Saudi Arabia, UAE, Switzerland, USA, Indonesia, Quatar, Iraq, Niegeria and South Korea.

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MODEL QUESTIONS

2.1 AGRICULTURE

Group - A: Objective Type (Compulsory) (1 mark each)

1. Write the correct answer choosing from the alternatives given in each question:

(a) What was the contribution of agriculture to India's G.D.P. in 2014-15 ?

(i) 35.7 per cent (ii) 17.4 per cent

(iii) 14.7 per cent (iv) 13.9 per cent

(b) What was the share of agriculture in total employment in India in 2011-12 ?

(i) 72 per cent (ii) 48.9 per cent

(iii) 65 per cent (iv) 58 per cent

(c) What is the share of expenditure on agricultural products in total household consumption expenditure in India ?

(i) 80 per cent (ii) 72 per cent

(iii) 75 per cent (iv) 60 per cent

(d) What is the share of expenditure on food items in the total household consumption expenditure in India ?

(i) 60 per cent (ii) 55 per cent

(iii) 50 per cent (iv) 45 per cent

(e) When did India achieve self-sufficiency in foodgrain production ?

(i) At the end of 4th plan (ii) At the end of 5th plan

(iii) During 6th plan (iv) At the beginning of 7th plan

(f) What is the share of area under cultivation of foodgrains in the total cultivated area in India ?

(i) 30 per cent (ii) 50 per cent

(iii) 60 per cent (iv) 70 per cent

(g) What is the rate of growth of agricultural GDP per annum in India since 1951 till now ?

(i) About 4 per cent (ii) About 3.5 per cent

(iii) About 2.7 per cent (iv) About 1.5 per cent

(h) What is the volume of foodgrain production in India in 2014-15 ?

(i) 235 million tonnes (ii) 252 million tonnes

(iii) 257.1 million tonnes (iv) 270 million tonnes

(i) What is the per capita land holding in India ?

(i) 0.2 hectare (ii) 0.5 hectare

(iii) 0.3 hectare (iv) 0.43 hectare

(j) What is the share of marginal and small land holdings in the total land holdings in India ?

(i) About 90 per cent (ii) About 85 per cent

(iii) About 80 per cent (iv) About 70 per cent

(k) What is the trend of contribution of agriculture to India's GDP ?

(i) Increasing (ii) Declining

(iii) Constant (iv) None of the above

(l) What amount of fertilizer is used per hectare in India ?

(i) 90 kg. (ii) 92 kg. (iii) 105 kg. (iv) 102 kg.

(m) When did India adopt green revolution ?

(i) During early 1970s (ii) During late 1960s

(iii) During early 1960s (iv) During late 1970s

(n) What is the rate of growth of agriculture productivity in India during post-green revolution period ?

(i) 2 per cent per annum (ii) 3 per cent per annum

(iii) 3.5 per cent per annum (iv) 4 per cent per annum

(o) Which crop has been benefited most under the impact of green revolution in India ?

(i) Rice (ii) Sugar cane

(iii) Wheat (iv) Oil seeds

(p) What is the share of land area under HYV seeds in the total cultivated land in India ?

(i) 50 per cent (ii) 60 per cent

(iii) 53 per cent (iv) 70 per cent

(q) What is the total land area under foodgrain cultivation in India in 2014-15 ?

(i) 126.7 million hectare (ii) 125.5 million hectare

(iii) 123.7 million hectare (iv) 122.1 million hectare

(r) What is trend of production of agriculture output in India ?

(i) Rising (ii) Falling

(iii) Constant (iv) None of the above

(s) Which of the following has larger demand than supply in India ?

(i) Rice (ii) Wheat

(iii) Pulses (iv) Maize

(t) In which of the following India is the largest producer ?

(i) Rice (ii) Wheat

(iii) Buffalo Milk (iv) Sugar cane

2. I Express each of following statements in one word:

(a) Total output divided by total land area.

(b) Amount of output produced per worker engaged in agriculture.

(c) Number of times by which a unit of land is put to cultivation in a single year.

(d) Distribution of total cultivated land among different crops in a year.

(e) The new agricultural strategy adopted in Indian agriculture in late-1960s for augmenting production of foodgrains.

2.II Answer the following questions in one sentence in each case:

(a) Why is agriculture called the most dominant sector of the Indian economy ?

(b) What are the main causes responsible for heavy dependence on agriculture ?

(c) During which plan period India achieved self sufficiency in foodgrain production ?

(d) What per cent of total consumer expenditure is incurred on agricultural products ?

(e) What per cent of consumer expenditure is incurred on food items ?

(f) During which period India had to face serious food problem ?

(g) What is the trend of growth of agricultural GDP in India since the inception of planning (1951) ?

(h) What is the amount of foodgrain production in India at present in 2014-15 ?

(i) Between food crops and non-food crops, whose growth is more prominent in India ?

(j) What is land productivity ?

(k) What is labour productivity ?

(l) Mention two causes of low productivity of Indian agriculture.

(m) What is meant by green revolution ?

(n) During which period the green revolution started in India ?

(o) What is the other name of green revolution ?

(p) Give two names of HYV seeds.

(q) What are the elements of new technology adopted in Indian agriculture to boost production ?

(r) Which crop is the most benefited crop due to green revolution ?

(s) What is the most important cause of increase in agricultural output in India ?

(t) What is cropping pattern ?

(u) What do you mean by cropping intensity ?

(v) To which States green revolution was confined initially ?

(w) What is the contribution of agriculture to India's GDP at present ?

(x) What is the total arable land area in India ?

(y) Name two agricultural produce in which India is the largest producer in the world.

(z) In which year wheat exports were banned in India ?

2.III Examine the correctness of the following statements. Correct them if necessary, without changing the portions underlined.

(a) Share of agriculture in India's GDP is steadily increasing.

(b) India achieved self-sufficiency in food grain production by the end of Sixth Five Year Plan.

(c) Food grains include oil seeds, cotton, sugar cane.

(d) Growth of food crops is more prominent than growth of non-food crops in India.

(e) The most spectular growth has been recorded by rice in India during post green revolution period.

(f) Proportion of total land put to food crops is showing a rising trend after green revolution.

(g) Trend of production of agricultural output in India is showing a declining trend since 1951.

(h) At present, demand for cereals is more than than their supply in India.

2.IV Fill up the blanks.

(a) _____ constitutes the most dominant sector of the Indian economy.

(b) Share of agriculture in India's GDP is _____ per cent in 2014-15.

(c) _____ per cent of total work force in India are engaged in agriculture.

(d) _____ per cent of the total consumer expenditure is incurred on agricultural products.

(e) _____ per cent of consumer expenditure is incurred on food items.

(f) Food grains cover about _____ per cent of total cultivated land in India.

(g) Among the food grains, the performance of _____ is the most spectacular in the post green revolution period.

(h) Green revolution is a new agricultural strategy adopted during _____.

(i) Green revolution is also called _____.

Group B (Short Type Questions)

3. Answer the following within two / three sentences (2 marks each).

(a) How does agriculture provide market for industrial products ?

(b) What are the elements of new technology adopted for green revolution ?

(c) How has green revolution resulted in an increase in inequality in the distribution of income ?

4. I Answer the following within six sentneces (3 marks each).

(a) How does agriculture stimulate industrial development ?

(b) How is agriculture an important source of capital formation ?

(c) How are the institutional factors responsible for low productivity of Indian agriculture ?

(d) What is the background of green revolution in India ?

(e) What are the elements of new technology used for boosting agricultural production during the late 1960s ?

2.II Distinguish between the following restricting your answer within six sentences in each case (3 marks).

(a) Cropping pattern and Cropping intensity.

(b) Land productivity and Labour productivity.

Group - C (Long Answer Type Questions) (7.5 marks each)

5. Examine the importance of agriculture in the Indian economy.

6. Explain the causes of low productivity of Indian agriculture.

7. What is Green Revolution ? What are its main elements ?

8. Discuss the impact of Green Revolution on the Indian economy.

9. Write a note on the present agricultural situation in India.

2.2 INDUSTRY

Group - A: Objective Type (Compulsory) (1 mark each)

1. Write the correct answer choosing from the alternatives given in each question.

(a) What is the contribution of industry to India's GDP at present ?

(i) 23.7 per cent (ii) 25 per cent

(iii) 30 per cent (iv) 27 per cent

(b) What is the share of employment in industry in the total work force in India ?

(i) 40 per cent (ii) 17 per cent

(iii) Approximately 20 per cent (iv) None of the above

(c) First Industrial Policy in India was formulated in:

(i) 1956 (ii) 1977 (iii) 1948 (iv) 1991

(d) IPR (1948) divided the various industries of the country into:

(i) Three categories (ii) Four categories

(iii) Two categories (iv) Five categories

(e) Which IPR is regarded as the economic constitution of India ?

(i) 1948 (ii) 1956 (iii) 1977 (iv) 1991

(f) Indian industries were divided into how many categories as per 1956 IPR ?

(i) Two (ii) Three (iii) Four (iv) Five

(g) How many industries in India are reserved for the public sector at present ?

(i) 17 (ii) 8 (iii) 6 (iv) 3

(h) How many industries in India are under the purview of industrial licensing at present ?

(i) 6 (ii) 4 (iii) 5 (iv) 3

(i) What is the size of population of cities for which there is no restriction for setting up of industries ?

(i) less than 1 million (ii) 1 million

(iii) 1 million (iv) 1.5 million

(j) What should be the distance from the perphery of the city having more than one million population for setting up of non-polluting industries ?

(i) More than 25 kms. (ii) 25 kms.

(iii) 10 kms. (iv) within 10 to 20 kms.

(k) What was the investment limit in plant and machinery in tiny sector according to IPR 1991 ?

(i) 5 lakh (ii) 10 lakh (iii) 20 lakh (iv) 25 lakh

2. I Answer each of the following questions in one word.

(a) The rules, regulations and principles formulated by the government in respect of ownership, operation and regulation of industries.

(b) An economy where both private sector and public sector exist side by side.

(c) Enterprises which are owned and operated by the government.

(d) Enterprises which are owned and operated by the private individuals.

2. II Answer each of the following questions in one sentence in each case.

(a) How can industrialisation help in solving unemployment problem ?

(b) What are the broad categories to which Indian industries were divided in IPR 1948 ?

(c) What are the broad categories to which Indian industries were divided in IPR 1956 ?

(d) Give the names of the industries which are now under the purview of industrial licensing.

(e) Give the names of the industries which are now reserved for the public sector.

(f) What is the norm for location of industries in IPR 1991 ?

(g) What is industrial policy ?

(h) What is public sector ?

(i) What is private sector ?

2. III Examine the correctness of the following statements. Correct them, if necessary, without changing the portions underlined.

(a) Share of industries in India's GDP is showing a declining trend.

(b) IPR 1948 made three fold classification of industries.

(c) IPR 1956 made four fold classification of industries.

(d) IPR 1948 emphasised a healthy relation between labour unions and management.

(e) IPR 1991 provided automatic approval of direct foreign investment up to 60 per cent equity in 34 high priority industries.

2. IV Fill up the blanks:

(a) India's First Industrial Policy was formulated in _____.

(b) IPR 1948 divided industries into _____ broad categories.

(c) IPR 1956 divided industries into _____ broad categories.

(d) IPR 1956 gave emphasis on _____ sector.

(e) IPR 1991 abolished licensing for all except _____ industries initially concerned with environmental problems.

(f) The investment limit in plant and machinery in the tiny sector increased to _____ in IPR 1991.

Group - B (Short Answer Type Questions)

3. Write short note on the following within two / three sentences in each case. (2 marks each)

(a) Public sector

(b) Private sector

(c) Basic and key industries

(d) Small-scale and cottage industries

(e) Mixed economy

4. Answer the following questions within six senences in each case (3 marks each).

(a) How does industrialisation help in alleviation of poverty ?

(b) How does industrialisation help agricultural development ?

(c) How does industrialisation help in reduction of inequality in the distribution of income.

(d) What are the objectives of IPR 1991 ?

(e) What are the achievements of IPR 1956 ?

Group - C (Long Answer Type Questions) (7.5 marks)

5. Discuss the importance of industrialisation in the Indian economy.

6. Explain the features of IPR 1948 of the government of India.

7. Explain the features of IPR 1956 of the government of India.

8. Discuss the main features of Industrial Policy Resolution (1991) of the government of India.

2.3 INFRASTRUCTURE AND ITS ROLE IN THE INDIAN ECONOMY

Group - A: Objective Type: Compulsory (1 mark each)

1. Write the correct answer choosing from the alternatives given in each question:

(a) Economic infrastructure includes :

(i) Irrigation works (ii) Roads (iii) Railways (iv) All of these

(b) Social infrastructure includes:

(i) Telecommunication (ii) Air transport

(iii) Education (iv) Irrigation works

(c) Commercial sources of energy consist of:

(i) Coal and lignite (ii) Oil and natural gas

(iii) Electricity (iv) All of the above

(d) Which of the following is not a source of renewable energy ?

(i) Solar energy (ii) Fuel wood

(iii) Tidal energy (iv) Wind energy

(e) Which of the following is not a source of conventional energy ?

(i) Electricity (ii) Bio-energy

(iii) Coal (iv) Oil and natural gas

(f) Air transport was started in:

(i) 1951 (ii) 1952

(iii) 1953 (iv) 1954

(g) The first railway line was laid between:

(i) Calcutta and Bombay (ii) New Delhi and Bangalore

(iii) Bombay and Thane (iv) Chennai and Calcutta

(h) First National Policy on Education was formulated in:

(i) 1986 (ii) 1987

(iii) 1968 (iv) 1969

2. I Answer the following questions in word in each case.

(a) Network which establishes close link between different regions, sections, sectors and people.

(b) Basic facilities and services which facilitate the functioning of an economy.

2. II Answer the following questions in one sentence in each case.

(a) What is infrastructure ?

(b) What is economic infrastructure ?

(c) What is meant by social infrastructure ?

(d) What are the conventional sources of energy ?

(e) What are the commercial sources of energy ?

(f) What is meant by renewable energy ?

(g) What is meant by non-renewable energy ?

(h) What are the different sources of electricity generation in India ?

(i) What is meant by thermal power ?

(j) What are the modes of road transport in India ?

(k) What is meant by communication system ?

3. III Correct the following, if, necessary without changing the portions underlined:

(a) Coal is a source of renewable energy.

(b) Bio-gas is a source of non-renewable energy.

(c) Indian railways is the second largest in Asia.

(d) National Policy on Education - 1986 recommended the introduction of 10+2+3 pattern of educational system in India.

(e) National Policy on Education - 1968 emphasised on development of vocational education at the higher secondary level.

(f) National Policy on Education - 1968 proposed to establish model schools for bright students.

2. IV Fill up the blanks:

(a) Education and health services constitute _____ infrastructure.

(b) Coal is an important source of _____ energy.

(c) _____ is the fastest mode of transport in India.

(d) Postal services in India were started in _____.

(e) A three language formula was recommended for the secondary level by _____ National Policy on Education.

(f) Education Commission 1964 is known as _____.

Group B (Short Answer Type Questions)

3. Write short notes on the following within two / three sentences in each case. (2 marks each)

(a) Social overhead capital

(b) Economic infrastructure

(c) Telecommunication

(d) Thermal Power

(e) Renewable energy

(f) Non-renewable energy

4. Distinguish between the following restricting your answer within six sentences in each case (3 marks each).

(a) Economic infrastructure and Social infrastructure.

(b) Commercial sources of energy and Non-commercial sources of energy.

(c) Renewable energy and Non-renewable energy.

(d) Conventional sources and Non-conventional sources of energy.

5. Answer the following within six sentences in each case (3 marks).

(a) Explain the meaning of infrastructure.

(b) Explain the different sources of renewable energy.

Group - C : Long Answer Type Questions (7.5 marks each)

6. Discuss the importance of infrastructure in the Indian economy.

7. Distinguish between economic and social infrastructure. Explain the different types of social infrastructure.

8. Explain the different commercial sources of energy.

9. Explain the different non-commercial sources of energy.
10. Explain the different sources of electricity generation in India.
11. Discuss the different modes of communication system in India.
12. Explain the importance of transport system in the Indian economy.
13. Describe the features of National Policy on Education - 1986.
14. Give a brief account of the health care system in India.

2.4 FOREIGN TRADE

Group - A: Objective Type (Compulsory) (1 mark each)

1. Write the correct answer choosing from the alternatives given in each question.

(a) Out of the following, which country was the major trading partner of India at the time of independence?

(i) USA (ii) UK (iii) Germany (iv) Japan

(b) Which one of the following is the India's top most item of exports at present?

(i) Vehicles (ii) Organic chemicals

(iii) Petroleum and Petroleum Products

(iv) Pearls, Precious and Semi-precious stones

(c) Which one of the following is the India's top most item of imports at present?

(i) Pearls, Precious and Semi-precious stones

(ii) Crude Petroleum and Petroleum Products

(iii) Plastic (iv) Fertilisers

(d) Which one of the following is the top most destination for India's exports?

(i) North America (ii) Asia

(iii) Africa (iv) Europe

(e) Which one of the following is the most important source of India's imports?

(i) North America (ii) Europe (iii) Africa (iv) Asia

(f) Which one of the following is the India's biggest export partner?

(i) USA (ii) China (iii) Hong kong (iv) UK

(g) Which one of the following is India's biggest import source?

(i) USA (ii) South Korea (iii) China (iv) Quatar

2. I Express each of the following statements in one word.

(a) Goods which are purchased from abroad.

(b) Goods which are sold to foreign countries.

(c) The exchange of goods and services between two or more countries.

(d) The list of goods a country imports and exports and their quantities and value in course of international transactions during a given time period.

(e) The phenomenon showing the countries from which import of a country comes and the countries to which the export of that country goes over a long period.

2. II Answer the following questions in one sentence in each case.

(a) What do you mean by composition of foreign trade ?

(b) What do you mean by direction of foreign trade ?

(c) What were the main items of India's exports at the time of independence ?

(d) What were the main items of India's imports at the time of independence ?

(e) With which countries India's foreign trade was concentrated at the time of independence ?

(f) Who are the major trading partners of India at present ?

2. III Examine the correctness of the following statements. Correct them, if necessary, without changing the portions underlined.

(a) At the time of independence, India's major trading partner was USA.

(b) OPEC is now the biggest partner of India's foreign trade.

(c) Share of India's imports of capital goods is increasing.

(d) Share of India's export of agricultural products is showing a rising trend.

(e) Germany has emerged as the biggest importer of Indian goods.

Unemployment may be voluntary or involuntary. Voluntary unemployment occurs when people who are able to work are not willing to work at the prevailing wage rate. But involuntary unemployment occurs when people who are able and willing to work do not find gainful work. In economics the term 'unemployment' refers to only involuntary unemployment. Voluntary unemployment is not considered as unemployment.

4.2.2 Nature and Types of Unemployment in India

The problem of unemployment in India is much more serious than that of the developed countries. In developed countries unemployment is cyclical, but in less developed countries like India it is structural. Cyclical unemployment is caused due to lack of effective demand. This is so called because it appears in the downward phase of the business cycle below the equilibrium growth path. But structural unemployment occurs due to lack of capital and other complementary factors.

Though there are various types of unemployment in India, it generally takes two forms-rural unemployment and urban unemployment.

(A) Rural Unemployment

Bulk of unemployment in India is found in rural areas. Rural unemployment usually assumes three forms - seasonal unemployment, disguised unemployment and educated unemployment.

(i) Seasonal Unemployment

Agriculture is the principal occupation in rural India. By nature agriculture is a seasonal occupation. Bulk of rural population are engaged in farm activities only in the farming seasons but during most part of the year remain unemployed. Such unemployment is due to the absence of alternative employment opportunities.

(ii) Disguised Unemployment

Rapid growth of population on the one hand, and lack of adequate gainful employment opportunities on the other, have resulted in overcrowding in agriculture. In such a situation even if some people are withdrawn from agriculture, production will not be affected much. Such a type of situation is called disguised unemployment.

Apparently all persons seem to be employed, but contribution of many workers to total product (i.e., marginal product) is almost zero. Disguised unemployment is the main type of unemployment found in the agricultural sector in India. It is also seen in bus stops where we notice more rickshaw pullers and coolies than required.

(iii) Educated unemployment

With the spread of education in rural areas, there has emerged a class consisting of educated and highly educated people. They find themselves misfit in usual agricultural operations and thus remain idle due to lack of employment opportunities outside agriculture.

(B) Urban Unemployment

While most part of unemployment in rural areas is disguised, most of unemployment in urban areas is open. Urban unemployment is of three types viz. i) Unemployment of unskilled industrial workers or industrial unemployment, or Blue collar unemployment, ii) Educated unemployment or White collar unemployment and iii) Underemployment.

(i) Industrial Unemployment

Although there has been a significant expansion of the industrial sector, industrial unemployment has expanded over the years. The factors which have contributed to this phenomenon are : a) Increase in economically active population in the country; b) Population in urban areas has grown faster largely because of migration from rural to urban areas, c) Concentration of industries in urban areas and d) Decay of cottage and small scale industries in rural areas.

(ii) Educated Unemployment

Educated unemployment arises mainly because of the following :

a) Although there has been a very fast expansion of general education, technical education and training have lagged behind in India. As a result, there is increase in supply of labour force having general education though demand for such educated population is less.

b) Economic growth has been taking place at a slow pace. Such slow pace of growth has not been able to create adequate employment opportunities. As such all types of educated people including engineers, general graduates and post graduates remain unemployed.

(iii) Underemployment

Underemployment constitutes a major part of unemployment found in all countries. It refers to a situation in which a worker is doing a wage job that is not sufficient relative to any acceptable standard. Underemployment can be studied from the point of view of an individual worker who is underemployed or in a macro sense in which case a large number of workers in a society remain underemployed. Underemployment has one or some or all of the following features.

1. The worker is not working full-time but part-time or is not working on all days but on some days due to unavailability of jobs.
2. The worker does a work that is inferior relative to his qualification/education, experience, skill and physical/mental abilities. An engineer working as a salesman in a mall may be an example.
3. There may be overstaffing/overcrowding in which case more people are working than are warranted. This is typical in traditional agriculture, the case of vehicles with drivers in bus stops and railway stations, etc.
4. It may indicate a situation in which technology is improving and the worker is not updating but manages to be on the job may be due to trade union action.
5. The worker is underutilised.

Raj Krishna's Classification of Unemployment

Prof. Raj Krishna discussed four criteria of unemployment basing on time, income, willingness and productivity. According to the time criterion a person is severely underemployed if he is engaged in gainful work for 28 hours or less in a week and

moderately unemployed if he is engaged for more than 28 hours but less than 42 hours in a week. A person working for 8 hours a day for 273 days of the year is regarded as employed on a standard person year basis.

A person may be employed on some wage or income but the income which he earns may not be sufficient for him to rise above the poverty level. This is the income criterion of unemployment.

A person may be considered underemployed if he is forced to take a job that he thinks is not adequate for his purpose or is not at par with his education and training. This is the willingness or recognition criterion of unemployment. Under this criterion, there are also voluntarily unemployed persons in urban areas who are searching for specific type of jobs according to their educational qualifications. Such persons may be considered as unemployed.

According to the productivity criterion disguised unemployment is a situation where the marginal productivity of labour over a wide range is zero or near zero.

The National Sample Survey Organisation (NSSO) had developed three concepts of unemployment since 1972-73. These are 1) Usual status unemployment or Chronic unemployment 2) Weekly status unemployment, and 3) Daily status unemployment. They are discussed in the following section.

4.2.3 Estimates of Unemployment

For a clear understanding of unemployment we should know the following concepts developed by National Sample Survey Organisation of India. The first is labour force participation rate (LFPR). It is the ratio of persons/ person days in the labour force to total population per 1000 persons / person-days. Person in the labour force includes the number employed and the number unemployed in the economically active age group 15-59 years.

$$LFPR = \frac{E + U}{P} \times 1000$$

The second is workers population ratio or WPR. It is the ratio of number of employed people to total population per 1000 persons.

$$WPR = \frac{E}{P} \times 1000.$$

The third is proportion unemployed (PU). It is the ratio of number of unemployed people to total population per 1000 persons. $PU = \frac{U}{P} \times 1000.$

The fourth is unemployment rate (UR). It is the ratio of number of persons / person-days unemployed to the total number of persons in the economically active age-group per 1000 persons. $UR = \frac{U}{E + U} \times 1000.$

NSSO provides estimates of employment and unemployment with reference to the activity status of population on the basis of three approaches. They are: usual status (US), current weekly status (CWS) and current daily status (CDS) approaches. In the US approach whether a person is employed or unemployed is decided by the major time criterion in a reference period of 365 days preceding the date of survey. It looks at the issue in terms of principal and subsidiary activity status of the workers. The activity status in which a person spent longer time of 283 days or more during the 365 days reference period (major time criterion) is considered the usual principal activity status of that person. Such person may have spent a relatively shorter time (minor time) of 30 days or more on some economic activity during the reference year. This is termed as the usual subsidiary economic activity status. Employment in the subsidiary economic activity may be there in two situations. First a person may spend major time in one economic activity and minor time in another economic activity. Second, he/ she may be engaged in one economic activity throughout the year and simultaneously in another economic activity for a comparatively shorter period. Adding the two activity status together we get the measure of usual principal and subsidiary status (UPSS) or usual status (US) unemployment.

CWS of employment is determined on the basis of a reference period of one week or seven days preceding the date of survey. In this approach, a person is considered as employed if he/ she pursued some economic activity for at least one hour on any day of the reference week. CDS of a worker is obtained in terms of economic activity pursued

by a person on each day during a reference period of seven days preceding the date of survey. It is based on day-to-day labour time disposition. According to this approach, a person in considered employed for the full day if he / she worked for four or more hours during the day. If he/she has worked for more than one hour but less than four hours, he/ she is considered to be employed for half day. If a person is available for work / seeking employment for more than four hours during a day but has not worked ever for one hour during the day, then he/ she is categorised as unemployed for full day. But if the person is reported seeking work for more than one hour but less than four hours, then he is classified as unemployed for half day and not in the labour force for the other half day.

It is thus clear that CDS is concerned with person-days and not with persons. Accordingly, person-days in employment/ unemployed of each day of the reference week is aggregated to obtain person-days of employment and unemployment in the economy. The UR in this approach is estimated as the ratio of person-days in employment to person-days in labour force per 1000 person-days.

The details of LFPR, WPR and UR according to UPSS, CWS and CDS for 2011-12 in respect of both India and Odisha are given in the following table.

Table - 4.4 : LFPR, WPR and UR in India and Odisha

Location		India			Odisha		
		UPSS	**CWS**	**CDS**	**UPSS**	**CWS**	**CDS**
LFPR	Rural	406	383	361	427	380	352
	Urban	367	363	354	395	385	379
	All	559	534	508	422	380	356
WPR	Rural	399	370	340	417	360	322
	Urban	355	347	335	381	367	357
	All	386	364	339	412	361	327
UR	Rural	17	34	57	22	51	87
	Urban	34	44	55	35	47	58
	All	23	37	56	24	51	83

According to the usual status approach, the unemployment rate is found to be high in the urban areas compared to the rural areas. This is because of migration of working age people from rural to urban areas in search of gainful employment. The unemployment rate is higher in Odisha than at the all-India level and this holds for both rural and urban areas. This means that creation of gainful employment opportunities is lacking more in the state than at the national level.

4.2.4 Causes of Unemployment

Unemployment problem in the country is mainly caused due to mismatch between supply of labour force and demand for labour force in the country. Excess supply of labour force over the demand has resulted in acute unemployment problem.

Causes of Large Supply of Labour Force

Rapid growth of labour force is caused due to the following factors:

(i) Fast Growing Population

The population of India is increasing due to faster decline in death rate compared to fall in birth rate. This is the main cause of significant growth in the labour force.

(ii) Urbanisation

Urbanisation has induced large scale migration of rural population to urban areas in search of better employment and to experience better livelihood. This has resulted in an increase in supply of job seekers in urban areas.

(iii) Inappropriate Educational System

Fast expansion of general education (Arts, Science and Commerce) has led to the increase in educated population resulting in an increase in the supply of educated labour force.

(iv) Change in Attitude of Women

After independence women's education has expanded. This has led to a change in attitude of women towards employment. They now compete with men for employment.

(v) Lack of Manpower Planning

Mismatch between supply of labour force and demand for labour force is mainly caused by lack of manpower planning in India. For a faster growth of any economy human resources play an important role. There should be long term planning for the provision of appropriate skills for meeting the requirements of development. No doubt, there has been an increase in facilities for higher education, technical education and training in different fields, but these are not in accordance with development needs. The obvious result is surplus of manpower in some fields and deficit in others. We find widespread unemployment among graduates and post-graduates in Arts, Science and Commerce while there is scarcity of physicians and technical personnel.

Causes of Inadequate Demand for Labour Force

Though there is rapid growth of supply of labour force in the country, job opportunities fail to increase in keeping pace with it. The following are the reasons for inadequate employment opportunities in the country.

(i) Slow Economic Growth

It is expected that as economic growth takes place, job opportunities expand. In the post-independence era, not doubt, economic growth has taken place in the country. But the rate of growth has been slow due to (a) Limited degree of industrialisation, (b) Inadequate infrastructure facilities, (c) Low priority given to agriculture, (d) Small public investment in agriculture and (e) Inadequate irrigation facilities. Because of slow economic growth, demand for labour is low.

(ii) Decay of Small and Cottage Industries

India was famous for small and cottage industries in the past. They are labour-intensive and provided employment to large number of rural people. But these industries are now decaying due to stiff competition from the manufacturing sector and government apathy.

(iii) Inappropriate Technology

It is a fact that in India labour is abundant while capital is scarce. Therefore, to solve the problem of unemployment, there is need to adopt such technology, which

2.IV Fill up the blanks.

(a) Inspite of manifold rise in domestic production, India still imports _____ per cent of her total POL requirements.

(b) _____ is the largest exporter to India.

(c) From the point of view of India's international trade the countries of the would have been divided into _____ trading blocks.

Group - B: Short Type Answer

3. Answer the following questions in two / three sentences in each case (2 marks).

(a) Which are the important agricultural products in India's exports in recent years ?

(b) How does international trade help in optimum utilisation of resources of the trading nations ?

(c) How does international trade promote competition ?

(d) How does international trade help in stabilisation of price level ?

(e) How does foreign trade help in increasing size of the Indian market ?

4. Distinguish between the following restricting your answer within sentences in each case:

(a) Composition of foreign trade and Direction of foreign trade.

(b) Internal trade and Foreign trade.

(c) Imports and Exports.

Group - C: Long Answer Type (7.5 marks)

5. Discuss the role of foreign trade in the Indian economy.

6. Analyse the changes in composition of foreign trade of India since independence.

7. Discuss the changes in direction of foreign trade since independence.

CHAPTER - 3

ECONOMIC PLANNING AND ECONOMIC REFORMS

- Planning - Meaning, Need, Objectives and Achievements, Niti Aayog
- Economic Reforms Since 1991– Need and Main Features of Liberalisation, Privatisation and Globalisation

3.1 ECONOMIC PLANNING

Introduction

On the eve of independence, India was in a state of stagnation, underdevelopment and backwardness. There was massive unemployment, illiteracy, malnutrition and hunger in the country. Government of India realised that planning is the only effective means of addressing these problems and initiating and accelerating the pace of economic development of the country. Accordingly, Planning Commission was set up in March 1950 to assess the country's material capital and human resources and to formulate plans for their most effective and balanced utilisation. India entered into an era of planning with effect from April 1951.

Before discussing different goals and objectives, achievements and failures of different plans implemented in India since 1951 till now, it is pertinent to know the meaning of planning.

3.1.1 Meaning of Planning

Planning is the process of preparing blue print of actions to be taken for achieving certain predetermined and well defined objectives within a definite period of time.

According to Dickinson, planning is "the making of major economic decisions - what and how much is to be produced and to whom it is to be allocated by the conscious decision of a determinate authority, on the basis of a comprehensive survey of the economic system as a whole".

Basically planning has two main elements, such as (a) the ends or objectives that are to be achieved and (b) the means or techniques or arrangements to be adopted for achieving the objectives. For making the plan effective and fruitful, proper knowledge about the availability of resources in the economy and requirements of people is very much essential. Hence before preparing a plan, a comprehensive survey of the economy has to be undertaken.

3.1.2 Need for Planning

On the eve of Independence, government of India realised that planning is indispensable for addressing the problems of stagnation, under development, unemployment and poverty which the country was facing at that time and for initiating and accelerating the pace of country's economic development. Need for planning in a less developed country like India is evident from the following discussion.

(1) Mobilisation of Resources : Paucity of resources is the chief cause of India's under development. Because of low income, majority of the people do not have capacity to save. Those who have capacity to save, instead of saving their surplus income in banks or other financial institutions, they utilise such surplus income in the purchase of gold and jewellery, land, building and expenditure on conspicuous consumption. Consequently, voluntary savings are low. It is the responsbibility of the government to mobilise sufficient resources from inside the country as well as from outside for stimulating economic development. Effective planning is needed for mobilisation of desired resources.

(2) Optimal Utilisation of Scarce Resources : Since resources are scarce, these must be put to the most desirable uses. It is the planning authority, which can make optimal utilisation of scarce resources by allocating them in favour of socially desirable channels and discouraging their flow into unproductive channels.

(3) Augmenting Output and Income : In a less developed country like India, government has to adopt planning for accelerating the pace of economic development by augmenting volume of production of output and enhancing income by making the most efficient utilisation of the available resources along with the use of appropriate technology and application of suitable strategey.

(4) Expansion of Employment Opportunities : A major problem facing the Indian economy is the prevalence of massive unemployment. The main cause of unemployment is the excess of supply of labour force in realation to demand.

Since massive unemployment is the main cause of acute poverty, solution of the problem of unemployment is a major challenge before the government. Employmnt opportunities can be created if resources are optimally utlised for setting up of a large number of small scale, cottage and village industries along with medium and large scale industries in the country. For this, planning is needed.

(5) Alleviation of Poverty : Acute poverty is the main problem facing India as well as other less developed countries. It is possible to create employment opportunities and alleviate poverty through rapid indusrialisation and development of agriculture and service sectors. But the planning authority will take decision regarding the type of industries to be set up, the place where such industries will be set up the amount of capital to be invested and the manner in which development of agriculture and service sectors will take place.

(6) Reduction of Inequality in the Distribution of Income and Assets : There is extreme inequality in the distribution of income and wealth among different sections of the society in India as well as in other less developed countries. Such inequality in the distribution of income and wealth is a major impediment in the path of the country's economic development. It is believed that inequality can be reduced through establishment of large number of cottage and small scale industries which are labour intensive in nature. Planning is needed for the preparation of roadmap of such programme.

(7) Reduction of Regional Disparity : Besides inequality in distribution of income and high incidence of poverty, presence of large regional disparity is another major problem facing the Indian economy. Regional disparity can be reduced through establishment of different types of industries and creation of economic infrastructure in underdeveloped and backward areas of the country. For preparation of blue print of such a programme, planning is needed.

(8) Creation of Infrastructure : In all less developed countries like India, economic infrastructure such as energy, transport, irrigation, communication etc. is found to be inadequate. Lack of adequate infrastructure is the major bottleneck in the path of economic development of the country. Infrastructure plays a very important role in expanding employment opportunities, increasing production and income by encouraging private investment. Therefore, development of infrastructure is indispensable. Suitable action plan is needed to create adequate and quality infrastructure in the country.

(9) Establishment of Basic and Key Industries : The role of basic and key industries such as iron and steel, cement, heavy engineering, fertilisers etc. is of immense importance for strengthening economic infrastructure and accelerating the pace of economic development of India. For establishment of such industries, there is a need to make large investment along with application of new and modern technical knowledge. Planning is needed for taking decision regarding how the resources will be mobilised, how much resources will be utilised and within what time the programme of establishment of basic and key industries will be completed.

On the basis of the above analysis, it can be concluded that planning is the sine-qua-non for moblisation of resources, optimum utilisation of such resources, alleviation of poverty, expansion of employment, reduction of inequality in the distribution of income and wealth among sections of the society, reduction of regional imbalances, creation of economic infrastructure, establishment of basic and key industries and a balanced development of agriculture, industry and other economic activities for accelerating the pace of economic development of India.

3.1.3 Different Five Year Plans

India launched the First Five Year Plan in 1951. By now, eleven Five Year Plans and five annual plans have been completed. Table 3.1 gives a picture of plan outlays, growth targets and achievements of the Five Year Plans launched so far in India.

Table-3.1 : Plan Outlays Under Different Plans and Growth Rates
(Target and Achievement)

Plans	Time Period	Plan Outlay (Rs. in crore)	Target (per cent per annum)	Achievement (per cent per annum)
1st Five Year Plan	1951-56	1,960	2.2	3.6
2nd Five Year Plan	1956-61	4,672	5.0	4.0
3rd Five Year Plan	1961-66	8,577	5.6	2.3
4th Five Year Plan	1969-74	16,160	5.7	3.4
5th Five Year Plan	1974-79	40,712	4.4	4.0
6th Five Year Plan	1980-85	1,10,821	5.2	5.4
7th Five Year Plan	1985-90	1,78,570	5.0	5.8
8th Five Year Plan	1992-97	3,80,524	5.6	6.8
9th Five Year Plan	1997-2002	8,59,200	6.5	5.5
10th Five Year Plan	2002-2007	15,92,300	8.0	7.19
11th Five Year Plan	2007-2012	36,44,718	9.0	7.9
12th Five Year Plan	2012-2017	35,68,626	8.0	-

Source: Plan Documents, Government of India
Note : N.A. - Not Available

The First Five Year Plan was launched in 1951 with a total outlay of Rs. 1960 crore. It was basically an agricultural plan, which emphasised on the increase in production and productivity of the agriculture sector to meet the growing demand for foodgrains. The plan expected the GDP to increase by 2.2 per cent per annum. But the actual growth was 3.6 per cent per annum. This made the planners over-enthusiastic. The Second Five Year Plan launched in 1956 accorded top priority to the heavy industries and expected GDP to grow by 5 per cent per annum. But the actual growth rate was 4 per cent. The Third Five Year Plan formulated in 1961, envisaged the economy to grow at 5.6 per cent per annum. But the actual growth rate was only 2.3 per cent per annum. This is due to the war with China (1962) and with Pakistan (1956).

To add fuel to the fire, there was severe drought in Gujarat and Maharastra in 1965-66. Thus the country faced acute food and foreign exchange crisis. Therefore, though it was decided to have plans for five years duration, the set pattern had to be modified in view of the lack of required resources and the country had a plan holiday for three years (1966 to 1969) and during these three years three Annual Plans were launched. The Fourth Five Year Plan was started in 1969 with a target of 5.7 per cent growth of GDP per annum, while the actual growth rate was only 3.4 per cent. The Fifth Five Year Plan was launched in 1974 with the twin objectives of self-reliance and poverty alleviation. It envisaged a growth rate of 5.2 per cent per annum but the actual annual growth rate was only 4 per cent. The Sixth Plan conceived by the Janata Government was formulated in 1980. In this plan, removal of poverty got top priority. The actual growth of GDP during this plan period was 5.4 per cent per annum against the target of 5.2 per cent annual growth. The Seventh Five Year Plan was launched in 1985 with a growth target of 5 per cent per annum. During the Seventh Five Year Plan, GDP grew at 5.8 per cent per annum. The Eighth Five Year Plan could not be started in time in 1990 as there was political instability as well as severe economic crisis. So this plan was delayed for a period of two years and thus it was launched in 1992 with target of annual GDP growth rate of 5.6 per cent after the acceptance of New Economic Policy based on liberalisation, privatisation and globalisation in 1991. The actual average annual growth of GDP was 6.8 per cent during the plan period. The Ninth Five Year Plan was formulated in 1997 with a total outlay of Rs. 8,59,200 crore. The targeted growth rate of this plan was 6.5 per cent per annum, but the actual growth rate was 5.5 per cent. Thus the actual growth rate during the Ninth Five Year Plan was lower than the targeted growth rate.

Tenth Five Year Plan

The Tenth Five Year Plan was launched in 2002 with a total outlay of Rs. 15,92,300 crore. It fixed target of 8 per cent growth of Gross Domestic Product per annum with a strong pro-poor focus in order to reduce poverty in the economy. The plan aimed at reduction of poverty ratio to 20 per cent by 2007 and reduction of gender gap in life expectancy and literacy by 50 per cent.

Thrust Areas of Tenth Five Year Plan

The approach paper of Tenth Five Year Plan emphasised the following as the major thrust areas of planning:

1. 8 per cent growth of Gross Domestic Product per annum;
2. Reduction of poverty ratio to 20 per cent by 2007;
3. Reduction of gender gap in life expectancy and literacy by 50 per cent;
4. Universalisation of primary education by the year 2007;
5. Reduction of decadal growth of population to 16.2 per cent in the period between 2001 and 2011; and
6. Reduction of unemployment through growth of related infrastructure and social development programmes.

Actual annual GDP growth rate during this plan period was 7.19 per cent.

Eleventh Five Year Plan

The Eleventh Five Year Plan (2007-12) was launched in 2007 with total public sector outlay of Rs. 36,44,718 crore. The plan envisaged a high growth of GDP of 9 per cent per annum. Besides, it emphasised on inclusive growth to ensure broad based improvement in the quality of life of the people, especially poor, SCs, STs, OBCs and the minorities.

Thrust Areas of the Eleventh Five Year Plan

Major thrust areas of the Eleventh Five Year Plan are the following:

1. To achieve 9 per cent growth of GDP per annum, and agricultural GDP growth of 4 per cent per annum;
2. To increase investment GDP ratio to 36.7 per cent;
3. To increase saving GDP ratio to 34.8 per cent;
4. To limit current account deficit to 1.9 per cent of GDP;

5. Reduction of poverty ratio by 10 per cent;
6. Generation of employment opportunities for 58 million unemployed;
7. Reduction of unemployment among the educated to less than 5 per cent;
8. Reducing gender gap in literacy by 10 per cent;
9. Reduction of infant mortality rate to 28 and maternity mortality rate (MMR) to 1 per 1 lakh.

Twelfth Five Year Plan

Twelfth Five Year Plan (2012-2017) was approved by the National Development Council (NDC) on 27th December, 2012. It has envisaged a growth target of 8 per cent per annum.

The most important goal of the Twelfth Five Year Plan is to achieve rapid, inclusive and sustainable growth. In the light of this objective of achieving inclusive and sustainable growth, Twelfth Plan sets 25 monitorable targets.

Some important targets are stated below.

(1) Average annual GDP growth of 8 per cent.

(2) Agriculture growth of 4 per cent per annum.

(3) Average annual growth of 10 per cent in case of manufacturing.

(4) Reducing head-count poverty by 10 per cent.

(5) Generating work opportunities for 50 million.

(6) Eliminating gender and social gap in education.

(7) Reducing Infant Mortality rate (IMR) to 25, Maternal Mortality Rate (MMR) to 100 and Total Fertility Rate (TFR) to 21.

(8) Reduction of malnutrition in case of children in the age group of 0 to 3 years by 50 per cent.

(9) Enhancing infrastructure investment to 9 per cent of GDP.

(10) Achieving universal road connectivity.

(11) Access to power for all villages.

(12) Access to banking services for 90 per cent households.

(13) Major welfare benefits and subsidies through AADHAR.

(14) Increasing total irrigated area from 90 million hectare to 103 million hectare.

(15) Reducing fiscal deficit to 3 per cent of GDP

(16) Increasing investment to 35 per cent of GDP

(17) Increasing saving GDP ratio to 34.2 per cent

(18) Reducing Current Account Deficit in the Balance of Payment to 2.5 per cent of GDP.

Twelfth Plan enlisages two strategies for achieving inclusive growth. One is through higher growth which help to create and expand income and employment opportunities. The other is through pro-poor government programmes which target poorer groups. These two routes are mutually reinforcing. High growth generates more revenue to financial inclusiveness programmes. Many inclusive programmes (health and education) contribute to growth.

3.1.4 Objectives of Five Year Plans in India

India's Five Year Plans have two types of objectives, such as short term objectives and long term objectives. Although the short-term objectives vary from plan to plan depending on the immediate problems faced by the economy, the long-term objectives are common to them. Therefore, it is worthwhile to discuss these objectives. The most important objectives which are common to different plans launched in the country are the following.

1. Stimulating rapid economic growth
2. Increasing standard of living of the people
3. Modernization of the economy
4. Self-reliance
5. Social justice
6. Expansion of employment and reduction of poverty
7. Economic stability

Each of these objectives is explained below.

1. **Stimulating Economic Growth:** Since the Indian economy was in a state of underdevelopment and backwardness at the time of independence, beginning from the First Five Year Plan, all the plans have aimed at stimulating economic growth of the country. GDP being the most important indicator of economic growth, top most priority has been accorded to growth of GDP in the country. The targeted growth rates of GDP per annum in different five year plans have been presented in Table - 3.1 before.

It may be seen from the table that the targeted growth rate of First Five Year Plan was only 2.2 per cent per annum. It was within the range of 5 to 6 per cent from Second to Eighth Five Year Plan. However, from Ninth to Eleventh Five Year Plan targeted annual growth rate of GDP was within the range of 6.5 to 9 per cent. Growth target of Twelfth Year Plan has been fixed at 8 per cent per annum because of the lingering economic crisis of the western economies and sluggishness at home.

Planners have realised that rapid economic growth is possible by :

(i) Raising productivity of agriculture,

(ii) Stimulating industrial growth by promoting investment in public sector and providing assistance to private sector, and

(iii) Expanding services sector.

Therefore, in all the plans emphasis was laid on the development of agriculture, industry and service sectors.

2. **Raising Standard of Living:** Increasing standard of living of the people is an important goal of all five year plans. Since standard of living greatly depends on per capita income, in all the five year plans targeted growth rate of GDP was more than population growth rate. Twelfth Five Year Plan has fixed GDP growth rate at 8 per cent per annum. Since population growth rate is approximately 1.6 per cent per annum during 2001 to 2011, per capita income is expected to grow by 6.4 per cent per annum during the plan period.

3. **Self-reliance:** From the Third Five Year Plan, the planners have set the goal of self-reliance. Because it has been realised that excessive dependence on foreign countries may lead to economic colonisation.

In the Indian context, self-reliance implies the following :

(i) Reduction and ultimate elimination of foreign aid,

(ii) Self sufficiency in food grains production,

(iii) Reduction and ultimate elimination of imports of certain critical commodities, and

(iv) Expansion and diversification of exports.

4. **Modernisation of the Economy:** Before independence, Indian economy was backward and feudal in character. Since Sixth Five Year Plan (1980-85), the planners aimed at modernising the economy by changing the structural and institutional set up of the country.

Structural changes are possible by increasing the share of industrial output in national output, diversifying the industrial sector and advancement of technology for upgradation of the quality of products and reduction of cost. Institutional changes include setting up of banks and other financial institutions for expanding credit, setting up of institutions for facilitating research, training and extension services for human resource development, and introduction of land reform measures to increase productivity of agriculture.

Modernisation aims at improving the standard of living of the people by adopting a better and more improved technique of production and through structural and institutional changes as noted above.

5. **Social Justice:** The Five Year Plans in India have highlighted the following three aspects of social justice, viz.

(i) improving the living standards of the poor and backward classes;

(ii) reduction of inequality in the distribution of income and wealth among different classes; and

(iii) reducing regional imbalances.

In order to uplift the socio-economic condition of the weaker sections like SC, ST, small and marginal farmers, landless labourers, rural artisans etc. a large number of target oriented programmes have been implemented in the country since Sixth Five Year Plan. For reducing inequality in asset distribution, particularly in rural areas, land reform measures have been undertaken. To reduce gap between rich and poor States, specific programmes are undertaken in backward States / regions.

6. **Reduction of Poverty and Unemployment:** Problem of massive poverty and widespread unemployment are the major challenges which government of India has been facing since independence. Therefore, reduction of poverty and unemployment constitutes an important objective of India's development planning. However, in the first three Five Year Plans, eradication of poverty was not a distinct plan objective, because growth of national income was expected to trickle down to poorer sections of the society. But actually this did not happen. From the early 1970s (from Fourth Five Year Plan) new strategies have been devised to alleviate poverty. Since the main cause of poverty is acute unemployment, the most important means of reducing the incidence of poverty is the creation of employment opportunities. Therefore, a large number of poverty alleviation-cum-employment generation programmes have been implemented by the government

of India since Fourth Five Year Plan. These programmes have been explained in detail in Chaptr - 4.

7. **Economic Stability:** Economic stability means controlling fluctuations in price level. After the Second Five Year Plan, Indian economy has been facing the problem of rapid rise in the price level in most of the years. Therefore, in different Five Year Plans several policy measures have been undertaken to stabilise the price level in the economy.

3.1.5 Appraisal of India's Five Year Plans

Indian economy has gone a long way in the process of planning over a period of about seven decades. Therefore, it is worthwhile to make an evaluation of these Five Year Plans and to highlight their achievements and failures.

Achievements

Some of the accomplishments of India's Five Year Plans are presented below:

1. **Increase in Rate of Growth of National Income and Per Capita Income:** During the first three decades of planning, i.e., from 1951 to 1980 (First Five Year plan to Fifth Five Year Plan) rate of growth of GDP at factor cost was only 3.7 per cent per annum. Since annual average population growth rate was 2.5 per cent during this period, the per capita GDP was increasing at only 1.2 per cent per annum. But from 1980 to 1990-91 (Sixth and Seventh Five Year Plan periods) GDP at factor cost increased at a rate of 5.4 per cent annum. Since the Eighth Five Year Plan, rate of growth of GDP is still higher. From 2005-06 to 2007-08, GDP growth rate was within the range 9.3 to 9.6 per cent. But, GDP growth came down to 6.7 per cent in 2008-09 due to global financial crisis. Thereafter, it increased to 8.6 per cent in 2009-10 and further to 8.9 per cent in 2010-11. In 2011-12, GDP growth came down to 6.7 per cent. Due to economic slowdown in India, although GDP growth declined to 5.1 per cent in 2012-13, it increased to 6.9 per cent in 2013-14 and further to 7.4 per cent in 2014-15 and 7.5 per cent in 2015-16. The average GDP growth rate per annum during the entire plan period is approximately 5 per cent and per capita GDP growth is about 3 per cent.

According to the Centre for Economics and Business Research (CEBR), India will overtake the UK by 2017 to become the largest economy in the commonwealth and the fourth largest economy in the world.

2. **Success in the Field of Self-reliance:** India has achieved self reliance in a number of fields during the planning era as noted below.

(i) Self-sufficiency in Foodgrains: By the end of Fifth Five Year Plan, India became self-sufficient in foodgrain production. In 2014-15, total food grain production in the country stood at 257.1 million tonnes. The overall per capita availability of food grains increased from 395 grams in 1951 to 498 grams in 2014-15.

(ii) Progress in the Field of Industrial sector: India has achieved self-sufficiency in consumer goods as well as in steel and cement. The growth of capital goods production has also become impressive. India is in a position to sustain the growth of many industries such as textiles, food processing, chemicals, sugar, power, transport etc.

(iii) In the field of science and technology, achievements are also remarkable.

3. **Some Modernisation:** Trend towards modernisation of the economy is a significant achievement of Five Year Plans. This is indicated by a variety of structural and institutional changes of the economy. Structural changes that have taken place in the economy include the following:

(i) Share of agriculture and allied activities in India's GDP has declined form 60 per cent in 1951 to 17.4 per cent in 2014-15. On the other hand, the share of industrial sector increased from 15 per cent to 29.7 per cent and that of the services sector in the country's GDP from 25 per cent to 52.9 per cent during the same period.

(ii) There has been diversification in industries. The relative share of traditional manufactures like food and textiles has declined and that of the new industries like engineering and capital goods has substantially increased.

(iii) There is considerable progress in the use of modern and capital intensive technology in industrial sector for promoting efficiency.

(iv) In the field of agriculture too there is extensive use of modern farm implements.

Institutional changes include:

(i) Establishment of large number of financial institutions such as banks, NBFCs, Mutual Fund houses etc., provision of infrastructure facilities such as roads, railways, power etc. to support private sector.

(ii) Setting up of a large number of institutions like, IITs, NITs, IIMs to promote education, research and training for skill formation.

4. **Increase in Saving and Investment:** The progress in respect of certain key elements, such as saving and investment has also been commendable. Saving as a percentage of GDP increased from 10.1 per cent in 1951 to 30.6 per cent in 2013-14. Similarly, percentage share of investment in GDP (Gross Domestic Fixed capital formation) has gone up from 8.4 in 1951 to 32.3 in 2013-14. But rate of growth of income is much smaller compared to rate of increase in investment in view of the high capital output ratio.

5. **Large Inflow of Foreign Direct Investment (FDI):** There is large inflow of FDI to the Indian economy in recent years for supporting growth. Table - 3.2 makes the point clear.

Table - 3.2 : FDI Inflow to India from 2007-08 to 2014-15

Year	FDI inflow ($ billion)
2007-08	24.58
2008-09	27.33
2009-10	25.83
2010-11	19.43
2011-12	24.19
2012-13	34.3
2013-14	36.0
2014-15	44.9

Source: Economic Survey (2015-16), Government of India.

6. **Development of Infrastructure:** From the beginning of the First Five Year Plan till now importance has been given on development of infrastructure. The expansion of National Highways, road transport, railway network and telecommunication network has made it possible to connect people and transfer goods from one part of the country to another and link India with the whole world. It has considerably enlarged the size of the market. Irrigation and power projects have given a boost to agriculture and provided energy to industries.

7. **Diversification of Exports and Import Substitution:** During the entire plan period India's dependence on foreign countries for importing capital goods has declined. Similarly, quite a good number of consumer goods imported earlier are now being produced indigenously. Also, the composition of its exports has changed in favour of manufactured goods.

8. **Significant Improvement in all Indicators of Social Development:** During the planning era, there has been significant improvement in almost all indicators of social development. For instance, life expectancy at birth has increased from 33 to 68.4 years; literacy rate has registered a rise from 16.7 per cent to 74.04 per cent, and infant mortality rate has come down to 41.8 in 2015.

9. **Significant Improvement in Educational System and Science and Technology:** There has been significant improvement in educational system and science and technology in the country during the planning era. This has considerably reduced India's dependence on foreign technology and expertise. Now India is extending technical expertise to many of the Middle East, Asian and African countries.

Failures

Though Five Year Plans in India have made many significant achievements in several fields, there are many areas of concern as noted below.

1. **Grim Poverty Scenario:** Though proportion of people living below the poverty line has declined from 38.47 in 1987-88 to 32.2 in 2004-05 and further to 29.8 in 2009-

10 and 21.9 per cent in 2011-12, it is still very high. The absolute number of people living below the poverty line in India (26.93 crore) is quite massive.

2. **Widespread Unemployment:** With the progress of planning, the magnitude of unemployment as well as underemployment is also on the increase. This is because the plans have not been able to absorb the natural increase in labour force in view of the inadequate job opportunities.

   According to NSSO data, during 1999-2000 to 2004-05, annual increase in employment growth rate was 2.8 per cent, but during 2004-05 to 2011-12, this figure came down to 0.5 per cent. Thus employment growth is slowing down and magnitude of unemployment is going up in the country. Employment growth rate in India during the period 1972-73 to 2012-13 stands at 2 per cent per annum, which is much lower compared to that of other countries of South Asia. Number of unemployed in India is about 40 million which is quite large.

3. **Extreme Inequalities:** Though there has been remarkable growth of national income during the plan period, such gains have not been equally distributed among all sections of the society. According to a recent study by NCAER, the bottom 20 per cent of households in India are getting 6.1 per cent of total income, while the top 20 per cent are getting 53.3 per cent of total income. Not only there is gross inequality in distribution of income, it is equally worse in case of land distribution and distribution of industrial ownership.

4. **Price Instability:** Inflation is one of the major problems of the Indian economy. During First Five Year Plan, price level was stable. During Second Five Year Plan, inflation rate measured by Wholesale Price Index (WPI) was 4 per cent per annum. From Third Plan onwards there was rapid rise in the price level. During 1981 to 1991 WPI was rising at 6.9 per cent per annum. In 1990-91 inflation rate was 10.3 per cent, which declined to 9.6 per cent in 2010-11 and further to 8.9 per cent in 2011-12, 7.4 per cent in 2012-13 and to 6 per cent in 2013-14, 2 per cent in 2014-15. But rate of inflation measured by Consumer Price Index (CPI) is

higher. It was 8.4 per cent in 2011-12 and it came down to 5.9 per cent in 2014-15. Though inflation rate is showing a declining trend, it is much above RBI's comfortable level (4 to 5 per cent).

5. **Inadequate Infrastructure Facility:** Infrastructure facilities such as roads, railways, irrigation projects, ports and power projects, are inadequate in relation to the country's requirements. Not only inadequate, infrastructure facilities are also poor in quality.

6. **Increase in Reliance on Foreign Funds:** Reliance on foreign funds is showing a rising trend. In 2004-05, share of foreign capital in gross capital formation in India was 4.1 per cent, which increased to 6.7 per cent in 2008-09 and further to 7.8 per cent in 2014-15.

7. **Low Human Development:** India's HDI rank in 2014 is much low (135) compared to other emerging economies of the world, such as China (91), Brazil (79), Russia (57) and South Africa (118) out of 187 countries.

8. **Lack of Development in Social Sector:** Though there has been significant improvement in many social indicators of development due to rise in social sector spending, India is far behind many Asian countries. According to the latest data, life expectancy at birth is 68 years in India, but 75 years in China; infant mortality rate is 41.8 in India but 12.44 in China; adult literacy rate is 52 per cent in India but 61 per cent in China. Though enrolment ratios have exhibited consistent improvement across States, poor quality of education imprated, low teacher-pupil ratios, decline in basic reading and arithmetic levels, and falling school attendance are major concerns.

In view of the above, there is urgent need to create a road map for creation of sufficient industrial infrastructure of global standards, technology upgradation, increase in physical and human capital formation for stimulating growth and expansion of employment and reduction of poverty.

3.1.6 NITI AAYOG

The National Institution for Transforming India or Niti Aayog is a Government of India policy think-tank formed on 1st January 2015 which replaced the Planning Commission. Formation of NITI Aayog took place in accordance with the promise made by the Prime Minister of India Sri Narendra Modi, elected by a landslide in 2014 for replacing the 65 year old Planning Commissioner with a body that will give state governments a much larger say in crucial decisions and help in reviving flagging growth and creating jobs.

India's Finance Minister Arun Jaitly made the following observation on the necessity of creating NITI Aayog :

"The 65 years old Planning Commission had become a redundant organisation. It was relevant in a command economy structure, but not any longer. India is a diversified country and its States are in various phases of economic development along with their own strengths and weaknesses. In this context, 'a one size fits all' approach to economic planning is obsolete. It cannot make India competitive in to-day's global economy."

NITI Aayog Comprises the Following :

(1) The Prime Minister of India as its Ex-officio chairperson.

(2) Governing Council comprising the Chief Ministers of all the States and Lieutenant Governors of Union Territories.

(3) Regional councils fomed to address specific issues and contingencies impacting more than one State or a region. Regional councils will be composed of the Chief Ministers of States and Lt Govenors of Union Territories in the region. They will be chaired by the chairperson of NITI Aayog or his nominee.

(4) Experts, specialists and practitioners with relevant domain knowledge as special invitees by the Prime Minister.

(5) Full-time organisational framework (in addition to the Prime Minister as the chairperson) comprising :

(i) Vice-Chairperson,

(ii) Three full time members,

(iii) Maximum of Two part time members from leading Universities, research organisations and other relevant instituions in ex-officio capacity on rotational basis,

(iv) Maximum four ex-officio members of the Union Council of Ministers to be nominated by Prime Minister,

(v) Chief Executive Officer (CEO) to be appointed by Prime Minister for a fixed tenure in the rank of secretary to the Government of India and

(vi) Secretariat as deemed necessary.

Present Members

At Present the members of NITI Aayog are :

(i) Chairperson : Sri Narendra Modi, Prime Minister of India.

(2) Vice-chairperson : Prof. Arvind Panagariya

(3) Chief Executive Officer : Sri Amitabh Kant.

(4) Ex-officio members : Sri Rajnath Singh, Sri Arun Jaitly, Sri Suresh Prabhu and Sri Radha Mohan Singh (all cabinet ministers).

(5) Special Invitees : Sri Nitin Gadkari, Smt. Smriti Zubin Irani and Sri Thawar Chand Gehlot

(6) Full-Time Members : Dr. Bibek Debroy (Economist), Dr. V.K. Saraswat (Former DRDO Chief), Prof. Ramesh Chand (Agriculture Expert)

(7) Governing Council : All Chief Ministers and Lieutenant Governors of Union Territories.

Objectives and Functions

Objectives of NITI Aayog are the following :

(i) To foster involvement and participation in the economy's policy making process by the State Governments.

(ii) To bring cooperative competitive federalism and to improve centre-state finance relation. This is well reflected when the Prime Minister of India appointed three sub-groups of Chief Ministers for making recommendations in three important areas (centrally sponsored schemes, skill development and Swachh Bharat).

(iii) To provide a critical directional and strategic input for the development process.

(iv) To develop mechanisms to formulate credible plans at the village level and aggregate these progressively at higher levels of government.

(v) To address the needs of the national security in the economic strategy and policy.

(vi) To pay special attention to the sections of the society that may be at risk or not benefiting adequately from economic progress.

(vii) Evaluate the implementation of the different Goverhment programmes.

(viii) A pro-people, pro-active and participation development agenda will be its guiding principle.

Difference between Planning Commission and NITI Aaayog

Following are the differences between the Planning Commission and NITI Aayog.

(i) Planning Commission makes assessment of the available resources of the country, prepares the plan, fixes objectives of the plan and makes allocation of resources to the states for achieving the goals.

NITI Aayog neither surveys the resoureces nor allocates them to states. NITI Aayog is a Government's think-tank or an advisory body which provides critical input for the success of development programmes. Allocation of resources to the states is the function of the Ministry of Finance.

(ii) The role of the States in planning commission is limited. The states need to interact with the planning commission once a year to get their plans approved. They have some limited functions in the National Development Council.

Since NITI Aayog has all Chief Ministers of the States and Lietutenant Governors of Union Territories in its governing council, it is obvious that they are expected to have a greater role and say in planning and implementation of policies.

(iii) Planning Commission adopts 'top down' approach in decision making in contrast to 'bottom up approach' adopted by NITI Aayog. While planning commission formulates the Five Year Plans at the central level and imposes these plans on the States, NITI Aayog will develop mechanism to formulate credible plans upto the village level and aggregate them progressively at higher levels of government.

3.2 ECONOMIC REFORMS SINCE 1991

After independence, government of India adopted planning as the chief tool for overcoming the problems of stagnation and backwardness and stimulating the pace of economic development. To achieve the goals of planning, it pursued conservative fiscal, monetary and trade policies till the 1980s. Because of the adoption of conservative policies, signs of serious economic crisis began to manifest in the late 1980s and became explicit in 1991 in the Indian economy both on internal and external fronts. India's foreign exchange reserve came down to a record low level. India was unable to honour her external payment obligations. Fiscal deficit had gone up to an alarming level

of 8.4 per cent of GDP. The wholesale prices increased to an annual average rate of 12 per cent during the year. Being unable to borrow further, government of India had to mortgage gold in Bank of England to get foreign exchange to meet its external obligations.

Against this backdrop the Congress assumed power at the centre. Prof. Manmohan Singh was appointed as the finance minister in P.V. Narasimaha Rao's cabinet. In 1991, government of India introduced a series of economic reforms in all the major sectors of the economy such as industrial sector, financial sector and external sector.

3.2.1 Need for Reforms

Need for economic reforms was felt to save the Indian economy from the worst economic crisis which it was facing during 1990-91 and to set the economy on the right path. To be more specific, the need for economic reforms (1991) emerged for achieving the following objectives.

(1) To achieve a higher growth rate,

(2) To reduce fiscal deficit,

(3) To maintain economic stability by arresting inflationary situation,

(4) To improve productivity, efficiency and competitiveness of the Indian industries,

(5) To augment exports for overcoming Balance of Payments deficit and foreign exchange crisis,

(6) Reduction of poverty through expansion of employment and generation of income and

(7) Reduction of inequality in the distribution of income.

3.2.2 Components of Economic Reforms

Economic reforms introduced in 1991 can be broadly divided into two parts, such as:

(A) A short-term stabilisation programme, and

(B) A long-term structural adjustment programme.

The aim of stabilisation programme was to control inflation and to overcome balance of payments deficit and of structural adjustment programme was to overcome the structural rigidities and bottlenecks in the economy for improving productivity and efficiency. Economic reforms are based on the principles of liberalisation, privatisation and globalisation (LPG).

3.2.2.1 Liberalisation

Liberalisation refers to the policies and programmes implemented by the government to free the economic system from the cobwebs of unnecessary bureaucratic control (or to free the economy from licence raj and permit raj) for promoting private investment and enterprise. The main objective of liberalisation is to allow the private sector to act freely without unnecessary government interference.

Features

The following are the main features of liberalisation.

(i) Industrial licensing: The new policy abolished licensing of industries except for those industries which relate to environmental problems and security. Their number was 18 in 1991. At present there are only 6 industries producing alcohol, cigarettes, hazardous chemicals, electronic aeroscope and defence equipment, industrial explosives, drugs and chemicals which require licence.

(ii) Amendment of MRTP Act: MRTP Act was amended to encourage investment by large industrial houses. Accordingly, all restrictions on expansion, modernisation and merger of industries were removed.

(iii) Automatic Approval for Obtaining Foreign Exchange: The industries requiring foreign exchange for import of capital and machinery were given automatic approval if the required foreign exchange is covered through foreign equity. However, the value of imported capital goods required should be less than 25 per cent of the value of plant and machinery subject to a maximum of Rs. 2 crore.

(iv) Location of Industries: There is no need to take approval from the government if industries are to be set up in cities with a population of less than 10 lakh. In cities

with a population of more than 10 lakh, non-polluting industries can be set up at a distance of more than 25 kms away from the city's periphery.

(v) Free Access to Capital Market: Private entrepreneurs can have free access to capital market.

(vi) Foreign Investment and Foreign Technology: High priority industries can use foreign technology. Foreign Direct Investment (FDI) up to 51 percent equity was allowed in the case of these industries.

3.2.2.2 Privatisation

Privatisation refers to transfer of ownership and management of public sector undertakings (PSUs), either partially or wholly to private hands. The public sector was given dominant position in Indian economy in the development strategy pursued by the government till 1990-91. With government support, performance of the public sector was dismal. More than half of PSUs were running on loss. In the case of profit making PSUs the rate of profit was very low. Government of India accepted the policy of privatisation for increasing productivity and efficiency of the economy.

Features

The following are the main features of privatization policy.

(i) Reduced Role of the Public Sector: The list of industries reserved for the public sector was reduced to 8 with security and strategic concerns. At present, there are only 3 industries which are reserved for the public sector. They are (a) atomic energy, (b) the substances specified in the schedule to the notification of government of India in the Department of Atomic Energy, and (c) rail transport.

(ii) Disinvestment in Public Sector Enterprises: The sick and loss making PSUs will be handed over partly or wholly to the private sector. Besides, a part of the government share holding in the public sector would be offered to mutual funds, financial institutions, the general public and employees for mobilisation of resources for reducing fiscal deficit and for encouraging wider public participation. This method of mobilization of resources through sale of government shares in

PSUs is called disinvestment. A separate ministry named as 'Ministry of Disinvestment' has been created for the purpose.

(iii) Reduction of Public Sector Outlay in the Total Plan Outlay : During the planning era till 1991, a major portion of plan outlay (50 to 60 percent on an average) was earmarked for public sector. But after introduction of reforms, i.e., since Eighth Five Year Plan, share of public sector outlay was reduced.

(iv) Removal of Mandatory Convertibility Clause: As per provision of the new policy, Mandatory Convertibility clause which enables the financial institutions to convert loans to public sector enterprises into equity will be withdrawn.

3.2.2.3 Globalisation

Globalisation refers to the policy of integrating the domestic economy with the world economy. It envisages free flow of trade, capital and technology between the domestic economy and the rest of the world. The objective of globalisation was to make the Indian industries internationally competitive.

Features

Globalization of the Indian economy has the following features.

(i) Devaluation of Rupee: To overcome the serious balance of payments (BOP) deficit and foreign exchange crisis, rupee was devalued by 23 per cent in two phases during June 1991 by the government of India. Besides, rupee was made fully convertible on current account in 1994-95 budget for augmenting exports.

(ii) Removal of Import Licensing : Various restrictions on trade such as import licenses, and quantitative restriction like quota were removed. Many items lying in the restricted list of imports were withdrawn and put on Open General Licence (OGL) for liberalisation of imports.

(iii) Reduction of Tariffs on Imports: Import tariffs were gradually reduced with the long term objective of bringing it to the level of other countries.

(iv) Reduction of Restriction on Foreign Investment: Earlier restrictions on foreign investments were removed. The new policy declared automatic approval of foreign direct investment up to 51 percent equity in 34 high priority industries. Automatic approval of foreign technology agreements related to certain high priority industries was also made.

Second Generation Reforms

In order to consolidate the benefits from reform measures, the government of India decided to undertake second generation reforms in 2001. While the first generation reforms (1991) gave emphasis on economic stability and structural adjustment, the second generation reforms aimed at growth and development through increase in efficiency and productivity of the economy. The second generation reforms have four components such as (1) fiscal reforms, (2) financial sector reforms, (3) structural reforms and (4) labour law reforms. In the fiscal sector, the reforms aimed at broadening the tax base of the economy through expansion of income tax base, streamlining the central excise and custom duty structure and introduction of VAT uniformly in all the States. In the financial sector, the reforms allowed foreign banks to open branches in India. In the case of labour law reforms, the organisations having less than 1000 employees were allowed to close their units without seeking government clearance. All flash and lightening strikes became illegal. Employees in public sector undertakings have to give 95 days notice for strike. An employer can lay off 2 percent staff per year linking it with productivity. Similarly, in the case of retrenchment, the employer has to give compensation of 45 days salary for each completed year of service.

In the case of structural reforms, the public sector enterprises are under way to reduce pressure on public finances, increase their efficiency and reduce incremental capital output ratio (ICOR). Legal, institutional and regulatory frameworks in insurance, banking, capital market, power and telecommunication have also been strengthened to increase private investment in the Indian economy. The objective of these reforms is to increase the productivity and efficiency of the economy and make it competitive at the international level.

Reform Action Taken by the New NDA Government

Since assuming office in May 2015 the new Government led by NDA has undertaken a number of reform measures whose cumulative impact could be substantial.

These include :

(1) Deregulating diesel price, paving the way for new investment in this sector.

(2) Raising gas prices from US$ 4.2 per million British thermal unit to US$ 5.6 and linking pricing, transperantly and automatically to international prices so as to provide incentives for greater gas supply and thereby relieving power sector bottlenecks.

(3) Since October 2014, taking advantage of declining oil prices, the excise duty on diesel and coal has been increased many times. In addition to collection of about $70,000 crore (on an annualised basis), this action will have positive environmental consequences.

(4) Replacing the cooking gas subsidy by direct cash transfer on a national scale.

(5) Passing an ordinance to reform the coal sector by auction.

(6) Amendment of the constitution for introduction of goods and services tax (GST) likely to be impleted from the middle of 2017.

(7) Instituting a major programme for financial inclusion in the name of the Pradhanmantri Jan Dhan Yojana under which over 12.5 crore new accounts have been opened till 2015.

(8) Continuing push to extending coverage under the Aadhar Programme, targetting enrolment of one billion Indians as of early February 2015, 757 million Indians have been bio-identified, 139 million Aadhar linked bank accounts created.

(9) Increasing FDI cap in defence upto 49 per cent.

(10) Eliminating quantitative restrictions on gold

(11) Passing an ordinance to make land acquisition less onerous, therby easing doing business, while ensuring that farmers get fair compensation.

(12) Facilitating Presidental assent on Rajasthan, setting an example for further reform initiatives by the States, and consolidating and making transparent a number of labour laws.

(13) Passing an ordinance increasing FDI cap in insurance to 49 per cent, in railway infrastructure up to 100 per cent and pension up to 49 per cent.

(14) Commencing a programme of disinvestments under which 10 per cent of the government's stake in coal India was offered to the public yielding about $22500 crore.

(15) Passing the Mines and Minerals (Development and Regulation) (MMDR) Amendment ordinance, 2015 is a significant step in revival of the hitherto stagnant mining sector in the country. The process of auction for allotment would usher in greater transperancy and boost revenues for the States.

(16) Reducing the list of industries that can be considered defence industries requiring license.

(17) Investment limit requiring prior permission from the Foreign Investment Board has been increased from Rs.1200 crore to Rs.3000 crore.

(18) Definition of investments by NRI, persons of Indian orgin (PIO) and overseas citizens of India (OCI) in the FDI policy has been liberalised.

3.2.3 Assessment of Economic Reforms

As the economic reform process has been initiated since the last 26 years, it is now worthwhile to make an appraisal to know the achievements and shortcomings of these reforms.

Achievements

An objective assessment of the new economic policy shows that economic reforms have the following achievements.

1. Higher GDP Growth

Prior to introduction of the economic reforms in 1991, rate of growth of GDP in the Indian economy was very low. For example, during 1980 to 1990-91 GDP at factor cost was growing at 5.4 percent per annum. But during the post-reform decade (1990 - 91 to 2000-01), rate of GDP growth was somewhat higher (5.8 per cent per annum). There was a distinct improvement in GDP growth rate during 2000-01 to 2007-08 when average annual growth rate was around 7.6 per cent. Though GDP growth came down to 6.7 per cent in 2008-09 due to global slow-down, it increased to 8.6 per cent in 2009-10 and 8.9 per cent in 2010-11. In 2011-12 growth rate came down to 6.5 per cent due to Euro-zone crisis. Due to economic slow-down in the Indian economy growth rate of GDP came down to 5.1 per cent in 2012-13. But it has gone up to 7.4 per cent in 2014-15 and 7.5 per cent in 2015-16.

2. Improvement in Performance of Public Sector Enterprises

On the basis of available information, it can be said that central public sector undertakings (PSUs) have shown better economic performance during the post- reform period judged on the basis of gross profit and net profit as percentage of capital employed. Table 3.3 makes this point clear.

Table - 3.3 : Performance of Public Sector in India.

Period	Gross Profit (%)	Net Profit (%)	Value-added (Per Unit of Capital)
1993-94	11.61	2.84	0.26
2005-06	21.5	12.1	0.44

3. Control of Inflation

The movement of Wholesale Price Index (WPI) reveals that in the pre-reform decade (1981 to 1991) annual average increase in WPI was of the order of 6.9 per cent

which came down to 6.3 per cent during the post-reform period (1993-94 to 2005-06). During 2008-09 there was negative growth of WPI. Thus, rise is WPI has cooled down in post-reform period. But in 2010-11, it increased to 9.6 per cent and in 2011-12 it came down to 8.9 per cent. But thereafter WPI came down rapidly and reduced to 2 per cent in 2014-15. However, Consumer Price Index (CPI) has remained at a higher level. In 2012-13, inflation measured by CPI was 10.2 per cent which came down to 9.5 per cent in 2013-14 and further to 5.9 per cent in 2014-15.

4. Improvement In India's Foreign Trade and Balance of Payments

Impact of economic reforms on Indian's foreign trade is found to be positive. During the pre-reform period exports as a percentage of imports were low (58 per cent during 1981- 82 to 1985-86, 64.1 per cent during 1986-87 to 1990-91). Similarly, average annual current account deficit was also very high (Rs. 3416 crore during 1981-82 to 1985-86, Rs. 6786 crore during 1986-87 to 1990-91).

But during the post-reform period, exports as per cent of imports have become higher (78.4 percent during 1991-92 to 1995-96, 71.1 percent during 1996-97 to 2000-01 and 74.9 per cent during 2001-02 to 2005-06). Further there was surplus in the current account of BOP during 2001-02 to 2005-06 to the tune of Rs. 1705 crore per annum.

However, since 2006-07, current account deficit in BOP as percentage of GDP is widening. In 2006-07, deficit as percentage of GDP was only one per cent, but in 2009-10 it increased to 2.8 per cent and further to 4.2 per cent in 2011-12 and 4.7 per cent in 2012-13. However, current account deficit as percentage of GDP has come down to 1.7 per cent in 2013-14.

5. Increase in Foreign Investment

During the post reform period there has been an increase in the flow of foreign capital to India. During 1991-92 to 2006-07 total foreign investment in India stood at US$ 136.5 billion. During 2007-08, FDI equity inflow to India was to the tune of $24.58 billion, in 2008-09 it was $ 27.33 billion, in 2009-10 it was $37.7 billion, in 2013-14 it was 36 billion and in 2014-15 it was $44.9 billion.

Failures

Though economic reforms have made significant achievements in several fields, there are many areas of concern as highlighted below:

1. **Acute Poverty:** Poverty scenario in the economy is grim. According to an estimate of the Planning Commission, 29.8 per cent of the population were lying below the poverty line in 2009-10. In 2011-12 21.9 percent (26.93 crore) of population were estimated to be below the poverty line.
2. **Large Scale Unemployment:** Economic reforms have failed to solve the problem of unemployment.
3. **Large Inequality:** There is large disparity in the distribution of income among different classes of people in the country and inequalities have increased.
4. **Higher Level of Fiscal Deficit:** Though fiscal deficit of the central government as percentage of GDP was declining from 2001-02 to 2007-08, during the period from 2008-09 to 2010-11 it was quite high. In 2001-02 fiscal deficit as percentage of GDP was 6 per cent which came down to about 2.5 per cent in 2007-08. It increased to 6.0 per cent in 2008-09, and further to 6.4 per cent in 2009-10. Again it declined to 4.7 per cent in 2010-11, but further increased to 5.7 per cent in 2011-12. However, fiscal deficit in the country is declining since 2012-13. It was 4.8 per cent in 2012-13, but came down to 4.1 per cent in 2014-15. But it is well above the 3 per cent threshold level.
5. **Slow Inflow of FDI:** Though the flow of FDI to India has increased during post-reform period, it is very small compared to other Asian countries like China and Korea.
6. **Neglect of Agriculture:** Neglect of agriculture is the major sin of economic reforms. C.S.O. data reveal that during the pre-reform period (1980-81 to 1990-91) foodgrains production was increasing at an annual average rate of 3.1 per cent, but during post-reform period (1990-91 to 2014-15) it has come down to around 2.0 per cent against the targeted rate of growth of 4 per cent per annum. The most important reason for slow growth of agriculture is inadequate public investment on irrigation and inadequate rural infrastructure.

7. **Failure in stimulating Industrial Growth:** The expectation that growth of industrial production would be stimulated due to reforms has not materialised. The index of industrial production (IIP) recorded an annual average growth rate of 7.8 per cent during pre-reform period (1981-82 to 1990-91). It has come down to 6.7 per cent during post-reform period (1993-94 to 2004-05). However, IIP growth increased to 8.3 per cent in 2009-10, but reduced to 3.6 per cent in 2010-11. It further declined to 2.3 per cent in 2011-12, but has gone up to 4.5 per cent in 2012-13 and further to 5.9 per cent in 2014-15. Thus rate of growth of industrial output is low.

Conclusion

The present Government at the centre has introduced a number of reforms which are expected to sitmulate growth in different sectors of the economy in near future.

SUMMARY

3.1 PLANNING

1. India accepted planning as the chief means of promoting economic development of the country since 1951.
2. Planning is the process of preparing blue print of actions to be taken for achieving certain predetermined and well-defined objectives within a definite time period.
3. India launched First Five Year Plan in 1951. By 1911-12 it has completed Eleven Five Year Plans and five annual plans. Twelfth Five Year Plan (2012-17) is now in operation.
4. Main objectives of these five year plans include.
   (a) Stimulating rapid economic growth
   (b) Increasing standard of living of the people
   (c) Modernisation of the economy
   (d) Self-reliance
   (e) Social justice

(f) Expansion of employment and alleviation of poverty

(g) Economic stability

5. Though Five Year Plans have made commendable progress in several fields, they have failed to solve the problems of poverty, unemployment, inequality, and inflationary situation. In India infrastructure facilities are inadequate and poor in quality.

3.2 ECONOMIC REFORMS SINCE 1991

1. In 1991 the government of India introduced a series of economic reforms. Need for economic reforms emerged for achieving the objectives such as.

(i) A higher growth rate

(ii) Reduction of fiscal deficit

(iii) Maintenance of economic stability

(iv) To improve productivity, efficiency and competitiveness of the Indian industries.

(v) Solving the problem of deficit in the country's balance of payments.

(vi) Alleviation of poverty though expansion of employment, and

(vii) Reduction of inequality.

2. Economic reforms are based on the principles of liberalisation, privatisation and globalisation of the Indian economy.

3. The second generation reforms started from 2001 has four components:

(a) Fiscal reforms (b) Financial reforms (c) Structural reforms and (d) Labour law reforms

4. Though economic reforms have made significant achievements in several fields, it has failed in several fronts such as failure in reducing fiscal deficit, failure in stimulating industrial growth and growth of agriculture. At present poverty, unemployment and inequality scenario in the country is quite grim.

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MODEL QUESTIONS

3.1 PLANNING IN INDIA

Group - A: Objective Type (Compulsory((1 mark each)

I. Write the correct answer choosing from the alternatives given in each question.

(i) In which year planning commission was set up ?

(a) 1951 (b) 1947 (c) 1950 (d) 1952

(ii) From which year India entered into an era of planning ?

(a) 1950 (b) 1951 (c) 1952 (d) 1949

(iii) How many five year plans have been completed in India by now?

(a) 10 (b) 11 (c) 12 (d) 13

(iv) How many Annual Plans have been formulated in India during the planning era ?

(a) 3 (b) 4 (c) 5 (d) 6

(v) For how many years there was plan holiday in India?

(a) 3 (b) 4 (c) 5 (d) 2

(vi) In which of the following years there was plan holiday ?

(a) 1961 to 1964, and 1982 to 1984 (b) 1966 to 1969 and 1990 to 1992

(c) 1957 to 1970 and 1990 to 1992 (d) 1966 to 1969 and 1982 to 1984

(vii) In which Five Year Plans, achievement of growth rate was less then targeted growth rate ?

(a) First, Second to Fifth, Ninth, and Tenth (b) Fourth, Fifth, Eighth and Tenth

(c) Second to Fifth, Ninth to Eleventh (d) None of the above

(viii) In which Five Year Plans, achievement in growth rate was higher than targeted growth rate ?

(a) Second, Third and Fourth (b) First, Sixth to Ninth

(c) Fourth, Fifth and Sixth (d) None of the above

(ix) In which year Twelfth Five Year Plan commenced?

(a) 2001 (b) 2003 (c) 2007 (d) 2012

(x) Which of the following is the most important indicator of economic growth according to the Indian planners?

(a) GNP (b) National Income

(c) GDP (d) None of the above

(xi) From which Five Year Plan, major emphasis was given on industrial development ?

(a) First (b) Second (c) Third (d) Fourth

2. I. Express each of the following statements in one word:

(a) The process of preparing blue print of actions to be taken for achieving certain predetermined objectives within a definite period of time.

(b) The period during which Annual Plans have been implemented instead of Five Year Plans.

2. II Answer the following questions in one sentence in each case.

(a) In which year Planning Commission was formed ?

(b) In which year First Five Year Plan was launched ?

(c) In which year Fourth Five Year Plan was launched ?

(d) What is plan holiday ?

(e) In which years, India had plan holiday ?

(f) In which Five Year Plans, achievement in growth rate was less than targeted growth rate ?

(g) In which Five Year Plans, achievement in growth rate exceeded the targeted growth rate ?

(h) Mention two important objectives of Indian planning.

(i) Which sector of the Indian economy was given major emphasis in First Five Year Plan ?

(j) Which sector of the Indian economy was given major emphasis during Second Five Year Plan ?

(k) Mention two major thrust areas of Twelfth Five Year Plan in India.

(l) Why did Indian planners set the goal of self-reliance in the Third Five Year Plan ?

(m) Upto which Five Year Plan, poverty alleviation was not a distinct plan objective ?

(n) Mention two major achievements of planning.

(o) Mention two areas where the Five Year Plans in India have failed.

2. III Examine the correctness of the following statements. Correct them, if necessary, without changing the portions underlined.

(a) India entered into planning era in 1952.

(b) By now India has competed ten Five Year Plans.

(c) India had plan holiday during 1960 to 1969 and 1990 to 1992.

(d) Industry was given major emphasis during First Five Year Plan.

(e) Agriculture was given major emphasis in the Second Five Year Plan.

(f) Poverty alleviation was not a distinct plan objective upto Second Five Year Plan.

(g) Eleventh Five Year Plan commenced in 2005.

(h) Annual average growth target of Eleventh Five Year Plan in India was 8 per cent.

2. IV Fill up the blanks.

(a) First Five Year Plan was basically an _____ plan.

(b) Inclusive growth was given emphasis in _____ plan.

(c) From _____ plan new strategies were devised to alleviate poverty.

Group - B: Short Type Answer

3. Answer the following questions within two / three sentences in each case. (2 marks each)

(a) What does self reliance mean ?

(b) What are the institutional changes that have taken place in the Indian economy during the planning era ?

(c) Why it is claimed that there has been significant improvement in several indicators of social development ?

(d) Why it is said the planning in India has not become successful in reducing inequality in distribution of income ?

4. Explain the following within six sentences in each case. (3 marks)

(a) Why it is claimed that modernisation of the economy is a significant achievement of Indian planning ?

(b) What were the major thrust areas of the Eleventh Five Year Plan?

(c) What steps have been taken during the plan period for achieving social justice ?

(d) Why it is claimed that India has achieved some success in the field of self-reliance ?

Group - C: Long Type Answer (7.5 marks)

5. Discuss the different objectives of Five Year Plans in India.

6. Analyse the different achievements of Indian planning.

7. Discuss the failures of Five Year Plans in India.

8. State the objectives of Five Year Plans in India. To what extent have these objectives been achieved ?

9. Write a note on NITI Aayog.

3.2 ECONOMIC REFORMS SINCE 1991

Group - A: Objective Type Questions (Compulsory) (1 mark each)

1. Write the correct answer choosing from the alternatives given in each question.

(i) In which year economic reforms were introduced in India ?

(a) 1990 (b) 1991 (c) 1992 (d) 1989

(ii) How many industries were requiring license in 1991 ?

(a) 8 (b) 9 (c) 18 (d) 3

(iii) What is the extent of devaluation of rupee in 1991?

(a) 20 per cent (b) 21 per cent

(c) 22 per cent (d) 23 per cent

(iv) What was the upper limit of foreign investment in equity of Indian companies as a part of economic reforms (1991) ?

(a) 50 per cent (b) 49 per cent

(c) 51 per cent (d) 61 per cent

(v) In which year the second generation of reforms started in India?

(a) 1991 (b) 2001 (c) 2009 (d) 2000

2. I. Express each of the following statements in one word.

(a) Policies and programme implemented by the government to free the Indian economy from the cobwebs of unnecessary bureaucratic control for promoting private investment.

(b) Transfer of ownership and management of PSUs to private hands.

(c) Method of mobilisation of resources through sale of government shares in public sector undertakings.

(d) The policy of integrating the domestic economy with the world economy.

2. II Answer the following in one sentence in each case.

(a) What does LPG stand for ?

(b) What is meant by liberalisation ?

(c) What is meant by globalisation ?

(d) What is meant by privatisation ?

(e) What does disinvestment mean ?

(f) What are the components of Economic Reforms (1991) ?

(g) What are the components of Second Generation Economic Reforms (2001) ?

(h) State the principles on which Economic Reforms (1991) are based.

2. III Examine the correctness of the following statements. Correct them, if necessary, without changing the portions underlined.

(a) FDI was allowed in high priority industries upto 49 per cent equity as part of liberalisation.

(b) The list of industries reserved for the public sector was reduced to 10 as a part of privatisation programme in 1991.

2. IV Fill up the blanks.

(a) Economic reforms were introduced in India in _____.

(b) Economic reforms (1991) were based upon the principles of _____.

(c) At present only _____ industries require lincence.

(d) Rupee was made fully convertible on current Account in Union budget for the year _____.

(e) As a part of the programme of globalisation, restriction on foreign investments were removed in case of _____ high priority industries.

Group - B: (Short Type Answer)

3. Answer each of the following within two / three sentences in each case. (2 marks)

(a) Against which backdrop, economic reforms (1991) were introduced in the Indian economy ?

(b) Why it is said that neglect of agriculture is a major sin of economic reforms ?

4. Write a note the following within six sentences in each case: (3 marks)

(a) Need for economic reforms in 1991

(b) Liberalisation

(c) Privatisation

(d) Globalisation

(e) Disinvestment

(f) Removal of Import Lincensing

(g) Removal of mandatory convertibility clause

Group - C: Long Type Answer (7.5 marks)

5. Explain the main principles of Economic Reforms (1991) introduced in India.

6. Discuss the main features of liberalisation.

7. Discuss the main features of globalisation.

8. Analyse the features of privatisation.

9. Make an assessment of Economic Reforms (1991) introduced in the Indian economy.

10. Explain the main achievements and failures of Economic Reforms (1991) introduced in the Indian economy since 1991.

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CHAPTER - 4

CURRENT CHALLENGES FACING THE INDIAN ECONOMY

- **POVERTY** - Absolute and relative poverty, causes of poverty, Important poverty alleviation programmes currently in place.

  UNEMPLOYMENT AND UNDER EMPLOYMENT– causes, dimensions and government programmes currently in place.

- **INFLATION** - Causes and anti-inflationary measures in place.

- **SUSTAINABLE ECONOMIC DEVELOPMENT** - Meaning of sustainable development, Economic growth and its adverse impact on Environment, Problems of global warming and climate change.

4.1 POVERTY

Introduction

At present massive poverty is considered as the most formidable problem facing the Indian economy. Presence of malnutrition, illiteracy, disease, high infant mortality, unhygienic environment, lack of proper housing facility etc. in the country are the outcome of massive poverty. Therefore, the issue of poverty has become a major concern of planners and policy makers in the country. As such, alleviation of poverty and improvement in the living standards of people are the prominent objectives of the developmental planning in India.

Here, an attempt is made to explain various concepts of poverty, the factors responsible for the emergence and persistence of poverty, and the measures taken by the government for its alleviation.

4.1.1 Meaning of Poverty

Poverty is defined as the deprivation from the minimum consumption requirements necessary to keep a person alive and active. In other words, a person is said to be poor if he is unable to secure the basic necessities of life such as the minimum amount of food, clothing and shelter for his / her bare subsistence.

Poverty can be interpreted in two ways, viz.

(a) Absolute Poverty

(b) Relative Poverty

4.1.1.1 Absolute Poverty

Absolute poverty is the inability to obtain the minimum standard of consumption necessary for one's bare existence. People are considered poor in the absolute sense if they fail to secure the basic minimum requirements of life such as foodgrains, vegetables and other non-food items such as clothing and shelter.

4.1.1.2 Relative Poverty

Relative poverty is said to exist when the consumption standard of one person falls behind the consumption standard of another person or of others in the society. As such, it is a measure of inequality in the living standards of the people and is reflected in inequality in the distribution of income.

In a society, there may be some rich people with higher income while others are poor people with lower income. The poor people with lower income can not be considered poor in absolute sense if they secure basic minimum consumption requirements for their bare existence with their available income. But they are considered poor in relative sense compared to the rich people with higher income. Inequality in the distribution of income among different sections of a society gives rise to relative poverty.

In India discussion on poverty is generally confined to absolute poverty. However, relative poverty has also drawn the attention of government, policy makers and researchers. Broadly speaking, concern for the poor has been an integral part of any discussion on development in India. It has gained prominence with the adoption of inclusive development as an objective of governance and economic growth.

4.1.2 Measures of Poverty

Although there are several measures of poverty such as Head Count Ratio (HCR), Poverty Gap Ratio (PGR), Sen's Index etc. the most common measure is the head count measure of poverty or head count ratio. Head count ratio (HCR) is calculated by dividing the number of persons living below the poverty line by the total population of the country. When this ratio is multiplied by 100, one can know the percentage of people who are poor, i.e., who are living below the poverty line.

$$HCR = \frac{\text{No. of persons living below the poverty line}}{\text{Total population}} \times 100$$

Since the concept of poverty line is used by the economists and policy makers to measure the extent of poverty in the country, it is necessary to know its meaning.

4.1.2.1 Poverty Line

Poverty line can be defined as the amount of money required to buy the absolute minimum consumption basket necessary for a healthy living of an individual per day. At the international level, per capita consumption expenditure equal to 1.25 US dollar ($) per day is considered as the absolute poverty line. People who can not afford expenditure of this amount (1.25 US $) are now regarded as poor at the international level. The main drawback of this measure is that it puts all poor people just in one group, i.e., people below poverty live (BPL), and hence fails to indicate the intensity of poverty in a country. But despite this defect poverty line based HCR gives a summary picture of poverty for which it is widely used in studies and research on poverty and in devising strategies for poverty alleviation.

4.1.2.2 Estimation of Poverty in India

The Task Force set up by the government of India in 1979 defined poverty line as the level of per capita consumption expenditure which can provide or buy 2400 calories daily per individual in rural areas and 2100 calories in urban areas. In terms of money, per capita monthly consumption expenditure of Rs. 49.09 in rural areas and Rs. 56.96 in urban areas at 1973-74 prices were defined as the poverty line by the Planning Commission. People who fail to make such amount of expenditure are said to lie below the poverty line.

Obviously, poverty line has been revised many times by now because of adoption of different consumption standards and due to rise in the consumer prices. For example, poverty line was fixed at Rs. 65 of per capita monthly expenditure in rural areas and Rs. 75 of per capita monthly expenditure in urban areas at 1977-78 prices. Further at 1983-84 prices, poverty line was revised to Rs. 101.80 of per capita monthly expenditure in rural areas and Rs. 117.50 in urban areas. At 1993-94 prices, poverty line was fixed at per capita monthly expenditure of Rs. 229 in rural areas and Rs. 264 in urban areas.

Realising the inappropriateness of the methodology used by the Task Force (1979) for estimating poverty, the Planning Commission constituted an Expert Group in 1989 under the chairmanship of Prof. D. T. Lakadwala to redefine the poverty line and make a fresh estimate of the extent of poverty. The Expert Group which submitted its report in 1993 (accepted in 1997) did not redefine the poverty line. The poverty line defined by the Task Force in 1979 in terms of calories was adopted by it. But it made two major changes in the estimation procedure. The incidence, depth and severity of poverty were re-estimated by Planning Commission on the basis of data of earlier surveys made by National Sample Survey Organisation (NSSO) in 1973-74, 1977-78, 1983-84 and 1993-94 as per recommendations of the Expert Group. The Lakadwala Committee Report was accepted by the Planning Commission. On the basis of this report, the estimated poverty ratio for 1999-2000 was revised by fixing poverty line at per capita monthly expenditure of Rs. 327.56 for rural areas and Rs. 451.11 for urban areas.

Table-4.1 shows the official estimates of poverty (i.e., percentage of people below the poverty line and number of persons below the poverty line in rural and urban areas) since 1973-74 till 1999-2000.

Table - 4.1 : Number and Percentage of Population lying below the Poverty Line

Year	Rural		Urban		All India	
	Number (Million)	Percentage	Number (Million)	Percentage	Number (Million)	Percentage
1973-1974	261	56.4	60	49	321	54.9
1977-1978	264	53.1	65	45.2	329	51.3
1983-1984	252	45.7	71	40.8	323	44.5
1987-1988	232	39.1	75	38.2	307	38.9
1993-1994	244	37.2	76	32.6	320	36
1999-2000	193	27.1	67	23.6	260	26.1

Source: Planning Commission of India.

From Table - 4.1 it is observed that there is steady decline in proportion of people living below the poverty line in India. This has been possible due to anti-poverty and employment generation programmes together with the overall economic growth.

After the release of official estimates of poverty for 1999-2000 a fierce debate on the incidence of poverty took place. Estimates for 1999-2000 show that between 1993-94 and 1999-2000, overall poverty declined by close to 10 per cent and rural poverty by more than 10 per cent. Many economists have questioned the comparability of 1993-94 and 1999-2000 estimates because of the changes in the method of data collection. They were of opinion that the incidence of poverty has been underestimated as there was over-reporting of expenditure by the surveyed households because of the change in survey design.

Therefore, the government set up an Expert Group in 2001 to evolve a proper framework for identifying BPL families. The Expert Group recommended a score based ranking of each household basing upon thirteen parameters. On the basis of recommendations of the Expert Group (2001), Planning Commission estimated poverty line in 2004-05 using NSSO survey data (2004-05).

However, government of India set up a committee headed by Prof. S.D. Tendulkar to relook poverty arithmetics in 2005. This committee submitted its report in December 2009. Poverty line is defined in terms of monthly per capita expenditure on food and non-food items like education and health. The earlier calorie approach has been discarded by the Tendulkar Committee. Poverty lines and Poverty ratios (percentage of population below the poverty line) estimated by the Planning Commission using the NSSO survey data on the basis of earlier methodology as well as on the basis of the methodology of Tendulkar committee for 1993-94, 2004-05, 2009-10 and 2011-12 are presented in Tables - 4.2 and 4.3.

Table-4.2 : Poverty Line : Tendulkar Methodology (Rupees/Month)

India/Odisha	Rural Areas			Urban Areas		
	2004-05	2009-10	2011-12	2004-05	2009-10	2011-12
India	447	672	816	579	860	1000
Odisha	409	567	595	497	736	861

Source : Planning Commission of India

Table-4.3 : Poverty Estimates : Tendulkar Methodology

India/Odisha No. and Ratio		Rural Area			Urban Area			Total		
		2004-05	2009-10	2011-12	2004-05	2009-10	2011-12	2004-05	2009-10	2011-12
India	No.	326.7	278.2	216.7	80.8	76.5	53.1	407.6	354.7	269.8
	Proportion	41.8	33.8	25.7	25.7	20.9	13.7	37.2	29.8	21.9
Odisha	No.	19.7	13.6	12.6	2.3	1.8	1.2	22.1	15.3	13.9
	Proportion	60.8	39.2	35.7	37.6	25.9	17.3	57.2	37.0	32.6

Source : Planning Commission of India

Note : No. in Million, Proportion-Percentage of total population.

The Planning Commission pegged the poverty line for 2004-05 at Rs. 447 per capita monthly expenditure for rural population and Rs. 579 for urban population at 2004-05 prices. However, poverty line for the year 2009-10 adjusted for 2009-10 prices stood at Rs. 22.40 per day (Rs. 672 per month) per capita expenditure for rural areas and Rs. 28.65 per day (Rs. 860 per month) per capita expenditure for people in the urban areas. They were further revised to Rs.816 per capita per month for rural and at Rs.1000 for urban areas in 2011-12. The table shows that there is an impressive decline of 7.4 per cent in poverty ratio from 37.2 per cent in 2004-05 to 29.8 per cent in 2009-10, and of 7.9 per cent in 2011-12 against 2009-10.

Even in absolute terms, the number of poor in the country based on per capita expenditure data came down by 13 per cent from 407.6 million in 2004-05 to 354.7

million in 2009-10 and by 14 per cent from 354.7 million in 2009-10 to 269.8 million in 2011-12.

However various quarters of the government and civil society have severely criticized the poverty line estimated in 2009-10 and 2011-12 for being too low.

4.1.3 Causes of Poverty

The incidence of poverty is still very high in the country. Since poverty is a threat we have to fight it out. This requires an enquiy into the causes of poverty. In this section a disscussion of the causes of poverty has been made. Poverty arises from low income. Income is derived from employment or from assets or from both. Therefore, absence of employment and lack of assets are the two important causes of poverty. In addition to these two, there are other causes also. But they are linked to employment and assets. Persistence of poverty in India over the years can be attributed to the following:

1. Inadequate Employment Opportunities

Unemployment is the most important factor responsible for poverty. This is because, employment generates income and when people are unemployed they do not have income and hence they are poor. In India the rate of creation of new job opportunities is much less than the rate of growth of labour force. As a result, magnitude of unemployment is on the rise and as such there is widespread poverty.

2. Slow Rate of Economic Growth

In India, slow rate of economic growth is one of the major causes of massive poverty. Till 1980, rate of economic growth measured by the rate of increase in GDP was only 3.7 per cent per annum. Therefore, poverty ratio was very high. According to an estimate of the Indian Planning Commission 51.3 per cent of the population were living below the poverty line in 1977-78. During the 1980s, the rate of growth of

GDP increased marginally and during the 1990s and thereafter it increased at a little higher rate. Following higher growth, poverty ratio declined. For example, in 2009-10 it stood at 29.8 per cent and in 2011-12 it came down to 21.9 per cent. Although poverty ratio has declined it is still very high. Massive poverty in India is mainly caused by low annual average rate of growth of per capita income. The annual average rate of growth of per capita income during the entire plan period (1951 to 2011) is only 3 per cent. This has resulted in low standard of living and widespread poverty.

3. Rapid Growth of Population

Rapid growth of population in India is responsible for low rate of growth of per capita income and low standard of living of the people. The annual average rate of growth of GDP in India over the entire plan period (1951 to 2011) has been 5 per cent. But the annual average rate of growth of per capita income is only 3 per cent because population growth has taken place at the rate of approximately 2 per cent per annum during the same period. This explains the persistence of massive poverty in India.

4. Low Productivity of Agriculture

Even to-day majority of the people in India depend on agriculture for their livelihood. But contribution of agriculture to the country's GDP is only 17.4 per cent because of its low productivity. This means that people who depend upon agriculture have low income and hence they are extremely poor.

5. Neglect of Small Scale and Cottage Industries

Inadequate attention to small scale and cottage industries in the country's development strategy is also an important cause of poverty in India. From the Second Five Year Plan onwards, emphasis has been laid on capital intensive heavy industries. Neglect of small scale and cottage industries, which are labour- intensive in nature has resulted in massive unemployment and widespread poverty in the country.

6. Inflation

The continuous and rapid increase in the price level has resulted in a rapid fall in real consumption and standard of living of the people, particularly of those who are poor. Thus inflation has made poor people poorer.

7. Socio-Cultural Factors

Socio-cultural factors such as rigid caste system, religious and spiritual values, unproductive expenditure in rituals and joint family system prevailing in India have stood as impediments in the path of rapid economic growth and they contribute to poverty.

8. Increase in Inequality in the Distribution of Income and Wealth

It has been stated earlier that relative poverty is reflected in inequality in the distribution of income. According to a study by the National Council of Applied Economic Research (NCAER), the top 20 per cent of India's population had 53.2 per cent share in the national income in 2009-10. This was higher than their share of 36.7 per cent in 2004-05. But the bottom 20 per cent of population had only 6.1 per cent share in the national income in 2009-10, which was 6.5 per cent as in 2004-05. This shows that there is not only extreme inequality in the distribution of income, such inequality is increasing over the years. The rich is becoming richer and the poor is becoming poorer and relative poverty is increasing.

Inequality in the distribution of income is caused due to inequality in the distribution of land and other assets among different sections of the society. Such inequality in the distribution of income and assets is the main cause of relative poverty in the country.

4.1.4 Poverty Alleviation Measures

Poverty is a matter of concern. It needs to be eradicated. But eradication of poverty is a difficult task. So steps need to be taken to alleviate poverty.

The government policy for alleviation of poverty after launching of Five Year Plans can be divided into two periods:

(i) Period from 1951 to 1969 (From 1st Plan to 3rd Plan)

(ii) Post - 1969 period (4th Plan and after)

Government Policy During 1951 to 1969 (From 1st Plan to 3rd Plan)

During the period of first three Five Year Plans, government of India relied primarily on fast economic growth to alleviate poverty. It was believed that if there is increase in GDP (or economic growth) the income of the poor households will rise automatically and thus they can rise above the poverty line. The approach was : take care of growth and poverty will be taken care of automatically'. This process of growth was supplemented by certain fiscal measures for redistribution of income and productive assets, and some other measures to generate new employment opportunities. But government could not succeed in its endeavour. Failure on these fronts prompted the government to redesign the strategy of poverty alleviation.

Government Policy During Post - 1969 Period

Since the early 1970s (from Fourth Plan onwards) new strategies were devised to alleviate poverty. Special programmes were adopted by the government of India in the Fourth Plan and Fifth Plan for the purpose of alleviation of poverty. They can be divided into two categories, viz.

(A) Area Development Programmes

(B) Beneficiary Oriented Programmes

Area Development Programmes

These programmes basically aimed at development of the rural and backward regions of the country and alleviation of rural poverty, and include the following:

(1) Hill Area Development Agency (HADA) Programme

This programme was launched in 1972. The main objectives of the programme were to minimise regional imbalances and accelerate economic development with the

management of natural resources and ecological and environmental development of hill areas of Jammu & Kashimir, North Eastern States, Tamil Nadu, West Bengal, Maharashtra, Kerala, Goa and Karnataka.

(2) Drought Prone Area Programme (DPAP)

This programme was launched in 1973-74. Creation of durable assets that would contribute towards reducing severity of drought and increase in wage employment etc. were the main objectives of the programme.

(3) Command Area Development Programme (CADP)

It was launched in 1974 for faster and optimum utilisation of irrigation potential created in the country.

(4) Desert Development Programme (DDP)

This programme was launched in 1978. Arresting environmental degradation and improving environmental productivity in Hot and Cold (Jammu and Kashmir, Himachal Pradesh) deserts were the main objectives of the programme.

Beneficiary Oriented Programmes

The following beneficiary oriented programmes were introduced during the early 1970s with a special focus on the small and marginal farmers, agricultural labourers and rural artisans.

(1) Small Farmers' Development Agency (SFDA) Programme

SFDA was introduced in 1973-74. The purpose of this programme was to supply adequate credit to small farmers so that they could adopt the latest techniques of cultivation and diversify their activities. Besides, the programme would assist the landless and skill-less poor in securing employment.

(2) Marginal Farmers and Agricultural Labourers (MFAL) Agency Programme

This programme was introduced in 1974-75 to take care of the marginal farmers, the rural artisans and the agricultural labourers. The MFAL, which was similar to SFDA, was merged with SFDA in 1976.

Since these programme were not so much successful in expansion of employment and removal of poverty, during the 6th Five Year Plan and afterwards, several programmes were launched in the country for generation of self-employment, wage employment and alleviation of poverty.

Self-employment Programmes

The important self-employment programmes introduced in the country include the following :

(1) Integrated Rural Development Programme (IRDP)

IRDP was launched in 1978 covering 2300 blocks of the country by the merger of the earlier programmes such as DPAP, CADP, HADA and SFDA. From 1980 onwards the programme covered the whole country. The objective of the programme was to lift the poor people above the poverty line by promoting self-employment. This programme was designed to help in generation of income on the one hand and creation of assets on the other. Under this programme, financial assistance was given for a variety of economic activities. Such activities were being partly financed by subsidies and partly by bank credit. The amount of subsidies varied between 25 per cent (in case of behebiearis of general castes) and 50 per cent (in case of SC / ST). It is a centrally sponsored scheme funded on 50:50 basis by the Centre and the States. It is stipulated that at least 50 per cent of the assisted families should belong to Scheduled Castes and Scheduled Tribes categories. Moreover, 40 per cent of beneficiaries should be women.

This scheme was merged with Swarnajayanti Gram Swarozgar Yojana (SGSY) in 1999.

(2) Training of Rural Youth for Self-Employment (TRYSEM)

TRYSEM was introduced in 1979 as a component of IRDP. Later, it was made an independent programme. The main objective of the programme was to improve technical and entrepreneurial skill of the rural youth from poor families in the age group

18-35 years to enable them to take up self-employment. This programme was merged with SGSY in 1999.

(3) Development of Women and Children in Rural Areas (DWCRA)

DWCRA was introduced in 1983 as a pilot scheme in 50 districts as a component of IRDP. Later, it covered the whole country as an independent programme. The objective of the programme was to improve the economic conditions of rural women through creation of income generating skills and activities.

This scheme was merged with SGSY in 1999.

(4) Supply of Improved Tool Kits to Rural Artisans (SITRA)

This programme was launched as a pilot scheme in 1992. Later, it covered the whole country. The objective of the programme was to improve the quality of outputs of rural artisans and thereby to enhance their income earning opportunities.

(5) Ganga Kalyan Yojana (GKY)

This programme was launched in 1995 as a component of IRDP. The objective was to provide financial assistance to BPL farmers to install tube wells for irrigating their farm land. The funds for the GKY are contributed by the Central government and the State government in the ratio of 80:20. Out of the total funds, 50 per cent have been earmarked for SC and ST farmers.

This programme was merged with SGSY in 1999.

(6) Swarnajayanti Gram Swarozgar Yojana (SGSY)

SGSY was launched in April 1999 as a result of merger of all the earlier self-employment programmes such as IRDP, TRYSEM, DWCRA, SITRA, GKY and Million Wells Scheme (MWS).

The objective of the SGSY is to lift the assisted poor families above the poverty line within a specified period of time.

Features of SGSY

(i) SGSY is an integrated self-employment programme for reduction of poverty.

(ii) Beneficiaries under this programme are called Swarozgaris and they could be either individuals or Self-Help Groups (SHGs). The programme seeks to achieve its goal of alleviation of poverty by organising the poor into Self-Help Groups (SHGs). SHG is a small homogeneous group of 10-20 members organized on the basis of self help and mutual help for promotion of their own economic well-being. Each member saves something out of his / her income and entrusts such saving to the group to form group corpus.

(iii) Individual Swarozgaris are selected from the list of BPL households, which is approved by the Grama Sabha. 50 per cent of beneficiaries under this programme belong to SC / ST, 40 per cent to women and 3 per cent to physically handicapped persons.

(iv) SHGs evolve through various stages. In the first stage, the people who live below the poverty line in a village and are eligible to be beneficiaries of SGSY have to be motivated to become members of SHGs. The motivation may come from a NGO, or a social activist, or a government agency or a bank, or any elected member of panchayat. In forming SHGs under SGSY, it should be noted that 50 per cent of the groups formed in each block should be exclusively for women. The group formation stage lasts for about six months.

Six months after the formation of SHGs a grading exercise is done in order to identify the weaknesses, if any, of a group and to help the group to overcome them.

In the second stage, only the good SHGs which are viable are given the revolving fund. The revolving fund is a grant given by the government to the good groups to help increase group corpus so that more and more members can get loans.

Six months after a SHG had received the revolving fund, the second stage of grading is done. The basic objective is to find out whether a SHG is capable of taking an economic activity through higher levels of investment. Since banks have to provide the loans, it is necessary that the evaluation process be completed to the satisfaction of the banks concerned.

After crossing the second stage of grading successfully, the SHG is eligible for receiving assistance for economic activities. This is provided in the form of loans and subsidies.

(v) SGSY encourages the individual Swarozgaries as well as SHGs to promote self employment and raise income through setting up of micro enterprises. However, the micro enterprises to be taken up are first indentified and then selected depending upon the availability of local resources, aptitude and skill of the beneficiaries and market demand.

(vi) For each key activity (or micro enterprise), a project report is prepared by the Block SGSY committee. The project report must indicate the number of people to be covered in a key activity, the required infrastructure, the level of investment required, the expected returns, the repayment schedule etc.

(vii) SGSY emphasises the cluster approach. The cluster approach implies that each block concentrates only on a few selected key activities. These activities are to be taken up in clusters to facilitate backward and forward linkages and to enable Swarozgaries to draw sustainable income.

(viii) Under the SGSY programme individual beneficiaries as well as the members of SHGs are given Basic Orientation Training and Skill Development Training as per the requirement of the key activity.

(ix) For success of the enterprise, appropriate technology support as well as marketing support are provided under the SGSY.

Several research studies show that SHGs formed under SGSY have produced significant positive impact on expansion of self employment, generation of income and alleviation of poverty.

(7) Prime Minister's Rozgar Yojana (PMRY)

The PMRY has been in operation since October 2,1993. Its aim is to provide financial assistance to the educated unemployed youth having income less than Rs 25,000 per annum for setting up micro enterprises in industry, service and business activities. Each educated unemployed youth is eligible for a loan of Rs 1 lakh to start a micro enterprise. He is given a subsidy of 15 per cent. In selecting the beneficiaries SC / ST applicants are given 22.5 per cent reservation and OBCs are given 27 per cent reservation. The selected beneficiaries have to pay 5 per cent of the project cost as margin money.

Wage Employment Programmes

Wage Employment Programmes launched for alleviation of poverty include the following:

(1) Food for Work Programme (FWP)

Food for work programme was launched in 1977. Objectives of this programme were: (i) to generate additional gainful employment for the unemployed in rural areas with a view to improving there income and nutrition and (ii) creation of durable community assets by utilising surplus foodgrains.

(2) National Rural Employment Programme (NREP)

The FWP was redesigned and called NREP in 1980. Objectives of this programme were to: (i) generate wage employment and (ii) create durable community assets.

(3) Rural Landless Employment Guarantee Programme (RLEGP)

RLEGP was launched in 1983. Its objective was to provide 100 man-days of guaranteed employment in a year to at least one person in each landless household during the lean season.

(4) Million Wells Scheme (MWS)

MWS was launched in 1998 as a part of RLEGP. Its objective was to provide irrigation through open wells to the SC / ST beneficiaries with 100 per cent subsidy.

(5) Jawahar Rozgar Yojana (JRY)

In 1998, two earlier programmes such as NREP and RLEGP were merged into a single programme called JRY. The objectives of JRY were the same as that of NREP and RLEGP. It was implemented as a centrally sponsored scheme on 80:20 (Centre:State) cost sharing basis all over the country.

(6) Employment Assurance Scheme (EAS)

This programme was launched in 1993. Objective of the programme was to cater to the employment needs in most difficult and backward areas and to provide 100 days of employment for 2 members from each poor household through the creation of productive community assets.

(7) Sampoorna Gramin Rojgar yojana (SGRY)

SGRY was launched in 2001 as a result of merger of the two earlier programmes such as JRY and EAS for generation of wage employment.

(8) Indira Awas Yojana (IAY)

This programme was started in 1985 as a part of RLEGP. Initially its objective was to provide housing free of cost to SC/ST families and free bonded labourers. From 1993-94, its scope has been extended to non SC/ST among the rural poor subject to the condition that benefits to non SC / ST should not exceed 40 per cent of the total allocation. From 1995-96, the scheme has been extended to the families of Ex-service men of the armed and paramilitary forces killed in action. 3 per cent of the houses are reserved for BPL disabled persons living in rural areas. At present, the permissible construction assistance per house is one lakh of rupees.

(9) Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS)

In 2006, Government of India launched a new scheme called National Rural Employment Guarantee scheme (NREGS) to provide at least 100 days of wage employment to one member of each BPL family. Later on this programme has been renamed as Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS). In 2008, SGRY has been merged with this Scheme.

In spite of implementation of so many poverty alleviation-cum-employment generation programmes, the twin problems of poverty and unemployment have persisted in the country.

4.2 UNEMPLOYMENT PROBLEM

Introduction

Now-a-days, widespread unemployment is looked upon as one of the major problems which Indian economy is facing. Since such widespread unemployment is the main cause of massive poverty in the country, its solution is one of the biggest challenges for India's policy makers. Therefore, expansion of employment opportunities is viewed as a very important objective of government policy in the country.

An attempt is made in this section to explain the meaning of unemployment, discuss the different concepts of unemployment, assess the extent of unemployment and identify the causes of unemployment problem in India. Measures to solve the unemployment problem are discussed at the end.

4.2.1 Meaning of Unemployment

Generally a person in the productive age group (15 to 59 years) who is not gainfully employed in any productive activity is called unemployed. This age group is considered because people of 15 to 59 years constitute the working population (or labour force) of the country. Thus unemployment is a situation which occurs if anybody belonging to the working population or labour force is willing and able to work but fails to secure gainful employment. The proportion of labour force to the country's total population is known as labour force participation rate (LFPR).

Unemployment may be voluntary or involuntary. Voluntary unemployment occurs when people who are able to work are not willing to work at the prevailing wage rate. But involuntary unemployment occurs when people who are able and willing to work do not find gainful work. In economics the term 'unemployment' refers to only involuntary unemployment. Voluntary unemployment is not considered as unemployment.

4.2.2 Nature and Types of Unemployment in India

The problem of unemployment in India is much more serious than that of the developed countries. In developed countries unemployment is cyclical, but in less developed countries like India it is structural. Cyclical unemployment is caused due to lack of effective demand. This is so called because it appears in the downward phase of the business cycle below the equilibrium growth path. But structural unemployment occurs due to lack of capital and other complementary factors.

Though there are various types of unemployment in India, it generally takes two forms-rural unemployment and urban unemployment.

(A) Rural Unemployment

Bulk of unemployment in India is found in rural areas. Rural unemployment usually assumes three forms - seasonal unemployment, disguised unemployment and educated unemployment.

(i) Seasonal Unemployment

Agriculture is the principal occupation in rural India. By nature agriculture is a seasonal occupation. Bulk of rural population are engaged in farm activities only in the farming seasons but during most part of the year remain unemployed. Such unemployment is due to the absence of alternative employment opportunities.

(ii) Disguised Unemployment

Rapid growth of population on the one hand, and lack of adequate gainful employment opportunities on the other, have resulted in overcrowding in agriculture. In such a situation even if some people are withdrawn from agriculture, production will not be affected much. Such a type of situation is called disguised unemployment.

Apparently all persons seem to be employed, but contribution of many workers to total product (i.e., marginal product) is almost zero. Disguised unemployment is the main type of unemployment found in the agricultural sector in India. It is also seen in bus stops where we notice more rickshaw pullers and coolies than required.

(iii) Educated unemployment

With the spread of education in rural areas, there has emerged a class consisting of educated and highly educated people. They find themselves misfit in usual agricultural operations and thus remain idle due to lack of employment opportunities outside agriculture.

(B) Urban Unemployment

While most part of unemployment in rural areas is disguised, most of unemployment in urban areas is open. Urban unemployment is of three types viz. i) Unemployment of unskilled industrial workers or industrial unemployment, or Blue collar unemployment, ii) Educated unemployment or White collar unemployment and iii) Underemployment.

(i) Industrial Unemployment

Although there has been a significant expansion of the industrial sector, industrial unemployment has expanded over the years. The factors which have contributed to this phenomenon are : a) Increase in economically active population in the country; b) Population in urban areas has grown faster largely because of migration from rural to urban areas, c) Concentration of industries in urban areas and d) Decay of cottage and small scale industries in rural areas.

(ii) Educated Unemployment

Educated unemployment arises mainly because of the following :

a) Although there has been a very fast expansion of general education, technical education and training have lagged behind in India. As a result, there is increase in supply of labour force having general education though demand for such educated population is less.

b) Economic growth has been taking place at a slow pace. Such slow pace of growth has not been able to create adequate employment opportunities. As such all types of educated people including engineers, general graduates and post graduates remain unemployed.

(iii) Underemployment

Underemployment constitutes a major part of unemployment found in all countries. It refers to a situation in which a worker is doing a wage job that is not sufficient relative to any acceptable standard. Underemployment can be studied from the point of view of an individual worker who is underemployed or in a macro sense in which case a large number of workers in a society remain underemployed. Underemployment has one or some or all of the following features.

1. The worker is not working full-time but part-time or is not working on all days but on some days due to unavailability of jobs.
2. The worker does a work that is inferior relative to his qualification/education, experience, skill and physical/mental abilities. An engineer working as a salesman in a mall may be an example.
3. There may be overstaffing/overcrowding in which case more people are working than are warranted. This is typical in traditional agriculture, the case of vehicles with drivers in bus stops and railway stations, etc.
4. It may indicate a situation in which technology is improving and the worker is not updating but manages to be on the job may be due to trade union action.
5. The worker is underutilised.

Raj Krishna's Classification of Unemployment

Prof. Raj Krishna discussed four criteria of unemployment basing on time, income, willingness and productivity. According to the time criterion a person is severely underemployed if he is engaged in gainful work for 28 hours or less in a week and

moderately unemployed if he is engaged for more than 28 hours but less than 42 hours in a week. A person working for 8 hours a day for 273 days of the year is regarded as employed on a standard person year basis.

A person may be employed on some wage or income but the income which he earns may not be sufficient for him to rise above the poverty level. This is the income criterion of unemployment.

A person may be considered underemployed if he is forced to take a job that he thinks is not adequate for his purpose or is not at par with his education and training. This is the willingness or recognition criterion of unemployment. Under this criterion, there are also voluntarily unemployed persons in urban areas who are searching for specific type of jobs according to their educational qualifications. Such persons may be considered as unemployed.

According to the productivity criterion disguised unemployment is a situation where the marginal productivity of labour over a wide range is zero or near zero.

The National Sample Survey Organisation (NSSO) had developed three concepts of unemployment since 1972-73. These are 1) Usual status unemployment or Chronic unemployment 2) Weekly status unemployment, and 3) Daily status unemployment. They are discussed in the following section.

4.2.3 Estimates of Unemployment

For a clear understanding of unemployment we should know the following concepts developed by National Sample Survey Organisation of India. The first is labour force participation rate (LFPR). It is the ratio of persons/ person days in the labour force to total population per 1000 persons / person-days. Person in the labour force includes the number employed and the number unemployed in the economically active age group 15-59 years.

$$LFPR = \frac{E + U}{P} \times 1000$$

The second is workers population ratio or WPR. It is the ratio of number of employed people to total population per 1000 persons.

$$WPR = \frac{E}{P} \times 1000.$$

The third is proportion unemployed (PU). It is the ratio of number of unemployed people to total population per 1000 persons. $PU = \frac{U}{P} \times 1000.$

The fourth is unemployment rate (UR). It is the ratio of number of persons / person-days unemployed to the total number of persons in the economically active age-group per 1000 persons. $UR = \frac{U}{E + U} \times 1000.$

NSSO provides estimates of employment and unemployment with reference to the activity status of population on the basis of three approaches. They are: usual status (US), current weekly status (CWS) and current daily status (CDS) approaches. In the US approach whether a person is employed or unemployed is decided by the major time criterion in a reference period of 365 days preceding the date of survey. It looks at the issue in terms of principal and subsidiary activity status of the workers. The activity status in which a person spent longer time of 283 days or more during the 365 days reference period (major time criterion) is considered the usual principal activity status of that person. Such person may have spent a relatively shorter time (minor time) of 30 days or more on some economic activity during the reference year. This is termed as the usual subsidiary economic activity status. Employment in the subsidiary economic activity may be there in two situations. First a person may spend major time in one economic activity and minor time in another economic activity. Second, he/ she may be engaged in one economic activity throughout the year and simultaneously in another economic activity for a comparatively shorter period. Adding the two activity status together we get the measure of usual principal and subsidiary status (UPSS) or usual status (US) unemployment.

CWS of employment is determined on the basis of a reference period of one week or seven days preceding the date of survey. In this approach, a person is considered as employed if he/ she pursued some economic activity for at least one hour on any day of the reference week. CDS of a worker is obtained in terms of economic activity pursued

by a person on each day during a reference period of seven days preceding the date of survey. It is based on day-to-day labour time disposition. According to this approach, a person in considered employed for the full day if he / she worked for four or more hours during the day. If he/she has worked for more than one hour but less than four hours, he/ she is considered to be employed for half day. If a person is available for work / seeking employment for more than four hours during a day but has not worked ever for one hour during the day, then he/ she is categorised as unemployed for full day. But if the person is reported seeking work for more than one hour but less than four hours, then he is classified as unemployed for half day and not in the labour force for the other half day.

It is thus clear that CDS is concerned with person-days and not with persons. Accordingly, person-days in employment/ unemployed of each day of the reference week is aggregated to obtain person-days of employment and unemployment in the economy. The UR in this approach is estimated as the ratio of person-days in employment to person-days in labour force per 1000 person-days.

The details of LFPR, WPR and UR according to UPSS, CWS and CDS for 2011-12 in respect of both India and Odisha are given in the following table.

Table - 4.4 : LFPR, WPR and UR in India and Odisha

Location		India			Odisha		
		UPSS	**CWS**	**CDS**	**UPSS**	**CWS**	**CDS**
LFPR	Rural	406	383	361	427	380	352
	Urban	367	363	354	395	385	379
	All	559	534	508	422	380	356
WPR	Rural	399	370	340	417	360	322
	Urban	355	347	335	381	367	357
	All	386	364	339	412	361	327
UR	Rural	17	34	57	22	51	87
	Urban	34	44	55	35	47	58
	All	23	37	56	24	51	83

According to the usual status approach, the unemployment rate is found to be high in the urban areas compared to the rural areas. This is because of migration of working age people from rural to urban areas in search of gainful employment. The unemployment rate is higher in Odisha than at the all-India level and this holds for both rural and urban areas. This means that creation of gainful employment opportunities is lacking more in the state than at the national level.

4.2.4 Causes of Unemployment

Unemployment problem in the country is mainly caused due to mismatch between supply of labour force and demand for labour force in the country. Excess supply of labour force over the demand has resulted in acute unemployment problem.

Causes of Large Supply of Labour Force

Rapid growth of labour force is caused due to the following factors:

(i) Fast Growing Population

The population of India is increasing due to faster decline in death rate compared to fall in birth rate. This is the main cause of significant growth in the labour force.

(ii) Urbanisation

Urbanisation has induced large scale migration of rural population to urban areas in search of better employment and to experience better livelihood. This has resulted in an increase in supply of job seekers in urban areas.

(iii) Inappropriate Educational System

Fast expansion of general education (Arts, Science and Commerce) has led to the increase in educated population resulting in an increase in the supply of educated labour force.

(iv) Change in Attitude of Women

After independence women's education has expanded. This has led to a change in attitude of women towards employment. They now compete with men for employment.

(v) Lack of Manpower Planning

Mismatch between supply of labour force and demand for labour force is mainly caused by lack of manpower planning in India. For a faster growth of any economy human resources play an important role. There should be long term planning for the provision of appropriate skills for meeting the requirements of development. No doubt, there has been an increase in facilities for higher education, technical education and training in different fields, but these are not in accordance with development needs. The obvious result is surplus of manpower in some fields and deficit in others. We find widespread unemployment among graduates and post-graduates in Arts, Science and Commerce while there is scarcity of physicians and technical personnel.

Causes of Inadequate Demand for Labour Force

Though there is rapid growth of supply of labour force in the country, job opportunities fail to increase in keeping pace with it. The following are the reasons for inadequate employment opportunities in the country.

(i) Slow Economic Growth

It is expected that as economic growth takes place, job opportunities expand. In the post-independence era, not doubt, economic growth has taken place in the country. But the rate of growth has been slow due to (a) Limited degree of industrialisation, (b) Inadequate infrastructure facilities, (c) Low priority given to agriculture, (d) Small public investment in agriculture and (e) Inadequate irrigation facilities. Because of slow economic growth, demand for labour is low.

(ii) Decay of Small and Cottage Industries

India was famous for small and cottage industries in the past. They are labour-intensive and provided employment to large number of rural people. But these industries are now decaying due to stiff competition from the manufacturing sector and government apathy.

(iii) Inappropriate Technology

It is a fact that in India labour is abundant while capital is scarce. Therefore, to solve the problem of unemployment, there is need to adopt such technology, which

makes use of more labour and less of capital to produce a given level of output. For India, labour-intensive technology is the appropriate technology. But it is unfortunate that, there is increasing use of capital intensive technology not only in industrial sector but also in agriculture. Thus the technology used in the country is labour-saving which is aggravating the unemployment problem.

A pertinent question at this point arises: Why, despite abundance of labour, capital intensive technology is adopted in India ? This happens because rate of return on capital and labour are not determined by the market. While on one hand, labour is assured of minimum wages despite their low productivity, rate of interest is not so high. As a result, people are inclined to make more use of capital-intensive technology, as it is economically more profitable. According to Lewis, in such a situation investment in capital equipment may be more profitable to the individual capitalist, but certainly not beneficial to society because it increases unemployment.

Rigid labour laws in India have also contributed to adoption of capital intensive techniques of production. On the part of industries, it is quite difficult to reduce the number of employees. Once a person is recruited, most likely he is retained till his retirement especially in the case of public sector. In addition, labour unrest and lack of work-culture have increased inefficiency of labour. These factors, again, have provided incentives for the use of labour-saving technology.

4.2.5 Measures to Solve Unemployment Problem

To solve the unemployment problem in India, the following measures need to be taken:

1. **Population Control:** Rapid population growth is an important cause of increasing the supply of labour. Since additional job opportunities being created in different sectors are quite inadequate, control of population should be given priority. Once population growth slows, solving the problem of unemployment will be easy.
2. **Manpower Planning:** Appropriate manpower planning can help solve unemployment problem in the country. The planners must estimate the manpower or labour force requirements for different economic activities and

different sectors of the economy. Accordingly, education and training facilities should be provided to people so that they become employable. At present, there is widespread unemployment among general graduates and post-graduates because their supply is much more than their demand. On the other hand, there is shortage of technical manpower because their supply is less than their demand. If proper planning is done, such unpleasant situation can be avoided.

3. **Revamping the Education System:** Since fast expansion of general education results in huge educated unemployment among general graduates in Arts, Science and Commerce, there is need to give a brake to such expansion. Instead, emphasis should be given on expansion of technical and vocational education to overcome the scarcity of physicians and technical personnel.

4. **Stimulating Economic Growth:** In India, slow rate of economic growth is one of the most important factors responsible for poor employment generation. According to the Trickle Down Theory, the benefits of higher rate of economic growth percolate down to the poor via greater demand for labour. Therefore, government must stimulate economic growth through rapid industrialisation, provision of sufficient infrastructure, and creation of irrigation facilities for increasing demand for labour.

5. **Emphasis on Small Scale and Cottage Industries:** Government should encourage establishment of small, medium and cottage industries for expansion of employment opportunities. These industries are capital light, skill light, import light, quick-yielding, non-inflationary and labour-intensive. They create employment opportunities and are sources of subsidiary employment. The development of these industries will create new work opportunities for the unemployed, more work for the underemployed and supplementary work for the seasonally unemployed.

6. **Tackling Seasonal Unemployment:** Seasonal unemployment problem can be tackled through expansion of irrigation facilities, and by giving incentives to the people to undertake dairy farming, horticulture, poultry farming etc.

7. **Appropriate Technology:** One of the important causes of unemployment problem in India is the indiscriminate use of capital intensive technology. This is not consistent with the factor endowment of the country. Therefore, there is need to adopt either labour intensive technology or intermediate technology as suggested by Schumacher in his book 'Small is Beautiful'. The development and application of such technology will increase the use of human labour for production of different goods and services. This will lessen unemployment.

8. **Self-employment:** It is not possible to provide employment to all in organized sector in a vast country like India. Therefore, the problem of unemployment can be solved through expansion of self-employment.

Government Policy for Addressing Unemployment Problem

Since widespread unemployment is the main cause of massive poverty in the country, government has adopted policies for alleviation of poverty through expansion of employment opportunities. Since Sixth Five Year Plan onwards, several self-employment and wage employment programmes have been launched in the country for solving unemployment problem. These self-employment and wage employment programmes have been discussed in detail in the previous section under the head 'Poverty Alleviation Programmes'. But in spite of the sustained efforts of the government these programmes have not been able to solve unemployment problem in the country. India needs to put on extra effort to solve this problem.

4.3 INFLATION

Introduction

Inflation is one of the major economic problems which India has been facing since the Second Five Year Plan. It is an important challenge in the investment landscape. Government and the policy makers keep regular track of the inflationary situation of the country since it impacts people of all walks of life and beyond a limit it may disrupt the whole economic system. Therefore, taming of inflation constitutes a major challenge facing the government and the monetary authority of the country.

4.3.1 Meaning of Inflation

Inflation can be defined as a state of sustained and rapid rise in the price level. Statistically, inflation can be measured with the help of Wholesale Price Index (WPI) as well as by Cost of Living Price Index or Consumer Price Index (CPI). Consumer price index is also calculated for Agricultural Workers (CPI-AW), Industrial Workers (CPI-IW) and Rural Labourers (CPI-RL) separately.

While the wholesale price index number measures changes in the average whole sale prices over a period of time (i.e., from base year to current year), consumer price index number measures changes in the average consumer prices (or retail prices) over a period of time (i.e., from base year to the current year). Base year is known as the bench-mark year or reference year. Average prices in the current year are compared with that of the base year to know the extent of rise in price. Average base year price or base year price index is always taken as 100. For example, if the average wholesale price in the year 2015-16 is 125 with base year 2010-11=100, we can say that WPI has gone up by 25 per cent over the period 2010-11 to 2015-16 which means that inflation rate is 25%/5 = 5 per cent per annum.

4.3.2 Inflationary Trend in Prices During the Plan Period

In order to study the trend of inflation in India during the planning era (i.e., from 1951 till now), the entire plan period can be divided into two parts - pre-reform period (1951-1991) and post-reform period (1991 and thereafter).

Trend of Inflation During Pre-reform Period (1951-1991)

During the period of First Plan (1951-56) price level was more or less stable. Price level started rising since the Second Plan (1956-61). In the Second Plan, WPI rose by 20 per cent with 1952-53 as the base year (i.e., 1952-53 = 100).

But during the Third Plan (1961-66) there was rapid rise in the price level due to Chinese invasion (1962), Indo-Pak conflict (1965) and the famine conditions in 1965-66. During this period, prices of foodstuffs, cereals and pulses rose by 40 per cent, 45 per cent and 70 per cent respectively. During the next two years (1966-67 and 1967-

68) WPI jumped by 14 per cent and 11 per cent respectively. However, in 1968-69, WPI declined by 1 per cent due to a bumper harvest.

During Fourth Plan (1969-74), inflation rate was very high due to heavy expenditure of the government on Bangladesh refugees, the widespread failure of kharif crops in 1972-73, and rise in crude prices in 1973. As a result, WPI in September, 1974 stood at 331 (with 1961-62 = 100) which means that inflation rate per annum was around 19 per cent.

However, due to adoption of strong fiscal and monetary measures inflation rate measured by WPI declined in 1975. During 1974-75 inflation rate declined by 3 per cent over the previous year and in 1975-76 there was still a larger fall. During 1977-78 and 1978-79, WPI stood at 184 (1970 - 71 = 100) which implies that inflation rate was 10.4 percent.

However, due to a record budgetary deficit WPI rose to 224 (1971 - 72 = 100), an increase of 13.8 percent in 1979-80. The Wholesale Price Index (WPI) increased by 32 points in 1980-81, i.e., from 224 to 256, an increase of 14.29 per cent in one year. In view of the high inflation rate, government and RBI adopted anti-inflationary measures. As a result, by and large, inflationary situation was brought under control during the 1980s, that is, during Sixth and Seventh Plan periods and the average annual inflation rate stood at around 7 per cent.

Thus, during the Second Plan to Seventh Plan period, i.e. upto 1990, inflation rate was not uniform in the country. In some years it was too high, and in some years it was at comfortable level depending upon the economic environment of the country.

Trend of Inflation During Post-reform Period (1991 onwards)

Signs of serious economic crisis began to manifest in 1990-91 in the Indian economy. Because of large fiscal deficit, inflation rate measured by WPI became 10.3 per cent in 1990-91. Annual inflation rates measured by WPI from 1990-91 to 2014-15 are presented in Table-4.5.

Table - 4.5 : Inflation During the Period 1990-91 to 2014-15

Year	Annual Inflation Rate (WPI) (in per cent)
1990-91	(1981-82 base = 100) 10.3
1991-92	13.7
1992-93	10.1
1993-94	8.4
1994-95	(1993-94 base - 100) 10.9
1995-96	8.0
1996-97	4.6
1997-98	4.4
1998-99	6.0
1999-00	3.3
2000-01	7.2
2001-02	3.6
2002-03	3.4
2003-04	5.5
2004-05	6.5
2005-06	(2004-05 base = 100) 4.5
2006-07	6.6
2007-08	4.7
2008-09	8.1
2009-10	3.8
2010-11	9.6
2011-12	8.9
2012-13	7.4
2013-14	6.0
2014-15	2.0

Source: Centre for Monitoring Indian Economy (CMIE), Mumbai & Economic Survey, Government of India (Different Issues)

From Table 4.5, it is observed that like the pre-reform period, inflation rate is not uniform during the post-reform period. During 1990-91 to 1995-96, the initial years of reform, inflation rates were very high. But, inflation moderated after 1995-96. During 1995-96 to 2007-08 inflation rates were comfortable / moderate except a few years such as 1998-99, 2000-01, 2004-05 and 2006-07. However, during the period of global financial crisis (2008-09), inflation increased to 8 per cent due to spike in crude oil prices and supply sock in food production. But, in the next year, when recovery started, inflation rate came down to a comfortable level (3.8 per cent). Since February 2010 inflation has been very close to double-digit level. Latest figures show that inflation rate stood at 9.6 per cent in 2010-11 and 8.9 per cent in 2011-12. Thus, India faced the worst price pressure much above the threshold level. It has lowered to 7.4 per cent in 2012-13, 6.0 per cent in 2013-14 and 2 per cent in 2014-15. RBI Research (2011) shows that mild inflation stimulates growth, but the grease affect of inflation almost ceases after 6 per cent level of annual inflation, which could be ideally considered as the estimated threshold level. It is pointed out that beyond this threshold level, inflation shaves off growth, rather than helping it. However, according to D. Subbarao, former Governor of RBI, inflation is said to lie at comfortable level, if it is within the range of 4 to 5 per cent per annum.

4.3.3 Causes of Inflationary Rise in Prices in Recent Years

To analyse the causes of growth of prices one has to consider the following commodity groups: foodgrains; fruits and vegetables; milk; eggs; oil seeds; manufacturing products, and fuel, power and lubricants. Average inflation rate measured by WPI is going up in recent years due to rise in prices of all the commodity groups.

It is widely believed that inflation is a state of persistent rise in the price level caused due to the excess of demand for goods over the supply of goods. Therefore, the factors which are responsible for the rapid rise in the price level can be grouped under two heads:

(a) Factors leading to a rise in demand, and

(b) Factors causing to a fall in supply or slow increase in supply.

These factors responsible for inflation are explained below.

(a) Demand side Factors

Demand-pull factors causing mounting inflationary pressure include the following:

1. Mounting Government Expenditure

The most important reason for increase in demand is the steady and continuous rise in government expenditure (revenue expenditure + capital expenditure). Total expenditure incurred by the government of India stood at Rs. 530 crore in 1950-51. It has gone up to Rs. 1777477 crore in 2015-16. Trend of growth of expenditure of government of India in recent years (2005-06 to 2015-16) is shown in Table 4.6.

Table - 4.6 : Expenditure of the Government of India

Year	Total Expenditure (Rs. Crore)
2005-06	506123
2011-12	1216576
2015-16	1777477

Source: Union Budgets

Mounting growth of government expenditure in recent years is mainly due to increase in salary of the government employees following implementation of the recommendations of Sixth Pay Commission, fiscal stimulus in 2008-09, increase in social sector spending on 13 flagship schemes including Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS), National Rural Health Mission (NRHM), Sarva Sikhya Abhiyan (SSA), Swarna Jayanti Grama Swarojgar Yojana (SGSY), and payment of huge amount of subsidies. Large government expenditure puts more money in the hands of the people leading to a rise in demand for goods and services.

2. Large Revenue Deficit and Fiscal Deficit

Excess of current expenditure (or revenue expenditure) over tax revenue collections is called revenue deficit. Revenue deficit is going up due to mounting revenue expenditure as stated above. Fiscal deficit is the excess of total expenditure over total receipts (revenue receipts plus receipts from disinvestment and loan recoveries). This deficit is bridged by market borrowings. The fiscal deficits of the central government in recent years are very high at Rs. 123273 crore or 4.48 per cent of GDP in 2003-04 and Rs. 531177 or 4.13 per cent in 2013-14. Mounting government expenditure financed through market borrowings (fiscal deficits) pushes up money supply in the country and consequently pushes up the public demand for goods and services.

3. Rapid Growth of Population

Growth of population in India (presently 1.58 per cent per annum) is responsible for the rapid increase in demand for all kinds of goods and thus exerts continuous pressure on prices.

4. Role of Black Money

It is well known that there is a huge accumulation of unaccounted money in the hands of tax evaders, smugglers, builders, corrupt politicians and unscrupulous government officials. A large part of such unaccounted money (black money) is used for buying real estate in urban areas and in extensive hoarding and black marketing of essential goods. These activities lead to a rise in the price level.

5. Increase in Rural Income as well as Urban Income

In view of the introduction of various employment guarantee schemes such as MGNREGS and impressive social welfare oriented development programmes and increase in wages of the rural workers, rural income keeps on rising. With high growth, there is also rise in income of the urban workers, government employees and those working in the corporate sector. While per capita GDP was only 228 USD in 1960, it

rose to 797 USD in 2006, 1032 USD in 2010 and 1263 USD in 2014. Rise in income has pushed up the demand for vegetables, fruits, milk and milk products etc. There is also an increase in demand for non-food items such as vehicles, mobile sets and other consumer durables like TV, refrigerator etc. and credit cards in recent years in the country. All these are adding to the price rise.

(b) Factors Responsible for Low Supply of Goods

While demand for food and manufacturing items goes on rising, supply of these goods lags behind. Rise in cost of some items also puts pressure on prices. The factors responsible for low supply and rise in cost are explained below.

1. Low Supply of Certain Food Items

In view of the rise in per capita income of the people both in rural and urban areas in recent years there is consistent increase in the demand for pulses, fruits and vegetables and milk and milk products. But lack of matching rise in output due to their slow yield growth and absence of efficient supply chain from farm to market put pressure on prices of vegetables and fruits in India. Pulses, vegetables, fruits, edible oil and wheat are the major consumer goods whose prices have risen remarkably.

Food inflation has been a major contributor to overall price inflation. Structural bottlenecks in terms of lack of warehousing and cold storage facilities, inadequate connectivity of farms to markets, colossal wastage of food grains kept fuelling food inflation.

Thus, low supply of food items leads to an increase in Food Price Index and Wholesale Price Index.

(2) Defective Public Distribution System (PDS)

In case of cereals such as rice and wheat, India has sufficient buffer stocks, but the real problem lies with distribution. Due to inefficiency in public distribution system these goods do not reach the targeted poor in time. A large part of goods meant for public distribution system slip to the open market due to rampant corruption by the

officials in the offices of civil supplies, storage agents, dealers etc. Again the routine tendering process of selling foodgrains in the open market by Food Corporation of India (FCI) slows down the response time and thus shortage in supply of these goods appears in the market from time to time.

(3) Hike in Oil Prices

A major part of oil requirements of India is met by oil imports. Therefore, sharp hike in the global prices of crude oil by the oil exporting countries from time to time due to artificial curtailment in its production and supply, is a key factor pushing headline inflation in India. It is heartening to note that oil prices have been controlled in the recent years.

(4) Imposition of Excise Duty and Other Commodity Taxes

Imposition of fresh doses of excise duty and other commodity taxes in different budgets gives an opportunity to the producers and traders to raise prices, often by more than the tax amount. The new goods and services tax system which is going to be implemented shortly can help the situation to a great extent.

(5) Rise in Prices of Raw-materials, Industrial Inputs and Wages

The increase in prices of manufactured goods can be explained mainly by two factors: First is the increase in prices of raw materials and industrial inputs. Second is the upward revision of wages and salaries of government employees, increase in wages of the workers in the unorganized sector and in the corporate sector. Increase in cost of production due to rise in wage and rise in prices of raw materials and inputs is largely responsible for rise in the general price level.

(c) Other Factors

The other factors which are responsible for inflationary rise in prices include the following.

(1) Upward Revision of Administered Prices

Regular upward revision of administered prices (i.e., government determined prices) of many goods such as diesel, kerosene, LPG, paddy, wheat, urea, etc. is also

an important factor responsible for inflationary rise in prices in the country.

(2) Failure of the Government in Enforcing its Policy

Failure of the government in enforcing the policy of distribution of essential goods through PDS and the policy of administered prices gives scope for rampant black marketing and hoarding in the country. Such black marketing and hoarding of essential goods are responsible for their shortage in the market and consequent rise in their prices.

4.3.4 Impact of inflation

According to RBI, inflation remains at comfortable level if it lies within the 4 to 5 per cent range. Such mild inflation promotes investment, stimulates production and serves as a tonic of economic growth. But all these beneficial effects of inflation disappear when it crosses the threshold level which is estimated at 6 per cent by the Reserve Bank of India. Double digit inflation or close to it produces adverse effects on consumption, production and distribution of income.

1. Consumption

Increase in prices of foodgrains and other essential goods is responsible for curtailment of consumption of the poor families. According to a report of United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP), climbing food prices across Asia, especially India, Bangladesh and Nepal have kept 19.4 million people in poverty in the region during the year 2010. The extent of decline in poverty in the post-reform period has been modest mainly because of considerably high inflation in foodgrains. The rise in prices of manufactured products has also adversely affected domestic consumption.

2. Reduction of Exports and Widening of Current Account Deficit

The continuous rise in prices of industrial products has adversely affected manufacturing exports, resulting in widening of current account deficit in the balance of payments of the country. In 2006-07, current account deficit stood at one per cent of GDP. It rose to 1.4 per cent in December, 2015.

3. Slow Rise in Saving, Investment and GDP

Rapid rise in the price level is also responsible for low Saving-GDP ratio and low Gross Domestic Capital Formation - GDP ratio in recent years. In 2007-08, Saving-GDP ratio stood at 36.4, it came down to 34 in 2009-10, 32.3 in 2010-11 and 31.46 in 2013-14. Similarly Gross Domestic Capital Formation - GDP ratio was 37.7 in 2007-08, but it came down to 35.1 in 2010-11 and further to 30.61 per cent in 2013-14. Annual investment growth (or growth in gross fixed capital formation) has come down from 15.3 per cent in 2006-07 to 11.1 per cent in 2010-11 and further declined to 5.8 per cent in 2011-12 and again to 2.95 per cent in 2013-14. Index of Industrial Production (IIP) has increased at a low rate. With 2004-05 base, IIP has increased to just 174.9 in 2014-15 from 172.0 in 2013.14.

GDP growth has also become very low. Whereas in 2006-07, GDP growth was 9.6 per cent, it came down to 6.7 per cent in 2008-09. However, in 2009-10 it increased to 8.4 per cent, but further declined to 6.5 per cent in 2011-12 and increased marginally to 7.5 per cent in 2015-16. The present slow down in economic growth is mainly caused by rapid rise in the price level in the country.

4. Inequality in the Distribution of Income and Wealth

Inflation makes the rich richer and the poor poorer. As such, continuous rise in the price level is responsible for accentuation of inequality in the distribution of income in the country. According to a study by the NCAER, the top 20 per cent of India's population had 53.2 per cent share in national income in 2009-10, up from 36.7 per cent in 2004-05, but the bottom 20 per cent of population had only 6.1 per cent share in the national income in 2009-10, down from 6.5 per cent in 2004.05. As in 2012 the top 0.1 per cent of population had 5.1 per cent share in national income.

5. Weakening of Rupee

At present the value of rupee in terms of US dollar is rapidly falling due to large current account deficit and because of outflow of Foreign Institutional Investment (FII)

from the Indian economy on account of high inflation. As on 31 May 2016, one USD was equivalent to Rs.67.17.

4.3.5 Control of Inflation

Since inflation adversely affects consumption, saving, investment and production, and widens inequality in the distribution of income, Reserve Bank of India and the government have introduced several measures from time to time to arrest the rise in price.

Measures for controlling inflation can be broadly divided into two categories:

(a) Measures to Reduce Demand for Goods
(b) Measures to Increase Supply of Goods

Measures for Reduction of Demand

For reduction of demand, the monetary authority (RBI) and the government have broadly undertaken two types of measures - monetary measures and fiscal measures.

1. Monetary Measures

Monetary measures refer to those tools which are used by the country's monetary authority (RBI) for changing the availability of money and cost of money for producing desirable effect on growth and stability of the economy. Different monetary measures adopted by RBI in recent times to combat inflation include the following:

(i) **Repo Rate:** Repo rate is the RBI's short term lending rate. RBI has raised repo rate many times during the recent past to control inflation. In 19 March 2010 repo rate stood at only 5 per cent, in January 2012 it increased to 8.5 per cent. In January 2013 it was fixed at 7.75 per cent. It has been lowered to 6.50 per cent in April, 2016. An increase in repo rate leads to an increase in interest rate charged by the commercial banks. That makes borrowing from commercial banks costlier and results in reduction in investment, income and demand for goods which help to contain prices. A reduction in repo rate does the opposite. It helps to raise prices.

(ii) **Reverse Repo Rate:** Reverse repo rate is the short term borrowing rate of the RBI. RBI pays interest to the commercial banks at this rate when they park their surplus funds with RBI. RBI has increased reverse repo rate many times in the past to control inflation. In March 2010, reverse repo rate stood at 4 per cent, in January 2012, it was raised to 7.5 per cent but fixed at 6.75 per cent in January 2013. It has been lowered to 6 per cent with effect from 05.04.2016. As a result of increase in reverse repo rate, commercial banks have to raise deposit rates from time to time for attracting funds from the general public. This results in diversion of funds from the people to banks leading to reduction in demand for goods and hence in lowering the upward pressure on price level. A reduction in reverse repo rate has the effect of raising prices.

(iii) **Cash Reserve Ratio (CRR):** The fraction of total deposits that has to be parked by the commercial banks with RBI is known as cash reserve ratio (CRR). RBI increases CRR to reduce the lending capacity of the commercial banks. Increase in CRR leads to reduction in the volume of credit available to the corporate sector for investment and household sector for consumption. As a result investment declines, income is reduced and demand for goods is curtailed. In January 2013 CRR is fixed at 4 per cent and it is so in April, 2016.

(iv) **Statutory Liquidity Ratio (SLR):** The proportion of total deposits that has to be maintained by the commercial banks in government securities and government guaranteed securities is called statutory liquidity ratio (SLR). RBI raises SLR from time to time to reduce the lending capacity of the commercial banks. This leads to reduction in the volume of credit to different sectors of the economy. Consequently, investment shrinks, income declines and demand contracts. The SLR stands at 21.5 per cent as in April, 2016.

Besides the above quantitative credit control measures, RBI also uses some selective measures to restrict the flow of credit to inflation sensitive trading activities such as food grains, cotton, oil-seeds and textiles so as to discourage speculative hoarding.

2. Fiscal Measures

Fiscal measures refer to the use of public expenditure, taxation, public borrowing and deficit financing by the government for producing desirable effects on growth and stability of an economy.

Since inflation is caused mainly due to large fiscal deficit in recent years, the most important policy option before the government of India is to cut fiscal deficit.

Fiscal deficit can be brought down in two ways:

(i) Reduction in avoidable and wasteful government expenditure

(ii) Increase in tax revenue

(i) Reduction in Avoidable and Wasteful Government Expenditure

Government of India incurs huge amount of expenditure on payment of subsidies on food, oil and fertilisers, and on a number of social sector schemes such as Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS), National Health Mission (NHM), Sarva Sikshya Abhiyan (SSA) etc. It is argued that spending so much of money on these schemes is wasteful since leakage in such schemes is huge and the benefits do not reach the targeted groups. Therefore, there is need to cut such wasteful expenditure. A good amount is also spent on laying foundation stones of government projects which is certainly wasteful and avoidable.

(ii) Increase in Tax Revenue

A substantial portion of income generated in India escapes tax. The reforms in direct tax regime has helped increased compliance, but the revamp of the indirect tax regime is stuck. Government has to lose huge amount of tax revenue due to large-scale tax exemptions to the companies such as excise duty relief for investment made in specific areas and low or no customs duty on crude oil and edible oils. It is necessary to minimise the number of exemptions. Besides, service tax rates and duty on gold imports are to be increased. Since tax-GDP ratio in India (16.6 per cent

in 2013-14) is much lower compared to many other countries, it should be raised for reducing fiscal deficit.

Measures for Increasing Supply

Monetary and fiscal measures as discussed above may lead to contraction in industrial growth and calm down manufacturing inflation, but cannot control food inflation which is a major component of overall inflation. Controlling food inflation requires an altogether different approach.

The decisive action to tackle food inflation as well as overall inflation has to be in the form of acceleration of farm sector growth and ensuring timely distribution of agricultural produce.

(i) Increase in Supply of Foodgrains

India has made tremendous progress in the field of agriculture since the inception of planning in 1951. The foodgrain production has gone up by five times from 51 million tonnes in 1950-51 to 257.1 million tonnes in 2014-15. Since 2007-08, supply of two key food items - rice and wheat - has been above their demand in our country. For example, in 2009-10, supply of rice was 95.54 million tonnes, but demand for it was only 94.83 million tonnes. Similarly supply of wheat stood at 80.84 million tonnes, whereas demand for it was 70-80 million tonnes. India has also sufficient buffer stocks of these two cereals. In 2015 grain stocks with State agencies such as FCI stood at 75 million tonnes. Out of this only 50 million tonnes can be kept under covered storage. Therefore, there is need to make additional storage space so that foodgrains will be available in the market in adequate quantity. However, there is shortage in the supply of pulses, which is the main source of protein for a large proportion of our population. For example, in 2009-10, supply of pulses was 14.86 million tonnes, whereas demand for it was 18.29 million tonnes. Such demand-supply mismatch need to be corrected through increased production.

Therefore, there is need to increase the yield of pulses through intensive Research and Development. Besides, government must put in place a robust procurement mechanism for raising the pulses output. Today, we only rely on NAFED for procurement of pulses, and this has not proved to be an effective channel to extend benefits of higher Minimum Support Prices (MSPs) to producers of pulses.

(ii) Increase in Supply of Fruits and Vegetables

With high growth, rising income and aggressive development work being undertaken in rural areas, demand for fruits, vegetables and milk is increasing. But supply of these items is much less. Therefore, there is need to increase production and supply of fruits, vegetables and milk in the country. Besides, there is need to minimise the wastage ratio in case of fruits and vegetables that can be as high as 40 per cent. Here, government must encourage private sector in building the required storage and transportation infrastructure. The supply chain from farm to market needs to be streamlined and the government must exploit the capacities of private sector including foreign retail players in this gigantic task.

(3) Alternative Mechanism to Public Distribution System (PDS)

Government of India has launched Public Distribution System (PDS) for ensuring supply of essential foodgrains such as wheat and rice as well as sugar, imported edible oil and kerosene through a wide network of fair price shops to BPL and APL families at subsidised prices. But this PDS is more a 'pilferage distribution system' rather than a 'public distribution system'. PDS has failed to serve the people below the poverty line. Now, the neediest has to rely heavily on the high priced open market. Thus there is need to develop an alternative mechanism to PDS.

(4) Release of Foodgrain Stocks in the Open Market

Although there is sufficient buffer stock of wheat and rice with the FCI, the real problem lies with distribution. The present system of releasing of foodgrain stocks in the open market is defective. FCI should extend selling smaller quantities, say, 100 tonnes,

at multiple locations through electronic platforms. Bulk sales through routine tendering process slows down the response time to any shortage that may appear from time to time.

4.4 SUSTAINABLE DEVELOPMENT

Introduction

In recent years, one of the important goals of the planners and policy makers of every country is to achieve 'sustainable development'. The term first came into prominence in the 'World Conservation Strategy' presented in 1980 by the International Union for the Conservation of Nature and Natural resources. It was popularised by the World Commission on the Environment and Development's study "Our Common Future" (1987), which is also known as the Brundtland Report. These and other studies by Repetto (1986), Redcliff (1987), Turner (1988) and other scholars have defined sustainable development in different ways.

4.4.1 Meaning of Sustainable Development

The study "Our Common Future" (1987) has defined sustainable development in the following words: "Sustainable development is development that meets needs of the present without compromising the ability of future generations to meet their own needs." Thus sustainable development may mean everlasting development. It is a situation in which the elements of development do not decrease over time. Simply speaking, sustainable development encompasses social development, economic development and environmental protection. Sustainable development is said to take place when there is alleviation of poverty, reduction of inequality, generation of employment, increase in per capita income, provision of quality education, adequate quality health care facilities, pure drinking water, pollution free water and a suitable environment.

4.4.2 Conditions for Sustainable Development

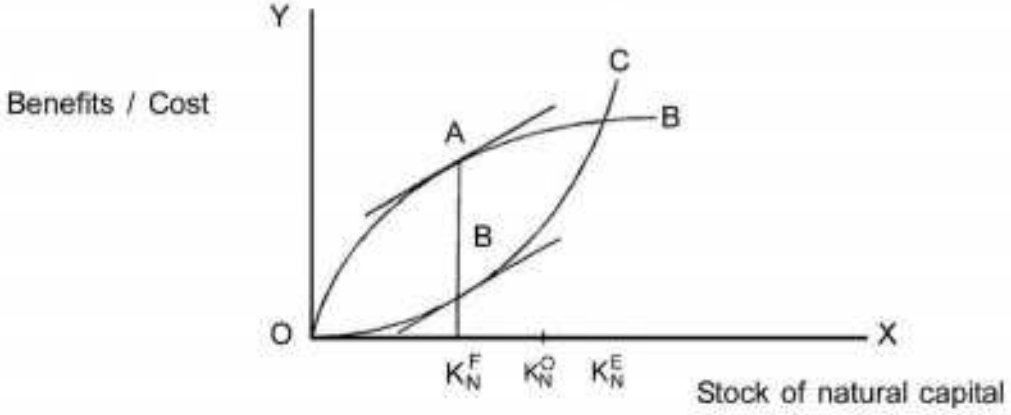
Economic development takes place through industrialisation and agricultural development. In course of industrialisation and agricultural operations, natural resources or natural capital like oil in the ground, mineral resources, ground water,

forests, rivers, natural environment etc. undergo depletion. Unless stock of natural capital is kept constant, future development will be at stake. Thus, for sustainability of development, natural capital stock should at least be kept intact.

According to Brundtland Report (1987) "If needs are to be met on a sustainable basis, the earth's natural resource base must be conserved and enhanced". Repetto (1986) points out that "Sustainable development is a development strategy that manages all assets, natural resources, and human resources as well as financial and physical assets, for increasing long-term wealth and well being".

It is known that depletion of natural capital stock involves benefits and costs. For example, clearance of tropical forest takes place for agricultural purpose. Natural habitats are reduced for housing development. Thus depletion of natural capital stock gives rise to benefits in terms of the gain from the use to which it is put. Destruction of natural resources also involves some costs since it adversely affects environment and brings in huge loss to the mankind.

The following Figure depicts the cost-benefit comparison. The stock of natural assets is shown on the horizontal axis and costs and benefits are shown on the vertical axis. Cost curve labeled C shows that as the stock of natural capital (K_N) increases, total cost in the form of forgone benefits increases at an increasing rate. The benefit curve labeled B shows that as the stock of natural capital (K_N) increases total benefits to users and non-users increases at a diminishing rate.



Stock of natural capital is said to be optimal when its benefits are maximum and costs are minimum or net total benefit is maximum.

Net total benefit = Total benefit (B) - Total Costs (C).

In the above Figure, K_N^O is the optimal stock of natural capital corresponding to which net total benefit (AB) is maximum. If the existing capital stock (K_N^E) is greater than the optimal capital stock (K_N^O) it is beneficial in net terms to use the stock, i.e. to engage in increasing production through taping natural capital. If the existing capital stock (K_N^E) is less than the optimal capital stock (K_N^F) it is necessary to increase the stock of natural capital. Sustainable development appears to be concerned with maintenance of optimal stock of natural assets. However, it is difficult to determine the size of optimal capital stock of a country. This is mainly due to the problems involved in the measurement of benefits and costs.

Therefore, for achieving sustainable development the existing stock of natural assets should at least be maintained (or conserved). It is believed that when natural capital stock is kept intact, economic development will be everlasting, i.e. "it will meet the needs of the present generation without compromising the needs of future generation".

Meaning of Constant Capital

Constancy of natural capital stock has several meanings. Commonly it means that the amount of capital stock should remain constant. But it is true for renewable resources, not for exhaustible resources since increase in the use of such resources reduces their stock.

Another meaning of constancy of natural capital stock is that economic value of the stock is to remain constant. This is possible only when real price of such natural resources would rise with fall in physical capital stock.

A broader version of the constant value rule would require that the total value of all capital stock (man made and natural) be held constant. Here the basic idea is that

future generation would inherit a combined capital stock which is not less than the one in the previous generation. This is possible when depletion of natural resources, say oil, minerals, forest resources etc. would be compensated for by other investments generating the same income so that the pressure on using natural resources would be reduced.

4.4.3 Indicators of Sustainable Development

Indicators of sustainable development refer to the norms or the guidelines on the basis of which one can judge whether the economy has achieved the key objectives of sustainable development.

Indicators can play an important role in helping countries to take appropriate decisions concerning the use of natural capital and achieving sustainable development. They can also provide an early warning sounding the alarm in time to prevent economic, social and environmental damage. However, indicators of sustainable development vary from country to country depending upon country-specific conditions, national priority and objectives.

A large number of international organisations such as United Nations Commission on Sustainable Development (UNCSD), Food and Agriculture Organisation (FAO), International Institute for Environment and Development (IIED), International Institute of Sustainable Development (IISD), Organisation for Economic Cooperation and Development (OECD), and World Bank have formulated different sets of indicators of sustainable development.

The United Nations Commission on Sustainable Development (UNCSD) developed a practical and widely agreed set of indicators of sustainable development during 1995-2000 that are suited to country-specific conditions. They can be used in monitoring progress towards sustainable development at the national level. However, the set of indicators developed during 1995-2000 has been revised later once in 2002 and then in 2005.

The Commission on Sustainable Development (CSD) indicators cover a broad range of issues intrinsic to all pillars of sustainable development - social development, economic development and environmental protection. In view of the multi-dimensional and integrated nature of sustainable development, these indicators attempt to measure sustainable development in its entirety.

The broad range of issues pertaining to all the pillars of sustainable development include poverty alleviation, employment creation and income redistribution, ensuring a healthy population, providing good education, reducing the rate of growth of population, stimulating economic development, and promoting environmental protection. Although a larger number of indicators have been formulated by CSD for achieving these key sustainable development objectives, the following indicators are frequently used by most of the countries.

(1) Proportion of people living below the poverty line

(2) Share of top income groups in national income

(3) Proportion of population using an improved water source

(4) Infant mortality rate

(5) Life expectancy at birth

(6) Percentage of population with access to primary health care facilities

(7) Nutritional status of children

(8) Gross intake ratio to last grade of primary education

(9) Net enrolment rate in primary education

(10) Adult literacy rate

(11) Emission of green house gases (i.e., carbon dioxide emissions)

(12) Emission of sulphur dioxide and nitrogen oxides

(13) Consumption of ozone depleting substances

(14) Ambient concentration of air pollutants in urban areas

(15) Loss of rural land due to development (or land covered by urban development)

(16) Arable and permanent crop land area

(17) Proportion of land area covered under forests

(18) Proportion of total water resources used

(19) Use of fertiliser and pesticides

(20) GDP (Gross Domestic Product) per capita

(21) Investment share in Gross Domestic Product

(22) Debt-GDP ratio

(23) Employment population ratio

(24) Current Account deficit as percentage of GDP

(25) Annual energy consumption

(26) Share of renewable energy to total energy use

Though these indicators have not been quantified, it is believed that sustainable development can be achieved if the country concerned has a smaller value in respect of indicators at serial number 1, 2, 4, 11, 12, 13, 14, 15, 18, 19, 22, 24 and 25, but a larger value in respect of the others i.e., at serial number 3, 5, 6, 7, 8, 9, 10, 16, 17, 20, 21, 23 and 26 listed above.

4.4.4 Effects of Economic Growth on Environment

Economic development mainly takes place through industrialisation and agricultural development. In course of industrialisation and agricultural operations, natural resources such as oil in the ground, mineral resources, ground water, forests, river, natural environment etc. undergo depletion. Besides, industrialisation and agricultural operations bring about climate change, global warming, air, water and land pollution and thus cause damage to environment. These environmental problems are regarded as the costs of economic development.

The environmental problems faced in recent years are discussed below.

1. **The Green House Effect:** The Green House Effect is caused due to emission of green house gases such as water vapour, carbon dioxide (CO_2), methane (CH_4) and ozone (O_3) as a result of human activities like deforestation and the burning of fossil fuel in course of undertaking agricultural operations and industrialisation. Over the last three decades of 20th century and the first decade of 21st century, GDP per capita and population growth were the main drivers of increase in green house gas emissions. The emission of these gases has resulted in increasing global warming. This has led to rise in the sea level, change in weather pattern, extinction of many species and decline in crop yield leading to a reduction in global food production.

2. **Acid Rain:** This is caused due to emission of sulphur dioxide and nitrogen oxides from thermal power stations, industry and vehicles. It has been responsible for the loss of forest cover in Central Europe and the contamination of many lakes and streams with the death of fish and plant life.

3. **Depletion of Ozone Layer:** This is caused due to use of Chlorofluorocarbon (CFC) gases in acrosols, refrigeration and the manufacture of polystyrene foam. The ozone layer protects us from harmful ultraviolet radiation coming from the sun. The depletion of ozone layer could lead to increase in skin cancer.

4. **Air Pollution:** Air pollution is caused due to emission of pollutants such as carbon monoxide, black smoke, and lead. Air pollution produces adverse effect on natural ecosystems, human health and quality of life.

5. **Nuclear Radiation:** It is a fact that accidents and tests at nuclear power stations cause dangerous release of radiation. The disposal of nuclear waste is another environmental hazard.

6. **Land and River Pollution:** The dropping of toxic waste into the ground or into rivers can cause long-term environmental damage. Soils can be poisoned, rivers

and seas can become polluted. It is not just industry that is to be blamed here. Sewage pollutes rivers and seas. Nitrogen run off and slurry from farming are also major pollutants. Use of fertilizers and pesticides for increasing productivity of agriculture also pollutes water and causes land degradation.

The costs of pollution abatements are high, especially in the short run. As long as those short-run costs are smaller than the costs of pollution, industry and government will incur such costs. However, in the long run, costs of pollution abatements are very high for which harmful effects of development programmes could be devastating in both financial and environmental sense.

Environmentalists stress the need for clean technologies for environmentally sound growth and for greater responsibility by industry, government and consumers.

4.5 GLOBAL WARMING

One of the biggest environmental problems facing the world today is global warming. Here, an attempt is made to know its meaning, causes, impact and the measures to deal with the problem.

4.5.1 Meaning of Global Warming

Global warming is the rising of average temperature of earth's atmosphere and oceans since the late 19th century mainly due to the increase and concentration of the green house gases. Over the period 1906-2005, earth's average temperature has increased by 0.74 ± 0.18^0 C. According to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), during the 21st century the global surface temperature is likely to rise further by 1.1 to 2.9^0 C for the lowest emission scenario and 2.4 to 6.4^0 C for the highest. Evidence for warming of the climatic system includes observed increase in global average air and ocean temperature, widespread melting of snow and ice, and rising average sea level.

Temperature changes vary over the globe. Since 1979, land temperature has increased by 0.25°C per decade whereas ocean temperature has gone up by 0.13° per decade. Ocean temperature increases more slowly than land temperature because of the larger effective heat absorption capacity of the ocean and because ocean loses more heat by evaporation.

4.5.2 Causes of Global Warming

Various factors are responsible for global warming. These are greenhouse gas concentration, depletion of ozone layer, change in solar luminosity and volcanic eruptions. These are discussed below.

(1) Green house Gas Concentration

More than 90 per cent of the scientists of the major industrialized nations are sure that most of the warming of the climate system is caused by increasing concentration of green house gases produced by human activities such as deforestation and the burning of fossil fuels (coal, mineral oil like petrol, natural gas etc). The major green house gases are Carbon Dioxide (CO_2), Water Vapour, Chlorofluorocarbons (CFCs), Methane (CH_4), Nitrogen Oxide (NO_2), and Ozone (O_3).

Green house gases are released in the atmosphere in various ways. For example:

- Electric power stations based on fossil fuels, mainly coal and mineral oil, emit huge amount of carbon dioxide which reach the atmosphere.
- A large number of factories spread over the world burn immense quantity of coal, mineral oil and natural gas and emit huge amount of carbon dioxide together with other undesirable gases through their chimneys into the atmosphere.
- Various types of vehicles all over the world burn immense quantity of petrol and diesel.
- Deforestation, burning of firewood and use of nitrogenous fertilizers also generate greenhouse gases, such as nitroxoxide and carbon dioxide.

- Methane is produced in paddy fields and marshy land by rotting and decomposition of plants by bacteria and from cow dung, rotten organic debris etc.

These green house gases function as the walls of 'green house' and absorb (trap) heat inside the green house and thereby warm the atmosphere. This phenomenon is called green house effect.

The green house effect is produced in the following manner. When light energy radiated from the sun penetrates earth's atmosphere, it is absorbed by earth's surface and changed into heat energy. The heat energy is radiated back as long-wave radiation. Green house gases (Carbon dioxide, Water vapour, Methane, CFC, Ozone etc.) present in the atmosphere absorb such heat and in turn warm the atmosphere creating green house effect. Global warming is thus caused due to green house affect.

(2) Depletion of Ozone Layer

In the upper atmosphere (i.e., stratosphere located 10-15 kms. above the earth's surface), the ozone layer acts as a natural shield. Ozone layer absorbs most of the harmful ultraviolet rays of the sun, thus preventing them from reaching the earth's surface. This helps in reducing the risk of global warming (or warming of the climate).

Changes in ozone concentration (or depletion of ozone layer) result from natural events such as cycles of the sun, changes in wind and seasonal changes. But the most important cause of ozone layer depletion is the emission of ozone depleting substances (ODS) such as Chlorine and Methane gases, Chlorofluorocarbons (CFCs) and Nitrogen oxides. Due to depletion of Ozone layer, ultraviolet rays of the sun reach the earth's surface and cause global warming.

(3) Volcanic Eruptions

Volcanic eruptions eject chemical substances such as chlorine and methane gases that react with ozone and deplete the ozone layer. As a result, the harmful ultraviolet rays of the sun reach the earth's surface and cause global warning.

4.5.3 Impact of Global Warming

Many problems could result from global warming. Some of these are explained below.

(1) Rise in Sea Levels

One of the biggest problems that is expected to occur due to increase in global temperature is the rise in sea levels. Increase in global temperature leads to melting of the polar ice-caps and thus causes sea level to rise. Global warming is predicted to cause an increase in global average sea level by 0.18 to 0.59 meter by the year 2098-2099 (IPCC, 1990). This could result in the flooding of low lying coastal areas and cities, such as Egypt, the Netherlands, and Bangladesh.

(2) Changes in Weather Pattern

Another problem is the change in weather patterns. Many areas of the world are experiencing increased hurricanes, floods, and other natural disasters. There may be more frequent occurrence of heat waves, droughts and irregular and heavy rainfall due to shifting temperature regimes.

(3) Negative Effect on Animals

Global warming could lead to the extinction of many species and reduced diversity of ecosystems.

In Antarctica, some penguin populations have crashed. Krill population - a food source for many marine animals has declined, seemingly killed by warmer waters.

Global warming has already changed the migration routes of some birds and can have dramatic impacts on wildlife with rapid depletion of the tiny plankton organisms which form the food web in the oceans. This is thought to have contributed to a recent drastic decline in the breeding rates of some seabirds.

Increase in storms may damage the breeding colonies of sea birds and sea animals.

Warmer seas could lead to some turtle species becoming entirely female, as water temperature strongly affects the sex-ratio of hatchlings.

(4) Adverse Effects on Social System

Over the 21st century, global warming is likely to adversely affect hundreds of millions of people through coastal flooding, reduction in water supplies, increase in malnutrition and increased adverse health impacts.

(5) Adverse Effect on Agriculture

Under present trends, by 2030, maize production in Southern Africa could decrease by up to 30 per cent, while rice, millet, maize in south Asia could decrease by up to 10 per cent. By 2080, yields in developing countries would decrease by 10 to 20 per cent on an average while India could experience a drop of 30 to 40 per cent. By 2100, rice and maize yields in the tropics are expected to decrease by 20 to 40 per cent because of higher temperatures while the persent world population of 3 billion is expected to double. Thus global warming is a great threat to food security.

(6) Habitat Inundation

In small islands and mega deltas, inundation as a result of sea level rise is expected to threaten vital infrastructure and human settlements. This could lead to issues of statelessness for population from countries including Maldives and Tuvalu and homelessness in countries in low lying areas such as Bangladesh.

4.5.4 Measures to Overcome the Problem

The following measures may be adopted for mitigating and solving the problem of global warring.

(1) Reduction of Greenhouse Gas (GHG) Emissions

Steps must be taken to switch over to renewable energy away from coal, oil and gas so that emission of green house gases can be reduced. Many countries, both developing and developed, are aiming at using cleaner and less polluting technologies which will aid mitigation and could result in substantial reduction in carbon dioxide emissions.

(2) Carbon Capture and Storage

Since in the most optimistic scenario, fossil fuels are going to be used for years to come, mitigation may also involve carbon capture and storage, a process that traps carbon dioxide produced by factories and gas by power stations and then store it, usually underground.

(3) To Plant More Trees

Trees should be planted in large scale which will absorb carbon dioxide and produce oxygen.

(4) Using less Energy and Recycling More Products

If we use less energy and become more environment-friendly, the earth's surface temperature may not rise so much.

In conclusion it can be said that, making small friendly changes now in the way we live means avoiding huge dangerous changes in the future. Scientists, governments and individuals must work together to overcome the serious threat.

4.6 CLIMATE CHANGE

Climate change is by far the greatest challenge the world has been facing in the recent decades. Unlike other great dangers like war, pestillence and inflation, which are usually location-specific, climate change is a global phenomenon. Broadly speaking, climate change refers to significant changes in average weather conditions occurring over an extended period of time stretching from few decades to millions of years. The rate and volume of current climate change is faster and larger than those observed over comparable time period in the past. They are caused by natural processes and human activity. The features of climate change are :

1. It represents significant changes in average weather condition.
2. It is occurring over an extended period of time.

3. Both the rate and the magnitude of current change are far greater than those observed in the past.
4. The climate change now occurring is partly due to natural processes and largely due to human activity.
5. The manifestations and repercussions of climate change events may be felt locally but may also spread over a much larger area as big as the world as a whole.
6. Climate change is largely irreversible.

Climate change is caused by both natural processes and human activity. The natural processes inclue variations in solar radiation received by earth, the motion of tectonic plates leading to reconfiguration of global land and ocean areas, terrestrial eruptions, volcanic emissions of carbon dioxide etc.

The human factors are : burning of fossil fuels such as coal, oil and natural gas for energy production, deforestation and use of forest land for agricultural and industrial activities etc. These actions lead to increase in green house gases and cause green house effect.

Melting of glaciers, arctic sea ice loss, disappearance of polar bear, global sea level rise, rising temperature known as global warming, more extreme weather events (exessive rain, cyclones, floods, droughts etc.), floral and faunal species extinction etc. are the evidences which show that the climate is changing. Climate change affects communities all over the world and the impacts are becoming increasingly negative.

Scientists, governments, non-government organisations, civil society and individuals need to join hands to regulate human activity so as to minimising the occurrence of climate change and managing the menace.

SUMMARY

4.1 POVERTY

1. Poverty is defined as the deprivation from the minimum consumption requirements necessary to keep a person alive and active.

2. There are two types of poverty - absolute and relative. But in the Indian context, discussion on poverty is generally confined to absolute poverty.

3. Although there are several measures of poverty, the most common measure is the Head Count Ratio (HCR).

$$HCR = \frac{\text{Number of persons living below the poverty line}}{\text{Total population of the country}}$$

4. Poverty line can be defined as the amount of money required to buy the absolute minimum consumption basket necessary for a healthy living of an individual per day.

5. The Task Force set up by the Government of India in 1979 defined poverty line as per capita consumption expenditure which can provide 2400 calories daily per individual in rural areas and 2100 calories in urban areas.

   In terms of money, poverty line has been defined in India from time to time since 1973-74 till now. Planning Commission of India fixes poverty line on the basis of consumption expenditure data of surveys made by NSSO.

6. On the basis of Suresh Tendulkar Methodology, Planning Commission has pegged the poverty line for 2009-10 at Rs. 22.40 per day (Rs. 672 per month) per capita expenditure for rural areas and Rs. 28.65 per day (Rs. 860 per month) per capita expenditure for people in the urban areas. Poverty line has been further revised at Rs. 816 per capita monthly expenditure for rural and at Rs.1000 for urban areas in 2011-12.

7. Poverty arises mainly due to absence of employment and lack of access to assets.

Persistence of poverty in India can be attributed to (a) Inadequate employment opportunities, (b) Slow rate of economic growth, (c) Rapid population growth, (d) Low productivity of agriculture, (e) Neglect of small scale and cottage industries, (f) Inflation, (g) Social and cultural factors, and (h) Large inequality in the distribution of income.

8. During the period of first three Five Year Plans, government of India relied primarily on fast economic growth to alleviate poverty.

But from Fourth Five Year Plan onwards new strategies have been adopted which include:

(A) Area Development Programmes

(B) Beneficiary Oriented Programmes

9. Area Development Programmes include:

(a) HADA Programme, (b) DPAP, (c) CADP and (d) DDP

10. Beneficiary oriented programmes during the early 1970s are: (a) SFDA and (b) MFAL.

Since these programmes were not so much successful in bringing about expansion of employment and alleviation of poverty, from Sixth Five Year Plan, Government of India launched several wage employment and self-employment programmes for the purpose.

11. Self-employment programmes include the following:

(a) IRDP, (b) TRYSEM, (c) DWCRA, (d) SITRA ,(e) GKY, (f) SGSY and (h) PMRY

12. Wage Employment Programmes include the following:

(a) FWP (b) NREP (c) RLEGP (d) MWS (e) JRY (f) EAS (g) SGRY (g) IAY and (i) MGNREGS

4.2 UNEMPLOYMENT PROBLEM

1. Unemployment is a situation which occurs if anybody belonging to the working population (population in the age group 15 to 59 years) or labour force who is willing and able to work but fails to secure gainful employment.

2. Though there are various types of unemployment in India, it generally takes two forms - rural unemployment and urban unemployment.

3. Rural unemployment is found in rural areas. It assumes three forms - seasonal unemployment, disguised unemployment and educated unemployment.

4. Whereas most of unemployment in rural areas is disguised, most of unemployment in urban areas is open. Urban unemployment is of three types, viz.

   - Unemployment of unskilled industrial workers
   - Educated unemployment
   - Underemployment

5. The Eleventh Plan Working Group on Labour Force and Employment Projections, estimated the backlog of unemployed at the end of Eleventh Plan at 23.3 million, and it predicted a decline in the rate of unemployment from 8.36 per cent in 2006-07 to 4.83 per cent in 2011-12.

6. Unemployment problem in India is caused due to the excess of supply of labour over demand for labour. Rapid growth of labour force in India is caused due to the following factors:

(a) Fast growing population

(b) Urbanisation

(c) Inappropriate educational system

(d) Change in attitude of women

(e) Lack of manpower planning

Following are the causes of inadequate demand for labour:

(a) Slow economic growth

(b) Decay of small and cottage industries

(c) Inappropriate technology

7. To solve unemployment problem in India, the following measures need to be taken:

(a) Population Control

(b) Manpower Planning

(c) Revamping the educational system

(d) Stimulating economic growth

(e) Emphasis on small scale and cottage industries

(f) Tackling seasonal unemployment

(g) Adoption of appropriate technology

(h) Creation and expansion of self-employment

From Sixth Five Year Plan onwards several self-employment and wage employment programmes have been implemented in India by the government for solving unemployment problem.

4.3 INFLATION

1. Inflation can be defined as a state of sustained rise in the price level as measured by either Wholesale Price Index (WPI) or Consumer Price Index (CPI).

2. During the period of First Plan price level was more or less stable. Price level started rising since the Second Plan. The latest figures show that inflation rate in India measured by WPI stood at 6.0 per cent in 2013-14 and declined substantially to 2 per cent in 2014-15. According to RBI, 6 per cent level of annual inflation can be considered threshold level. But inflation remains at comfortable level if it remains within 4 to 5 per cent range.

3. In recent years inflationary situation in India is caused due to the excess of demand for goods over the supply of goods.

4. Factors responsible for rapid rise in demand in the country include the following:

(a) Mounting government expenditure

(b) Large revenue deficit and fiscal deficit

(c) Rapid growth of population

(d) Huge accumulation of black money

(e) Increase in rural income and urban income

5. Factors responsible for low supply of goods include the following:

(a) Low supply of certain food items

(b) Defective public distribution system (PDS)

(c) Hike in oil prices

(d) Imposition of fresh dose of excise duty and other commodity taxes

(e) Rise in prices of raw-materials, industrial inputs and wages

(f) Other factors:

(i) Upward revision of administered prices.

(ii) Government's failure in enforcing its policies.

6. High inflation produces adverse effects on consumption, production and distribution of income in India.

7. Measures for controlling inflation can be broadly divided into two categories:

- Measures to reduce demand
- Measures to increase supply

For reducing demand for goods, the monetary authority (RBI) and the government have broadly undertaken two types of measures, viz.

- Monetary measures
- Fiscal measures

For control of food inflation which is a major component of overall inflation, there is need to

- Increase supply of foodgrains
- Increase supply of fruits and vegetables
- Development of an alternative mechanism to PDS
- Release of foodgrain stocks in open market

4.4 SUSTAINABLE DEVELOPMENT

1. Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
2. For achieving sustainable development the existing stock of natural resources should at least be maintained.
3. The broad range of issues pertaining to all the pillars of sustainable development-social, economic and environmental-include poverty alleviation, employment creation and income redistribution, ensuring a healthy population, providing good education, reducing the rate of growth of population, stimulating economic development and environmental protection.
4. There are large number of indicators as formulated by Commission on Sustainable Development for achieving the above key sustainable development objectives.
5. Environmental problems caused by developmental activities include the following:

(a) Green House effect
(b) Acid rain
(c) Depletion of ozone layer
(d) Air pollution
(e) Nuclear radiation
(f) Land and river pollution

4.5 GLOBAL WARMING

1. Global warming is the rising of average temperature of earth's atmosphere and oceans since the late 19th century mainly due to the concentration of the green house gases.
2. Various causes of global warming are:

(a) Greenhouse gas concentrations

(b) Depletion of ozone layer

(c) Volcanic eruptions

3. Some of the problems resulting from global warming are the following:

(a) Rise in sea levels

(b) Changes in weather pattern

(c) Negative effects on animals

(d) Adverse effects on social system

(e) Adverse effects on agriculture

(f) Habitat inundation

4. The following measures may be adopted for mitigating and solving the problem of global warming:

(a) Reduction of Green House Gas (GHG) emissions

(b) Carbon capture and storage

(c) Planting of more trees

(d) Using less energy and recycling more products

4.6 CLIMATE CHANGE

1. Broadly speaking climate change refers to significant changes in average weather conditions over an extended period of time strateging from few decades to millions of years.
2. The features of climate change are :

(i) It represents significant changes in average weather condition.

(ii) It is occurring over an extended period of time.

(iii) Both the rate and the magnitude of current change are far greater than those observed in the past.

(iv) The climate change now occurring is partly due to natural processes and largely due to human activity.

(v) The manifestations and repercussious of climate change events may be falt locally but may aoso spread over a much longer area.

(vi) Climate change is largely irrecersible.

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MODEL QUESTIONS

4.1 POVERTY

Group - A: Objective Type (Compulsory) (1 mark each)

1. Write the correct answer choosing from the alternatives given in each question:

(a) What is the per capita level of consumption expenditure per day at the international level at present for defining poverty line?

(i) 1 US dollar (ii) 2 US dollar

(iii) 1.5 US dollar (iv) 1.25 US dollar

(b) What is the 'poverty line' according to the Task Force appointed by government of India in 1979?

(i) 2000 calories daily per individual in rural areas and 2200 calories in urban areas.

(ii) 2400 calories daily per individual in rural areas and 2100 calories in urban areas.

(iii) 2100 calories daily per individual in rural areas and 2400 calories in urban areas.

(iv) None of the above.

(c) What is the per day per capita expenditure requirement for rural areas for defining poverty line in 2009-10 as per Suresh Tendulkar methodology ?

(i) Rs. 14.80 (ii) Rs. 22.40 (iii) Rs. 37.2 (iv) Rs. 41.8

(d) What is the per month per capita expenditure requirement for defining poverty line in 2011-12 in rural areas?

(i) Rs. 568 (ii) Rs.1000 (iii) Rs. 816 (iv) Rs. 861

(e) What was the recent estimate of poverty ratio in India made by the Planning Commission ?

(i) 21.9 (ii) 27.5 (iii) 37.2 (iv) 29.8

(f) What was the share of top 20 per cent of India's population in 2009-10 according to a study by NCAER ?

(i) 50.5 per cent (ii) 49.8 per cent

(iii) 36.7 per cent (iv) 53.2 per cent

(g) What is the share of bottom 20 per cent of India's population in 2009-10 according to a NCAER study ?

(i) 6.5 per cent (ii) 6.1 per cent

(iii) 7.1 per cent (iv) 7.5 per cent

(h) Which of the following is not a self employment programme of the government of India ?

(i) SGSY (ii) PMRY (iii) SGRY (iv) DWCRA

(i) Which of the following is not a wage employment programme ?

(i) MGNREGS (ii) SGRY (iii) JRY (iv) IRDP

(j) Which of the following was launched by the government of India during Sixth Five Year Plan ?

(i) JRY (ii) SGRY (iii) IRDP (iv) SGSY

(k) Which of the following was merged with MGNREGS in 2008 ?

(i) IRDP (ii) TRYSEM (iii) SGRY (iv) MWS

2. I Express each of the following statements in one word.

(a) The deprivation from the minimum consumption requirements to keep a person alive and active.

(b) Ratio of persons living below the poverty line to the total population of the country.

2. II Answer the following questions in one sentence in each case.

(a) What is absolute poverty ?

(b) What is relative poverty ?

(c) What is poverty line ?

(d) What is Head-count ratio ?

(e) What is Tendulkar methodology of estimating poverty line ?

2. III Examine the correctness of the following statements. Correct them, if necessary, without changing the portions underlined:

(a) In Indian context, the discussion on poverty is generally confined to relative poverty.

(b) Poverty line is fixed by Indian Planning Commission on the basis of per capita income.

(c) Swarna Jayanti Grama Swarojgar Yojana (SGSY) is the example of a area development programme.

(d) Mahatma Gandhi National Rural Employment Programme is an example of self-employment generation programme.

2. IV Fill up the blanks:

(a) _____ per cent of people live below the poverty line in India in 2011-12 as estimated by Planning Commission.

(b) IRDP was launched in _____ for alleviation of poverty in India.

(c) Poverty ratio in India is showing a _____ trend.

Group - B (Short Type Answer)

3. Answer the following questions within two / three sentences in each case: (2 marks each)

(a) How poverty line was fixed by the Indian Planning Commission in 1979 ?

(b) What does relative poverty reflect ?

(c) What is head-count measure of poverty ?

4. I Answer each of the following within six sentences: (3 marks each)

(a) How do inadequate employment opportunities cause poverty ?

(b) How does slow rate of economic growth cause poverty ?

(c) What was the government of India's policy during first three Five Year Plans for alleviation of poverty ?

(d) How do the area development programmes alleviate rural poverty ?

4. II Distinguish between the following restricting your answer within six sentences in each case.

(a) Absolute poverty and Relative poverty.

(b) Self-employment programmes and Wage employment programmes.

Group - C : Long Answer Type (7.5 marks)

5. What is poverty? Discuss the causes of poverty in India.

6. Give an account of poverty alleviation measures adopted by the government of India.

4.2 UNEMPLOYMENT

Group - A: Objective Type (Compulsory) (1 mark each)

1. Write the correct answer choosing from the alternatives given in each question:

(a) What is the nature of unemployment in developed countries ?

(i) Structural (ii) Cyclical

(iii) Seasonal (iv) Disguised

(b) What is the nature of unemployment in India ?

(i) Cyclical (ii) Open

(iii) Structural (iv) None of these

(c) Which of the following is the main cause of unemployment in India ?

(i) Lack of manpower planning (ii) Inappropriate technology

(iii) Slow economic growth (iv) All of the above

(d) Which of the following is not a wage employment programme ?

(i) SGSY (ii) SGRY (iii) MGNREGS (iv) JRY

(e) Which of the following is not a self employment programme?

(i) SGRY (ii) SGSY (iii) IRDP (iv) RLEGP

(f) Which of the following two programmes were merged to formulate JRY ?

(i) NREP and EAS (ii) NREP and RLEGP

(iii) TRYSEM and SITRA (iv) DWCRA and IRDP

2. I Express each of the following statements in one word.

(a) The situation which occurs if anybody belonging to the working population is willing to work and able to work but fails to secure gainful employment.

(b) The situation in which many people are not able to get job in line with their ability and educational qualification.

2. II Answer the following questions in one sentence in each case:

(a) What do you mean by unemployment ?

(b) What is underemployment ?

(c) What is seasonal unemployment ?

(d) What is disguised unemployment ?

(e) What do you mean by labour force participation rate ?

(f) What does SGSY stand for ?

(g) What is the full form of SGRY ?

(h) What is the full form of DWCRA ?

(i) What is RLEGP ?

(j) What does MGNREGS stand for ?

(k) How was SGSY formed ?

(l) In which year SGRY was merged with MGNREGS ?

(m) State any two measures for solving unemployment problem in India.

(n) Who are actually poor in India ?

2. III Examine the correctness of the following statements. Correct them, if necessary, without changing the portions underlined:

(a) Unemployment is the main cause of poverty.

(b) India's unemployment is cyclical in nature.

(c) Disguised unemployment refers to a situation when there is no work for those who are willing to work.

(d) Rapid population growth increases employment opportunities.

(e) Swarnajayanti Gram Swarozgar Yojana (SGSY) is a wage-employment programme.

(f) Indira Awas Yojana was launched in 1985-86.

(g) Manpower Planning aggravates unemployment problem.

(h) SGRY was launched as a result of merger of NREP and RLEGP.

2. IV Fill up the blanks:

(a) At present, at the international level, poverty line is fixed at _____ US dollar per day.

(b) According to the latest estimate (2011-12) made by Planning Commission _____ per cent of people in India are living below poverty line.

(c) Planning Commission uses consumption expenditure data collected by _____ for estimating poverty.

(d) Tendulkar methodology takes into account consumption expenditure on food, education and _____ for defining poverty line.

(e) National Rural Employment Guarantee Scheme was renamed as Mahatma Gandhi National Employment Guarantee Scheme in the year _____.

(f) Swarna Jayanti Gram Swarojgar Yojana is a _____ programme.

Group - B : Short Answer Type

3. Answer the following questions within Two / Three sentences in each case: (2 marks each)

(a) Why there is educated unemployment in India ?

(b) What is the appropriate technology for the Indian economy ?

(c) What is Trickle-down theory ?

(d) Why is unemployment in India called 'structural unemployment' ?

(e) What are the factors that contribute to industrial unemployment in India ?

(f) What is meant by work participation rate ?

4. I Answer the following within six sentences in each case: (3 marks each)

(a) Explain the concept of 'disguised unemployment'.

(b) Why, despite abundance of labour, capital intensive technology is used in India ?

(c) How does the lack of manpower planning in India result in unemployment problem ?

(d) How does economic growth solve unemployment problem ?

(e) What are the objectives of SGSY ?

(f) What are the main features of MGNREGS ?

(g) Describe the features of Indira Awas Yojana.

4. II Distinguish between the following restricting your answer within six sentences in each case.

(a) Voluntary unemployment and Involuntary unemployment.

(b) Open unemployment and Disguised unemployment.

(c) Labour intensive technology and capital intensive technology.

Group - C: Long Answer Type (7.5 marks)

5. What is unemployment ? Discus the causes of unemployment problem in India.

6. Explain the measures which are to be taken to solve unemployment problem in India.

7. Discuss the special programmes implemented by the Government of India to solve unemployment problem.

4.3 INFLATION

Group - A: Objective Type Questions (Compulsory) (1 mark each)

1. Write the correct answer choosing from the alternatives given in each question:

(a) Which of the following is the threshold level of annual inflation according to RBI ?

(i) 5.5 per cent (ii) 4.8 per cent

(iii) 6 per cent (iv) 5 per cent

(b) Which of the following is the comfortable level of inflation according to RBI ?

(i) 3 per cent (ii) 5 per cent

(iii) 4 to 5 per cent (iv) 3 to 4 per cent

(c) Which of the following is the major contributor to overall inflation in India ?

(i) Food inflation (ii) Fuel inflation

(iii) Manufacturing inflation (iv) None of these

(d) Which of the following is not a monetary measure for control of inflation?

(i) Repo rate (ii) Reverse repo rate

(iii) Government expenditure (iv) CRR

(e) Which of the following is not a fiscal measure of controlling inflation?

(i) Government expenditure (ii) Taxation

(iii) Repo rate (iv) Government borrowing

2. I Express each of the following statements in one word.

(a) A state of rapid and continuous rise in the price level.

(b) Unaccounted money in the hands of tax evaders, smugglers, builders and corrupt persons.

(c) A statistical device which measures changes in average wholesale prices over a period of time.

2. II Answer the following questions in one sentence in each case.

(a) What is inflation ?

(b) What is Wholesale Price Index number ?

(c) What is Consumer Price Index number ?

(d) What is food inflation ?

(e) What is the major component of overall inflation in India ?

(f) What factors are responsible for mounting government expenditure in recent years ?

(g) What is revenue deficit ?

(h) What is fiscal deficit ?

(i) What is black money ?

(j) Why there is rise in rural income and urban income in recent years ?

(k) What do you mean by administered prices ?

(l) Which group of people is more adversely affected during inflation ?

(m) What are the monetary measures of controlling inflation ?

(l) What is repo rate ?

(m) What is reverse repo rate ?

(n) What is CRR ?

(o) What is SLR ?

(p) What do you mean by fiscal measures ?

(q) What are the fiscal tools ?

(r) How can food inflation be checked ?

2. III Examine the correctness of the following statements. Correct them, if necessary, without changing the portions underlined.

(a) Fiscal deficit is the excess of total government receipts over total government expenditure.

(b) Excess of total expenditure over total receipts (revenue receipts plus receipts from disinvestment) is called revenue deficit.

(c) Inflation reduces the gap between rich and poor.

(d) Repo rate is a fiscal measure of controlling inflation.

(e) Public expenditure is a monetary measure of controlling inflation.

Group - B: Short Type Answer

3. Answer the following within two / three sentences in each case: (2 marks each)

(a) How can repo rate control inflation ?

(b) How can reverse repo rate control inflation ?

(c) How can inflation be controlled by CRR ?

(d) How does inflation affect consumption ?

(e) How does inflation affect saving and investment ?

4. I Answer the following within six sentences in each case. (3 marks each)

(a) What are the factors responsible for rise in demand ?

(b) What are the factors responsible for slow growth in supply ?

(c) How does inflation affect exports and widen current account deficit ?

(d) How does inflation increase inequality in the distribution of income between rich and poor ?

(e) What steps should be taken for increasing supply of foodgrains ?

(f) How can the problem of food inflation be tackled ?

(g) How can SLR help in controlling inflation ?

(h) How can fiscal deficit be reduced ?

4. II Distinguish between the following restricting your answer within six sentences in each case.

(a) Repo rate and Reverse repo rate.

(b) Monetary measures and Fiscal measures of controlling inflation.

(c) CRR and SLR.

Group - C: Long Type Answer (7.5 marks each)

5. Discuss the causes of inflationary situation in India.
6. Discuss the methods of controlling inflation in India.
7. Analyse the effects of inflation on the Indian economy.

4.4 SUSTAINABLE DEVELOPMENT, GLOBAL WARMING AND CLIMATE CHANGE

Group - A: Objective Type (Compulsory) (1 mark each)

1. Write the correct answer choosing from the alternatives given in each question:

(a) In which year, the term 'sustainable development' came into prominence?

(i) 1985 (ii) 1987 (iii) 1990 (iv) 1980

(b) What is the extent of increase in earth's average temperature during 1906-2005?

(i) $0.62 \pm 0.12^{\circ}$ C (ii) $0.74 \pm 0.18^{\circ}$ C

(iii) $0.74 \pm 0.25^{\circ}$ C (iv) $0.62 \pm 0.18^{\circ}$ C

(c) What is the extent of increase in land temperature per decade since 1979?

(i) 0.13° C (ii) 0.25° C (iii) 0.18° C (iv) 0.23° C

(d) What is the extent of increase in ocean temperature per decade since 1979?

(i) 0.25° C (ii) 0.23° C (iii) 0.13° C (iv) 0.11° C

2. I Express each of following statements in one word:

(a) A situation in which the elements of development do not decrease over time.

(b) Rising of average temperature of earth's atmosphere and oceans mainly due to the concentration of greenhouse gases.

2. II Answer the following questions in one sentence in each case:

(a) What is sustainable development ?

(b) What is the name of the study that popularised the term 'sustainable development' ?

(c) What is the condition for sustainable development ?

(d) What do you mean by constant capital ?

(e) What are the greenhouse gases ?

(f) How is acid rain caused ?

(g) How is ozone layer depleted ?

(h) How is air pollution caused ?

(i) What is meant by global 'warming' ?

(j) What do you mean by carbon capture and storage ?

(k) What do you mean by indicators of sustainable development ?

(l) What are the pillars of sustainable development ?

2. III Examine the correctness of the following statements. Correct them, if necessary, without changing the portions underlined:

(a) Depletion of natural resources involves only costs.

(b) Natural capital stock is said to be optimal when total benefit is greater than total cost.

(c) Sustainable development can be achieved when proportion of land area covered under forests decreases.

(d) Ocean temperature increases more rapidly than land temperature.

2. IV Fill up the blanks.

(a) World Commission on the Environment and Development's Study "Our Common Future" is also known as _____.

(b) Sustainable development can be achieved when nutritional status of children _____.

(c) The most important cause of global warming is _____.

Group - B: Short Type Answer

3. Answer the following within two / three sentences in each case: (2 marks each)

(a) Acid rain

(b) Depletion of Ozone layer

(c) Air pollution

(d) Nuclear radiation

(e) Habitat inundation

(f) Carbon capture and storage

4. Answer the following within six sentences in each case: (3 marks)

(a) Explain the condition for sustainable development.

(b) Explain the greenhouse effect.

(c) How are the green house gases released in atmosphere ?

(d) How does depletion of Ozone layer cause global warming ?

(e) How does global warming cause rise in sea levels ?

(f) How does global harming produce negative effects on animals ?

(g) How does global warming produce adverse effect on agriculture ?

(h) What is climate change ?

Group - C: Long Type Answer (7.5 marks)

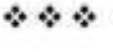
5. What is sustainable development? Give a note on indicators of sustainable development.

6. Discuss the effects of economic growth on environment.

7. What do you mean by global warming ? Discuss its causes.

8. Discuss the problems that arise from global warming.

9. What is global warming ? Discuss the measures for mitigating and solving the problem of global warming.



CHAPTER - 5

INTRODUCTORY STATISTICS

- Meaning, Scope, Importance and Limitations of Statistics
- Sources of Statistical Data - Primary and Secondary, NSSO and Census of India as Sources of Secondary Data
- Methods of Data Collection - Census and Sampling Methods and Their Relative Merits and Demerits

5.1 MEANING, SCOPE, IMPORTANCE, AND LIMITATIONS OF STATISTICS

The word "Statistics" seems to have been derived either from the Latin word 'Status', or Italian word 'Statista' or German word 'Statistick'; each of these words means a political state. Initially statistics was used to meet the administrative need of the state. In modern times, statistics has become indispensable in almost all spheres of human knowledge. In our day today activities we are often using statistics in one form or another. It has become a part and parcel of human civilisation. Probably for this H.G. wells once had observed, "Statistical thinking will one day be as necessary for efficient citizenship as the ability to read and write."

5.1.1 Meaning and Definition

Statistics can be interpreted either in 'plural' or in 'singular' sense. In plural sense it refers to numerical information or statistical data. In singular sense, statistics means statistical methods.

Statistics like other disciplines dose not have an unique definition. Different authors have given different definitions of the subject. Some have emphasised its subject matter while others have stressed its methodology in their definitions. In other words some have defined statistics in its plural sense and some in its singular sense.

(A) Plural Sense

In the plural sense, statistics refers to information in terms of number or numerical data such as numerical information concerning income, expenditure, population etc. Some important definitions are *"Statistics are numerical statements of facts in any department of enquiry, placed, in relation to each other".*

- A. L. Bowley.

"Statistics are measurements, enumerations or estimates of natural or social phenomena, systematically arranged so as to exhibit their interrelationship".

- Conner.

"By statistics we mean quantitative data affected to a marked extent by multiplicity of causes".

- Yule and Kendall

Each of these definitions is too narrow and hence incomplete. They confine the scope of statistics to certain characteristics of data in an enquiry. A comprehensive definition has been given by **Horace Secrist**. He defined statistics as *"aggregates of facts, affected to a marked extent by multiplicity of causes, numerically expressed, enumerated or estimated according to reasonable standard of accuracy, collected in a systematic manner for a predetermined purpose and placed in relation to each other".*

This definition highlights all the main characteristics of statistics in terms of numerical data which are as follows.

(i) Aggregates of Facts

Single and isolated figures are not statistics.For example the age of a student is 20 or the price of a commodity is Rs.10 is not statistics, but average age of a student in +2 1st year is 20 is statistics. When we consider the prices of a basket of commodities like price of onion is Rs.20/kg while that of patato is Rs.15/kg are statistics as they are aggregate of facts.

(ii) Numerically Expressed

Statistics are quantitative phenomena. Mostly, statistical techniques deal with quantitative factors rather than with qualitative aspect. So statistics should always be numerically expressed. For example, 'there are 30 districts in Odisha' is a numerical statement. But the standard of living of the people of Odisha has improved over the years is not a numerical statement. Here the first statement is statistical whereas the second is not. So the subjective statements relating to qualitative information like honesty, beauty etc. are not statistics. Only those statements which can be expressed numerically are statistics.

(iii) Affected by Multiplicity of Causes

Numerical facts should be affected by a number of factors to become statistics. For example, the yield of rice depends on a number of factors like rainfall, fertility of the soil, method of cultivation, quality of seeds used etc. Price of a commodity affected by many factors like demand and supply of the commodity, rise in wage rate, rise in taxes etc.

(iv) Enumerated or estimated with reasonable accuracy

Statistical data should be capable of being either enumerated i.e. exactly counted or measured; or estimated. Where the field of enquiry is vast or indefinite exact counting or enumeration is not possible. In such cases data are to be estimated. In estimation some errors in counting or measurement are likely to take place. But estimation of data should be made according to a reasonable standard of accuracy. The standard of accuracy of any statistical enquiry depends on the nature and purpose of the enquiry, available resources, size of data etc.

(v) Collected in a Systematic Manner

Information (data) constitute the basis of any statistical enquiry. They should be collected in a scientific and systematic manner. For this, the purpose of the enquiry must be decided in advance. The purpose should be specific and well defined. The information should be collected by trained, skilled and unbiased investigators. Otherwise irrelevant and unnecessary information may be collected and the very purpose of statistics will be defeated.

(vi) Collected for a Predetermined Purpose

Statistics relating to an enquiry are always collected for a predetermined purpose. So it is essential to define clearly the purpose or the objective of the enquiry before actually collecting data. This ensures the inclusion of all essential information and the exclusion of all irrelevant and confusing data. This will make the analysis specific and result oriented.

(vii) Placed in Relation to Each Other

Statistics should be comparable. They may be compared with respect to time of occurrence or place of collection. This requires that the data should be homogeneous and are placed in relation to each other because heterogeneous data are not comparable. For example, data relating to production of rice and the number of students taking admission in a class are not statistics. Because they are not comparable. On the other hand, the foodgrain production of a State for the last ten years constitute statistics as they are comparable. So statistical data should express some phenomenon.

"*All statistics are numerical statements of facts but all numerical statements of facts are not statistics*". The definition given by H. Secrist is considered as complete and suitable from all angles. It covers the entire field of the subject and mentions most of the methods of statistical study.

(B) Singular Sense

In singular sense statistics refers to statistical methods. It refers to techniques or methods relating to collection, classification, presentation, analysis and interpretation of quantitative data. In singular sense statistics is defined as *"a body of methods which provides tools for data collection, analysis and interpretation."* In the singular sense also statistics has been defined differently by different statisticians.

"Statistics is the science which deals with the collection, classification and tabulation of numerical facts as a basis for explanation, description and comparison of phenomenon."

– Lovitt

According to Prof. Bowley, *"statistics may be called the science of counting."* Among these, the definition given by *Croxton and Cowden* is considered the best. According to them *"statistics may be defined as the collection, presentation, analysis and interpretation of numerical data"*. To the methods given by Croxton and Cowden one more method i.e. Organisation of Data may be added.

Thus in the singular sense, statistics refers to the methods of

(i) Collection of Data.
(ii) Organisation of Data
(iii) Presentation of Data.
(iv) Analysis of Data, and
(v) Interpretation of Data.

(i) Collection of Data

Collection of data forms the beginning of any statistical study or enquiry. At the outset a researcher identifies the problem and then collects data on that problem. Data can be obtained either from original source or from secondary sources. Depending on the problem under study as to how, when, where and what kind of data are to be collected is decided.

(ii) Organisation of Data

Data which are collected by the researcher from the primary source for the first time are *Raw data*. Raw data are like raw materials. As such they do not convey any meaning. So after collection, information should be organized before presentation.

(iii) Presentation of Data

Presentation of data is essential for their analysis. Generally, data are presented in terms of tables or by using graphs or diagrams. That gives tabular, graphic or diagrammatic presentation of data.

Data must be arranged in groups or classes according to some similarities or resemblances. This is known as '*classification of data*'. Classification makes the analysis simple and intelligible. For this, it is said ,*"Classification and arranged facts speak for themselves. Unarranged they are as dead as mutton"*.

(iv) Analysis of Data

Valid conclusions are detrived after careful analysis of data. The different methods of analysing the data are the mesures of central tendency, measures of dispersion, correlation & regression analysis etc.

(v) Interpretation of Data:

The final step in a statistical enquiry is the interpretation of data. Here the results of the enquiry are examined carefully to draw conclusions. The interpretation of data depends on the intelligence and skill of the statistician. He must be very careful while deriving conclusions. Correct interpretation gives valid conclusions, otherwise the result may be very much confusing and misleading.

Thus statistics can be used either in plural or in singular sense. In plural sense it means quantitative facts or numerical data. In singular sense it refers to statistical methods or techniques used for making wise decisions in the face of uncertainty.

5.1.2 Functions of Statistics

The basic objective of statistics is to simplify the complexity of information in an enquiry. It studies almost all aspects in an enquiry. It simplies the collected information and makes them intelligible. It analyses data and facilitates drawal of conclusions. Some of the important functions of statistics are the following:

1. Presents Facts in Simple Form

Statistics presents facts and figures in a definite form. That makes the statement logical and convincing than mere description. It condenses the whole mass of figures into a single figure. This makes the problem intelligible.

2. Reduces the Complexity of Data

Statistics simplifies the complexity of data. The raw data are unintelligible and to make them simple and intelligible different statistical measures are used. Some such commonly used measures are graphs, averages, measures of dispersion, skewness, kurtosis, correlation and regression etc. These measures help in interpretation and drawing inferences so that the complex data can be presented in a simple form.

3. Facilitates Comparison

Comparison between different sets of observation is an important function of statistics. Comparison is necessary to draw conclusions. As professor Boddington

points out. "*The objective of statistics is to enable comparison between past and present results to ascertain the reasons for changes, which have taken place and the effect of such changes in future*". So to determine the efficiency of any measure comparison is necessary. Statistical devices like averages, ratios, coefficients etc. are used for the purpose of comparison.

4. Testing of Hypothesis:

Formulating and testing of hypothesis is an important function of statistics. This helps in developing new theories. Many laws of economics, namely law of data and law of supply have been verified with the help of statistics.

5. Formulation of Policies

Statistics helps in formulating plans and policies in different fields. Statistical analysis of data forms the beginning of policy formulation. Hence, statistics is essential for planners, economists, scientists and administrators to prepare different plans and programmes. Monetary and Fiscal Policies of country are formulated on the basis of relevant data.

6. Forecasting

Statistics helps in forecasting the trend and tendencies. Statistical techniques are used for predicting the future values of a variable. For example a producer forecasts his future production on the basis of the present demand conditions and his past experiences. Similarly, the planners can forecast the future population or production on the basis of the data relating to population or production of the country in previous years.

7. Derives Valid Inferences

Statistical methods mainly aim at deriving inferences from an enquiry. Statistical techniques are often used by scholars, planners and scientists to evaluate different projects. These techniques are also used to draw inferences regarding population parameters on the basis of sample information.

5.1.3 Importance and Scope of Statistics

The importance of statistics in recent years cannot be over emphasized. The development in statistical studies has considerably increased its scope and importance. It is no longer regarded as the science of statecraft or a by-product of state administration. Now it embraces a host of sciences-social, physical and natural. Statistical findings have assumed unprecedented dimensions these days. Statistical thinking has become indispensable for able citizenship. Statistics is of immense importance in the following cases:

1. In Planning and Policy Formulation

Planning is necessary for efficient workmanship and in formulating future policies. Statistics provides the valued information of facts and figures relevant to planning. Statistics provides the necessary feedback for planning and policy formulation through statistical studies.

2. In Business

Statistical knowledge is very helpful to the businessman. He formulates different plans and policies using statistics. It helps him in forecasting the future trends and tendencies. To estimate the market fluctuation, changes in the demand conditions etc. statistical techniques are often used. Hence for becoming a successful businessman, knowledge in statistics are essential.

3. In Economics

Statistics are the '*straws out of which Economists have to make bricks*'. Statistics is indispensable in economic studies. Statistical data and their analysis are used to solve a variety of economic problems-such as consumption, production, distribution of income and assets, poverty, unemployment etc. These problems are described, compared and correlated by using statistics. Use of statistics in economics has led to the formulation of many economic laws like Engel's law of consumption and Pareto's laws of distribution of income etc. Similarly statistical tools like index numbers are used as economic barometers.

4. In Administration

In ancient times statistics was used as the science of statecraft. It was used to collect data relating to manpower, crimes, income etc., for formulating different policies. In modern times, its role has become manifold. It has become indispensable for the administrators. It is being widely used in formulating different plans and policies of the state administration.

5. In Business Management

Business managers take decisions in the face of uncertainty. Statistical tools like collection, classification, analysis and interpretation of data are essential in business management. The success of modern business primarily depends on accurate forecasting of the future demand and market trends. For this statistics is essential. Hence statistics is widely used in business management.

6. In Research Activities

One cannot think of undertaking research activities without using statistics. Primarily, statistical techniques are used for collecting information in any research. Besides, statistical methods are used for analysis and interpretation of research findings.

Thus there is hardly any branch of study where statistics is not being used. It is used in all spheres of human activities.

5.1.4 Limitations of Statistics

Statistics is often used in most of the spheres of human activity. In spite of the wide scope of the subject it has certain limitations. Some important limitations of statistics are the following:

1. Statistics Does Not Study Qualitative Phenomena

Statistics deals with facts and figures. So the quality aspect of a variable or the subjective phenomenon falls out of the scope of statistics. For example, qualities like

beauty, honesty, intelligence etc. cannot be numerically expressed. Thus the qualitative characteristics cannot be examined statistically, which limits the scope of the subject.

2. Statistical Laws are Not Exact

Statistical laws are not exact as in case of natural sciences. These laws are true only on average as normally they are based on approximations not on exact values. They hold good under certain conditions and cannot be universally applied. So statistics has less practical utility.

3. Statistics Does Not Study Individuals

Statistics deals with aggregate of facts. Single or isolated figures are not statistics. This is considered to be major handicap of statistics.

4. Statistics Can be Misused

Statistics is mostly a tool of analysis. Statistical techniques are used to analyse and interpret the collected information in an enquiry. As it is, statistics does not prove or disprove anything. It is just a means to an end. Statements supported by statistics are more appealing and are commonly believed. For this, statistics is often misused. Statistical methods rightly used are beneficial but if misused they become harmful. Statistical methods used by less expert hands will lead to inaccurate results. Here the fault does not lie with the subject of statistics but with the person who makes wrong use of it.

5.1.5 Distrust of Statistics

It is a general belief that "*statistics can prove anything.*" This statement is partly true and partly false. It is false because mere statistics should not be taken for granted without proper verification, it is true because statistics is often used by unscrupulous people to achieve their personal ends. This results in loss of faith or confidence in statistics or in causing distrust of statistics.

Distrust of statistics literally means *lack of trust in statistical data, statistical analysis and the conclusions derived from it.* We often hear statements like:

(i) Statistics is an unreliable science.

(ii) Statistics are lies of the first order.

(iii) There are three type of lies - lies, damned lies and statistics.

(iv) Figures do not lie, liars figure.

These are expressions of distrust in statistics. These views of statistics stem from the misuse of statistics by the interested parties. Publishers, advertisers of various products, governments and other organisations are trying to promote their sectional interest using statistics and statistical methods. This causes distrust of statistics.

Some of the important reasons of distrust in statistics are the following:

(a) Facts based on figures are more convincing. But these figures can be manipulated according to one's wishes. This misguides public causing distrust of statistics.

(b) Sometimes statistical analysis are misinterpreted causing distrust in statistics. Suppose one believes that the mortality rates of patients are more in Indian hospitals. From this one may wrongly conclude that it is safer to treat the patients at home. This type of misinterpretation also causes distrust in statistics.

Statistics are useful tools. One uses them according to his knowledge and experience. Use of statistics makes a statement more convincing. But its misuse causes distrust. So it is necessary that people should be adequately prepared to know the reality or to distinguish truth from untruth, good statistics from bad statistics. W. I. king has rightly observed "*statistics are like clay from which you can make a 'God' or a 'Devil' as you please*".

5.2 COLLECTION OF DATA

Generally statistics means numerical data or quantitative information relating to an enquiry. Statistical informations are always collected with a purpose to make the enquiry more authentic. Those who collect the data are called statistical investigators or enumerators. The persons from whom the informations are collected are called respondents or informants. The process of collecting, counting and systematic recording of the informations is called 'collection of data'. The reliability of data in any

branch of enquiry primarily depends upon the expertise and honesty of the investigator and whole hearted co-operation of the respondents. The result of the enquiry depends on the collection of correct informations. So, collection of relevant data concerning a problem is the first and most important step in statistical investigation.

Statistical enquires primarily depend upon adequate and reliable informations. It is desirable that the investigator should have certain preliminary ideas before actually collecting data. These ideas are called 'preliminaries to data collection' which includes-

(i) The nature and scope of the enquirry.
(ii) The purpose and objective of the enquiry.
(iii) Scource of informations.
(iv) Availability of funds and time.
(v) Degree of accuracy desired and
(vi) Statistical units to be used.

5.2.1 Types of Data

Broadly speaking, there are two sources of statistical data - *internal* and *external*. Internal source refers to the information collected from within the organisation. For example different organisations and Government departments generate large volume of information. These information relate to production, sales, purchases, profits, wages, salaries etc. These internal data are complied in the basic records of the institutions. Compilation of internal data ensures smooth management and future policy formulation of the organisation. On the other hand, if data are collected from outside, they are called external data. External data can be collected either from the primary (original) source or from secondary sources. Such data are termed as primary and secondary data respectively.

Primary Data

Primary data are the first hand information. These information are collected directly from the source by means of field studies. Primary data are original and are like raw materials. These are the most crude from of informations. The investigator

himself collects primary data or supervises its collection. These data may be collected on a sample or census basis or from case studies.

Secondary Data

Secondary data are the second hand information. The data which have already been collected and processed by some agency or persons and are not used for the first time are termed as secondary data. According to M. M. Blair, "*Secondary data are those already in existence and which have been collected for some other purpose*". Secondary data may be abstracted from existing records, published sources or unpublished sources.

The distinction between primary and secondary data is a matter of degree only. The data which are primary in the hands of one becomes secondary for all others. Generally the data are primary to the source who collects and processes them for the first time. It becomes secondary for all other sources, who use them later. For example, the population census report is primary for the Registrar General of India and the information from the report are secondary for all of us.

Both the primary and secondary data have their respective merits and demerits. Primary data are original as they are collected from the source. So they are more accurate than the secondary data. But primary data involves more money, time and energy than the secondary data. In an enquiry, a proper choice between the two forms of information should be made. The choice to a large extent depends on the "*preliminaries to data collection*".

5.2.2 Methods of Collecting Primary Data

Primary data are always collected from the source. It is collected either by the investigator himself or through his agents. There are different methods of collecting primary data. Each method has its relative merits. The investigator has to choose a particular method to collect the information. The choice to a large extent depends on the preliminaries to data collection. Some of the commonly used methods are discussed below.

1. Direct Personal Observation

This is a very common method of collecting primary data. Here the investigator directly contacts the informants, solicits their cooperation and enumerates the data. Thus, in case of this method, the information are collected by direct personal interviews.

The method of collecting primary data through Direct Personal Investigation is suitable when the (i) field of investigation is not very large and limited, (ii) when direct contact with is informants is necessary and (iii) the accuracy of data is of great significance.

Merits

(i) The novelty of this method is its simplicity. It is neither difficult for the enumerator nor the informants. Because both are present at the spot of data collection.

(ii) This method provides most accurate information as the investigator collects them personally.

(iii) The data collected in this medhod are original in nature.

(iv) Related informations can be collected by the investigator himself.

(v) Has got greater elasticity as depending on the situation and the informant the investigator can change the question and mode of questioning.

(vi) As the investigator alone is involved in the process, his personal bias may influence the accuracy of the data.

(vii) The method is quite costly and time-consuming. So the method should be used when the scope of enquiry is small.

Demerits

(i) It is difficult to cover vide area through the method of Direct Personal Investivation.

2. Indirect Oral Interviews:

This is an indirect method of collecting primary data. Here informations are not collected directly from the source but by interviewing persons closely related with the problem. This method is applied to apprehend culprits in case of theft, murder etc. The information relating to one's personal life or which the informant hesitates to reveal are better collected by this method. Here the investigator prepares a small list of questions relating to the enquiry. The answers (information) are collected by interviewing persons well connected with the incident. The investigator should cross-examine the informants to get correct information.

Merits

(i) This method can be applied when the investigation is complex in nature and it is not possible to have direct contact with the concerned informants.

(ii) Using this method an investigator can make the information more reliable by seeking the opinion of the experts.

(iii) This method is normally free from the personal bias of the investigator.

(iv) This is a simple method of data collection which also involves less cost and less time.

Demerits

(i) The facts obtained from Indirect Oral Investigation may not be reliable as the evidence given by the witnesses may be affected by their personal bias.

(ii) Wrong and improper choice of the witness may distort the reliability of data collected.

3. Mailed Questionnaire Method

This is a very commonly used method of collecting primary data. Here information are collected through a set of questionnaire. *A questionnaire is a document prepared by the investigator containing a set of questions*. These questions relate to

the problem of enquiry directly or indirectly. Here first the questionnaires are prepared and then mailed to the informants with a formal request to answer the questions and send them back. For better response the investigator should bear the postal charges. The questionnaire should carry a polite note explaining the aims and objectives of the enquiry, definition of various terms and concepts used there. Besides, the investigator should ensure the secrecy of the information as well as the name of the informants, if required.

Success of this method greatly depends upon the way in which the questionnaire is drafted. So the investigator must be very careful while framing the questions. The questions should be

(i) Short and clear.

(ii) Few in number.

(iii) Simple and intelligible.

(iv) Corroboratory in nature or there should be provision for cross check.

(v) Impersonal, non-aggressive type.

(vi) Simple alternative or multiple-choice type.

The method is suitable when the area of the stuy is very large and the informants are educated.

Merits

(i) This method is economical interms of cost, time and effort required to collect information.

(ii) The data collected by this method are original and reliable.

(iii) There is no room for personal bias of the investigator.

Demerits

(i) Success of this method entirely depends on the co-opertion of the informants which is lacking in most of the cases.

(ii) The answer given by the informants may be vague, incomplete and irrelevant.

(iii) This method can not be used in case of illeterate and indifferent respondents.

(iv) It is difficult to verify the degree of accuracy of the informations provided by the informants.

(v) This method is not flexible to the changing circumstances.

4. Schedule Method

In case the informants are largely uneducated and non-responsive data cannot be collected by the mailed questionnaire method. In such cases, schedule method is used to collect data. Here the schedules (list of questions) are sent through the enumerators to collect information from the field. They directly meet the informants with the schedule. They explain the scope and objective of the enquiry to the informants and solicit their cooperation. The enumerators ask the questions to the informants and record their answers in the schedule and compile them. The success of this method depends on the sincerity and efficiency of the enumerators. So the enumerator should be sweet-tempered, good-natured, trained and well-behaved.

This method is usually adopted by big business houses, large public enterprises, government and research institutions like National Council of Applied Economic Research (NCAER), Federation of Indian Chamber of Commerce and Industries (FICCI). Population census all over the world is conducted by this method.

This method is mostly used when the field of investigation is large and the investigation needs specialised and skilled investigators.

Merits

(i) This method is capable of wide coverage.

(ii) Illiterate people can be covered by this method.

(iii) As investigation is generally done by specialised persons, the degree of accuracy is high.

(iv) Unlike the method of mailed questionnair, there is personal contact with the informants which results in greater accuracy of the informations.

(v) It ensures large response from the informants due to personal contact of the investigator.

(vi) There is scope of cross checking of the informations provided by the respondents.

Demerits

(i) This is an expensive method of data collection as the involved investigators are need to be trained persons.

(ii) This method is very time consuming as it requires the enumerators to approach each of the informants.

(iii) Availability of competent enumerators also limits the scope of this method.

(iv) The accuracy of the data may be affected by the personal prejudices of the enumerators.

(v) The efficacy of this method depends on the efficiency of the enumerators and the efficacy with which the schedule is prepared.

(vi) Since this method is very expensive, it is not suitable, for private investigations.

5. From Local Agents

Sometimes primary data are collected from local agents or correspondents. These agents are appointed by the sponsoring authorities. They are well conversant with the local conditions like language, communication, food habits, traditions etc. Being on the spot and well acquainted with the nature of the enquiry they are capable of furnishing reliable information. This method is suitable particularly when regular and continuous information is needed and the area is large.

Information from a wide area at less cost and time can be collected by this method. The method is generally used by government agencies, newspapers, periodicals etc. to collect data.

Merits

(i) This method is very economical in terms of time, money and energy involved in it.

(ii) The quality of data is better as they are collected through local agents who are close the events or the source of data.

(iii) This method can cover a vide area of investigation.

(iv) As the correspondents supply regular information continuity of data can be ensured.

(v) This method is suitable for the purpose where regular and continuous information is needed for example, price quotations from the different markets for different commodities for the news papers.

Information are like raw materials or inputs in an enquiry. The result of the enquiry basically depends on the type of information used. Primary data can be collected by employing any of the above methods. The investigator should make a rational choice of the methods to be used for collecting data. Because collection of data forms the beginning of the statistical enquiry.

5.2.3 Sources of Secondary Data

Secondary data are second hand information. In other words, secondary data are those which have already been collected. Secondary data can be obtained from a number of sources which can broadly be classified into two categories:

(i) Published sources.

(ii) Unpublished sources.

5.2.3.1 Published Sources

Mostly secondary data are obtained from published sources. Some important sources of published data are the following:

1. Official Publications of Governments Authorities

Ministries of Central and State Governments in India publish a variety of statistics as their routine activity. The Central Statistical Organisation (CSO), The National Sample Survey Organisation (NSSO), Directorate of Economics and Statistics, Labour Bureau, Office of the Registrar General and Census Commission etc regularly publish informations. Some of the important publications on statistics of the Government authorities are Statistical Abstract of India, Annual Survey of Industries, Agricultural Statistics, Census Report, Labour Gazette, Vital Statistics of India etc.

2. Semi-Government Publications

Semi-Government bodies such as Municipalities and Metropolitan Councils publish data relating to education, health, birth and death. Statistical Department of the Reserve Bank of India, The Institute of Economic Growth, New Delhi whose main publications include Annual Report of the Banks, Currency and Finance, Reserve Bank of India Bulletin (Monthly) and Vital statistics of he local authorities.

3. Official Publications of Foreign Governments and International Organisations– International Bodies like

The United Nations Organisation (UNO), World Health Organisaion (WHO), International Labour Organisation (ILO), International Monetary Fund (IMF), World Bank (WB) etc. provide valuable informations on a variety of important economic and social aspects through their publications like UNO statistical year book, world bank report, Demographic Year Book etc.

4. Reports and Publications of Commercial and Financial Institutions

Trade Associations, Federation of Indian Chamber of Commerce and Industries, Banks, Co-operative Societies, Stock Exchanges etc publish reports and statistical materials on current economic and business phenomena usually in the form of periodicals and bulletins.

5. Official Publications of Research Institute

Indian Statistical Institute (ISI), Indian Council of Agricultural Research (ICAR), National Council of Educational Research and Training (NCERT) etc. publish their findings of the researches in the form of research papers.

6. Reports of Committees and Commissions

Simon Kuznet Committee on National Income in India, Wanchoo Commission on Educational Reforms, Pay Commissions, Land Reforms Committee etc. reveal important matters relating to economic and social phenomenon like wages, dearness allownces, national income, prices, taxation, education etc.

7. Technical Trade Journals and paper

The Journals like the Economics, The Financial Express, Economic Times, Eastern Economic, Capital, Commerce etc. publish statistical data on a number of important current socio-economic problems.

8. Publications of Research Scholars

Individual research scholars also sometimes publish their research work containing some useful statistical information.

5.2.3.2 Unpublished Sources

Statistical data can also be obtained from various unpublished sources. Some of the important unpublished sources from which secondary data can be collected are:

1. The research work carried out by scholars, teachers and professionals.
2. The record maintained by private firms and business enterprises. They may not like to publish the information considering them as business secret.
3. Records and statistics maintained by various departments and offices of the Central and State governments, corporations, undertakings etc.

Secondary data are already collected information. They might have been collected for some specific purposes. So they must be used with caution. It is

generally very difficult to verify such information to find out inconsistencies, errors, omissions etc. Therefore scrutiny of secondary data is essential. Because the data might be inaccurate, unsuitable or inadequate. Thus it is very risky to use statistics collected by other people unless they have been thoroughly edited and found reliable, adequate and suitable for the purpose.

5.3 Indian Statistical System

Systematic data collection in India probably started with the advent of British rule. Certain other modes of data collection were there before the first population census in 1871-72. However there was no separate government agency for the systematic collection of data till the attainment of independence in 1947. After independence a central statistical unit was set up in the cabinet secretariat in 1949. This was expanded into the present Central Statistical Organisation (CSO) in 1951. Besides CSO, there is another important stastical organisation of the Government of India called NSSO.

5.3.1 National Sample Survey Organisation (NSSO)

The National Sample Survey (NSS) was started in 1950 as a multipurpose continuing survey for collecting information on all aspects of Indian economy. The necessity for establishing NSS was primarily due to the difficulties in the speedy collection of economic information on a comprehensive basis for different economic plans and policies. Besides the constraints of money and man power were responsible for conducting sample surveys instead of complete enumeration.

NSS caters to the data needs of the National Income Committee, the Planning Commission and various ministries of the Government. Originally, the Directorate of NSS was under the control of Ministry of Finance. It was transferred to the Cabinet Secretariat in 1957. In 1969, the Directorate of NSS was turned into the National Sample Survey Organisation (NSSO). Since then it operates under the department of statistics in the Ministry of Planning like CSO. NSSO is a unique set up to carry out surveys on socio-economic industrial and agricultural subjects for collecting data from the households and enterprises located in villages and towns of the country.

The NSS is being conducted ever since its inception in the form of successive rounds relating to household consumption expenditure, employment, industrial production and agricultural production. Till the 13th round, the field enquiries were of varying duration ranging from 3 to 6 months. The survey period has been made a full year since the 14th round. Each round now coincides with the agricultural year.

The NSSO has two important publications:

(i) The reports on the various rounds of the NSS and

(ii) The quarterly bulletin - Survekshna.

5.3.2 Census of India

The decennial census is the principal source of population statistics in India. The first census was taken in 1871-72, which did not cover the whole country and so was left out of account. The comprehensive census operation was taken in 1881.

In the literal sense population census means *an official count of all the people either physically present or regularly residing in a given region at a given point of time*. The population census of India in its scope includes the collection of information on various aspects of the people counted. Thus, the main function of population census in India is to collect data relating to (i) Size of population (ii) Rate of growth of population (iii) Occupational structure (iv) Age structure (v) Literacy (vi) Sex ratio (vii) Religion (viii) Caste (ix) Density of population (x) Level of urbanisation etc.

In recent years Indian censuses are conducted under the Census Act 1948. According to the Act all citizens are legally bound to supply data sought during a census. The census data are used for statistical purposes only. The Registrar General of India (RGI) works as the ex-officio census commissioner to conduct population census.

5.4 METHODS OF DATA COLLECTION / STATISTICAL ENQUIRY

Preliminaries to data collection enable the investigator to select the suitable method for collecting data. Besides, collection of data also requires a pre-consideration of the type of enquiry to be under taken. The investigator may go for a detailed and exhaustive enquiry or may decide for a limited or simple type of enquiry. Accordingly, there are two methods of statistical enquiry:

(a) Census method (complete enumeration method)

(b) Sample method (partial enumeration method)

5.4.1 Census Method

Census enquiry refers to the complete enumeration of each and every unit of the '*universe*' or '*population*'. In statistics, *Population or Universe refers to the aggregate of objects, animate or inanimate under study*. It includes all the items possessing a common characteristic. For example, if we want to know the average mark of the students of a class, then the population or universe will consist of all the students of that class.

If a statistical enquiry is based on all items of the universe, it is called census enquiry. For example if we want to know the average income of 20,000 households in a particular village, relevant data should be collected from each and every 20,000 households in the cencus method. Alternatively if statistical data for every 5th or 10th household of the village is collected, then each and every item of the universe is not covered, only a sample of the universe is covered. This is called sample method of a statistical enquiry.

Census method is that method in which each and every item of the universe is covered. According to census method if it is required to collect data on the income of the Indian population, each and every population of India is covered through complete enumeration. In India census of population is conducted in every ten years and the last census was done in 2011. Census method is suitable where the size of the population is small and widely diversed. Census method is adopted where there is need for intensive study and high degree of accuracy required.

Merits

Census enquiry has the following advantages:

(i) It gives accurate and exact information as it studies the totality of items.

(ii) Possibility of 'bias' is less as the entire population is studied.

(iii) Diverse characteristics of population can be studied by using census method.

(iv) In case of small and finite population, this method is recommended.

(v) Exhoustive informations can be obtained through census method.

Demerits

Census method has also a number of disadvantages:

(i) It requires handling of large volume of data which is very costly and time consuming.

(ii) This technique of data collection cannot be applied where the universe is infinite or hypothetical.

(iii) It takes long period of time. During the process the entire problem under study may undergo a change. In such case the purpose of enquiry is defeated.

(iv) Not suitable for large investigations.

5.4.2 Sampling Method

Sampling method is the technique to study the universe on the basis of a sample. *A finite subset of the universe is called a sample*. In sample technique data are not collected from all the units of the universe. Instead data are collected in respect of some representative units that constitute a sample of the universe. Inferences about the entire population can be drawn on the basis of the sample. For example, a doctor examines a few drops of blood to test the blood of a patient. The number of units in the sample is called the sample size. Sampling method is suitable when the sample size is large, neither high degree of accuracy nor intensive study of the items is required and the different units of the Universe are more or less are broadly similar.

Merits

Prof. R. A. Fisher sums up the advantages of the sampling method in terms of speed, economy, adaptability and scientific approach.

(i) *Speed*: Since a finite subset of the population is to be inspected and examined, the sample process requires less field work , tabulation etc. It results in saving of time.

(ii) *Economy*: It involves less cost in comparison to census method.

(iii) *Reliability*: A high level of reliability can be achieved because fewer units are surveyed in a sample than a full survey. Further, in this case, well trained field staff can be employed, more checks and tests can be made.

(iv) *Scientific*: The random sampling which is a mathematical concept is very scientific. It is based on the principle of statistical regularity.

(v) *Administrative convenience*: Organisation and management of sample survey is relatively more convenient as it requires less number of people.

(vi) *Infinite and hypothetical population*: If population is too large or hypothetical there is no other way but to adopt sampling method.

(vii) *Detailed information*: Detailed information can be collected and intensive enquiries can be conducted only in sampling method.

Demerits

Despite its advantages it should be borne in mind that samples are like medicines. They can be harmful when they are taken carelessly or without the knowledge of their effects. The following are the demerits of sampling method.

(i) If it is question of deliberate selection, the result may be very much biased.

(ii) Sample survey needs proper planning and execution by trained personnel, other wise it may give wrong results.

(iii) It is not very easy to select a sample which would represent the population.

(iv) Due to the law of inertia of large numbers, accuracy is less in this method than the census method.

(v) Sampling needs persons with technical knowledge which is not easy to find.

(vi) All characteristics of the population may not be found in the samples when the characterstic of the population is diversed.

5.4.3 Choice Between Sampling and Census Methods

It is important for the investigator to decide whether to use sample or census method of collecting data. The selection primarily depends upon the nature and extent of coverage of the enquiry and the degree of accuracy desired. At the same time, the scope of the enquiry, its cost, the time of enquiry, the selection and training of the enumerators etc. are also to be taken into account. Basically, accuracy and precision depend upon the human element. If the human element is perfectly impartial and unbiased then best results can be expected from either of the methods. Both the methods have their respective merits and demerits. Both the systems of enumeration are useful and advantageous at different occasions. Hence both or any of these methods may be followed according to the need or environment. Generally census method is adopted where the population size is small, widely diversed, intensive examination of different items and high degree of accuracy are required. On the contrary sampling method is suitably adopted for a very large population and units with similar characteristics, where neither intensive study nor high degree of accuracy in required.

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SUMMARY

INTRODUCTORY STATISTICS

1. The word 'Statistics' can be interpreted in two senses. In plural sense statistics refers to numerical statements of facts related to each other. In singular sense, it refers to the science of collection, presentation, analysis and interpretation of data.

2. Statistics presents facts in simple form, reduces the complexity of data, helps in comparison, forecasting etc. It is of great use in planning, business, economics and administration.

3. Statistics has got several limitations. It does not deal with qualitative phenomena. It can be misused by inexpert hands.

4. Collection of data is the first step in any statistical enquiry. Internal data are collected from within the organisation whereas external data are collected from outside.

5. External data are again of two types (1) Primary Data (2) Secondary Data. Primary data are first hand information. Secondary data are already collected by some agency and are currently used as second hand information. Primary data can be collected by direct personal investigation, indirect personal interview, mailed questionnaire method, schedule method and from local agents.

6. Primary data may be collected though census enquiry or sample enquiry. Census enquiry refers to complete enumeration of each unit of the universe or 'population'. Sample survey is the technique to study the universe on the basis of a sample. A sample is a finite subset of the population. The selection of the method depends upon the nature of the enquiry.

7. Secondary data are second hand information. These data can be obtained from published and unpublished sources.

8. Primary data can be collected by

   i) Direct Personal Investigation

   ii) Indirect Oral Interviews

   iii) Mailed Questionnaire Method

   iv) By schedules sent through enumerators

   v) Through Local correspondents

9. Secondary data can be collected either from published or unpublished sources.

10. Data can be collected either through method of sampling or census method.

11. Census method refers to complete enumeration of each and every unit of univrse or population

12. Population in statistics refers to the aggregate of objects animate or inanimate under study.

13. A finite subset of a universe is called sample.

14. Sampling method is the technique of studying the universe on the basis of a sample.

15. Choice between census or sampling method depends on the nature of the data, the purpose of enquiry, degree of accuracy required and the coverage of the investigation.

MODEL QUESTIONS

INTRODUCTORY STATISTICS

Group - A: Objective Type (Compulsory) (1 mark each)

1. Write the correct answer choosing from the alternatives give in each question:

(a) Which of the following is a statistical statement of facts ?

(i) Weekly wages of 100 workers in a factory

(ii) Height of Hari is six feet

(iii) Mohan's weight is 70 kgs., Raghu's height is 5 ft., Rama's monthly income is Rs. 2000

(iv) Standard of living of the people of Odisha is improving

(b) Which of the following is a discrete variable ?

(i) Yearly income of school teachers

(ii) Temperature of a patient

(iii) Height of a group of students

(iv) Number of share holders in a company

(c) Which of the following is not a function of statistics ?

(i) Presenting facts in a definite form

(ii) Comparing different sets observations

(iii) Forecasting future values of a variable

(iv) Determination of price of a commodity

(d) Who is father of statistics ?

(i) R.A. Fisher (ii) Irving Fisher (iii) Adam Smith (iv) Horace Secrist

(e) In case of an array, data are arranged in

(i) Ascending order (ii) Descending order

(iii) Either ascending or descending order (iv) None of the above

(f) Census method is suitable for that investigation in which :

(i) the size of population is large.

(ii) high degree of accuracy is not required

(iii) there are sidely diversed items

(iv) intensive examination of diverse items is not required.

(g) Which of the folowing methods in used for the estimation of population in a country?

(i) Census method (ii) Sampling method

(iii) Both census and sampling method (iv) None of the above

(h) Reliability of sampling data depends on

(i) Size of sample (ii) method of sampling

(iii) training of enumerators (iv) all of the above

2. I Answer the following questions in one sentence:

(a) What do you mean by primary data ?

(b) What do you mean by secondary data ?

(c) State two advantages of census method.

(d) What is meant by 'sample' ?

(e) What is meant by 'population' ?

(f) What is an array ?

(g) What do you mean by questionnaire ?

(h) What do you mean by a schedule ?

(i) What is Direct Personal Investigation Method ?

(j) What is Indirect Oral Interview Method ?

(k) In which case local correspondents are employed to collect data ?

(l) What is sampling method ?

(m) What do you mean by statistics in the plural sense ?

n) What is the meaning of statistics in the singular sense ?

(o) Data collected for the first time are known as which data ?

II. Fill in the Blank:

(a) _____ data should be used after careful scrutiny.

(b) In ancient times statistics was considered as the science of _____.

(c) Already collected information are called _____.

(d) _____ is regarded as the father of statistics.

(e) Sample is a part of _____.

III. Are the following statements incorrect ? Correct them if necessary without changing the portions underlined:

(a) In singular sense, statistics refers to numerical statement of facts.

(b) In plural sense, statistics refers to the body of methods of collection, presentation, analysis and interpretation of data.

(c) Statistics does not study qualitative phenomena.

(d) Primary data are used when the time of enquiry is short.

(e) In case of sample survey data are collected from all units of population.

(f) Sampling method is comparatively more expensive.

Group - B: Short Type Answer

3. Answer the following within two / three sentences in each case: (2 marks each)

(a) Write two important functions of statistics.

(b) What is a questionnaire ?

(c) What is meant by universe?

(d) What are the important sources of secondary data ?

(e) What is meant by sample method ?

(f) What is meant by census method ?

4. I. Distinguish between the following restricting your answer within six sentences in each case: (3 marks each)

(a) Primary data and Secondary data

(b) Census and Sample survey

(c) Direct personal investigation and indirect oral interview method.

(d) Schedule and Questionnaire

II. Write short notes on the following limiting your answer within six sentences in each case:

(a) Secondary data

(b) Functions of statistics

(c) Distrust of statistics

(d) Sample survey

(e) NSSO

(f) Census of India

(g) Census method of data collection

(h) Questionnaire

Group - C: Long Type Answer (7.5 marks each)

5. Distinguish between primary and secondary data. Describe various methods of collecting primary data.

6. What are secondary data ? Discuss the sources of secondary data.

7. What is statistics ? Discuss different functions of statistics.

8. What is meant by census method ? Discuss the relative merits and demerits of census.

9. Explain the meaning of sample survey. What are its advantages and disadvantages ?

❖ ❖ ❖

CHAPTER - 6

FREQUENCY DISTRIBUTIONS

- Organisation of data
- Meaning and types of vairables
- Frequency Distribution - Meaning, Types
- Presentation of data - Tabular and diagrammatic presentation, Bar Diagram, Pie-diagram, Histogram, Frequency Polygaon, Ogives, Line graphs histogram.

6.1 ORGANISATION OF DATA

The data collected in any statistical investigation are voluminous, unwieldy and not easy to comprehend. So after collection and editing the collected data are to be organised. Organisation of data means to present the data in a condensed form so that it can be readily comprehensible. Organisation of data helps in highlighting the important characteristics of the data, facilitates comparison and makes it suitable for further analysis and interpretation.

Organisation of data involves two steps

(i) Systematic arrangement of the raw data into different homogeneous classes according to resemblances and similarities; which is technically known as classification.

And (ii) Presentation of the condensed, classified data

The Presentation of the data is of two types

(i) Tabular Presentation

(ii) Diagrammatic & Graphic Presentation

6.2 VARIABLES

All statistical data arise out of observations on individuals. Individual may refer to an animate or inanimate object, an event or any other activity. A variable is an observable characteristic of phenomenon which is capable of being measured and changes its value over time. Thus a variable refers to that quantity which is subject to change and which can be measured by some unit. For example, the number of students in a class, the heights of a group of students, monthly income of a person, price of a commodity, rainfall at a particular area are all variables.

Statistical variables may be discrete or continuous. Discrete variables are those variables that increase in jumps or in complete numbers. So discrete variable is one which can assume only integral values. The number of books in the library, the number of students in a class, marks secured by students in economics etc.are examples of discrete variables which could be 1,2,3,4,10,11,12,15 or 20 etc but can not be 1.3, 2.7,6.8 etc.

On the other hand continuous variables can assume a range of values or increase not in jumps but continuously or infractions are called continuous variables. Continuous variables can assume any value within an appropriate range. Such variables are obtained

by measurement not by counting. The height, weight etc are examples of —' continuous variables as height of the boys can be 5.11, 5.76, 6.1 feet etc. In short while the values of the discrete variables are in complete numbers (1, 2, 3, 4,...etc.), values of the continuous variables are in fractions(be 5.11, 5.76,6.1 feet etc) or in any range such as 10-15 ,15-20, 20-25 etc.

6.3 FREQUENCY DISTRIBUTION

Meaning

Frequency distribution is a systematic arrangement of item values along with their respective frequencies. Here frequency means the number of times an item in the series occurs. The arrangement of item values along with their respective frequency is called frequency distribution.

A frequency distribution has two components-

(i) Variables

and (ii) its frequency

Types

The frequency distribution may be of two types depending on the nature of variable, namely-

(i) Discrete frequency distribution.

(ii) Continuous frequency distribution.

6.3.1 Discrete Frequency Distribution

Discrete frequency distribution involves discrete variables. To prepare it, we count the number of times a particular item value in the series is repeated. This is the frequency of that item. The frequency is noted against the item value. The process is repeated for all item values. That gives a discrete 'frequency distribution' or a 'discrete series'. Discrete frequency distribution can be (i) Individual frequency distribution (ii) Discript ungrouped and, (iii) Discrete grouped frequency distribution.

(i) Individual frequency distribution

In an individual frequency distribution, the values of the variable is shown individually. So frequency of each variable is one. Thus in individual frequency distribution only variable values are given.

Example 1: The following are the marks obtained by 25 students of a class in Economics is an examples of individual frequency distribution.

Marks: 10, 20, 20, 30, 40, 25, 25, 30, 40, 20, 25, 25, 50, 25, 15, 40, 30, 50, 50, 40, 25, 30, 25, 15, 40.

(ii) Discrete ungrouped frequency distribution

In a discrete ungrouped frequency distribution, the number of times each value of the variable occurs is counted. An individual frequency distribution can be converted to a discrete ungrouped frequency distribution through the technique of Tally Makrs or Tally Bars.

Step - 1 : In the first column all the possible values of the variable is taken.

Step - 2 : In the second column a vertical bar (i) called the Tally mark is put against the number (values of the variable) whenever it occurs. After a particular value has occured four times, for the fifth occurrence, a crossi put on the first four tally marks (III) to give a block of 5. This technique of putting cross at every 5th repetition facilities the counting of number of occurrences. After putting tally marks for all values in the data, the number of times each value occurs called frequency is presented in the third coloumn.

Answer: The Discrete Frequency Distribution is shown in Table 6.1.

Table 6.1: Distribution of marks of 25 Students in a class

Marks	Tally bars	Frequencies
10	|	1
15	||	2
20	|||	3
25	||	7
30	||||	4
40		5
50	|||	3
Total		**25**

The above series shows that there is one student who has scored 10 marks, 2 students have scored 15 marks each and so on.

(iii) Grouped Frequency Distribution

When the number of observation is very large, the discrete frequency distribution does not yield satisfactory results. In such case the data are grouped into some predetermined intervals or classes.

In a **discrete grouped frequency** distribution variable values are presented in a class or group but there exists gap between the upper limit of one class and the lower limit of the next class. The classes are not continous. The following Table 6.2 presents a descrete grouped frequency distribution.

Table 6.2

Marks	10 - 14	15 - 20	25 - 30	40 - 50	60 - 70
Number of Students	5	6	8	10	2

In the above example there is no class for the variable values like 1, 21, 22, 23, 24, 31, 32 etc.

In case of continuous grouped frequency distribution there exists no gap between the upper limit of one class and the lower limit of the next class.

When grouped frequency distribution are used for continuous variables. So they are called **continuous frequency distributions** or continuous series. This type of classification is most popular in practice.

There is no hard and fast rule in preparing a frequency distribution. The frequency distribution largely depends on the nature of the given data and the object of classification. In constructing a frequency distribution generally we face the following problems.

The grouped frequency distribution involves three basic problems.

(i) Determining the number of classes and their magnitudes.

(ii) Choosing the appropriate class limits.

(iii) Counting the number of items in each class.

(i) The Number of Classes

In a grouped frequency distribution, the number of classes into which the observations are divided depends on the number of observations in the series. There is no hard and fast rule to determine the number of classes. The number of classes should be chosen in a manner so that it is neither too small not too large. The number of classes is determined by applying a rule, known as '*Sturges rule*'. According to the rule,

$$K = 1 + 3.322 \text{ Log}_{10} N$$

Where K represents the number of classes and N represents the total number of items in the series. The value is rounded up to the next higher integer.

2. The Magnitude of Class Intervals

Determination of the magnitude of the class interval is also important. The classes should be of equal magnitude. That helps in comparing among different classes. The magnitude of class intervals mainly depends on:

(a) The number of observations in the series,

(b) The number of classes.

For the sake of simplicity, the class intervals should be either 5 or a multiple of 5. Class intervals should not be odd figures like 3, 7, 11, 13, 19 etc. However, there is no rigidity in selection of the magnitude of class intervals.

Once the number of classes is decided the size of the class interval can be easily determined. The magnitude of the class interval is found by dividing the number of classes with the difference between the highest and lowest item values. The formula is:

$$\textit{Magnitude of the class (i)} = \frac{\textit{Highest item value} - \textit{Lowest item value}}{\textit{Nmber of classes}}$$

3. The Class Limits

Selection of class limits is another problem. The classes should be exhaustive and mutually exclusive. They are exhaustive if each item in the series is included in any of the classes. Classes should also be mutually exclusive. There should be no overlapping of items. In other words no item should find a place in more than one class.

Preferably, the lower limit of the first class should be either zero or 5 or a multiple of 5. For example, suppose the lowest item value in a series is '3' and the given class interval is 10. Then the first class should be '0-10' instead of '3'-13'. That simplifies calculation. However there is no rigidity in selection of class limits.

Each class is defined by the class limits. The class limits are the lowest and highest item values that can be included in the class. These two limits are called the lower limit (L_1) and the upper limit (U_2). The lower limit of a class is a value so that no lower value can fall into that class. Similarly the upper limit of a class is a value such that no higher value can fall into that class. The difference between these two limits is known as '*class interval*' or the '*width of the class*'.

Thus the class interval is $U_1 - L_1$.

The value half-way between the lower and the upper limits is called the 'mid-point' or 'mid-value' of the class. So the mid value of a class is $\frac{U_1+L_1}{2}$

(iii) Class Frequency

The number of observations corresponding to a particular class is known as class frequency. Class frequency is found by counting the number of items falling in each class. The frequencies are counted by using 'tally-bars'.

The distribution containing the classes along with their respective frequencies is known as the grouped frequency distribution.

Methods of Preparing Grouped Frequency Distribution

In a grouped frequency distribution class limits can be written in a number of methods. Any method is acceptable, if it involves no ambiguity. The important methods are-

1. Exclusive Method

In this method, the upper limit of one class becomes the lower limit of the next class. So exclusive method ensures continuity of data. Here the upper limit of a class excluded from that class is included in the next class. The following is an example of exclusive type of grouped frequency distribution.

Table - 6.3 : Frequency Distribution of Income of 20 Persons

Income (in Rs.)	Number of Persons (f)
100 - 200	5
200 - 300	8
300 - 400	3
400 - 500	4
Total	**20**

In the above series, there are 5 persons whose income is Rs100 or above but below Rs. 200, i.e., $100 \leq x < 200$. Similarly there are '8' persons whose income is Rs.200 or above but below Rs. 300, i.e., $200 \leq x < 300$, and so on. Here x represents income

2. Inclusive Method

In this method the upper limit of a class is not same as the lower limit of the next higher class. Here both the limits of a class are included in the same class. The following is an example of inclusive type of grouped frequency distribution.

Table - 6.4 : Frequency Distribution of Income of 20 Persons

Income (in Rs.)	Number of Persons (f)
100 - 199	5
200 - 299	8
300 - 399	3
400 - 499	4
Total	**20**

In the above series, the class 100 - 199 includes persons whose income is between Rs. 100 and Rs. 199 (i.e., $100 \leq x \leq 199$). There are 5 such persons. The person whose income is exactly Rs. 200 is included in the next higher class (i.e., 200 - 299) and so on.

Conversion of an Inclusive Series into an Exclusive Series

The choice between 'inclusive' and 'exclusive' type of classification depends on the nature of data. For discrete variables inclusive method may be used. But for continuous variables exclusive method of classification is preferred.

In inclusive method the class limits are not continuous. For instance in the above example, suppose the income of a person is Rs. 199.50. He is not included in the first class (100 -199) nor in the second class (200 - 299). So to ensure continuity one should adopt exclusive method of classification.

The inclusive type of series can be easily converted into exclusive type in the following steps:

Steps

(i) Find the difference between the lower limit of the second class and the upper limit of the first class.

(ii) Divide the difference by 2. This is the correction factor.

$$\text{Correction factor} = \frac{\text{Lower limit of the 2nd class} - \text{upper limit of the 1st class}}{2}$$

(iii) Subtract the correction factor from the lower limit of the class and add it to the upper limit of the class. This gives continuous classes. Now the series becomes exclusive.

Example 2: Convert the following series into exclusive type of series.

Marks	Number of Students
20 - 29	5
30 - 39	10
40 - 49	15
50 - 59	8
60 - 69	2
Total	**40**

Answer: The above is an inclusive type of series. Here the correction factor $= \frac{1}{2}$ (the lower limit of 2nd class - upper limit of 1st class)

$$= \frac{30-29}{2} = 0.5$$

To find the exclusive type of classes, deduct 0.5 from the lower limit of all classes and add 0.5 to the upper limit of all classes. The adjusted classes would be:

Marks	Number of Students
19.5 - 29.5	5
29.5 - 39.5	10
39.5 - 49.5	15
49.5 - 59.5	8
59.5 - 69.5	2
Total	**40**

Here it can be seen that before adjustment the class interval was 9. But after adjustment it is 10. Note that class adjustments does not affect frequency.

(iii) Open-end Classes:

In a series with open-end classes, either (a) the lower limit of the first class, or (b) the upper limit of the last class or (c) both these limits are not specified. For example the classes like marks less that 20, age above 60 etc. are open-end classes. Because here one of the limits is missing.

As far as possible, open end classes should be avoided. Because one cannot exactly fix the missing limits. In practice, the missing limits are determined after carefully observing the series. However these values are only approximate values.

Example: 3 *The following are the data showing the weekly wages of 40 workers. Construct a frequency distribution taking a class interval of 10.*

Weekly wages (in Rs) - 138, 164, 150, 131, 144, 125, 149, 157, 146, 158, 140, 147, 136, 148, 152, 144, 168, 126, 138, 176, 163, 119, 154, 165, 146, 173, 142, 147, 135, 153, 142, 135, 140, 136, 161, 145, 150, 156, 145, 128

Answer: Here the lowest value is 119 and the highest value is 176. Their difference is 176 - 119 = 57. Since the given class interval is 10 there will be 57 ✚ 10 = 5.7 ≅ 6. So there will be approximately '6' classes.

Here we may take 115 as the lower limit of the first class instead of 119 for convenience.

Table - 6.5 : Frequency Distribution of the Weekly Wages of 40 Workers

Wages (in Rs.)	Frequency
115 - 125	1
125 - 135	4
135 - 145	12
145 - 155	13
155 - 165	6
165 - 175	3
175 - 185	1
Total	**40**

Example 4: *The mid-values of classes in a frequency distribution of weekly wages* (In Rupees) of workers are: 128, 137, 146, 155, 164, 173, 182.

Find (a) The size of the class interval.

(b) The class limits.

Answer: (a) The size of the class interval is the common difference between successive mid-values.

So here the class interval will be 137 - 128 = 146 - 137 = 9.

(b) Since the class intervals are of equal size, the class limits will be mid-way between the mid-values. So the class limits are

$$\left(\frac{128+137}{2}\right), \left(\frac{137+146}{2}\right) \ldots\ldots, \left(\frac{173+182}{2}\right)$$

or, 132.5, 141.9, ... 177.5

The lower limit of the first class is 132.5 - the size of the class interval (9). So the lower limit of the first class is 132.5 - 9 = 123.5. The upper limit of the last class is 177.5 + 9 = 186.5. Since the class interval is 9, the class limits are, 123.5, 132.5, 141.5, 150.5, 159.5, 168.5, 177.5 and 186.5. So the classes will be,

123.5 - 132.5

132.5 - 141.5

141.5 - 150.5

150.5 - 159.5

159.5 - 168.5

168.5 - 177.5

177.5 - 186.5

6.4 Presentation of Data

Classification refers to the process of dividing data into different groups (or classes) according to certain similarities or resemblances. Thus classfication of data is preliminary to its presentation, because the items with similarities must be brought together before the data are presented. The main objectives of classification of data are:

i) To divide voluminous and heterogeneous data into homogeneous groups and put them in an orderly and condensed form.

ii) To make the data easily understandable for the common man.

iii) To serve as a preliminary for tabular and diagrammatic presentation of data.

There are two general forms of presenting statistical data, namely -

i) Tabular presentation

ii) Diagrammatic or graphic presentation

6.4.1 Tabular Presentation

Tabular presentation means presenting statistical data through tables. This is called '*tabulation*'. It is a process of presenting the voluminous and heterogeneous data in a simple and systematic form. However, before tabulation care should be taken to arrange data in different homogeneous groups, i.e., to classify data.

Definition

Tabulation is a process of systematic and orderly arrangement of data into rows and columns. Rows are horizontal arrangements and columns are vertical arrangements.

The purpose of tabulation is (i) to simplify presentation of data. (ii) It makes data intelligible and comparable. (iii) Tabulation attempts to furnish maximum information contained in the data in the minimum possible space. So it is an intermediate process

between the collection of data and statistical analysis. (iv) Tabulation reduces the bulkiness of data. (v) It leaves a lasting impression on the minds of the investigator.

6.4.1.1 Rules of Tabulation

There is no hard and fast rule for constructing statistical tables. What is required is a clear understanding of the nature, scope and objective of the enquiry. Here the skill, experience and the common sense of the tabulator are important. It is said "*in the tabulation of data, common sense is the chief requisite and experience is the chief teacher.*" However efforts should be made to make the statistical tables. (i) compact and concise, (ii) accurate, (iii) unambiguous and (iv) complete. These are the requisites of an ideal statistical table.

6.4.1.2 Components of a Table

The components of a statistical table generally depends on the nature of data. Basically, a statistical table should contain the following components.

(i) Table number.

(ii) Title.

(iii) Head note.

(iv) Stub or row heading.

(v) Caption or column heading.

(vi) Body of the table.

(vii) Total, sub-totals and averages.

(viii) Foot-notes and definitions.

(ix) Source notes.

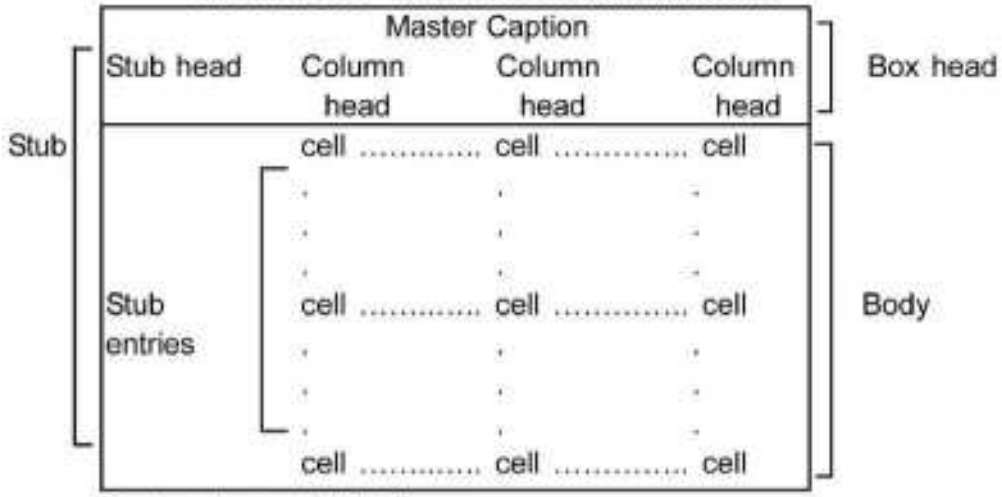
The major components of a statistical table has been shown in the following format.

Format

Table number .....

Title .....

Head notes .....



Foot notes and definitions .....

Source .....

Now let us briefly discuss each of the above components.

(i) **Table Number:** Statistical tables are numbered serially for easy reference. Generally they are numbered according to their order of appearance in a chapter. For example table 2.1 indicates that it is the first table in chapter 2. Similarly the second table in the same chapter is numbered 2.2 and so on. Usually the table number is written at the top of the table.

(ii) **Title:** A statistical table should accompany a suitable title. The title describes in brief the content of the table and should precusely describe the nature, place, time and the source data. The title should be simple, clear and self explanatory. A complex table may have sub-titles besides the main title.

(iii) **Head Note:** Head note provides additional information about the title. Usually it indicates the units of measurement. Head note is generally placed in bracket after the title.

(iv) Stub: The headings or designations of horizotal rows are known as stubs. The wordings of the stub should be brief, unambiguous and simple. The stub may contain one or more row heads.

(v) Caption: The heading or designation of vertical columns are known as captions. The wordings of the caption should be simple concise and selfexplanatory. The caption consists of one or more column heads. Under a column head there may be subheads.

(vi) Body of the Table: This is the main part of a statistical table. The arrangement of statistical data according to descriptions in the captions and stubs forms the body of the table.

(vii) Totals and Sub Totals: A statistical table should contain sub total of each column and row. It should also have the grand total.

(viii) Foot Notes and Definition: Foot-notes are given to explain certain specific points of the table. Anything which can not be understood directly from the title, stub or captain should be explained in the foot-note. Foot-note is placed at the bottom of the table.

(ix) Source Note: The source of the data presented in the table is given in the source note. This is very important. It allows the reader to check the figures and to get additional information.

A hypothetical statistical table is given below as an illustration.

Table

Title - Supply of xyz Rice Mills in Odisha, 2010.

Sub-title - Supply of rice and wheat

Head note - Supply in tonnes.

	CAPTION			
	Column 1 (Months)	**Column 2 (Rice)**	**Column 3 (Wheat)**	**Total**
Stub and Body	Jan.	6	2	8
	Feb.	5	3	8
	March	7	4	11
	April	7	5	12
	May	9	6	15
	June	8	5	13
	July	15	12	27
	August	16	14	30
	Sept.	10	9	19
	Oct.	14	14	28
	Nov.	15	10	25
	Dec.	18	6	24
	Totals and Grand total	130	90	220

Foot-notes: Figures include supply to the Govt. at subsidized rates for cyclone relief.
Source: Annual Report of xyz rice mills.

6.4.1.3 Kinds of Table

Statistical tables may be broadly classified into two categories, namely -

1. Simple and complex table.
2. General purpose and special purpose tables.

1. Simple and Complex Table

Depending on the number of characteristics studied, statistical tables may be simple or complex. A simple table studies only one characteristic. So it is also called 'one-way' table. On the other hand if a table studies two or more characteristics then

it becomes a complex table. Complex tables may be 'two-fold', 'three-fold' or 'many fold' depending on the number of characteristics studied.

Example of simple and complex tables are given below.

Simple Table (One-way Table)

Here only one characteristic of data is studied. This is the simplest of all types of tables. For example, suppose we want to classify the households of a village (x) according to the level of education of the household-head. Let the village consists of 100 households.

Table - 4.4: Classification of Households According to the level of Education of Household Head

Level of Education	**Number of households**
Illiterate	26
Primary Education	14
Secondary Education	20
Higher Secondary Education	15
Graduates	15
Post Graduates and above	10
Total	**100**

Source: Annual Report of DPEP.

Manifold or Complex Table

A statistical table showing more than one characteristic of data is called a complex table. A complex table may show a two-fold, three-fold or manifold classification of data. For simplicity let us consider a two-fold (two-way) table.

A two-way table shows two characteristics of data. It is formed when either the stub, or the caption is divided into two parts. In the following table, we have taken only one characteristic - the level of education of the household heads. If we add one more attribute say sex of the house-hold head, it becomes a two-way table. An example of a two table is given below.

Table - 6.6 : Classification According to the Level of Education and Sex of the Household Head

Level of Education	Sex		Total
	Male	Female	
Illiterate	10	16	26
Primary	8	6	14
Secondary	18	2	20
Higher Secondary	12	3	15
Graduation	14	1	15
Post-graduation and above	10	Nil	10
Total	**72**	**28**	**100**

Source: Annual Report of DPEP.

2. General Purpose and Special Purpose Tables

General purpose tables are also known as reference or source tables. They contain detailed information. These tables are repository of information. Tables published by government agencies like the census report etc. are reference tables.

Special purpose tables are called '*summary*' or '*text*' tables. These tables provide information for a particular purpose. They are derived from the reference tables. These tables emphasize specific items, relationships or significant comparisons. For example the census report of Government of India is a reference table. But the table showing the literacy percentage among woman in a particular state is a summary table.

6.4.2 Diagrammatic and Graphic Presentation of Data

Diagrammatic and Graphic presentation means presenting statistical data through diagrams and graphs. It is a more convincing and appealing method of presenting data. In fact graphic presentation is an important complement to tabular

presentation. Data given in the form of a table make sense only to a specialist dealing with such data. A statistical table may not convey much to a common man. On the otherhand, graphic presentation is a visual form of presenting data. It is eye-catching and more effective for the general public. It has great memorising effects. It creates lasting impression for a longer time than the abstract figures given in statistical tables.

6.4.2.1 Difference between Diagrams and Graphs

1. Diagram are constructed on plane paper and furnish only approximate information. But graphs are constructed on graph papers and are more precise and acurate.
2. In diagrams data are presented through bars, rectangles, circles, cubes etc. While graphic presentation is done through points, lines etc.
3. Diagrams are used only for comparism not for studying the relationship between the variables while graphs help us to study the mathematical relationship between the variables.
4. Diagramatic presentation is usually done for Layman and for a common appeal while graphs are constructed for accurate presentation, further analysis and interpretation of data.
5. Diagrams are useful in depicting categorical and geographical data while graphs are used to present frequency distributions and time series data.

6.4.2.2 General Rules for Constructing Diagrams and Graphs

There is no hard and fast rule for constructing diagrams and graphs. However the following basic rules should be observed for the purpose.

1. Title

Every diagram or graph should contain a title. The title conveys the main idea contained in the diagram. The title should be brief and self-explanatory. Generally, titles are given at the top of the diagram.

2. Proportion Between Width and Height

In diagrams and graphs the width and height should be proportional. That makes them attractive and eye-catching.

3. Selection of Scale

The scale in a graph specifies the size of the unit and what it represents. For example weight in tonnes, units in lakhs, number of persons in thousands etc. For the sake of simplicity the scale showing the values should be in even numbers. They should be in multiples of 5 or 10, e.g. 25, 50, 75 or 10, 20, 30, etc.

4. Index

An index illustrates different types of lines, shades or colours used in the diagram. It helps in easy understanding and analysis of statistical data.

5. Foot Notes

To clarify certain points in the diagram, foot notes should be given. Generally foot notes are given at the bottom of the diagram.

6. Simplicity

Diagrams are basically meant for easy understanding of data. So they should be as simple as possible. It should help the reader to understand the meaning clearly. Besides, diagrams should be neat and clean.

6.5 Types of Diagram

In diagrammatic presentation of statistical data, a variety of diagrams are in use. Some of the commonly used diagrams are

(a) Bar diagrams

(b) Pie-diagrams

(c) Pictogram

(d) Cartogram

6.5.1 Bar Charts / Bar Diagram

Bar chart is the simplest method of diagrammatic presentation of data. It consists of a group of rectangles (bars). Each bar corresponds to a particular group or category of data. The values or magnitudes are represented by the height of the bars. All the bars should be of equal width. Bars may be arranged vertically or

horizontally. The bars should be constructed on the same base line. The distance between each bars should be same.

Bar charts are one-dimensional diagrams. So they can present only one classification or one category of data. For example, while presenting the population for the last 5 years, one can only depict the total population through bar charts, not its sex-wise distribution or anything else.

Example 5: *Draw an appropriate diagram to present the following data.*

Annual Steel Production of SAIL from 1950-1955

Year	1950	1951	1952	1953	1954	1955
Production in thousand tonnes	210	220	240	230	250	260

Answer: The appropriate diagram to represent above data is a simple bar-diagram.

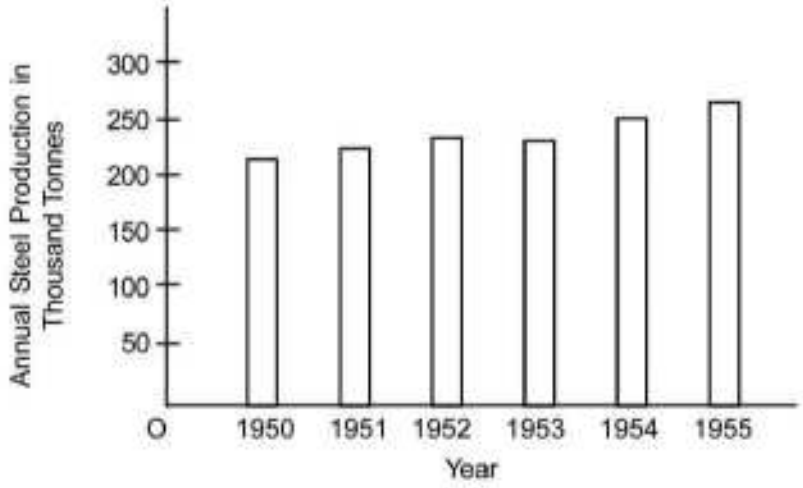


Fig. 6.1 - Simple Bars

Multiple Bar Diagram

Simple bar charts represent only one variable over time. But a multiple bar chart represents two or more sets of inter-related data. The technique of drawing a multiple bar chart is same as that of a simple bar chart. As more than one variable (phenomenon) are represented, here, different shades or colours are used to

distinguish between the bars. An index explaining the shades or colours should be given for clear understanding. Multiple bar diagrams give better comparison between the variables.

Example 6: *Represent the following data diagrammatically.*

Production of Wheat and Rice for the Years 1950-1954 in Bihar (in million tonnes)

Year	1950	1951	1952	1953	1954
Wheat	10	12	14	15	13
Rice	7	10	11	14	12

Answer: As we have to represent two sets of variables, we use a multiple bar diagram.

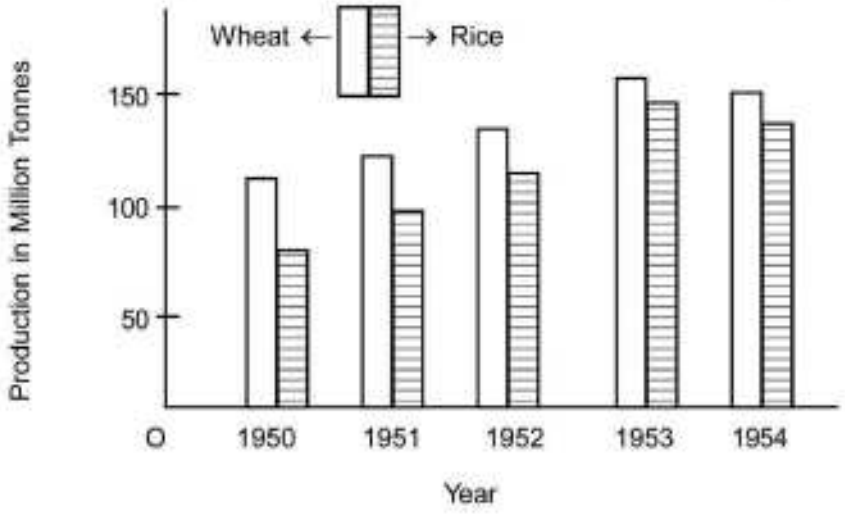


Fig. 6.2 - Multiple Bar Diagram

6.5.2 Pie-Charts

Pie-chart is a circle broken down into component parts. So they are called '*circle-charts*'. Pie-charts are used to show the break-up of a total into component parts. Hence more than one variable can be represented in a pie-chart. Generally pie-diagrams are used on a percentage basis, not on an absolute basis. Because absolute figures give large totals which require big circles for representation.

In constructing a pie-chart the following steps may be followed.

Step

(i) Prepare the data so that various component values can be converted into corresponding degrees in the circle. For example, suppose there are 4 component values in a series. In percentage terms their values are 60%, 25%, 10% and 5% respectively. The angle of the circle is 360°. So 1% value shall cover 360 ÷ 100 = 3.6°. So the corresponding values of the 4 components are 216° (60 x 3.6°), 90° (25 x 3.6°), 36° (10 x 3.6°) and 18° (5 x 3.6°) respectively.

(ii) Draw a circle with a compass considering the available space. The size of the radius (r) may be proportional to the square root of the total value of the variable i.e., $r = \sqrt{\text{total value of the variable}}$

(iii) Measure points on the circle representing the size of each component by a protractor. Now different components can be shaded differently for easy identification and comparison. The colours should be mentioned in the index for reference.

Example 7: The following data relate to the expenditure of two families per month. Represent the data by pie-diagram.

Items of Expenditure (in Rs.)	**Family** A	**Family** B
Food	40	60
Rent	20	40
Clothing	20	30
Education	10	40
Medicine	5	10
Miscellaneous	5	20

Solution: To construct the pie-diagram first we express the absolute values into percentage forms. Then these percentage values are converted to angles in the circle.

Item of Expenditure (in Rs.)	Family 'A'		Family 'B'	
	Rs.	Degree	Rs.	Degree
Food	40	$\frac{40}{100} \times 360^0 = 144^0$	60	$\frac{60}{200} \times 360^0 = 108^0$
Rent	20	$\frac{20}{100} \times 360^0 = 72^0$	40	$\frac{40}{200} \times 360^0 = 72^0$
Clothing	20	$\frac{40}{200} \times 360^0 = 72^0$	30	$\frac{30}{200} \times 360^0 = 54^0$
Education	10	$\frac{10}{100} \times 360^0 = 36^0$	40	$\frac{40}{200} \times 360^0 = 72^0$
Medicine	5	$\frac{5}{100} \times 360^0 = 18^0$	10	$\frac{10}{200} \times 360^0 = 18^0$
Miscelleneous	5	$\frac{5}{100} \times 360^0 = 18^0$	20	$\frac{20}{200} \times 360^0 = 36^0$
Total	100	360^0	200	360^0
Square root	10		14.14	
Radius (r)	1.0		1.4	

So the radius of the two circles will be in the ratio 1:1.4.

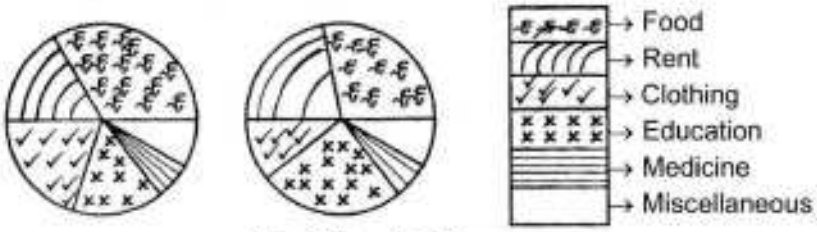


Fig. 6.3 - Pie Diagram

6.6 Graphic presentation of data

Types of Graphs: Graphs are of two types - Frequency Graphs and Time Series Graphs

The commonly used frequency graphs.

1. Histogram
2. Frequency polygon
3. 'Ogives' or Cumulative frequency curves

6.6.1 Histogram

Histogram is a two-dimensional graph. It consists of a set of vertically erected adjacent rectangles. These rectangles represent the frequency distribution.

Histogram of a frequency distribution may be constructed in the following steps,

Steps

(i) Take the classes along the X-axis and the corresponding frequencies along the Y-axis.

(ii) Take the class intervals as base, the corresponding frequencies as heights in erecting rectangles.

(iii) All these adjacent rectangles together constitute histogram.

Thus histogram is a set of rectangles drawn over each class interval on the horizontal axis. With equal class intervals, all the rectangles will have same base. In such case the area of each rectangles will be proportional to the frequency of corresponding classes. If the class intervals are unequal, the base of the rectangles will be different. Their corresponding height will be proportional to the calculated 'frequency density'.

The frequency density of a class is found by dividing the frequency of the class by the magnitude of the class interval.

$$\text{Frequency density} = \frac{\text{Frequency of the class}}{\text{Magnitude of the class interval}}$$

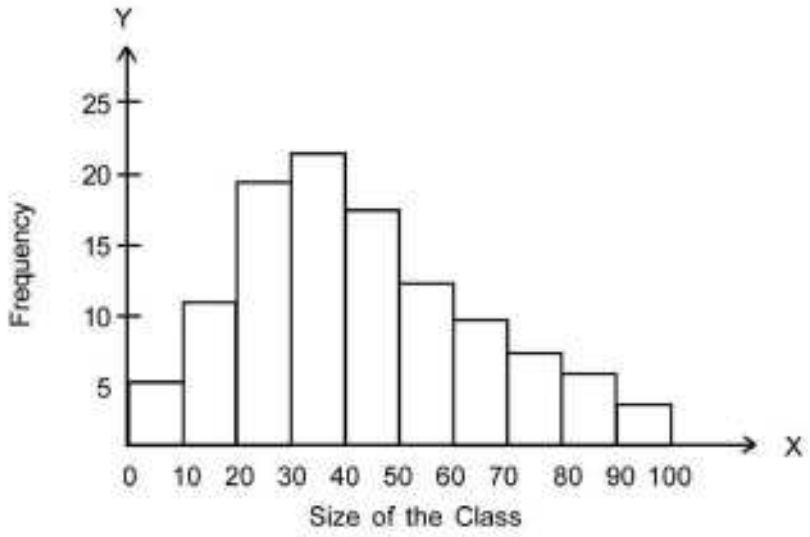
Histogram is also known as 'block diagram' or 'stair case chart'. It is very simple to construct. So histogram is frequently used to graphically represent frequency distribution. However, histogram cannot be constructed in case of 'open-end' classes. It may be misleading in case of unequal classes if the corresponding frequencies are not suitably adjusted.

Example 8: Draw a histogram using the following data.

Size of the class	0-10	10-20	20-30	30-40	40-50	50-60
Frequency	5	11	19	21	16	10
Size of the class	60-70	70-80	80-90	90-100		
Frequency	8	6	4	2		

Answer: Here all classes are of equal width. So adjustment of frequency is not necessary.

Fig. 6.4 - Histogram



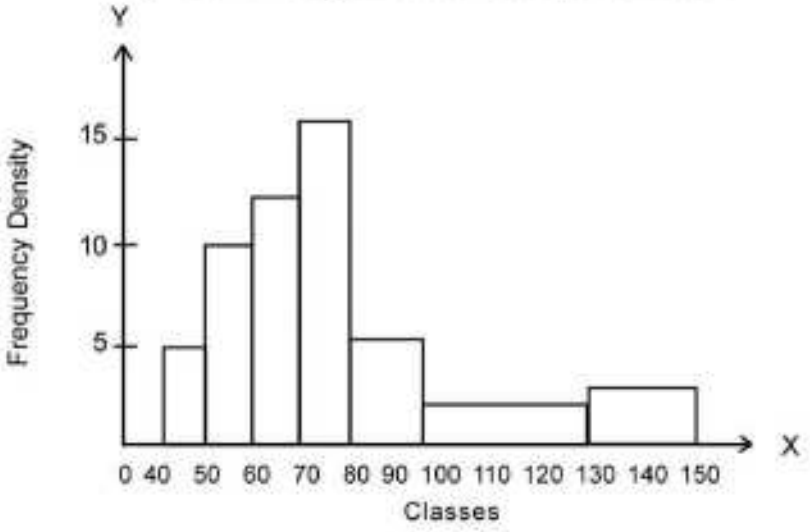
Example 9: Construct a histogram for the following data.

Monthly Salary (in Rs.)	40-50	50-60	60-70	70-80	80-100	100-130	130-150
Number of Persons	36	85	120	154	110	60	50

Answer: In the above example the class intervals are unequal. So here the height of the rectangles should be equal to the frequency density of the corresponding classes.

Monthly Salary (in Rs.)	**Number of Persons**	**Class Width**	**Frequency Density**
40 - 50	36	10	36 ÷ 10 = 3.6
50 - 60	85	10	85 ÷ 10 = 8.5
60 - 70	120	10	120 ÷ 10 = 12
70 - 80	154	10	154 ÷ 10 = 15.4
80 - 100	110	20	110 ÷ 20 = 5.5
100 - 130	60	30	60 ÷ 30 = 2
130 - 150	50	20	50 ÷ 20 = 2.5

Fig 6.5 - Histogram with Unequal Classes



6.6.2 Frequency Polygon

'Polygon' literally means many angles. In statistics *frequency polygon is a curve representing a frequency distribution.*

Frequency polygon is often derived from histogram. Here (i) one has to first find the mid-points of the upper horizontal sides of the rectangles in the histogram and then (ii) join these points by straight lines to get the frequency polygon.

One can also get the polygon without drawing the histogram. In such case plot the frequency of each class against the mid points of the correspondending class. Join these points by straight lines to get the polygon. Frequency polygon in case of unequal class intervals are drawn after adjusting the class frequencies as in case of histogram.

Some statisticians prefer closing both ends of the polygon. This is done by extending the polygon to the base line. In such case two hypothetical classes with zero frequency at each end are included. This makes the area under the polygon equal to that under the corresponding histogram.

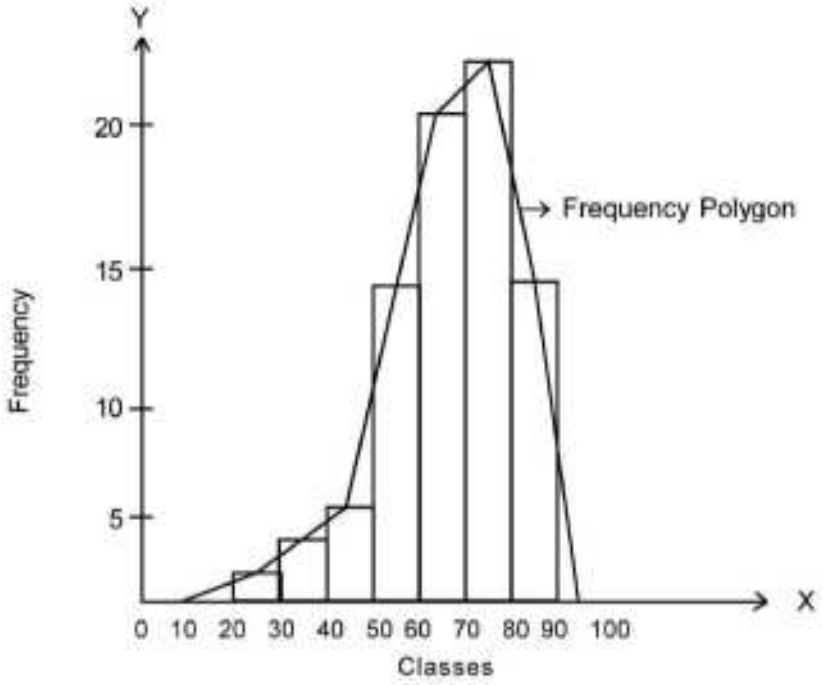
Frequency polygon is preferred to histogram. It makes comparison between different distributions easier. Because two or more frequency polygon can be shown on the same graph. But not more than one histogram can be drawn on a single graph.

Example 10: Draw the frequency polygon for the following distribution.

Marks	20-30	30-40	40-50	50-60	60-70	70-80	80-90
Frequency	1	3	5	14	20	22	14

Answer: To construct the frequency polygon first we shall erect the rectangle over each class. The height of the rectangles represents the frequencies. Then we join the mid-points of the upper surface of the rectangular bars by straight lines to get the polygon. To find the area, we extend both ends of the curve to touch the x-axis. For this we take two hypothetical classes (10-20 and 90-100) each with zero frequency. These two classes are shown at the two ends.

Fig. 6.6 - Frequency Polygon



6.6.3 Ogives or Cumulative Frequency Curves

The *cumulative frequency curves* are also known as *ogives*. Here we plot the cumulative frequency against the variables instead of actual frequency. When the frequencies are added serially, we get the cumulative frequency. The cumulative frequencies are plotted against the mid-points of the class intervals. These points are joined by a smooth curve to get ogive.

Ogives are used to study certain characteristics of the distribution. For example:

(i) To study certain trends or to estimate the missing variables, ogives are used.

(ii) From ogives, the number of items above or below certain size can be determined.

(iii) Ogives help in comparing two or more frequency distributions.

(iv) Ogives are also used to determine the partition values like median, quartiles etc. of a frequency distribution.

There are two methods of constructing ogives, viz.

1. The Less Than Method

Here we start with the upper limit of the classes. We go on adding the frequencies to get the cumulative frequency. The cumulative frequencies are plotted against the upper limits of classes. Joining these points by free hand method we get a rising curve which is known as '*the less than ogive*'.

2. More than Method

In this method we start with the lower limit of the classes. The frequency of each class is serially deducted from the total frequency. These frequencies are plotted against the lower limits of the corresponding classes. Joining these points by free hand method we get a falling curve which is known as 'the more than ogive'.

The following example illustrates construction of ogives by both the methods.

Example 12: Construct the ogives from the following data:

Marks	10-20	20-30	30-40	40-50	50-60	60-70
Number of Students	4	6	10	20	18	2

Answer: To construct the ogives, first the distribution is converted into a cumulative frequency distribution. This is done as follows:

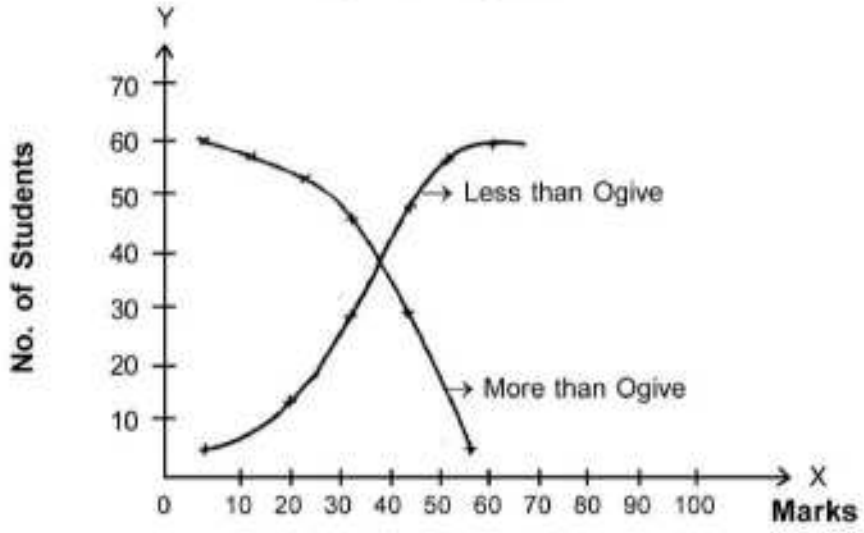
Cumulative Frequency Distribution

Less than Cumulative Frequency Distribution		**More than Cumulative Frequency Distribution**	
Marks less than	**No. of Students**	**Marks more than**	**No. of Students**
20	4	10	60
30	4 + 6 = 10	20	60 - 4 = 56
40	10 + 10 = 20	30	56 - 6 = 50
50	20 + 20 = 40	40	50 - 10 = 40
60	40 + 18 = 58	50	40 - 20 = 20
70	58 + 2 = 60	60	20 - 18 = 2

The above cumulative frequency distribution tells the number of students above or below a particular mark. For example, there are 40 students below 50 marks and 50 students above 30 marks.

Now plot the variables in the X-axis and the cumulative frequencies in the Y-axis. Joining the corresponding points by free-hand method, we get the 'less-than' and 'more-than' ogives.

Fig. 6.7 - Ogives



6.7 Graphs of Time Series or Historigrams

Time series graphs are otherwise called Historigrams.

The time series is a chronological arrangement of the statistical data. in other words, time series is an arrangement of a variable according to its time of occurrence. It reflects the dynamic pace of movements of a phenomenon over time. Most of the data relating to economics, commerce and business are time series data.

The graph of the time series is known as *'Historigram'*. To construct the time series graph, usually we take 'time' on the X-axis. The corresponding values of the phenomenon are taken on the Y-axis. We get a set of points corresponding to these combinations. Joining these points we get the required graph.

Time series graphs are widely used in practice. A time series graph is simple to understand and easy to construct. It helps in analyzing changes in the variable at

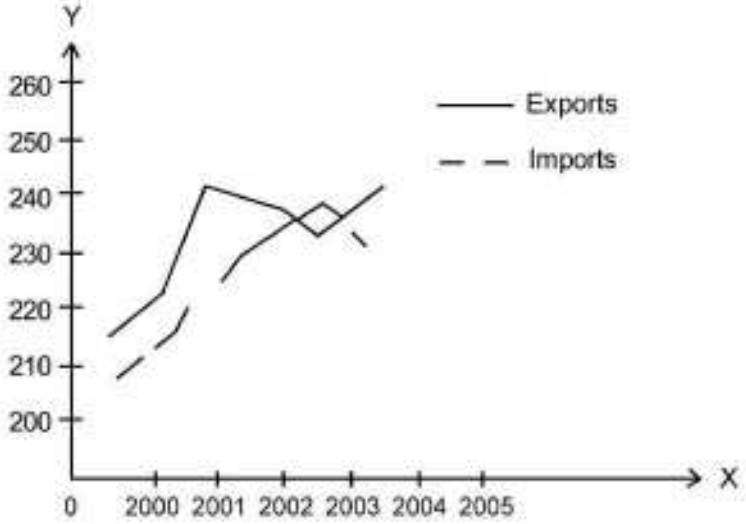
different points of time. Many variables may be shown on the same graph. So time series graph is more useful for easy comparison between the variables.

Example 13: Represent the following time series data graphically.

Year	2000	2001	2002	2003	2004	2005
Exports (In million tonnes)	215	225	245	242	240	250
Imports (In million tonnes)	210	215	230	240	245	230

Answer: To present the above time series data in graphs, let us take time on the X-axis. The corresponding values of exports and imports are taken on the Y-axis.

Fig. 6.8 - Graphs of Time Series



Vaious types of time series graphs are

(i) Horizontal Line Graph
(ii) Net Balance Graph
(iii) Range Graph
(iv) Bang Graphs

Horizontal Line Graphs or Historigrams

In such a graph only one variable can be presented. The time variable is plotted along the X and the other dependent variable is plotted along the Y axis on a sutable

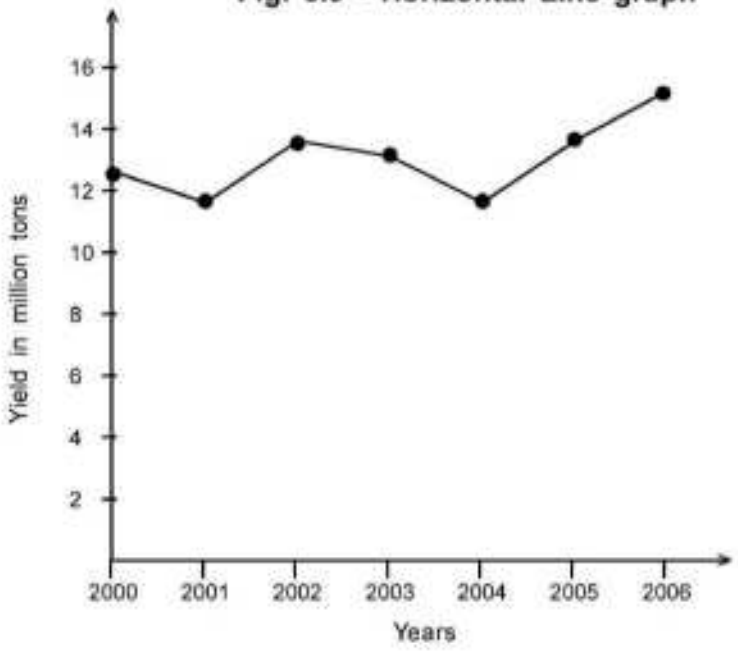
scale. These points are joined by straight lines. The following example show how line graphs are drawn.

Example - 14

Year	2000	2001	2002	2003	2004	2005	2006
Reice yield in million tons	12.5	11.9	13.2	13	10.4	13.9	15

Yield in million tons in differnet years

Fig. 6.9 - Horizontal Line graph



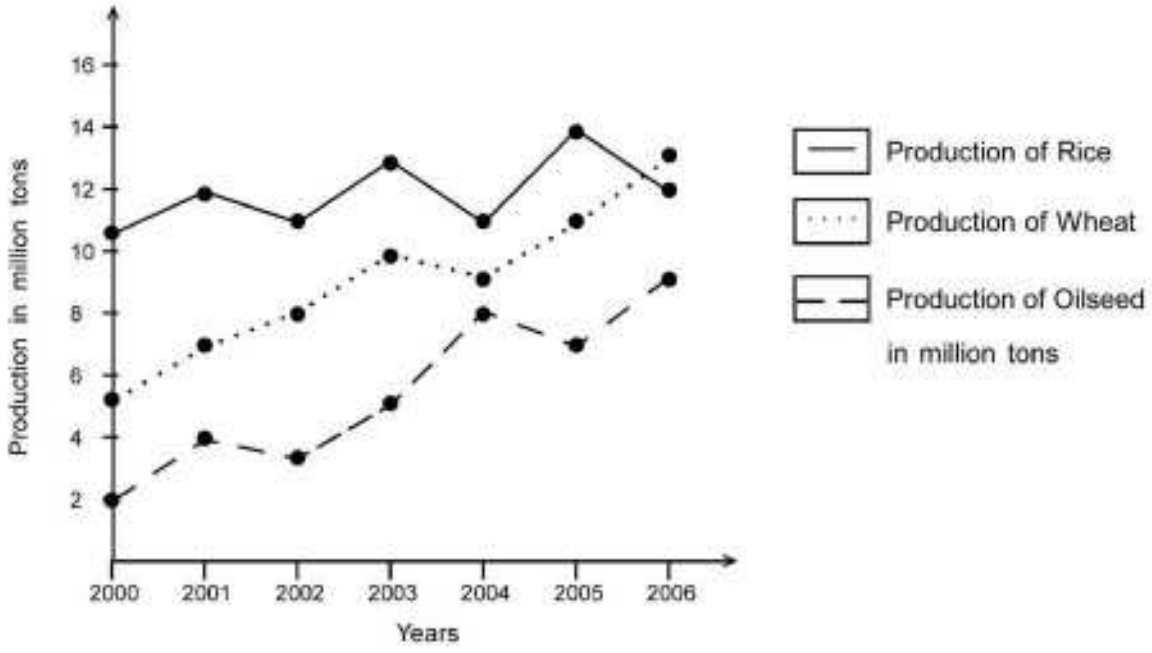
Historigram for two or more variables

Whe two or more variables measured in the same unit and refer to the same time period, line graphs are drawn using the same scales for all the variables along the vertical axis and the same scale for time along X axis for each variable.

The method of drawing such graphs is same as that for one variable but differnet types of lines or colours can be used to distinguish differnet variables. The following illustration shows how line graphs for more variables are drawn.

Year	2000	2001	2002	2003	2004	2005	2006
Rice	10.5	12	11	13	11	14	12
Wheat	5.5	7	8	10	9.5	11	13
Oil Seeds	2	4	35	5	8	7	9

Fig. 6.10 - Historigram for two or more variables



6.8 Comparison Between Tabular and Diagramatic & Graphic Presentation

Statistical data can be presented through tables or through graphs and diagrams. All forms of presentation have their relative merits and demerits. The investigator chooses any one of these two forms, considering the nature of data, the scope of the enquiry and degree of accuracy desired. The following comparison between the two forms is worth mentioning in this context.

Tabulation / Tabular Presentation	Diagramatic & Graphic Presentation
1. Statistical tables contain precise figures. So they provide more accurate information.	1. Diagrams and graphs are visual aids. They give a bird's eye view about the data. So they give only approximate information.
2. More and detailed information can be presented through tabulation.	2. Relatively less detail information are given through diagrams and graphs.
3. Information given through tables are bit difficult to understand and analyse for a common man.	3. Diagrams and graphs have a visual appeal. They are simple to understand and easy to interpret.
4. Statistical tables just contain abstract figures. So comparison of information is difficult through tabulation.	4. Graphs and charts can show trends. So comparison of information are easy in graphic presentation.

6.9 Limitations of Diagrams and Graphs

Diagrams and graphs are powerful and effective methods of presenting statistical data. They are complementary to tabulation. However, there are certain limitations of these methods:

1. Diagrams and graphs only give approximate idea about the distribution of data.
2. They can exhibit only limited number of observations.
3. They can be easily mis-interpreted.

Therefore, diagrams and graphs should not be accepted without a close inspection of the bonafides. Very often things are not as they appear to be. So graphs and diagrams should be analysed by the statisticians only. They better know when to use and when not to use them.

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SUMMARY

FREQUENCY DISTRIBUTION

1. Organisation of data refers to presentation of data in a condensed from so that it can be easily comprehended.
2. Systematic arrangement of raw data into different homogeneous groups according to semilarities is called classfication of data.
3. Presentation of data can be done in two ways.
   (i) Tabular presentation
   (ii) Diagrammatic and Graphic presentation
4. A variable is an observable characteristic of phenomenon which is capable of being measured and changes its value over time.
5. Statistical variables can be discrete or continuous.
6. Discrete variables are those which can assume only integral values.
7. Continuous variables can assume any value within an appropriate range.
8. Frequency distribution is a systematic arrangement of observations along with their respective frequencies.
9. A frequency distribution has two elements- (i) variable and (ii) its frequency
10. Frequency distribution may be either discrete frequency distribution or continuous or grouped frequency distribution depending upon whether the variables involved are discrete or continuous.
11. The grouped frequency distribtion involves three basic problems;
    (i) Determination of the number of class
    (ii) Choosing appropriate class intervals and calls limits
    (iii) determination of class frequencies

12. Sturgen Rule for number of classes (K)

    $K = 1 + 3.322 \log N$

13. Class interval is the difference between the upper limit (U_1) and lower limit of the class (L_1)

14. Mid value of a class is $\frac{U_1 + L_1}{2}$

15. Tabulation is a process of systematic and orderly arrangement of data into rows and columns. It is a process of presenting the voluminous and heterogeneous data in a simple and systematic form.

16. Presentation of statistical data through diagrams and graphs is called Diagrammatic and Graphic representation of data.

17. Bar diagrams, Pictogram, Cartograms are various types of Diagrammatic presentation of data. $\frac{U_1 + L_1}{2}$

18. Histogram, frequency, polygon, ogive, historigrams are various types of graphic presentation of data.

19. The upper class limit is excluded but lower class limit is included in exclusive method.

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MODEL QUESTIONS

4. INTRODUCTORY STATISTICS

Group - A: Objective Type (Compulsory) (1 mark each)

1. Write the correct answer choosing from the alternatives give in each question:

(a) In the inclusive method

(i) Only upper class limit is included

(ii) Only lower class limit is included

(iii) Upper class limit is included a lower limit

(iv) Both the upper and lower class limit one included.

(b) In the Exclusive method

(i) Upper class limit included but lower class limit is excluded.

(ii) Upper class limit is excluded and lower class limit is included.

(iii) Both upper and lower class limit are included.

(iv) Both upper and lower class limits are excluded.

(c) Number of children in a family

(i) a descrete variable

(ii) continuous variable

(iii) can be both discrete and continuous variable.

(iv) can neither be discrete nor continous.

(d) Heights of children is a

(i) discrete variable

(ii) continuous variable

(iii) both discrete and continous variable

(iv) neither discrete not continous.

(e) Which of the following is a discrete variable ?

(i) Yearly income of school teachers

(ii) Temperature of a patient

(iii) Height of a group of students

(iv) Number of share holders in a company

(f) Who is father of statistics ?

(i) R.A. Fisher (ii) Irving Fisher

(iii) Adam Smith (iv) Horace Secrist

(g) Open and series is one, where

(i) Lower limit of the first class is not specified

(ii) Upper limit of the last class is not specified

(iii) Both of lower limit of the first class and upper limit of the last class are not specified

(iv) None of the above

(h) Which of the following is a one-dimensional diagram ?

(i) Histogram (ii) Frequency polygon

(iii) Bar Chart (iv) None of the above

(i) Counting of population in India is based on:

(i) Census (ii) Sampling

(iii) Both Census and Sampling (iv) None of the above

2. I. Answer the following questions in one sentence:

(a) What is organisation of data ?

(b) What is a variable ?

(c) What are the different types variables ?

(d) What is classification ?

(e) What do you mean by frequency ?

(f) What is Histogram ?

(g) What is meant by frequency distribution ?

(h) What is an inclusive series ?

(i) What is an exclusive series ?

(j) What is an open end series ?

(k) What is a historigram ?

(l) What is a frequency polygon ?

(m) What is Ogive ?

(n) What is Pictogram ?

(o) What is Cartogram ?

3. Fill in the blanks :

(i) ——— in the first step in tabulation.

(ii) A ——— is the systamatic arrangement of data in rows and columns.

(iii) The numberical information in a statistical table is called the ——— of the table.

(iv) In statistical table ——— refer to row headings and ——— rerfer to column headings.

(v) In the collection and tabulation ——— is the chief requisite and ——— is the chief teacher.

(vi) Classification is the ——— step in ———.

(vii) In a statistical table the data are arranged in ——— and ———.

(viii) Time series graphs are otherwise called ———.

(ix) ——— is taken on the X axis while drawing time series graphs.

(x) Cumulative frequency curves are otherwise called ———.

Group - B: Short Type Answer

4. Answer the following within two / three sentences in each case: (2 marks each)

(a) What do you mean by frequency polgon ?

(b) What is Histogram ?

(c) What is pie-chart ?

(d) What is a continuous frequency distribution ?

(e) How can an inclusive series be converted into an exclusive series ?

4. I. Distinguish between the following restricting your answer within six sentences in each case: (3 marks each)

   (a) Discrete and continuous variable

   (b) Diagrams and Graphs

   (c) Histogram and Historigram

   (d) Inclusive series and Exclusive series

   (e) Discrete frequency distribution and Continuous frequency distribution

II. Write short notes on the following limiting your answer within six sentences in each case:

   (a) Frequency distribution

   (b) Variable

   (c) Tabular presentation of data

   (d) Diagrammatic presentation of data

   (e) Graphic presentation of data

   (f) Bar diagrams

   (g) Histogram

   (h) Pie-chart

   (i) Ogives

   (j) Bar diagram

   (k) Sturges rule

Group - C: Long Type Answer (7.5 marks each)

5. What is classification of data. Discuss the basic problems faced in classification of data.

6. What is meant by tabulation of statistical data ? State the requirements of a good statistical table.

7. What do you mean by Diagrammatic presentation of data. Discuss the various methods of diagrammatic presentation.

8. What is graphic presentation of data? Discuss the various methods of graphical presentation.
9. What are the different methods of graphical presentation of frequency distribution. Discuss the method of construction of Histogram.
10. What is Histogram? Discuss in details how line graphs are constructed to present data.
11. Prepare a histogram and a frequency polygon from the following data:

Class	0-6	6-12	12-18	18-24	25-30	30-36
Frequency	4	8	15	20	12	6

12. Form a frequency distribution using the following data:

7, 4, 3, 5, 6, 3, 3, 2, 4, 3, 4, 3, 3, 4, 2, 2, 7, 7, 6, 2, 6, 7, 2.

12. Draw a less than ogive from the following data:

Class	20-29	30-39	40-49	50-59	60-69
Frequency	5	10	15	8	2

13. Draw a histogram using the following data:

Class Interval	10-20	20-30	30-40	40-50	50-60
Frequency	8	12	18	10	6

14. Draw a pie-chart on the basis of the following data:

Sources of Revenue	Tax	Disinvestment	Borrowing	Other sources
Percentage	45	10	40	5

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CHAPTER - 7

STATISTICAL METHODS - I

- Measures of Central Tendency - Simple and Weighted Arithmetic Mean, Median and Mode
- Measures of Dispersion - Absolute Measures: Range, Quartile Deviation, Mean Deviation and Standard Deviation and their Merits and Demerits;

  Relative Measures: Co-efficient of Range, Quartile Deviation, Mean Deviation and Standard Deviation
- Lorenz Curve: Meaning and Application

7.1 MEASURES OF CENTRAL TENDENCY

Introduction

Statistics deals with data. After collection, data are edited and classified, tabulated and then presented in the form of frequency distribution. But statistical analysis and interpretation of data need further condensation to make them easily comparable. That helps in deriving valid conclusions from the statistical enquiry. For this purpose, the whole mass of raw data need to be reduced to a single representative figure. This single figure that is used to represent all the values in the distribution is called a measure of central tendency or measure of location or average of first order or simply average.

7.1.1 Meaning of Measures of Central Tendency

Measures of central tendency are very commonly used statistical tools. As the name suggests, these are centrally located single figures which represent the distribution in the best possible manner. The measures of Central Tendency refer to all those methods of statistical analysis by which averages of the statistical series is worked out.

According to **Croxton and Cowden**, "*A measure of central tendency is a single figure within the range of data that is used* to represent all of the values in the distribution." In the words of **A. L. Bowley**, "*Averages are statistical constants which enable us to comprehend in a single effort the significance of the whole*." According to clark, 'An average is a figure that represents the whole group."

The concept of averages is very common in statistics. Often we say "*statistics is the science of averages*". Averages are the typical values around which other items of the distribution concentrate. So they are called '*measures of location*'.

We study the measures of central tendency mainly for three purposes:

1. *To describe the distribution in a concise manner.*
2. *For the comparative study of different distributions.*

3. *To calculate various other statistical measures like the measures of dispersion, measures of skewness etc. basing upon the values of measures of Central Tendency.*

7.1.2 Various Measures of Central Tendency

There are different types of averages. Some are mathematical averages and some are positional averages. There are three types mathemetical averages. They are Arithmetic mean, Geometic mean, Harmonic mean. We have two positional averages-median and mode.

Qualities of an Ideal Average

An average is a single figure in which the net result of a complex group of numbers is condensed. It represents the whole distribution. We have different averages. Hence it is interesting to know the best of these averages. The best average is called the *'ideal measure of central tendency'*.

Professor *Yule* has suggested certain characteristics of an ideal measure of central tendency. The characteristics are:

1. It should be Rigidly Defined

An ideal average should be defined clearly and rigidly. It must lead to same interpretation by all. In other words the definition should not leave anything to the discretion of the investigator. Otherwise there may be 'bias' which will make the average unrepresentative.

2. It should be Simple to Understand any Easy to Calculate

An ideal average should be simple to calculate. It should also be intelligible to the common man. So an average should not require complicated mathematical calculations.

3. It should be Representative

This is the basic requisite of an ideal average. An average should truly represent a distribution. It should be based on all the items in the series. In other words it should give equal importance to every item in the series.

4. It should be Capable of Further Algebraic Treatment

An ideal measure of central tendency should be capable of further algebraic or mathematical treatment. This enhances the scope of its use in further statistical studies.

5. It should have Sampling Stability

An ideal average should be least affected by fluctuations in sampling. Fluctuation in sampling means the differences in the values of an average calculated from different samples drawn from a population. For example, we select some random samples of equal size from a population, and then compute a measure of central tendency for each sample. If these values are nearly same, we say the average has 'sampling stability'.

6. It should be Least Affected by the Extreme Values

Extreme values refer to the highest and the lowest values of the variable in the distribution. An ideal measure of central tendency should not be unduly affected by these extreme values.

Generally, we compare a measure of central tendency with respect to the above characteristics to determine its idealness. An average that satisfies these characteristics is considered as an ideal average.

7.1.2.1 Arithmetic Mean

Arithmetic mean is usually called 'average' or the 'mean'. It is the most commonly used measure of central tendency. It is the typical of all the averages. It is defined as *the sum-total of all values in the sample, divided by the number of observations*. It is denoted by a 'bar' above the symbol of the variable being averaged. For example, '$\bar{X}$' stands for the arithmetic mean of x-values in the sample.

Calculation of Arithmetic Mean

(A) Simple Series (Series of Individual Observations)

In simple series, observations occur once. Here arithmetic mean is calculated by dividing the aggregate of the values in the sample by the number of observations.

For a sample consisting of 'n' observations $x_1, x_2, x_3, \ldots x_n$, the arithmetic mean ($\bar{X}$) is:

$$\bar{X} = \frac{x_1 + x_2 + x_3 + \ldots + x_n}{n}$$

or $$\bar{X} = \frac{\sum x}{n}$$

Here the notation $\sum$ (sigma) stands for summation.

Short cut method (Indirect method):

This method is used when the sample contains numerically higher item values. It simplifies the process of calculation. In this method the arithmetic mean is calculated by using the formula:

$$\bar{X} = A + \frac{\sum d}{n}$$

Where 'A' is any arbitrary value called the *assumed mean*. 'd' is the deviation of x - values from the assumed mean 'A', i.e., d = X - A. For easy calculation 'A' should be a centrally located item value.

In the indirect method we proceed as follows,

Steps

(i) Take any item value from the middle portion of the series as 'A'.

(ii) Find d = X - A.

(iii) Apply the formulae, $\bar{X} = A + \frac{\sum d}{n}$

Example 1: Calculate arithmetic mean from the following data by (a) Direct method and (b) Indirect method.

Sl. No.	Values
1	110
2	112
3	111
4	110
5	110
6	111
7	111
8	110
9	110
10	114

Answer - (a) Direct Method

Here the number of observations 'n' = 10.

$\sum X$ = 110 + 112 + 111 + 110 + 110 + 111 + 111 + 110 + 110 + 114

= 1109

$\therefore \quad \bar{X} = \frac{\sum X}{n} = \frac{1109}{10} = 110.9$

(b) Short-cut-Method

Let the assumed mean (A) = 110

$\therefore$ d = X - 110

The values of 'd' for different values of 'X' has been calculated as follows:

Sl. No.	Item values (X)	Deviations (d) d = X - A
1	110	110 - 110 = 0
2	112	112 - 110 = 2
3	111	111 - 110 = 1
4	110	110 - 110 = 0
5	111	110 - 110 = 0
6	111	111 - 110 = 1
7	111	111 - 110 = 1
8	111	110 - 110 = 0
9	110	110 - 110 = 0
10	114	114 - 110 = 4

Here $\sum d = 0 + 2 + 1 + 0 + 0 + 1 + 1 + 0 + 0 + 4 = 9$

$$\therefore \ \overline{X} = A + \frac{\sum d}{n}$$

$$\text{or, } \overline{X} = 110 + \frac{9}{10} = 110.9$$

(B) Discrete ungrouped Series

In discrete series, item values are given with frequencies. When the observations in simple series are grouped according to their frequencies, the series becomes a discrete series. Here frequency refers to the number of times an observation occurs in a distribution. For example, consider the series, 2, 2, 3, 4, 2, 5,

3, 4, 2, 1, 5, 3, 1, 3, 2, 1, 3, 2. Here the item '1' repeats '4' times. Item '2' repeats '7' times and so on. If the items are written along with their corresponding frequencies, we get a discrete series. The series becomes:

Item Values 'x'	Frequency 'f'
1	4
2	7
3	5
4	2
5	2

The arithmetic mean of the discrete series is found by using the formula:

$$\bar{X} = \frac{\sum fx}{N}$$ (Where $N = \sum f$ = the sum total of the frequencies)

To find mean in a discrete series the following steps are adopted:

Steps

(i) multiply the items with the corresponding frequencies and add. That gives $\sum f x$

(ii) Divide it by the total frequency (N)

Short cut method

If the item values or the frequencies are big numbers, then the calculation of arithmetic mean becomes cumbersome. In such cases, we use the indirect method. In this method arithmetic mean is given by

$$\bar{X} = A + \frac{\sum fd}{N}$$

Where 'A' is the assumed mean. '**d**' is the deviation of X-values from 'A'. N is the total frequency.

Steps

(i) Assume any item value preferably from the middle portion of the series as 'A'.

(ii) Find the deviation of X - values from 'A', i.e., d = X - A.

(iii) Multiply the deviations with the corresponding frequencies and add.

(iv) Use the formula: $\bar{X} = A + \frac{\sum fd}{N}$

Example 2: Calculate arithmetic mean of the following series by (a) Direct method and (b) Indirect method.

Item values 'X'	Frequency ' f '
10	5
15	4
20	4
25	4
30	3

Answer (a) Direct Method

X	f	f.X
10	5	50
15	4	60
20	4	80
25	4	100
30	3	90
	$\sum f = 20$	$\sum fx = 380$

The arithmetic mean is $\bar{X} = \frac{\sum f d}{N}$ Where $\sum f = N$

or, $\bar{X} = \frac{380}{20} = 19$.

(b) Indirect Method

Let A = 20, then d = X - A

X	f	d = X - A	fd
10	5	10 - 20 = - 10	- 50
10	4	15 - 20 = - 5	- 20
20	4	20 - 20 = 0	0
25	4	25 - 20 = 5	20
30	3	30 - 20 = 10	30
	N = $\sum f$ = 20		$\sum d$ = - 20

$\therefore$ $\bar{X} = A + \frac{\sum fd}{N}$

or, $\bar{X} = 20 + \frac{-20}{20} = 20 - 1 = 19$

(C) Grouped Frequency Distribution

In case of grouped frequency distribution items are given in groups and the frequencies are given for the whole group. Groups or classes may be 'implicit' or 'explicit' type. Classes may have equal or unequal intervals. We may also have open-end classes.

In case of series with class intervals, to compute arithmetic mean, first the mid-values of the classes are determined. The mid-value (x) is found by adding the two

limits of a class and dividing it by 2, i.e., $X = \frac{L_2 + L_1}{2}$.

The mid values (X) represent the average size of items in each group. Given the corresponding frequencies, the series is now converted to a discrete series. The mean is computed by using the formula:

$$\bar{X} = \frac{\sum fx}{N}, \text{ where } N = \sum f$$

Indirect Method

The mid values of the classes taken along with their respective frequencies comprise the discrete series. So the same indirect formula as stated above is used to find the mean. The formula is:

$$\bar{X} = A + \frac{\sum fd}{N} \text{ where } d = X - A.$$

Step Deviation Method

This method is applied when the classes have same interval. A step deviation is the deviation of mid-values from the assumed mean, divided by the magnitude of class interval. Thus if '**h**' be the magnitude of class-interval then the step deviation is defined as $d = \frac{X - A}{h}$. The mean of the series becomes,

$$\bar{X} = A + h.\frac{\sum fd}{N}, \text{ where } d = \frac{X - A}{h}$$

Steps

(i) Find the mid values (X) of each class.

$$\text{Mid value} = \frac{\text{upper limit} + \text{lower limit}}{2}$$

(ii) Assume 'A' and find the step-deviation 'd'

where, $d = \frac{X - A}{h}$, 'h' being the magnitude of class - interval.

(iii) Use the formula: $\bar{X} = A + h.\frac{\sum fd}{N}$ to find the mean.

Example - 3 Calculate the mean of the following series by

(a) Direct method and (b) step-deviation method.

Values	Frequency
0 - 10	15
10 - 20	10
20 - 30	16
30 - 40	5
40 - 50	4

Answer (a) Direct Method

The given series is given in exclusive form.

Class	Mid values (X)	Frequency (f)	fx
0 - 10	$\frac{10+0}{2} = 5$	15	75
10 - 20	$\frac{20+10}{2} = 15$	10	150
20 - 30	$\frac{30+20}{2} = 25$	16	400
30 - 40	$\frac{40+30}{2} = 35$	5	175
40 - 50	$\frac{50+40}{2} = 45$	4	180
		$\sum f = 50$	$\sum fx = 980$

Here, $\bar{X} = \frac{\sum fx}{N} = \frac{980}{50} = 19.6$

(b) Step-deviation method

Class	Mid values X	Frequency f	$d = \frac{X-A}{h}$	fd
0 - 10	5	15	$\frac{5-25}{10} = -2$	- 30
10 - 20	15	10	$\frac{15-25}{10} = -1$	- 10
20 - 30	25	16	$\frac{25-25}{10} = 0$	0
30 - 40	35	5	$\frac{35-25}{10} = 1$	5
40 - 50	45	4	$\frac{45-25}{10} = 2$	8
			$N = \sum f = 50$	$\sum fd = -27$

Here we have taken '25' as the assumed mean and '10' is the class interval 'h'. The values of step-deviation 'd' corresponding to different values of variables (X) have been calculated and then mean has been calculated.

Here, $\bar{X} = A + h\frac{\sum fd}{N}$

$= 25 + 10\frac{(-27)}{50}$

$= 25 - 5.4 = 19.6$

Properties of Arithmetic Mean

Arithmetic mean is a mathematical average. It has a number of algebraic properties. Some of the important properties are given below.

1. *The algebraic sum of deviation of items from arithmetic mean is always equal to zero. i.e.* $\Sigma(X-\bar{X})=0$ and $\Sigma f(X-\bar{X})=0$

This is easy to verify.

$$\Sigma (X - \bar{X}) = \Sigma X - \Sigma \bar{X}$$

$$= \Sigma X - n.\bar{X} \quad (\because \Sigma X = n.\bar{X} \text{ and } \Sigma \bar{X} = \bar{X} + \bar{X} + ... + \bar{X} \text{ n times} = n\bar{X})$$

$$= n\bar{X} - n\bar{X}$$

$$= 0$$

So the algebraic sum of deviation of values taken from arithmetic mean is always equal to zero.

2. *The sum of squares of deviation of the items in a series from it's arithmatic mean is the least.*

i.e. $\sum(X-\bar{X})^2 < \sum(X-A)^2$

Proof to prove

$$\Sigma(X-\bar{X})^2 < \Sigma(X-A)^2$$

or $$\Sigma\left\{X^2 - 2X\bar{X} + (\bar{X})^2\right\} < \Sigma\left\{\left(X^2 - 2AX + A^2\right)\right\}$$

or, $$\left(\Sigma X^2 - 2\bar{X}\Sigma X + \Sigma \bar{X}^2\right) < \left\{\Sigma X^2 - 2\Sigma AX + \Sigma A^2\right\}$$

or, $$\Sigma x^2 - 2\bar{x}\Sigma x + \Sigma \bar{x}^2 - \Sigma x^2 + 2\Sigma Ax - \Sigma A^2 < 0$$

or, $$n\bar{x}^2 - 2n\bar{x}^2 + 2\Sigma Ax - \Sigma A^2 < 0 \quad [\text{as } \Sigma \bar{x}^2 = n\bar{x}^2 \text{ and } \Sigma \bar{x} = n\bar{x}]$$

or, $$-(n\bar{x}^2 - 2\Sigma Ax - \Sigma A^2) < 0$$

or, $$-(\bar{x}-A)^2 < 0$$

Which is always true as $(\bar{x} - A)^2$ is always positive

So for any value $\bar{x} \neq A^2 \sum(x - \bar{x})^2 < \sum(x - A)^2$

Where $\bar{A}$ is any item in the series except the mean. The following example explains the property.

Sum of the squres of deviations of deviations of times from the mean = 4			Sum of the wqures of deviation of items from any other value (Say 5)		
X	$(X - \bar{X})$, $\bar{X} - 4$	$(X - \bar{X})^2$	X	X – 5	$(X - 5)^2$
2	–2	4	2	–3	9
3	–1	1	3	–2	4
4	0	0	4	–1	1
5	1	1	5	0	0
6	2	4	6	1	1
		$\sum (X - \bar{X})^2 = 10$			$\sum (X - 5)^2 = 15$

3. *If all the item values in a series of 'n' items are equal to 'K', then the mean of the series is K.*

Here all the item values are equal to K.

We have $\sum X = K + K + ... + K = n.K$

$$\therefore \bar{X} = \frac{\sum X}{n} = \frac{nK}{n} = K$$

4. *The mean of a series found by multiplying each item values by a constant 'c', is 'c' times the mean of the original series.*

In otherwords, if all the items in a series are multiplied by a given constant then its mean is also multiplied by the same constant.

Here let $\bar{X}$ be the arithmetic mean of a series with 'n' items, $X_1, X_2, ... X_n$

so $\bar{X} = \frac{\sum X}{n}$

Now multiply each item by 'c' and add. Then the aggregate of the values in the new series becomes

$$\sum X = cX_1 + cX_2 + \ldots + cX_n = c(X_1 + X_2 + \ldots + X_n)$$

Now the mean becomes $\bar{X} = \frac{\sum X}{n} = c.\frac{\sum X}{n} = c.\bar{X}$

5. If $\bar{X}_A$ be the mean of series A. $\bar{X}_B$ the mean of series B,

If B = A + h

then $\bar{X}_B = \bar{X}_A + h$

If B = A – a, then $\bar{X}_B = \bar{X}_A - h$

Where h is any number which is constant i.e. when a constant value is added or subtracted to all the values of a series then the value of the arithmetic mean of the new series is increased or decreased by that constant amount.

6. The sum of the given values of a series is equal to the product of their arithmetic mean and number of items.

$\sum X = n\bar{X}$

$\sum fX = N\bar{X}$

as $\bar{X} = \frac{\sum X}{n}$ in individual series.

and $\bar{X} = \frac{\sum fx}{N}$ in diserete series

7. Combined Mean:

If $\bar{X}_1$ be the mean of a series with 'n_1' items and '$\bar{X}_2$' be the mean of a series with 'n_2' items, then the mean of the combined series $\bar{X}_{12}$ is

$$\bar{X}_{12} = \frac{n_1\bar{X}_1 + n_2\bar{X}_2}{n_1 + n_2}$$

This is simple to verify.

We have $\bar{X}_1 = \frac{\sum X_1}{n_1} \Rightarrow \sum X_1 = n_1 \bar{X}_1$

Thus the sum total of the observations in the first series is $n_1 \bar{x}_1$.

Similarly, $\bar{X}_2 = \frac{\sum X_2}{n_2} \Rightarrow \sum X_2 = n_2 \bar{X}_2$

Thus the sum total of the observations in the second series is $n_2 \bar{X}_2$.

Therefore, the sum of the observations of the combined series with $(n_1 + n_2)$ items is $n_1 \bar{X}_1 + n_2 \bar{X}_2$.

Hence, the combined mean $(\bar{X}_{12}) = \frac{\text{Sum of the observations}}{\text{Number of observations}}$

or, $\bar{X}_{12} = \frac{n_1 \bar{X}_1 + n_2 \bar{X}_2}{n_1 + n_2}$

This formula can be generalised for more than 2-series.

$\bar{X}_{1, 2, 3, \ldots, k} = (n_1 \bar{X}_1 + n_2 \bar{X}_2 + n_3 \bar{X}_3 + \ldots\ldots n_k \bar{X}_k) / (n_1 + n_2 + \ldots. nk)$

Example - 4: The arithmetic mean of a series consisting of 10 observations is 20 and that of another series with 20 observations is 10. Calculate the arithmetic mean of the combined series.

Answer: Given $n_1 = 10$, $\bar{X}_1 = 20$

$n_2 = 20$, $\bar{X}_2 = 10$

Now let the arithmetic mean of the combined series be $\bar{X}_{12}$

We have $\bar{X}_{12} = \frac{n_1 \bar{X}_1 + n_2 \bar{X}_2}{n_1 + n_2}$

Putting the values, $\bar{X}_{12} = \frac{10 \times 20 + 20 \times 10}{10 + 20} = \frac{400}{30} = 13.33$ (approx)

So the arithmetic mean of the combined series is 13.33 (approx)

Advantages of Arithmetic Mean

The arithmetic mean is a very commonly used measure of central tendency. It satisfies almost all the characteristics of an ideal measure. Its advantages are:

(i) It is rigidly defined. Because it is computed by using a definite formula.

(ii) It is simple to understand and easy to calculate.

(iii) It is representative. Because it is based on all the observations in the series.

(iv) It is a relatively stable measure of central tendency. Mean is less affected by fluctuations in sampling in comparison to median and mode.

(v) Mean is capable of further algebraic treatment. That makes it useful in further statistical analysis. For example combined mean can be found from the values of arithmetic means and no of observations of differen series.

Disadvantages of Arithmetic Mean

The arithmetic mean also has a number of demerits. They are:

(i) The arithmetic mean is very much affected by the extreme values. It gives more importance to large item values than smaller ones. For example, the arithmetic mean of the series, 1, 2, 3, 4, 100 is $\frac{110}{5}$ = 21. If we replace the item 100 by another item say '5', then the mean becomes $\frac{1+2+3+4+5}{5}=\frac{15}{5}$ = 3 This shows that the mean is much affected by the item '100' than any other item in the series.

(ii) Arithmetic mean cannot be exactly calculated in case of open-end classes. Because in such cases we estimate (not calculate) the class limits and so also mid-values of the classes.

(iii) The calculation of arithmetic mean is relatively difficult than other measures of central tendencies. It can not be determined by inspection, nor it can be located graphically.

(iv) Arithmetic mean cannot be used to determine the typical values in qualitative information. Because the attributes like talent, beauty, honesty etc. are not quantifiable.

(v) Arithmetic mean may lead to wrong conclusions if the details of data are not given. For example, imagine a person with a height of 5ft. He does not know swimming. He wants to cross a river. The depth of the river in the banks are 2ft each. In the middle it is 8ft. So the mean depth becomes $\frac{2+8+2}{3}$ = 4 ft. If he crosses the river as his height is more than 4ft he will be drowned.

Hence arithmetic mean often misguides the investigator.

Weighted Arithmetic Mean

The arithmetic mean is a very commonly used measures of central tendency. It is considered to be representative, as it is based on all observations in a series. While computing the arithmetic mean we assume that all the items in the distribution are of equal importance. But in practice, we may come across situations where the relative importance of different items in the distribution are different.

For example, if we want to have an idea of the change in cost of living of a certain group of people, then simple average of the prices of the commodities consumed by them shall be improper. Because all the commodities are not equally important, e.g. rice, fuel, housing etc. are more important than tea, cosmetics etc.

In such cases, proper weightage is to be given to various items to make arithmetic mean more representative and meaningful. Here the weightage assigned to each item must be proportional to the importance of the items in the distribution. *The arithmetic mean computed by assigning weightage to different items of the distribution according to their respective importance is called weighted arithmetic mean.*

Let $w_1, w_2, \ldots\ldots w_n$ be the weights attached to variable values $x_1, x_2, \ldots\ldots x_n$ respectively. Then the weighted arithmetic mean, usually denoted by $\bar{X}_w$ is given by:

$$\bar{X}_w = \frac{W_1X_1 + W_2X_2 + \ldots\ldots + W_nX_n}{W_1 + W_2 + \ldots\ldots + W_n}$$

This formula is similar to the formula used to calculate arithmetic mean in the case of frequency distribution, the weights replacing the frequencies.

In case of **discrete series**, if f_1, f_2 ..... fn are the frequencies of the variables x_1, x_2, ... x_n respectively then the weighted arithmetic mean is given by,

$$\bar{X}_w = \frac{w_1(f_1x_1)+w_2(f_2x_2)+.....+w_n(f_nx_n)}{w_1+w_2+.....+w_n}$$

In case of series with class intervals, the mid-values of different classes are taken to be the variables. The formula becomes:

$$\bar{X}_w = \frac{w_1(f_1m_1)+w_2(f_2m_2)+.....+w_n(f_nm_n)}{w_1+w_2+.....+w_n}$$

or, $\bar{X}_w = \frac{\sum w\ (fm)}{\sum w}$, where m's are mid values.

It is to be noted that Mid-value (m) e.g. $m = \frac{l_2 - l_1}{2}$.

Example 5

Comment on the performance of the students in two universities using simple and weighted averages.

University	Utkal		Ravenshaw	
Courses of Study	% of Pass	No. of Students	% of Pass	No. of Students
B.A.	73	500	73	600
B.Com.	74	200	76	700
B.Sc.	65	300	65	300
M.A.	71	300	82	200
M.Com.	83	400	76	300
M.Sc.	66	300	60	700

Answer: Computation of Simple and Weighted Average:

University	Utkal		Ravenshaw		$W_1 X_1$	$W_2 X_2$
Courses of Study	% of Pass	No. of Students	% of Pass	No. of Students		
	x_1	w_1	x_2	w_2		
B.A.	73	500	73	600	36500	43800
B.Com.	74	200	76	700	14800	53200
B.Sc.	65	300	65	300	19500	19500
M.A.	71	300	82	200	21300	16400
M.Com.	83	400	76	300	333200	22800
M.Sc.	66	300	60	700	19800	42000
Total	**432**	**2000**	**432**	**2800**	**145100**	**197700**

University	Simple Average	Weightage Average
Utkal	$\frac{\sum X_1}{6} = \frac{432}{6} = 72$	$\frac{\sum w_1 x_1}{\sum w_1} = \frac{145100}{2000} = 72.55$
Ravenshaw	$\frac{\sum X_2}{6} = \frac{432}{6} = 72$	$\frac{\sum w_2 x_2}{\sum w_2} = \frac{197700}{2800} = 70.61$

On the basis of simple average, the pass percentage of both Universities are same, i.e., 72. But the weighted averages reveal that the average result of Utkal University (72.55) is better than that of the Ravenshaw University (70.61).

7.1.2.2 Median

The median is a positional average. It is the middle most item value in a distribution. It divides an arranged series into two equal parts. The series may be arranged either in ascending or descending order of magnitude. So median is a value which exceeds and is exceeded by same number of observations. According to Professor Connor, "*the median is that value of the variable which divides the group into two equal parts, one part comprising all the values greater and the other all values less than median.*"

Calculation of Median

(A) Simple Series

In simple series, median is the middle most item value after the series is arranged in ascending or descending order of magnitude. The number of observations(n) in the series may be odd or even.

Case - 1 When 'n' is Odd

When 'n' is odd, the median is the value of $\left(\frac{n+1}{2}\right)$th item, after the series is arranged. In such case, first arrange the series in order of magnitude. Locate the $\left(\frac{n+1}{2}\right)$th item. The corresponding item value is the median.

Example 6: Calculate the median age from the following data:

7, 12, 15, 19, 2, 8, 14, 16, 3, 9, 20.

Answer: First we arrange the series in ascending or descending order of magnitude. If we arrange the above series in ascending order, then the series becomes: 2, 3, 7, 8, 9, 12, 15, 15, 16, 19, 20.

Here n = 11

So median will be the value of $\left(\frac{n+1}{2}\right)=\frac{11+1}{2}$ = 6th item

The 6th item value is 12. So the median is 12.

Case-2 When 'n' is even

In case of even number of items, there will be two middle most observations. Here median is the arithmetic mean of the two middle items, after the series is arranged. $\frac{1}{2}\left[\text{value of } \frac{n}{2}\text{th item} + \left(\frac{n}{2}+1\right)\text{th item}\right]$

Example 7: Find the median from the following data:

8, 12, 17, 7, 9, 31, 28, 6, 27, 5.

Answer: First arrange the series. If it is arranged in ascending order of magnitude then the series becomes:

5, 6, 7, 8, 9, 12, 17, 27, 28, 31

Here n = 10

So $\frac{n}{2} = \frac{10}{2} = 5, (5+1) = 6$

Hence the 5th and the 6th are the two middle most items.

∴ Median is the arithmetic mean of the 5th and 6th item.

Thus, median = $\frac{9+12}{2}$ = 10.5

Here median is not the value of any item in the series.

(B) Discrete Series

In discrete series, observations are given with their respective frequencies. Here to find median we need not arrange the distribution. We just compute the cumulative frequency (c.f). Cumulative frequency is found by adding the frequencies one by one. The last of the cumulative frequency must be equal to the sum total of the frequencies (N). This can be used as a check. Then we find the value of $\left(\frac{N+1}{2}\right)$ and adjust it with the cumulative frequency. If $\left(\frac{N+1}{2}\right)$ equals any of the cumulative frequency then the corresponding value is median. If they are not equal, the next higher value in the cumulative frequency is considered. Its corresponding item value is median.

Thus in a discrete series the following steps are taken to find median

Steps

(i) Prepare the less than cumulative frequency.

(ii) Find $\frac{N+1}{2}$, where $N = \sum f$.

(iii) Locate the cumulative frequency just equal to or greater than $\left(\frac{N+1}{2}\right)$.

(iv) The corresponding value of the variable is median.

Example 8 Calculate median of the following distribution:

Size of items	0	1	2	3	4	5	6	7	8
Frequency	1	10	45	120	210	252	210	120	45

Answer: The median is calculated as follows:

Size of Items x	**Frequency f**	**Cumulative Frequency c.f**
0	1	1
1	10	1 + 10 = 11
2	45	11 + 45 = 56
3	120	56 + 120 = 176
4	210	176 + 210 = 386
5	252	386 + 252 = 638
6	210	638 + 210 = 848
7	120	848 + 120 = 968
8	45	968 + 45 = 1013
	$N = \sum f = 1013$	

The median is the size of $\left(\frac{N+1}{2}\right)=\left(\frac{1013+1}{2}\right)$ = 507th item. As we do not have the 507th item in the c.f. coloumn, the next higher item is considered. It is 638. Its corresponding value is 5. Hence the median is 5.

(C) Continuous series

In a continuous series, individual items donot have their identity. So here we locate the 'median class' instead of any exact value. Thereafter we use a formula to find the value of median from the median class. To locate the median class we proceed as follows:

Steps

(i) Prepare the less than cumulative frequency column.

(ii) Find $\frac{N}{2}$, where N = $\sum f$.

(iii) Locate the item just greater than $\frac{N}{2}$ in the cumulative frequency column.

(iv) Its corresponding class is the median class.

Then median is calculated by using the formula:

$$M_d = L_1 + \frac{L_2 - L_1}{f_1} \text{ (m - c)}$$

where M_d stands for median,

L_1 - Lower limit of the median class.

L_2 - Upper limit of the median class.

m = N/2

c = the c.f. of the class just preceding the median class.

The above formula is used to calculate median in a continuous series.

Median is a positional average. To compute median in a continuous series, the classes must be continuous. So if *the data are given in 'inclusive form', then first it must be converted into 'exclusive form' before calculating median.*

Example 9: Calculate median from the following:

Item values	0-10	10-20	20-30	30-40	40-50	50-60
Fequency	14	18	8	20	7	3

Answer: Calculation of median:

Item values	**Frequency**	**Less than cumulative frequency (c.f)**
0 - 10	14	14
10 - 20	18	14 + 18 = 32
20 - 30	8	32 + 8 = 40
30 - 40	20	40 + 20 = 60
40 - 50	7	60 + 7 = 67
50 - 60	3	67 + 3 = 70
	N = $\sum$f = 70	

Here N = 70. So $\frac{N}{2} = \frac{70}{2}$ = 35.

The value just higher than 35 in the c.f. column is 40. Its corresponding class (20 - 30) is the median class.

So, $M_d = L_1 + \frac{L_2 - L_1}{f_1}(m - c)$

$= 20 + \frac{30 - 20}{8}(35 - 32)$

$= 20 + \frac{30}{8} = 20 + 3.75 = 23.75$

$\Rightarrow M_d = 23.75$

D. Graphic Location of Median

Since median is a positional average it can easily be located graphically. The graph used for the purpose is ogive. The steps to be adopted for determination of median with the help of ogive are the following:

(i) The classes should be arranged in ascending order.

(ii) Draw a less than cumulative frequency curve or ogive using the given data.

(iii) Compute N/2 and locate this on the vertical axis, i.e., y-axis.

(iv) Draw a line parallel to the X-axis from this point to intersect the cumulative frequency curve.

(v) From the point of intersection draw a perpendicular to the X-axis.

(vi) The value of the median is read at the point at which the perpendicular touches the X-axis.

Example 10: Compute the median graphically from the following data:

X	0-10	10-20	20-30	30-40	40-50
f	5	7	10	6	2

Solution

The following table is constructed from the data to draw the ogive:

X	f	Less than Item Value	Cumulative Frequency c.f.
0-10	5	Less than 10	5
10-20	7	Less than 20	12
20-30	10	Less than 30	22
30-40	6	Less than 40	28
40-50	2	Less than 50	30
	$N = \sum f = 30$		

In the X-axis item values are plotted. In the Y-axis culumative frequencies are plotted. Median item is N/2th item or 30/2 = 15th item.

This is located in the Y-axis. At this point a line is a drawn parallel to x-axis. It intersects the ogive at point A. From A another perpendicular is drawn on the horizontal axis. The point where it intersects X-axis is B. The median value is now measured on the x axis. Here, median is OB, i.e., 23.

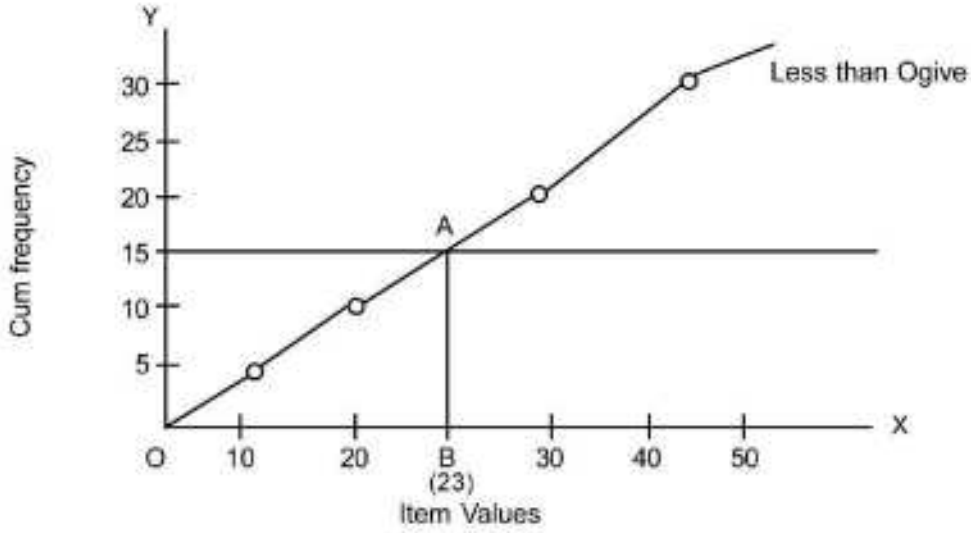


Fig. 7.1

Median can also be located from the 'more than ogive' curve. The procedure of location in such case is exactly similar to the location of median from the 'less than ogive' curve. Besides, median can also be located by drawing both the 'less than ogive' and 'more than ogive' curves. Both the curves intersect corresponding to median value. So in such case first the point of intersection is located. From that point draw a perpendicular to the x-axis - measuring the item values. The corresponding item value is median. This has been shown in the following figure no. 7.2.

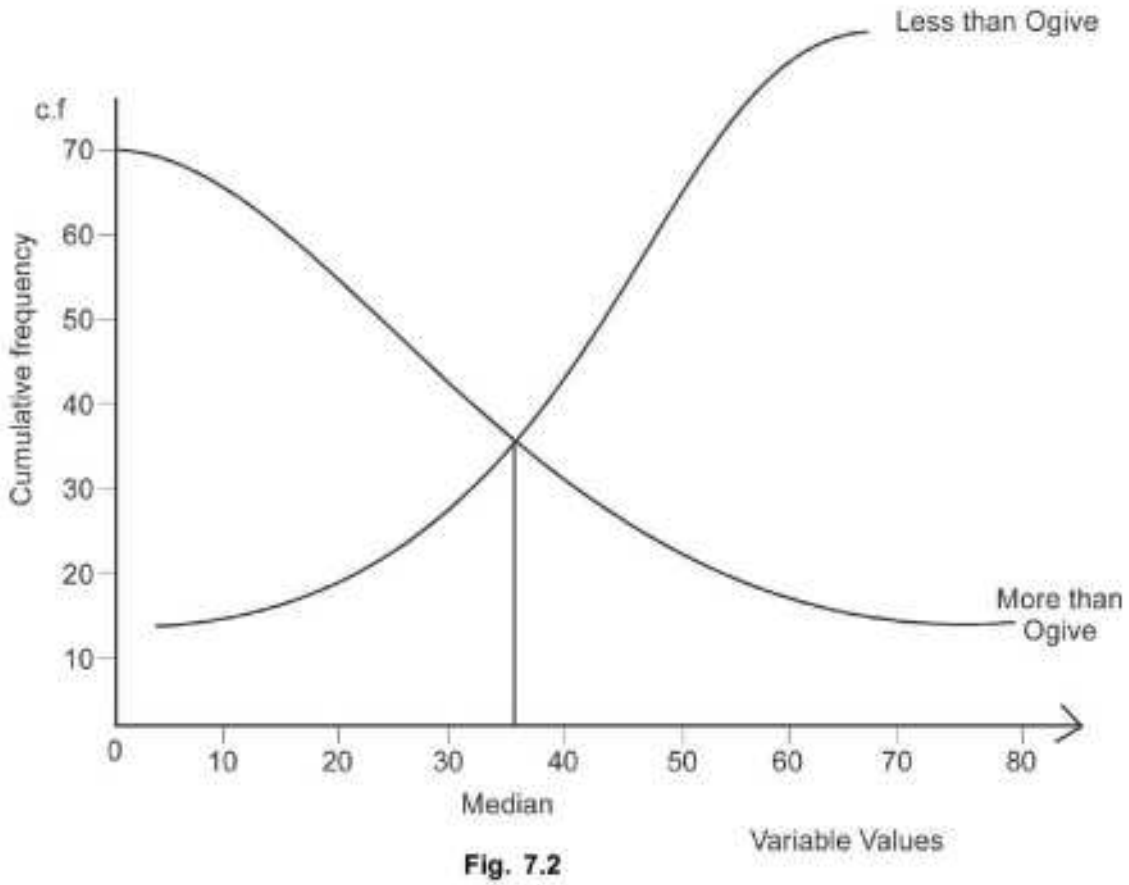


Fig. 7.2

Advantages of Median

As a measure of central tendency, median has certain advantages. Some of the important advantages are:

(i) Median is very simple to understand and easy to calculate. In some cases it can be located just by inspection.

(ii) In grouped frequency distribution it can be graphically located by drawing ogives.

(iii) Since median lies at the middle part of the series, it is not at all affected by the extreme values.

(iv) Median is the special average used in qualitative phenomena, such as determination average talent, average beauty etc. Because these attributes cannot be quantified. They can only be ranked. So other measures of central tendency are not used in such cases.

Disadvantages of Median

In spite of all the above advantages, median has a number of disadvantages as noted below:

(i) In a simple series, the item values have to be arranged. If the series contains large number of items, then the process becomes tedius and time-consuming.

(ii) Median is a relatively less representative average. Because it does not depend on all items in the series.

(iii) There is a general controversy whether $\left(\frac{N}{2}\right)^{th}$ or $\left(\frac{N+1}{2}\right)^{th}$ item should be considered to determine median. Besides in simple series containing even number of items, median cannot be exactly found. Hence median is not rigidly defined. Sometimes it is ill-defined.

(iv) Median is a less stable measure of central tendency. Because it is very much affected by fluctuations in sampling.

(v) Median is not capable of further mathematical treatment.

Uses

As a measure of central tendency, median has some special uses. It is the only average to deal with subjective phenomena. The characteristics like talent, beauty, honesty etc. cannot be expressed in quantitive terms. But they can be arranged in order of proficiency. The middle ranked value is the median in such cases.

Partition Values

The values that divide a series into different equal parts are called '*partition values*'. Median is a partition value as it divides the series into two equal parts. We have one median in a series.

Similarly other partition values of common use are '*Quartiles*', '*Deciles*' and '*Percentiles*'.

Quartiles are values which divide the series into four equal parts. Thus we have three quartiles. Each *quartile* covers one-fourth of the series.

If Q_1, Q_2 and Q_3 be the three quartiles, then, Q_1 covers 1/4th of observations in the series. Q_2 is the median. Q_3 covers 3/4th of observations in the series.

The method of locating the quartiles is similar to that used for finding median. For example in continuous series, we first locate the classes where the quartiles lie. Thus for Q_1, we first find the cumulative frequency, and then determine $\frac{N}{4}$. Thereafter, we locate the item just higher than $\frac{N}{4}$ in the cumulative frequency column. The corresponding class contains Q_1. Q_1 is found by using the formula:

$$\mathbf{Q_1 = L_1 + \frac{L_2 - L_1}{f_1}} \text{ (m - c)}$$

Here $m = \frac{N}{4}$. Other notations have their usual meaning.

Similarly for Q_3, we locate the item in the cumulative frequency column just higher than $\frac{3N}{4}$. The corresponding class contains Q_3.

Here $\mathbf{Q_3 = L_1 + \frac{L_2 - L_1}{f_1}}$ (m - c),

where $m = \frac{3N}{4}$

Deciles are the partition values that divide the series into *ten equal parts*. So we have nine deciles. Each decile covers one-tenth of observations in the distribution.

Similarly, percentiles are the partition values that divide the series into *100 equal parts*. As such we have *ninty nine* percentiles. Each percentile covers one-hundredth of the distribution.

Obviously, the median value concides with the *2nd quantile, 5th decile and 50th percentile*. Because all of these partition values divide the series into two equal parts.

The calculation of quartiles, deciles and percentiles are exactly similar to that of calculation of median.

7.1.2.3 Mode

Mode is a positional average. It is the item value which occurs maximum number of times in a distribution. Thus mode is the most common value in a distribution. It is the value that occurs most frequently in a distribution. So mode is considered to be the most frequently occurred item of the distribution.

Calculation of Mode

(A) Simple Series

In a simple series mode can be easily located. The item occuring maximum number of times is the mode. For example, in the series of item values 22, 20, 23, 24, 19, 23, 21, 22, 20 and 22, the mode is 22. Because the item '22' occurs maximum number of times.

However in a series, if all items occur once, we cannot find mode. For example, the series of items 60, 56, 74, 82, 85 and 90 doesnot have a mode. Because all the items occur only once.

(B) Discrete Series

In a discrete frequency distribution mode can also be located by inspection. Here mode is the value having highest frequency.

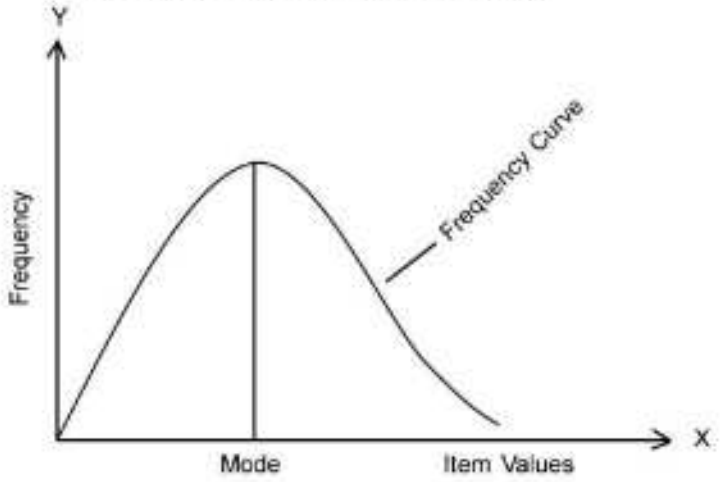
Example 11: Calculate mode of the following series:

x :	1	2	3	4	5	6	7
f :	5	8	12	18	16	11	9

Answer: This is a unimodal distribution. Because the highest frequency (18) corresponds to a single item. The corresponding item-value is the mode. So here mode = 4.

Mode can be located graphically in discrete series by drawing the frequency curve. The value corresponding to the highest point (peak) of the frequency curve is mode.

(Graphic Determination of Mode)



To determine mode graphically, draw a perpendicular from the peak of the frequency curve. The corresponding value of the variable is mode.

(C) Continuous Series

To calculate mode in a continuous series, first we locate the modal class. The class corresponding to highest frequency is called the modal class. This is found by just inspecting the frequencies. Then mode is calculated by using the formula:

$$M_0 = L_1 + \frac{f_1 - f_0}{2f_1 - f_0 - f_2}(L_2 - L_1)$$

Where, M_0 stands for mode.

L_1 - Lower limit of the modal class.

L_2 - Upper limit of the modal class.

f_1 - frequency of the modal class.

f_0 - frequency of the class just preceeding the modal class.

f_2 - frequency of the class just succeeding the modal class.

Like median, mode is also a positional average. For calculating mode in continuous series we assume the following:

1. The class should be continuous. So if data are given *in 'inclusive form' they should be converted into 'exclusive form' before locating the modal class.*
2. The class intervals must be uniform throughout. In case of unequal classes, the intervals must be made equal. This is done by 'interpolation'. Here we assume that the frequencies are uniformly distributed over all the classes. We equalise the intervals of all classes by suitably dividing the frequency.

Example 12: Locate the modal class in case of the following frequency distribution.

Class	Frequency
0 - 10	15
10 - 30	40
30 - 40	25
40 - 70	30
70 - 80	08

Answer: Here the class intervals are not equal. So the class 10-30 corresponding to maximum frequency (40) is not the modal class. To locate the modal class, we have

to re-arrange the classes. Here the classes can be rearranged so that each class will have an interval of '10'.

We need to re-arrange the 2nd and the 4th class. The 2nd class (10-30) have an interval 20 with frequency 40. We can form 2 classes from this, viz (10 - 20) and (20 - 30). Each will have frequency equal to 40 ✚ 2 = 20. Similarly the 4th class (40 - 70) can be split into three classes such as (40 - 50), (50 - 60) and (60 - 70), each with a frequency 30 - 3 = 10. Now the distribution becomes:

Class	Frequency
0 - 10	15
10 - 20	20
20 - 30	20
30 - 40	25
40 - 50	10
50 - 60	10
60 - 70	10
70 - 80	8

Clearly the modal class, corresponding to the highest frequency (25) is 30 - 40.

3. In frequency distributions (both discrete and continuous) the mode or the modal class is located by inspection, if:

(a) The maximum frequency in the series does not repeat.

(b) The highest frequency occurs at the middle portion of the distribution, and

(c) The distribution is regular, In other words the corresponding curve is a smooth curve.

Example 13: Calculate mode of the following series.

Class :	0-10	10-20	20-30	30-40	40-50	50-60
Frequency:	15	18	20	25	22	12

Answer: First we locate the modal class, corresponding to highest frequency.

Class	Frequency
0 - 10	15
10 - 20	18
20 - 30	20
30 - 40	25
40 - 50	10
50 - 60	10

Here the class corresponding to the highest frequency is (30-40). So this is the modal class.

$$\text{Now, } M_0 = L_1 + \frac{f_1 - f_0}{2f_1 - f_0 - f_2}(L_2 - L_1)$$

$$= 30 + \frac{25 - 20}{2 \times 25 - 20 - 22}(40 - 30)$$

$$= 30 + \frac{5 \times 10}{50 - 42} = 30 + \frac{50}{8} = 30 + 6.25$$

Mo = 36.25

Advantages of Mode

As a measure of location, mode has the following advantages:

(i) Mode is very simple to understand.

(ii) Mode can be easily calculated. In most cases it can be located by mere inspection. It can also be estimated graphically from histograms.

(iii) In a continuous series, mode can be calculated even if all the item values are not given. Only the modal class and the frequencies of its adjoining classes are required to compute mode.

(iv) Mode is not at all affected by the extreme values.

(v) Mode can be correctly calculated in open-end classes.

Disadvantages of Mode

Mode as a measure of central tendency has a number of disadvantages as noted below.

(i) Mode is ill-defined. It is not rigidly defined if

(a) The maximum frequency repeats. Such distribution becomes bi-modal or multi modal.

(b) If the maximum frequency occurs at the beginning or at the end of the distribution.

(c) If the distribution is irregular.

In such cases mode is computed by applying the methods of grouping. (Method of grouping is beyond the scope of the book)

(ii) Mode is not a representative average. It is not based on all the items in the distribution. In case the maximum frequency repeats, mode is estimated from the median and mean of the distribution. Empirically, mode is related with mean and median as

Mode = 3 Median - 2 Mean.

(iii) Mode is not capable of further mathematical treatment.

(iv) Mode is not a stable measure of central tendency. It is very much affected by the fluctuations in sampling.

Uses

Mode is the most typical item in a distribution. It has got a number of special uses. It is used in finding the most popular size in studies relating to marketing, trade and business. Mode is the appropriate average used in business forecasting. for example, in producing shoes, or ready-made garments etc.

7.1.2.4 Geometric mean

Geometric mean, usually abbreviated as Gm is a mathematical average. For a set of observations, the Gm is the n^{th} root of their products. So, if X_1, X_2, X_3 ..... Xn are given 'n' observations than their Gm is given by

$$Gm = \sqrt[n]{X_1, X_2, X_3 \ldots\ldots Xn} = (X_1, X_2, X_3 \ldots\ldots Xn)^{\frac{1}{n}} \text{ or } Gm = \text{Antilog}\left[\frac{\sum \log^X}{n}\right]$$

If n=2, i.e., if we are dealing with two observations only than Gm can be computed by taking the square root of their product. For example, Gm of 4 and 25 is $\sqrt{4 \times 25} = \sqrt{100} = 10$. In case of **discrete series**, where item values are given alongwith their respective frequencies, then Gm is calculated as shown below.

Let the discrete series be.

Items	Frequencies
x_1	f_1
x_2	f_2
.	.
.	.
.	.
x_n	f_n

Here Gm is calculated by using the formulae.

$$Gm = \left[x_1^{f_1}, x_2^{f_2}, x_3^{f_3} \ldots\ldots x_n^{f_n}\right]^{\frac{1}{N}} \text{ where } N = \sum f. \text{ or } Gm \text{ - Antilog}\left[\frac{\sum f \log^X}{N}\right]$$

In case of series with classinternals. First the mid-values of different classes are determined. Then the series reduces to a discrete series and then Gm is calculated by applying the above formulae.

Merits of Gm

The followings are some of the merits of Gm.

(i) It is rigidly defined as it is calculated by using a definite formulae.

(ii) It is representative as it is based on all observation in a series.

(iii) Gm is capable of further mathematical treatment.

(iv) Unlike arithmetic mean which has a bias for higher values in the series, Gm has bias for smaller observation. So Gm is is useful in phenomenon (such as prices) which has a lower limit (> 0) but has no upper limit.

(v) Compared to arithmetic mean, Gm is less affected by extreme values.

(vi) Gm is not much affected by fluctuation is sampling.

Dmerits of Gm

(i) Computation of Gm is purely mathematical. So it is neither simple to understand nor easy to calculate for a non-mathematical person.

(ii) If any one of the observations in a series is zero, the Gm of the series becomes zero. If any one item is negative then the Gm becomes imaginary, irrespective of the magnitude of other items.

(iii) Gm can not be located graphically like the positional averages.

Uses of Geometric mean

Gm, like other averages has certain specific uses. It is specially useful in averaging ratios, percentages and rates of charges of a phenomenon between two periods. Fro example, Gm is the appropriate average to be used for computing the average rate of growth of population, or average increase in the rate of profits, sales, productions etc. For this Gm is the special average used in the construction of index numbers. Besides this, while dealing with data relating to economic and social science, we may come accross situations where it is desired to give more weightage to smaller items and small weightage to larger items. Gm is the most appropriate average to be used in such cases.

7.1.2.5 Harmonic mean

Harmonic mean, usually abbreviated as Hm. is a mathematical measures of

central tendency. Hm. is the raciprocal of the arithmetic mean of the raciprocals of the given observations. For example the Hm. of two observations x and y is

$$Hm = \frac{1}{\frac{1}{2}\left(\frac{1}{x}+\frac{1}{y}\right)} = \frac{2xy}{x+y}$$

For 'n' observations $x_1, x_2 \ldots\ldots\ldots x_n$ the Harmonic mean is given by

$$Hm = \frac{1}{\frac{1}{n}\left(\frac{1}{x_1}+\frac{1}{x_2}+\ldots\ldots+\frac{1}{x_n}\right)} = \frac{1}{\frac{1}{n}\sum\left(\frac{1}{x}\right)} = \frac{n}{\sum\left(\frac{1}{x}\right)}$$

In case of frequency distribution the Hm is calculated as follows. Let the descrete series be given as

Items	Frequencies
x_1	f_1
x_2	f_2
.	.
.	.
.	.
x_n	f_n

Here $Hm = \frac{1}{\frac{1}{N}\left(\frac{f_1}{x_1}+\frac{f_2}{x_2}+\ldots\ldots+\frac{f_n}{x_n}\right)}$

$$= \frac{1}{\frac{1}{N}\sum\left(\frac{f}{x}\right)}$$

Or, $Hm = \frac{N}{\sum\left(\frac{f}{x}\right)}$ Where $N = \sum f$.

In case of grouped frequency distribution, 'x' is the mid-value of the class and 'f' is the corresponding frequency of x.

Merits of Harmonic mean

(i) HM like other mathematical is rigidly defined.

(ii) It is a representative measure as it is based on all observations of the distribution.

(iii) Hm is capable of further mathematical treatment.

(iv) Since here the raciprexals of the values of the variable are involved, it gives greater weightage to smaller observations and vice-versa.

(v) Hm is less affected by fluctuations in sampling.

Demerits of Harmonic mean

(i) The computation of Hm is not easy and it is not simple to understand as it involves the raciprocals.

(ii) Like arithmetic mean, harmonic mean can not be calculated if any item is missing.

(iii) Hm, like other mathematical measures can not be graphically located.

Uses

Harmonic mean is specially useful in averaging rates and ratios where the time factor is variable and the act being performed is constant. For example in calculating the average speed where distance is constant and time-taken is variable, the Hm is used.

Relation among Am, Gm and Hm

The Arithmetic mean (Am), Geometric mean (Gm and Harmonic mean (Hm) of a series of 'n' observations are connected by the reaction.

$Am \geq Gm \geq Hm$ – (i)

The sign of equality holds when all the 'n' observations are equal. For two positive real number $AM \times HM = (Gm)^2$ – (ii)

Proof : Let $a > 0$ and $b > 0$ be two positve real numbers.

Then, $Am = \frac{a+b}{2}$, $Gm = \sqrt{ab}$ and $Hm = \frac{2ab}{a+b}$

Now, $Am - G = \frac{a+b}{2} - \sqrt{ab}$

$$= \frac{a+b-2\sqrt{ab}}{2}$$

$$= \frac{1}{2}\left(\sqrt{a}-\sqrt{b}\right)^2 \geq 0$$

because the squares are always positive.

Hence $Am \geq Gm$ – (i)

For number $\frac{1}{a}$ and $\frac{1}{b}$, since $Am \geq Gm$,

We have, $\frac{1}{2}\left(\frac{1}{a}+\frac{1}{b}\right) \geq \left(\frac{1}{a}.\frac{1}{b}\right)^{1/2}$

or, $\frac{a+b}{2ab} \geq \frac{1}{\sqrt{ab}}$

or, $\sqrt{ab} \geq \frac{2ab}{a+b}$

i.e., $Gm \geq Hm$ ... (ii)

From (i) and (ii) it follows $Am \geq Gm \geq Hm$.

Now, $Am \times Hm = (Gm)^2$

Selection of the ideal measures of central tendency

Since we have five measures of central tendencies, it is imperative to have their relative evaluation in order to determine the ideal measure. We have discussed the characteristics of an ideal measures of cerntral tendency. Therefore that particular measure which fulfills all or majority of the requisites shall be considered as the best average.

In the preceding sections we have discussed the merits and demerits of various measures of central tendencies. It is seen that all the measures have certain merits as well as demerits. Besides, no single average is suitable for all practical puposes. Each has its own field of importance. For example, arithmetic mean is not suitable while dealing with serises having extreme values or incase of open and classes. Median and mode are the averages to be used in case of open end classes. In case of qualitative data like beauty, honesty, intelligence etc. median is the only average to be used. Mode is specially used to determine the most common item in a distribution and useful in business activiies. Similarly, while dealing with rates and ratios Geometric mean is used. Harmonic mean is used in computing special type of averages where time factor is a variable. Hence the averages can not be used indiscrimnately.

For sound statistical analysis and interpretation a judicious selection of the average is essential the slelection of the average for the analysis in general depends upon-

(i) The purpose an the enquiry.

(ii) The nature and availability of data.

(iii) The basis of classification and tabulation adopted.

(iv) The use of the average for further statistical analysis.

Considering abve facts and comparing the merits and demerits of different measures of central tendencies, it is relevent to consider arithmetic mean to be the ideal measure. This is primarily because, arithmetic mean fulfills almost all requisites of an ideal measure of central tendency. Besides this the arithmetic mean its the commonly used average and has wider applications in statistical analysis compared to other measures. Hence for all practical purposes, arithmetic mean can be considered as the ideal measure of cnetral tendency.

However it should be understood that choosing an appropriate average forms the begining of any statistical analysis it is not an end to data analysis much more still

remains. One has to study other statistical measures such as disperson, skewness and kurtosis of the distribution besides the measures of central tendency to make an indepth analysis of statistical data.

7.2 MEASURES OF DISPERSION

Introduction

Measures of central tendency are *'averages of first order'*. In many cases, the calculated average does not coincide with any item in the series. So averages alone cannot adequately describe a set of observations, unless all the observations are equal. In otherwords averages fail to reveal all the peculiarities of a series. They just give a bird's eye-view about the distribution. It does not tell anything regarding the distribution of items in the series. For example in series I, II and III arethmetic mean, Median are same but they are different.

Series I	Series II	Series III
1000	600	0
1000	800	500
1000	1000	1000
1000	1200	1500
1000	1400	2000

Therefore, besides the measures of central tendency we ought to know something about the internal variability of data. That will give us a better idea about the distribution. Such additional information regarding the variability of data are given by the '*measures of dispersion*.'

7.2.1 Meaning and Definition of Dispersion

Dispersion is a very commonly used term in statistics. It means *scatterness, variation, deviation, spread or variability of* data. Dispersion also denotes the degree

of heterogeneity or lack of uniformity of statistical data. According to Spiegel, "*the degree to which numerical data tend to spread about an average value is called the variation or dispersion of the data.*" Thus dispersion studies the variability or the scatteredness of data from an average value.

Measures of dispersion are called "*averages of second order*". It is an average of the differences of all items of a series from an average of those items. In other words, it studies by how much different items in a series are scattered around a measure of central tendency.

We study measures of dispersion mainly for three purposes:

1. To examine the reliability of an average.
2. To compare variability among different series.
3. To facilitate the use of other statistical measures.

7.2.2 Absolute and Relative Measures of Dispersion

Measures of dispersion may be absolute or relative. Absolute measures of dispersion measure the extent of dispersion of the item values from a measure of central tendency. They are expressed in terms of original units in the series. These measures only give idea about dispersion with reference to a given measure of central tendency. So they are not suitable for comparing variability among distributions.

Relative measures of dispersion are known as '*coefficients of dispersion*'. They are obtained as ratios or percentages. They are pure numbers, independent of the units of measurement. Variability or dispersion among different distributions are compared by these relative measures.

Characteristics of an Ideal Measure of Dispersion

Like an ideal average, a good measures of dispersion should posses certain requisites. The important requisites are:

(i) It should be rigidly defined.

(ii) It should be simple to understand and easy to calculate.

(iii) It should be representative. In other words it should be based on all observations in the series.

(iv) It should be capable of further algebraic manipulations.

(v) It should be stable. It should be least affected by fluctuations in sampling.

(vi) It should not be unduly affected by the extreme values.

Various Measures of Dispersion (Absolute and Relative)

There are five commonly used absolute measures of dispersion.

They are:

1. Range
2. Semi Inter-quartile range or Quartile deviation
3. Mean deviation
4. Standard deviation and
5. Lorenz curve

Coefficients of these are the relative measures of dispersion.

From these, the first four are mathematical measures and the Lorenze Curve is a graphical measure of dispersion.

7.2.3 Range

The range is the simplest of all measures of dispersion. It is defined as the difference between the two extreme item values in a series. If the items in a series are arranged in order of magnitude, then the difference between the highest value (H) and the lowest value (L) defines its range. In symbols,

$$R = H - L. \text{ or } R = X_{max} - X_{min}$$

In case of frequency distribution, the frequencies are immaterial. Range is concerned with the item values. For grouped frequency distribution, range is the difference between the upper limit of the last class and the lower limit of the first class.

Coefficient of Range

Range is an absolute measure of dispersion. To compare the variability between different distributions we cannot use it. In such case we use the relative measure of dispersion based on range. It is called the '*coefficient of range*'.

$$\text{Coefficient of range} = \frac{H-L}{H+L}$$

Obviously the coefficient of range is always ≤ 1.

Merits

The important advantages of range as a measure of dispersion are the following:

(i) Range is rigidly defined.

(ii) It is simple to understand and easy to calculate. Range of a series can be found by mere inspection.

(iii) Range of a series can be calculated from its extreme values only. So we donot need the details of the series to find range.

Demerits

However range is not an ideal measure of dispersion. Its drawbacks are:

(i) Range is not representative. Because it is not based on all the observations in the series. Hence range is not a reliable measure of dispersion.

(ii) It is not a stable measure of dispersion. It is very much affected by the fluctuations in sampling.

(iii) Range is not capable of further algebraic treatment.

(iv) In case of open-end classes, range cannot be exactly determined.

(v) Range does not measure deviations from any measure of central tendency. So in the strict sense, range is not a measure of dispersion.

Uses

Inspite of above limitations, range has certain special uses.

(i) It is used when data have small variations. For example, to study stock market fluctuations, variations in the exchanges rates etc. range is used.

(ii) In certain fields like statistical quality control of industrial products range is used to measure variations.

(iii) Range is commonly used in weather forecasting and also to determine the maximum and minimum temperature etc.

Example 1: Given the marks secured by 6 students in a subject, determine the range.

Marks: 63, 45, 55, 43, 66, 34

Answer: The series of marks when arranged in ascending order of magnitude, becomes:

34, 43, 45, 55, 63, 66

Here the highest item value (H) is 66. The lowest item value (L) is 34.

So, R = H - L = 66 - 34 = 22 marks.

Example 2: Calculate range and the coefficient of range for the following series:

Wages (in Rs.):	5-10	10-15	15-20	20-25
Number of labourers:	9	7	25	10

Answer: In frequency distributions, frequencies do not affect range. In the above series,

the lower limit of the first class (L) = Rs. 5 and

the upper limit of the last class (H) = Rs. 25

So R = H - L = Rs. (25 - 5) = Rs. 20

The coefficient or Range = $\frac{H-L}{H+L} = \frac{20}{25+5} = \frac{20}{30} = \frac{2}{3}$

7.2.4 Quartile Deviation (Semi-Inter-Quartile Range)

The Inter-quartile range is an improved measure of dispersion. It is the difference between the two extreme quartiles. If Q_3 be the upper quartile and Q_1 be the lower quartile in a series, then inter quartile range is $\mathbf{Q_3 - Q_1}$. Since 'Q_3' covers 75% of the items and 'Q_1' covers 25% of the items, $Q_3 - Q_1$ covers the middle 50% of the item values.

The quartile deviation (Q.D) or semi-inter-quartile range is half of the inter quartile range. In symbols,

$$\textbf{Q.D.} = \frac{\mathbf{Q_3 - Q_1}}{\mathbf{2}}$$

Co-efficient of Quartile Deviation

Quartile deviation is an absolute measure of dispersion. The relative measure of dispersion based on quartile deviation is called Coefficient of Quartile Deviation. It is used to compare the variability of two or more distributions.

$$\text{The coefficient of Q.D.} = \frac{\frac{Q_3 - Q_1}{2}}{\frac{Q_3 + Q_1}{2}} = \frac{\mathbf{Q_3 - Q_1}}{\mathbf{Q_3 + Q_1}}$$

The coefficient of Q.D. is always ≤ 1.

Merits of Quartile Deviation

Quartile deviation is more reliable as a measure of dispersion than range. Its merits are:

(i) It is simple to understand and easy to compute.

(ii) It is not affected by the extreme values.

(iii) It is more representative than range. Because it takes into account at least 50% of the observations.

(iv) It is the only method of dispersion calculated incase of '*open-end classes*'.

Demerits

The quartile deviation has the following demerits.

(i) Since quartile deviation is based on quartiles, sometimes it is not rigidly defined.

(ii) It does not take into account all the observations in the series. So it is not representative.

(iii) It is not capable of further mathematical treatment.

(iv) It is not a stable measure of dispersion. It is very much affected by fluctuations in sampling.

Example 3: Find the value of quartile deviation and its coefficient from the following data:

Roll number	:	1	2	3	4	5	6	7
Marks	:	20	28	40	12	30	15	50

Answer: Q.D. = $\frac{Q_3 - Q_1}{2}$

To calculate quartiles, the marks should be arranged. If we arrange the marks in ascending order of magnitude then the series becomes:

12, 15, 20, 28, 30, 40, 50

Q_1 = Size of $\left(\frac{n+1}{4}\right)^{th} = \left(\frac{7+1}{4}\right)$ = 2nd item.

The second item is 15. So Q_1 = 15 marks.

Q_3 = size of $3\left(\frac{n+1}{4}\right)^{th} = 3\left(\frac{7+1}{4}\right)$ = 6th item.

The 6th item is 40. So Q_3 = 40 marks.

Now Q.D = $\frac{Q_3 - Q_1}{2} = \frac{40-15}{2}$ = 12.5 marks.

The coefficient of Q.D. = $\frac{Q_3 - Q_1}{Q_3 + Q_1} = \frac{40-15}{40+15} = \frac{25}{55} = 0.45$

Example 4: Compute the coefficient of Quartile deviation from the following data.

Marks	:	10	20	30	40	50	60
Numbers of students	:	4	7	15	8	7	2

Answer: This is a discrete series. So to calculate quartiles, the cumulative frequency is found.

Marks	Frequency (f)	Less than c.f.
10	4	4
20	7	7 + 4 = 11
30	15	15 + 11 = 26
40	8	8 + 26 = 34
50	7	7 + 34 = 41
60	2	2 + 41 = 43

Here $N = \sum f = 43$

Q_1 = size of $\left(\frac{N+1}{4}\right)^{th} = \left(\frac{43+1}{4}\right) = 11^{th}$ item.

The item corresponding to the cumulative frequency (11) is 20. So $Q_1 = 20$.

Q_3 = size of $\left(\frac{N+1}{4}\right)^{th} = 3 \times \frac{44}{3} = 33$rd item.

In the cumulative frequency column we do not have 33. So the next higher item (34) is considered. Its corresponding item value is Q_3. So $Q_3 = 40$

Now Q.D. = $\frac{Q_3 - Q_1}{2} = \frac{40-20}{2} = 10$

Coefficient of Q.D. = $\frac{Q_3 - Q_1}{Q_3 + Q_1} = \frac{40-20}{40+20} = \frac{20}{60} = 3.3$

Example - 5 Calculate an approipriate measure of dispersion and its coefficient for the following series:

Income (in Rs.):	Less than 50	50-60	60-70	70-80	80-90	90 and above
Number of Persons:	25	34	30	28	23	10

Answer: We are given a distribution with open end classes. So the appropriate measure of dispersion is quartile deviation.

Calculation of quartile deviation

Income (in Rs.)	No. of Persons f	Less than c.f
Less than 50	25	25
50-60	34	34 + 25 = 59
60-70	30	59 + 30 = 89
70-80	28	89 + 28 = 117
80-90	23	117 + 23 = 140
Above 90	10	140 + 10 = 150
	$\sum f = 150$	

Q.D. = $\frac{Q_3 - Q_1}{2}$ Here N = $\sum f$ = 150

Calculation of Q_1 : Q_1 covers $\frac{N}{4}$ items

$\frac{N}{4} = \frac{150}{4}$ = 37.5

The value just higher than 37.5 in the c.f. column is 59.

So the corresponding class (50 - 60) contains Q_1.

$Q_1 = L_1 + \frac{L_2 - L_1}{f_1}(m - c)$, where $m = \frac{N}{4}$

$= 50 + \frac{10}{34}(37.5 - 25) = 50 + \frac{125}{34}$

= 53.67 (approx).

Calculation of Q_3:

Q_3 covers $\frac{3N}{4}$ items.

$\frac{3N}{4} = \frac{3 \times 150}{4}$ = 112.5

The value just higher than 112.5 in the c.f. column is 117. So the corresponding class (70 - 80) contains Q_3.

$$\therefore Q_3 = L_1 + \frac{L_2 - L_1}{f_1} (m - c) \text{ here } m = \frac{3N}{4} = 112.5$$

$$= 70 + \frac{10}{28} (112.5 - 89)$$

$$= 78.39 \text{ (approx)}$$

$$\text{Now Q.D.} = \frac{Q_3 - Q_1}{2} = \frac{78.39 - 53.67}{2} = 12.36$$

$$\text{The coefficient of Q.D} = \frac{Q_3 - Q_1}{Q_3 + Q_1} = \frac{24.72}{132.06} = 0.19$$

7.2.5 MEAN DEVIATION (AVERAGE DEVIATION)

Range and quartile deviation are not considered as measures of dispersion in the true sense of the term. Because they are neither ased on all items nor they show scatterness from the average value. In this context mean deviation is considered as a better measure of dispersion.

Mean deviation is the average deviation of the item values from a measure of central tendency. The deviations are taken either from mean, median or mode. While calculating the deviations we ignore the algebraic signs. In other words we consider the absolute values of the deviations. Absolute values are called *modulus* values. For example, if we take the deviation (D) of values (X) from the arithmetic mean ($\overline{X}$), then the absolute deviation becomes $|D| = |X - \overline{X}|$. ($|D|$ is the modulus or absolute value of the deviation. It ignores the algebraic sign for example, $|-5| = |5| = 5$).

Thus mean deviation is defined as *the arithmetic mean of the absolute deviations of item values taken either from mean, or from median or from mode.*

Here we ignore the negative sign while computing the deviations. Because, we know the algebraic sum of deviations of values taken from mean is equal to zero and arithmetic mean is the widely used and most popular measure of central tendency.

Calculation of Mean Deviation

(A) Simple Series

In a simple series consisting of 'n' observations x_1, x_2 .... x_n, the mean deviation is defined as,

$$\textbf{M.D} = \frac{\mathbf{1}}{\mathbf{n}}\boldsymbol{\Sigma} \textbf{|D|}$$

Where | D | is the absolute devition of items from the arithmetic mean (x), or from median (Md) or from mode (M_0) of the series.

To compute mean deviation from mean, the deviations are taken from mean, i.e. $D = X - \overline{X}$

So mean deviation from mean is $M.D_X = \frac{1}{n} \Sigma \mid D \mid$

where $D = X - \overline{X}$

Similarly mean deviation from median is

$$M.D_{MD} = \frac{1}{n} \Sigma |D|$$

where D = X - Md.

and mean deviation from mode is

$$M.D_{MD} = \frac{1}{n} \Sigma |D|,$$

where $D = X - M_0$.

Thus to find mean deviation in simple series, the steps are -

Steps

(i) Find the average from which M.D. will be calculated.

(ii) Find the sum of the absolute deviations of values from the selected measures of central tendency. That gives |D|.

(iii) Divide $\sum |D|$ if by the number of observations in the series to find the mean deviation.

(B) Discrete Series

In discrete series, the formula for calculating mean deviation is **M.D.** = $\frac{\sum f|D|}{N}$

Where |D| is the absolute values of deviations of items taken from mean, median or mode.

N = $\sum f$, the sum of the frequencies.

For example, the mean deviation from arithmetic mean is calculated in the following steps:

Steps

(i) Find the mean ($\bar{X}$) of the distribution.

(ii) Find the deviation of the item values from X, ignoring the algebraic sign. That gives $| D | = | X - \bar{X} |$.

(iii) Multiply the absolute deviations with the corresponding frequency and add. That gives $\sum f | D |$.

(iv) Divide it with the sum of the frequency (N) to get the mean deviation from mean.

Similarly, the mean deviation from median or mode can be computed.

(C) Continuous Series

The procedure to calculate mean deviation in a continuous series is exactly same as that in a discrete series. The only difference is, here we have to calculate the mid-values of various classes. Here deviations are taken from these mid-values.

The formula for calculation is same as in discrete series, i.e.,

$$\textbf{M.D.} = \frac{\sum f|D|}{N}$$

Co-efficient of Mean Deviation

The relative measure of dispersion based on mean deviation is found from its coefficients. The coefficient of mean deviation is defined as the ratio of the mean deviation to the measure of central tendency from which it is calculated. For example-

$$\text{The coefficient of mean deviation from mean} = \frac{\textbf{Mean deviation}}{\textbf{Mean}}$$

$$\text{The coefficient of mean deviation from median} = \frac{\textbf{Mean deviation}}{\textbf{Median}}$$

$$\text{The coefficient of mean deviation from mode} = \frac{\textbf{Mean deviation}}{\textbf{Mode}}$$

To compare the variability of different distributions we use the coefficient of mean deviation.

Merits of Mean Deviation

Range and quartile deviation are not based on all the observations in a series. Besides they do not show the dispersion of the item values from any measure of central tendency. So range and quartile deviation completely ignore the composition of the series. Mean deviation overcomes all these shortcomings. Some of the important merits of mean deviation are -

(i) Mean deviation is rigidly defined.

(ii) It is simple to understand and easy to calculate.

(iii) It is representative. Because it is based on all the observations in the series.

(iv) It can be calculated from mean, median or mode. So it is more flexible as a measure of dispersion.

(v) Mean deviation is less affected by the extreme values.

Demerits

The following are some limitations of mean deviation -

(i) Mean deviation is mathematically unsound and illogical. Because it ignores the algebraic signs while calculating the deviations.

(ii) It is not capable of further mathematical treatment.

(iii) Mean deviation from mean cannot be exactly calculated incase of open-end classes.

Uses

In spite of the above drawbacks, mean deviation is often used as a measure of dispersion. It is used by the economists and statisticians because of its simplicity and accuracy. It is mainly used in business forecasting.

Example 6: The marks obtained by 7 students in a test are given as

Roll No. :	1	2	3	4	5	6	7
Marks :	17	19	22	26	32	44	50

Calculate (a) Mean deviation from mean and its coefficient.

(b) Mean deviation from median and its coefficient.

Answer: Calculation of mean deviation from mean:

Serial no.	Marks	$D = X - \bar{X} = x - 30$	$\lvert D \rvert$
1	17	17 - 30 = 13	| - 13 | = 13
2	19	19 - 30 = - 11	| - 11 | = 11
3	22	22 - 30 = - 8	| - 8 | = 8
4	26	26 - 30 = - 4	| - 4 | = 4
5	32	32 - 30 = 2	| 2 | = 2
6	44	44 - 30 = 14	| 14 | = 14
7	50	50 - 30 = 20	| 20 | = 20
Total	**210**	**0**	**72**

Here the mean is $\bar{x} = \frac{\sum x}{n} = \frac{210}{7} = 30$

$$M.D._{\bar{x}} = \frac{1}{N}\sum|D| = \frac{72}{7} = 12$$

Coefficient of mean deviation from mean = $\frac{M.D}{\bar{x}} = \frac{12}{30} = 0.4$

(It can be seen that $\sum D = \sum (x - \bar{x}) = 0$. That proves the algebric sum of deviations from mean = 0)

(b) Calculation of Mean Deviation from Median

The series 17, 19, 22, 26, 32, 44, 50 has been given in ascending order of magnitude. Here n = 7.

The median is the size of $\left(\frac{n+1}{4}\right)^{th} = \left(\frac{7+1}{2}\right)^{th} = 4^{th}$ item.

The 4th item is 26. Hence median is 26.

Sl. no.	Marks	D = X - Md = X - 26	| D |
1	17	17 - 26 = - 9	| - 9 | = 9
2	19	19 - 26 = - 7	| - 7 | = 7
3	22	22 - 26 = - 4	| - 4 | = 4
4	26	26 - 26 = 0	| 0 | = 0
5	32	32 - 26 = 6	| 6 | = 6
6	44	44 - 26 = 18	| 18 | = 18
7	50	50 - 26 = 24	| 24 | = 24
Total			**68**

$$M.D._{Md} = \frac{|D|}{n} = \frac{68}{7} = 97.$$

The coefficient of mean deviation from median is

$$\frac{M.D.}{Median} = \frac{9.7}{26} = 0.37$$

(It can be seen that the *mean deviation from median is always less than mean deviation from mean*).

Example 7: Calculate mean deviation from median for the following series:

Marks	10	11	12	13	14
No. of students	3	12	18	12	3

Solution: Calculation of mean deviation from median.

X	f	c.f	D (X - Md)	|D|	f |D|
10	3	3	- 2	2	6
11	12	15	- 1	1	12
12	18	33	0	0	0
13	12	45	1	1	12
14	3	48	2	2	6
Total		**N = 48**	**0**	**6**	**36**

Here N = 48. So median is the size of $\left(\frac{48+1}{2}\right)^{th}$ = 24.5th item. The value in the cumulative frequency column just higher than 24.5 is 33. Its corresponding item is 12. So here median is 12.

$$M.D_{Md} = \frac{\Sigma f|D|}{N} = \frac{36}{48} = 0.75$$

Example 8: Calculate mean deviation from mode for the following series:

Class	:	17-22	22-27	27-32	32-37	37-42
Frequency	:	2	3	4	2	1

Solution: Calculation mean deviation from mode -

Class	Frequency	Mid value	$D = X - M_0$	| D |	f | D |
17-22	2	19.5	- 9.1	9.1	18.2
22-27	3	24.5	- 4.1	4.1	12.3
27-32	4	29.5	0.9	0.9	3.6
32-37	2	34.5	5.9	5.9	11.8
37-42	1	39.5	10.9	10.9	10.9
Total					**56.8**

Here the class (27-32) has the highest frequency. So it is the modal class.

$$\text{Mode} = L_1 + \frac{f_1 + f_0}{2f_1 - f_0 - f_2} (L_2 - L_1)$$

$$= 27 + \frac{4-3}{8-3-2} \times 5 = 27 + \frac{5}{3} = 28.6 \text{ (apx)}$$

$$\text{M.D.} \quad (M_0) = \frac{\Sigma f|D|}{N} = \frac{56.8}{12} = 4.7 \text{ (apx)}$$

7.2.6 STANDARD DEVIATION

The concept of 'standard deviation' as a measure dispersion was given by Karl Pearson in 1893. Standard deviation is the commonly used measure of dispersion. It is very popular. Because it is free from all the defects of range, quartile deviation and mean deviation.

Standard deviation is defined as the *positive square root of the mean of the squares of derivations of items taken from the mean*. It is denoted by 'σ' (read as

sigma). It is also known as the '*root-mean square deviation*', because it is '*the square root of the mean of the squared deviations from the mean*'. The square of standard deviation (σ^2) is called variance or the 'mean square deviation'.

Calculation of Standard Deviation

Simple Series

Consider a series consisting of 'n' observations x_1, x_2 .... x_n. The standard deviation can be calculated in two methods.

1. By taking deviation from actual mean ($\bar{x}$).

2. By taking deviations from assured mean (A).

1. Deviation Taken from Actual Mean ($\bar{X}$)

When the deviations of item values are taken from the actual mean, the standard deviation is given by the formula:

$$\sigma_x = \sqrt{\frac{1}{n}\Sigma(x-\bar{x})^2}$$

Where $\bar{x} = \frac{\Sigma x}{n}$, the arithmetic mean of the series.

The above formula can be reduced to the form:

$$\sigma_X = \sqrt{\frac{\Sigma X^2}{n} - (\bar{X})^2} = \sqrt{\frac{\Sigma X^2}{n} - \left(\frac{\Sigma X}{n}\right)^2}$$

2. Deviations Taken for Assumed Mean (A)

When the actual mean is fractional, the above method of calculating standard deviation becomes cumbersome. In such cases deviations of items are taken from the assumed mean (A).

Let, d = x - A.

The standard deviation is computed by using the formula:

$$\sigma = \sqrt{\frac{\Sigma d^2}{n} - \left(\frac{\Sigma d}{n}\right)^2}$$

Steps

(i) Take the deviation of the items from an assumed mean 'A'. So d = X - A. Find the sum of the derivation ($\sum d$).

(ii) Square the deviations and find its sum. That gives $\sum d^2$.

(iii) Put the values of $\sum d^2$, $\sum d$ and 'n' in the formula to get standard deviation:

$$\sigma = \sqrt{\frac{\Sigma d^2}{n} - \left(\frac{\Sigma d}{n}\right)^2}$$

Example 9: Find the standard deviation of the age of 5 students, 10, 12, 14, 15, 19.

Answer: Calculation of standard deviation.

Sl. No.	Age (X)	d = X - A = X - 15	d^2
1	10	- 5	25
2	12	- 3	9
3	14	- 1	1
4	15	0	0
5	19	4	16
Total		**$\sum d$ = - 5**	**$\sum d^2$ = 51**

Here we have taken the deviations from the assumed mean 15.

So d = x - 15

$$\text{Now} = \sigma = \sqrt{\frac{\Sigma d^2}{n} - \left(\frac{\Sigma d}{n}\right)^2}$$

$$\text{or, } \sigma = \sqrt{\frac{51}{n} - \left(\frac{-5}{5}\right)^2} = \sqrt{\frac{51}{n}} - \sqrt{\frac{46}{5}} = 3.033$$

Standard Deviation in Discrete Series

In discrete series, the item values (x), are given with their respective frequencies (f). Here standard deviation can be calculated in two methods:

1. Actual mean method
2. Assumed mean method

1. Actual Mean Method

In this method, standard deviation is found by using the formula:

$$\sigma = \sqrt{\frac{\Sigma f (X - \bar{X})^2}{N}} \quad \text{where } \bar{X} = \frac{\Sigma fx}{N}$$

$$N = \Sigma f$$

The formula can be reduced to,

$$\sigma = \sqrt{\frac{\Sigma fx^2}{N} - \left(\frac{\Sigma fx}{N}\right)^2}$$

In practice this method is rarely used. Because if the items or the actual mean becomes fractional, the calculation becomes difficult.

2. Assumed Mean Method

This method makes the calculation of standard deviation easier. Here we take the deviation (d) of the item values (X) from the assumed mean (A), so that d = X - A. The formula is:

$$\sigma = \sqrt{\frac{\sum fd^2}{N} - \left(\frac{\sum fd}{N}\right)^2}$$

Steps

(i) Take the deviations (d) of the items from an assumed mean (A), i.e., d = X - A.

(ii) Find the square of deviations d^2.

(iii) Multiply the deviations 'd' by the respective frequencies and add. The sum is $\sum fd$.

(iv) Multiply the squared deviations 'd^2' by the respective frequency and find the sum, $\sum fd^2$.

(v) Substitute these values in the formula:

$$\sigma = \sqrt{\frac{\sum fd^2}{N} - \left(\frac{\sum fd}{N}\right)^2}, \text{ where } N = \sum f$$

d ' =

Example 10: Calculate standard deviation from the following series:

X:	5	8	10	14	27
F:	6	5	4	5	4

Answer: Calculation of standard deviation:

X	f	d = X - 10	d^2	fd	fd^2
5	6	- 5	25	- 30	150
8	5	- 2	4	- 10	20
10	4	0	0	0	0
14	5	4	16	20	80
27	4	17	289	68	1156
Total	**24**			**48**	**1406**

Here we have taken deviations from the assumed mean 10.

$$\sigma = \sqrt{\frac{\sum fd^2}{N} - \left(\frac{\sum fd}{N}\right)^2} = \sqrt{\frac{1406}{24} - \left(\frac{48}{24}\right)^2}$$

$$= \sqrt{\frac{1310}{24}} = \sqrt{54.58} = 7.3878$$

Standard Deviation in Continuous Series

In continuous series, first the mid-values of various classes are found. Now the series becomes discrete. Then any of the methods for discrete series can be used to compute standard deviation.

So if the deviations of the mid-values (m) are taken from actual mean ($\bar{x}$) the formula is:

$$\sigma_x = \sqrt{\frac{\sum f(m-\bar{x})^2}{N}}$$

or, $$\sigma_x = \sqrt{\frac{\sum fm^2}{N} - \left(\frac{\sum fx}{N}\right)^2}$$

If the deviations are taken from the assumed mean (A), the formula becomes:

$$\sigma = \sqrt{\frac{\sum fd^2}{N} - \left(\frac{\sum fd}{N}\right)^2}, \quad \text{where } d = X - A$$

Step-Deviation Method

However in practice we use the 'step deviation' method to compute standard deviation in continuous series having equal class-intervals. This method simplifies the calculation of standard deviation. In this method, the formula used is:

$$\sigma = h\sqrt{\frac{\sum fd^2}{N} - \left(\frac{\sum fd}{N}\right)^2}$$

$d = (X - A)$

where $d' = \frac{X - A}{h}$, A - being the assumed mean, and

$d' = \frac{d}{h}$ h - the common factor by which the deviations (d) are divided.

(Here A is called the change of origin and 'h' is the change of scale. The above formula shows that *standard deviation is independent of change in origin but depends on change in scale*).

Example 11: Calculate the standard deviation and variance of the following series.

Class :	33-35	36-38	39-41	42-44	45-47
Frequency:	17	19	23	21	27

Answer: The series is given in inclusive form. For computing standard deviation we need not convert it into exclusive form. Here we have used the step deviation method to compute standard deviation.

Calculation of standard deviation

Class	**Frequency**	**Mid value (x)**	**$d = \frac{x - A}{h} = \frac{x - 40}{3}$**	**d^2**	**fd**	**fd^2**
33-35	17	34	- 2	4	- 34	68
36-38	19	37	- 1	1	- 19	19
39-41	23	40	0	0	0	0
42 -44	21	42	1	1	21	21
45-47	27	46	2	4	54	108
Total	**107**				**22**	**216**

$$\sigma = h\sqrt{\frac{\sum fd^2}{N} - \left(\frac{\sum fd}{N}\right)^2}$$

$$\sigma^1 = 3\sqrt{\frac{216}{107} - \left(\frac{22}{107}\right)^2} = 3.\sqrt{\frac{21148}{107}} = 4.22$$

The variance $\sigma^2 = (4.22)^2 = 17.81$

Properties of Standard Deviation

Standard deviation has certain important mathematical properties. So it has wider application in statistics. Some important properties are:

1. *Standard deviation is always greater than the mean deviation from mean.*
2. *Standard deviation of the first 'n' natural numbers* 1, 2, 3, ... n is given by

$$\sigma = \sqrt{\frac{n^2 - 1}{12}}$$

3. *Combined standard deviation -*

Let n_1, $\bar{X}_1$, σ_1 and n_2, $\bar{X}_2$, σ_2 be the number of items, mean and standard deviation of two series respectively. Then the standard deviation of the combined series is given by:

$$\sigma_{12} = \sqrt{\frac{n_1(\sigma_1^2 + d_1^2) + n_2(\sigma_2^2 + d_2^2)}{n_1 + n_2}}$$

where is σ_{12} is the standard deviation of the combined series,

Here, $d_1 = \bar{x}_1 - \bar{x}_{12}$, $d_2 = \bar{x}_2 - \bar{x}_{12}$

and $\bar{x}_{12}$ (combined mean) = $\dfrac{n_1\bar{x}_1 + n_2\bar{x}_2}{n_1 + n_2}$

4. *Standard deviation can be expressed in terms of other measures of dispersion.* For example, in case of continuous series, Quartile deviation (Q.D.), Mean deviation (M.D.) and standard deviation (S.D.) are related as follows:

$$\text{Q.D. : M.D. : S.D. : } = \frac{2}{3} : \frac{4}{5} : 1 = 10 : 12 : 15$$

That means, **S.D. = $\frac{4}{5}$ M.D. = $\frac{2}{3}$ Q.D**

5. Standard deviation is independent of change of origin but not scale.

Example 12: Calculate the standard deviation of the items:

1, 2, 3, 4, 5, 6, 7, 8, 9

Answer: The given series contains the first '9' natural numbers. Here n = 9

$$\text{So, } \sigma = \sqrt{\frac{n^2-1}{12}} = \sqrt{\frac{9^2-1}{12}} = \sqrt{\frac{80}{12}} = \sqrt{6.66} = 2.5806$$

Example 13: The performance of two groups of students in a test gives the following result:

	Group - 1	**Group - 2**
No. of students	12	8
Mean marks	10	15
Standard deviation	2	3

Calculate the mean and standard deviation of the two groups combined.

Answer: Given $n_1 = 12$, $\bar{x}_1 = 10$, $\sigma_1 = 2$

$n_2 = 8$, $\bar{x}_2 = 15$, $\sigma_2 = 3$

The combined mean $\bar{x}_{12} = \frac{n_1\bar{x}_1 + n_2\bar{x}_2}{n_1 + n_2}$

or, $\bar{x}_{12} = \frac{12 \times 10 + 8 \times 15}{20} = 12$

So, $d_1 = \bar{x}_1 - \bar{x}_{12} = 10 - 12 = -2$

$d_2 = \bar{x}_2 - \bar{x}_{12} = 15 - 12 = -3$

$$\text{Now} \quad \sigma_{12} = \sqrt{\frac{n_1(\sigma_1^2+d_1^2) + n_2(\sigma_2^2+d_2^2)}{n_1+n_2}}$$

$$= \sqrt{\frac{12(4+9)+8(9+19)}{20}} = \sqrt{\frac{12\times 8+8\times 18}{20}} = \sqrt{\frac{96+144}{20}}$$

$$\text{or,} \quad \sigma_{12} = \sqrt{\frac{24}{2}} = \sqrt{12} = 3.464$$

Merits

Standard deviation is considered to be an ideal measure of dispersion. It has a number of advantages in comparison to other measures of dispersion. This is mainly because, standard deviation is based on the values of arithmetic mean which is considered to be an ideal measure of central tendency. Standard deviation is considered as the total variation in mean. So it possesses all the characteristics, peculiarities and advantages of arithmetic mean. The merits of standard deviation are:

(i) It is rigidly defined.

(ii) It is algebraically accurate.

(iii) It is representative. Because it is based on all the items in the series.

(iv) It is capable of further mathematical treatment.

(v) It is a relatively stable measure of dispersion. It is less affected by the fluctuations in sampling.

Demerits

Inspite of its popularity and usefulness, standard deviation has certain drawbacks as noted below:

(i) It is relatively difficult to calculate and understand in comparison to other measures of dispersion.

(ii) It is affected more by the extreme items in the series.

(iii) It cannot be exactly calculated in case of open-end classes.

Uses

Standard deviation being considered an ideal measure of dispersion, it is widely used in statistical analysis. For example, it is used to determine the skewness and kurtosis of a distribution. In correlation and regression analysis, sampling theory etc. standard deviation is generally used as the measure of dispersion.

Coefficient of Variation

Standard deviation is an absolute measure of dispersion. It depends on the units in which items in the series are measured. So for comparing dispersion among different series, we cannot use standard deviation.

The relative measure of dispersion based on standard deviation is called "*coefficient of standard deviation.*" It is defined as -

$$\textbf{Coefficient of standard deviation} = \frac{\textbf{The standard deviation}}{\textbf{The arithmetic mean}}$$

$$\textbf{or, Coefficient of '}\sigma\textbf{'} = \frac{\sigma}{\bar{x}}$$

"*100 times the coefficient of dispersion based on standard deviation is called the coefficeint of variation.*" In other words,

$$\textbf{Coefficient of Variation} = 100 \times \frac{\sigma}{\bar{x}}$$

The concept of coefficient of variation was given by Professor Karl Pearson. It is a *pure number expressed in percentage form. "Coefficient of variation is the percentage variation in coefficient of standard deviation.*

Coefficient of variation is used to compare the variability or consistency of items in different series. A *series with smaller coefficient of variation is said to be more uniform or consistent (less variable). Similarly, if the coefficient of variation is higher the series becomes more variable or less consistent.*

Example 14: Calculate the coefficient of variation from the following information: n = 10, $\bar{x}$ = 12, $\sum x^2$ = 1530

Answer: We know C.V. = $100 \times \frac{\sigma}{\bar{x}}$

$$\sigma = \sqrt{\frac{\sum x^2}{n} - \left(\frac{\sum x}{n}\right)^2} = \sqrt{\frac{\sum x^2}{n} - (\bar{x})^2}$$

or, $$\sigma^2 = \frac{\sum x^2}{n} - (\bar{x})^2$$

$$= \frac{1530}{10} - (12)^2 = 9$$

$\therefore \sigma = + \sqrt{9} = 3$ (we ignore the negative sign of the square-root as 'σ' is always positive)

$$\text{C.V.} = 100 \times \frac{\sigma}{\bar{x}} = 100 \times \frac{3}{12} = 25$$

Example 15: The mean score by two batsman A and 'B' in 10 innings are 50 and 48 respectively. The standard deviation of their runs are 15 and 12. Who is a more consistent batsman ?

Answer: The consistency or variability of a series depends on its coefficient of variation.

Given n = 10, $\bar{x}_A$ = 50, σ_A = 15

$\bar{x}_B$ = 48, σ_B = 12

$$\text{Now C.V. for A} = 100 \times \frac{\sigma_A}{x_A} = 100 \times \frac{15}{50} = 30$$

$$\text{C.V. for B} = 100 \times \frac{\sigma_B}{x_B} = 100 \times \frac{15}{48} = 25$$

Since C.V. for A is greater than the C.V. for 'B', 'A' is more variable than B. So batsman 'B' is more consistent than 'A'.

7.3 LORENZ CURVE

The concept of 'Lorenz curve' was introduced by Professor Max O. Lorenz. It is a graphic method of studying dispersion in a distribution. This method is often used to study dispersion in the distribution of income, expenditure, wages, wealth etc. It is a cumulative percentage curve. Here the cumulative % of items is combined with the cumulative % of the frequencies. To draw the Lorenz curve in a frequency distribution we proceed as follows:

Steps

(i) Both the item values and frequencies are cumulated.

(ii) Take the grand total of each as 100. Express the cumulative values as % of the grand total.

(iii) On the x-axis, start from 0 to 100 and take the % value of the cumulative frequencies.

(iv) On the y-axis, start from 0 to 100 and take the % value of the cumulative item values.

(v) Draw a diagonal line joining the origin (0, 0) to the point 'P' (100, 100). Any point on this line shows the same % both in x and y. This diagonal line is called the '*line of equal distribution*'.

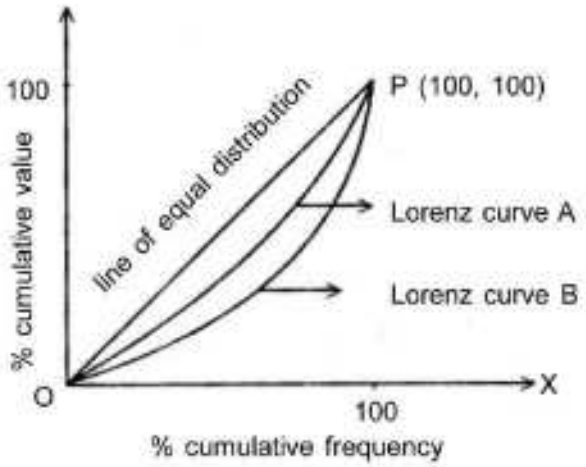
(vi) Plot various points corresponding to 'x' and 'y'. Join these points to get the *Lorenz curve*.

Application of Lorenz Curve

Comparing the Lorenz curve with the line of equal distribution we determine the dispersion of a distribution. Dispersion among different distributions can also be compared from their respective Lorenz curves. For example, degrees of inequality in the distribution of income or wealth between two or more groups of people in a country can be compared with the help of Lorenz curve.

The application of Lorenz curve has been shown in the following figure.

Figure: Lorenz curve



The above figure shows Lorenz curve for distribution 'A' and 'B'. 'OP' is the line of equal distribution. Curve 'A' is closer to the line 'OP' than curve 'B'. Hence dispersion or the degree of inequality in distribution 'B' is higher than that in distribution 'A'.

The Lorenz curve is also known as the 'curve of concentration'. The area between the line of equal distribution and the Lorenz curve is called the 'area of concentration'. The larger the area, the greater is the concentration and vice-versa. Twice this area is the '*Gini's coefficient of concentration*". *Ginni's coefficient is used as a measure of inequality.*

Lorenz curve just gives a rough (graphic) idea about dispersion in a distribution. It is not an exact measure of dispersion. Hence it is not scientific.

Example 16: The following series gives the amount of profits earned by a number of firms of an industry located in different areas in a year. Draw the Lorenz curve.

Profits earned in Rs.'00:	6	25	60	84	105	150	170	400
No. of firms :	6	11	13	14	15	17	10	14

Answer: Calculations for drawing the Lorenz curve:

Profits			**No. of firms**		
Profits earned in Rs.'00	Cumulative Profits	Cumulative Percentage	No. of Firms	Cumulative Number	Cumulative Percentage
6	6	0.6	6	6	6
25	31	3.1	11	17	17
60	91	9.1	13	30	30
84	175	17.5	14	44	44
105	280	28.0	15	59	59
150	430	43.0	17	76	76
170	600	60.0	10	86	86
400	1000	100.0	14	100	100

In the profit column, the grand total of the cumulative values is 1000. Expressing the cumulative profits and % of 1000, we get the cumulative percentage of profits. Now, the total number of firms in different areas is 100. Expressing the cumulative number of firms as % of 100, we get cumulative % of firms. Now plotting the cumulative percentage of profits in the y-axis and the corresponding cumulative percentage of firms in the x-axis we get a set of points on the x-y plane. Joining these points we get the 'Lorenz curve'. The line of equal distribution 'OP' is found by joining the point P (100, 100) with the origin.

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SUMMARY

MEASURES OF CENTRAL TENDENCY

1. Measures of Central Tendency are averages of first order. They are also called measures of location or simply averages.
2. A measure of central tendency is a single figure that precisely represents the whole distribution. As such, a measure of central tendency should lie at the middle portion of the distribution. As a single figure it gives a bird's eye-view of the whole mass of data in the distribution.
3. An ideal measure of central tendency should be rigidly defined, simple to understand, easy to calculate and representative. It should be capable of further mathematical treatment and should have sampling stability.
4. Arithmetic mean is a mathematical average and median and mode are positional averages.
5. Arithmetic mean is the ratio of the aggregate of item values to the number of items in a distribution.
6. Median is the middle most value of a distribution arranged in order of magnitude. It is a partition value. Other commonly used partition values are Quartiles, Deciles and Percentiles.
7. As median divides an arranged series into two equal parts, quartiles divide the distribution into four equal parts, deciles into ten equal parts and percentiles into hundred equal parts, after the item values are arranged.
8. Mode is the typical or most common item in a series, an item having highest frequency.
9. For normal distributions mean, median and mode coincide. For other distributions, mode = 3 median - 2 mean.

10. The sum of deviations of items from A.M. is always zero.
11. In case of a symmetrical distribution mean, Median and mode will be identical.
12. The relationship between mean, median and mode is generally given by

    Mode = 3 Median – 2 Mean
13. Geometric mean is defined as the n^{th} root of the product of n observations.
14. Geometric mean is specially used to calculate Index number, and in the case of social and economic fields where more weights are given to smaller items and vice versa.
15. Harmonic mean is defined as the reciprocal of the arithmetic mean of the reciprocals of the values of the variable.
16. From among mean, median and mode, mean is considered the best as it fulfills almost all requisites of an ideal measure of central tendency.

MEASURES OF DISPERSION

1. Measures of Dispersion, known as averages of second order, measures the variability or the extent of scatterness of values in a distribution from a measure of central tendency.
2. Measures of dispersion can be either absolute or relative. Absolute measures determine the extent of scatterness of items around an average and are expressed in terms of the units of the data. Relative measures, known as coefficient of dispersion are pure numbers used to compare dispersion among different distributions.
3. There are four absolute measures of dispersion - Range, Quartile deviation, mean deviation and standard deviation. Correspondingly, there are four relative measures of dispersion.

4. 100 times the coefficient of standard deviation is known as coefficient of variation-

   C. $V_x = \frac{\sigma_x}{\bar{x}} \times 100$, is the percent variation in coefficient of standard deviation. Coefficient of variation is used to compare variability or consistency of these values among different distributions.

5. From among different measures of dispersion, standard deviation is considered the best as it fulfills majority of the requisites of an ideal measure.

6. Graphically, dispersion among different distributions is shown in form of Lorenz curve.

7. Range is the difference between the highest value and the lowest value in a series.

8. Difference between third quartile (Q_3) and first Quartile (Q_1) of a series is called inter Quartile range

   $IQR = Q_3 - Q_1$

9. Half of the inter quartile range is quartile deviation

   $Q.D = \frac{Q_3 - Q_1}{2}$

10. Coefficient of Quartile deviation is $\frac{Q_3 - Q_1}{Q_3 + Q_1}$

11. Mean Deviation is the Artithmetic Avarage of absolute deviations of items from a statistical average; either from mean or median or mode.

    $$MD = \frac{\Sigma | X - M |}{n}$$

12. Standard deviation is the square root of the arithmetic mean of the squares of deviations of the items from their mean value.

    $$SD = \sigma = \sqrt{\frac{\Sigma (X - \bar{X})^2}{n}}$$

MODEL QUESTIONS

MEASURES OF CENTRAL TENDENCY

Group - A: Objective Type (Compulsory) (1 mark each)

1. Write the correct answer choosing from the alternatives give in each question:

(a) Which of the following is amendable to further algebraic treatment ?

(i) Mean (ii) Median (iii) Mode (iv) All of the above

(b) Which of the following divides a series into two equal parts after the items are arranged ?

(i) Mean (ii) Median (iii) Mode (iv) All of the above

(c) The item value having the maximum frequency is called:

(i) Mean (ii) Median (iii) Mode (iv) Quartile

(d) If Mean = 20, Median = 18, Mode is:

(i) 16 (ii) 12 (iii) 14 (iv) 15

(e) If item values in a series are 15, 3, 7, 21, 28, 11, 5 median is:

(i) 7 (ii) 15 (iii) 11 (iv) 21

2. I. Answer the following questions in one sentence:

(a) What is Mean ?

(b) What is Median ?

(c) What is Mode ?

(d) Give two examples of positional average ?

(e) What is geometric mean ?

(f) What is harmonic mean ?

(g) What is geometric mean of 5 and 45 ?

(h) What is the relationship between AM, GM and HM ?

II. Are the following statements incorrect? Correct them if necessary without changing the portions underlined:

(a) Measures of Central Tendency are also known as averages of first order.

(b) Mode is the most representative item in a distribution.

(c) Median is least affected by fluctuations in sampling.

(d) In an asymmetrical distribution, mean, median and mode coincide.

(e) Median divides a series into four equal parts after items are arranged.

(f) The algebraic sum of values taken from median is always equal to zero.

(g) In qualitative data mode is the best measure of central tendency.

(h) Median is the most typical value in a distribution.

(i) If $n = 6$, $\bar{x} = 5$, then $\sum x = 25$.

(j) The mean is a positional average.

III. Fill in the Blanks.

(a) Measures of central tendency are otherwise called _____.

(b) The mean of 10 observations is 20. If 5 is added to each observation, the new mean is _____.

(c) The item having the highest frequency in a series is called _____.

(d) If average mark of 10 boys is 52 and that of 20 girls is 50 combined average is _____.

(e) Median is equal to _____ quartile.

(f) If in a distribution mean and median are 25 each, then mode is _____.

(g) Geometric mean of X_1 and X_2 is _____.

Group - B: Short Type Answer

3. Answer the following within two / three sentences in each case: (2 marks each)

(a) Why is mean a more stable measure of central value than median and mode?

(b) What are the uses of median ?

(c) In which case geometric mean is used ?

(d) How to calculate Harmonic mean ?

4. Write notes on the following restricting your answer within six sentences in each case: (3 marks each)

(a) Measures of central tendency.

(b) Weighted arithmetic mean

(c) Characteristics of an ideal measure of central tendency

(d) Mode

(e) Uses of geometric mean

(f) Demerits of Harmonic mean

(g) Uses of Median

(h) Characteristics of an Ideal Average

Group - C: Long Type Answer (7.5 marks each)

5. What do you mean by measures of central tendency ? Discuss the characteristics of an ideal measure of central tendency.

6. What is a statistical average ? Which average you consider the best and why?

7. Define arithmetic mean and discuss its relative merits and demerits.

8. Compare mean, median and mode as measures of central tendency.

9. Prove $(x_1 - \bar{x}) + (x_2 - \bar{x}) + (x_3 - \bar{x}) + ... + (x_n - \bar{x}) = 0$

10. Calculate mean, median and mode of the following frequency distribution.

Marks	5	10	15	20	25	30	35	40	45	50
No. of students	20	43	75	67	72	45	39	9	8	6

11. Find mean, median and mode of the following distribution.

Variable	15-25	25-35	35-45	45-55	55-65	65-75
Frequency	4	11	19	14	0	2

MEASURES OF DISPERSION

Group - A: Objective Type (Compulsory) (1 mark each)

1. Write the correct answer choosing from the alternatives give in each question:

(a) The difference between the upper quartile and lower quartile is called:

(i) Quartile deviation (ii) Semi interquartile range
(iii) Interquartile range (iv) Range

(b) Standard deviation of 100 items in a series is 10. If 2 is subtracted from each item, new standard deviation becomes:

(i) 12 (ii) 8 (iii) 10 (iv) 20

(c) If $Q_1 = 10$, $Q_3 = 30$, Quartile Deviation is:

(i) 20 (ii) 10 (iii) 0.5 (iv) None of the above

(d) What is range ?

(i) Maximum value – Minimum value (ii) Maximum value + Minimum value

(iii) $\frac{X_{Max} - X_{Min}}{X_{Max} + X_{Min}}$ (iv) None of the above

(e) Inter quartile range is

(i) Same as Quartile Deviation (ii) 2 x Q.D.
(iii) $\frac{Q.D.}{2}$ (iv) None of the above.

(f) M.D. can be calulated from

(i) Mean (ii) Median (iii) Mode (iv) all of the above

(g) Which of the following is a relative measure of deviation ?

(i) Range (ii) Quartile Deviation
(iii) Standard Deviation (iv) Coefficient of variation

2. I. Are the following statements incorrect ? Correct them if necessary without changing the portions underlined:

(a) Measures of dispersion are averages of first order.

(b) Standard deviation is always greater than mean deviation from mean.

(c) Variance is the value of root mean square deviation.

(d) While calculating standard deviation, deviations of the item values from mean are ignored.
(e) A series with smaller coefficient of variation is considered more variable.
(f) Absolute measures of dispersion are expressed in terms of ratios.

II. Fill in the Blanks:

(a) Mean deviation from median is _____ than the mean deviation from mean.
(b) The square of standard deviation is known as _____.
(c) Standard deviation is _____ of change of origin.
(d) Standard deviation is always _____ the mean deviation from mean.
(e) The statistical measure used to compare variability or consistency between distributions is called _____.
(f) Difference between the highest value and the lowest value is a series is called _____.

3. Answer the following questions in one sentence in each case:

(a) What is 'range' ?
(b) What is 'quartile devition' ?
(c) What is interquartile range ?
(d) What is mean deviation ?
(e) What is meant by standard deviation ?
(f) What is co-efficient of variation ?

4. Write notes on the following restricting your answer to six sentences.
   a) Measures of dispersion
   b) Range
   c) Mean Deviation
   d) Inter Quartile Range
   e) Standard deviation
   f) Lorenz Curve
   g) Coefficient of variation

Long Type Answers

5. Discuss the various measures of dispersion and their uses.
6. Define Mean Deviation and discuss its relative merits and demerits.
7. Define standard deviation and its coefficients. Also bring out its relative merits and demerits.
8. What is Lorenz curve ? Discuss the method of drawing Lorenz curve.
9. What is standard deviation ? Discuss the properties of standard deviation.

CHAPTER - 8

STATISTICAL METHODS - II

- Correlation - Meaning, correlation and causattion, types of correlation, scatter diagram method of measuring correlation, uses of correlation in Economics.
- Regression - Meaning, deifference between correlation and regression, uses of regression in Economics.
- Index number - Meaning, importance, uses, consumer and wholesale price index number.
- Time series - Meaning, uses and components.

8.1 CORRELATION

In economic studies we often come across distributions involving more than one variable e.g. Income and expenditure of a group of people, heights of fathers and that of sons, heights and weight of individuals, income level and educational standard, yield of crop and rain fall etc. The questions–

- Whether the variables are related or not
- If related what is the nature and degree of relationship.

Can be studied with the help of correlation analysis.

As the name suggests correlation is a statistical tool used to study and analyse the relationship or association between variables in a distribution.

8.1.1 Meaning of Correlation

According to *A.M. Tuttle "Correlation is an analysis of the co-variation between two or more variables."* In the words of Croxton and Cowden "*When the relationship is of a quantitative nature the appropriate statistical tool for discovering and measuring the relationship and expressing it in a brief formula is known as correlation.*"

From the above definition it is evident that in a bi-variate distribution, when two variables are related to each other so that change in one corresponds to a change in the other, the variables are said to be correlated.

8.1.2 Correlation and causation

Correlation analysis gives us ideas about the degree and direction of the relationship between the variables. It does not reflect upon the cause and effect relationship between them. Hence correlation and causation are not the same thing. In fact if two variables are casually inter-linked then they must be correlated. But that does not mean if the variables are correlated then there exists cause and effect relationship between them. Even when there are grounds to believe that causal relationship between the variables exists, correlation does not specify which is the cause and which

is the effect. For example the demand for a commodity and its price are generally correlated. But here correlation does not specify whether demand depends upon price or vice-versa. Two variables may be correlated because of their mutual dependence or may be due to some other factors. So, causation necessarily implies correlation but the converse is not always true.

Even fairly high degree of correlation between the two variables may be due to the following reasons :

1. Mutual dependence : Two variables may show high degree of correlation due to mutual dependence but difficult to isolate them, one as cause and another as effect. For example price of a commodity and demand. When price increases demand decreases other things remaining constant. So pice is cause and demand is effect. But when demand for a commodity a commodity decreases this result in decrease in price where demand acts as cause and price effect.
2. Both the variables may be influenced by some other factor :The yield of rice and yeild of wheat show a high degree of positive correlation as the year of good wheat yield are also the years of good rice yield and vice versa. But yield of rice and yield of wheat do not have any cause and effect relation. They both depend on other factors like weather condition, fertilizer used, irrigation facilities etc.
3. Pure chance : In certain, cases correlation exists between size of the shoe and educational level, milk consumption and incidence of cancer; but from this we should not establish cause and effect relationship. The existence of correlation in the small sample may be due to mere chance. Such correlation is called spurious correlation.

8.1.3 Types of Correlation

Depending upon the number of variables involved in the distribution, correlation may, be classified into different categories. In a bivariate distribution correlation may be

either (i) *positive or negative*, or (ii) *Linear or Nonlinear*. These types of correlation comes under the purview of simple correlation analysis. In case of tri-variate or multivariate distributions, we use partial or multiple correlation analysis.

Positive and Negative Correlation

In a bivariate distribution, the two variables are said to be correlated if with the change in one variable, the other variable changes. Otherwise there exists no relationship between the variables. In such cases, variables are said to be uncorrelated or there exists zero correlation between them.

If both variables change in the same direction, then correlation between them becomes positive. In such a case both variables are directly related. For example correlation between income and consumption, height and weight, price and quantity supplied etc. are positive or direct. The following schedule of data is an example of positive correlation where both variables 'X' and 'Y' vary in the same direction.

X	1	2	3	4	5
Y	10	12	15	16	18

On the other hand, if the variables deviate in the opposite direction then correlation between them becomes negative, inverse or indirect. In such cases an increase or decrease in the values of one variable results in a corresponding decrease or increase in the values of the other variable respectively. The relation between price of a commodity and its quantity demanded, rate or interest and volume of investment, volume and pressure of a gas are examples of negative correlation. The following schedule shows negative correlation between the variables X and Y as they vary in opposite directions.

X	5	8	12	15
Y	50	30	25	15

Linear and Non-linear Correlation

If for an unit change in one variable, the other variable changes at a constant rate, correlation between them becomes linear. In such cases, the relationship between the variables X and Y can be expressed in terms of a linear equation or an equation of a straight line, in the form **Y = mx + c,** with constant slope m = $\Delta y / \Delta x$. In case of linear correlation the series represented on the xy plane, shall give a straight line. Linear correlation may be either positive or negative. For linear positive correlation, the straight line so obtained shall have a positive slope and for linear negative correlation, the straight line shall have a negative slope.

Correlation between two sets of variables becomes non-linear or curvilinear, if corresponding to an unit change in the values of one variable, the other variable changes at a fluctuating rate. In such a case, the data plotted on the xy-plane gives a curve, rather than a straight line.

Simple, Partial and Multiple Correlation

As said earlier, simple correlation studies the extent of relationship between variables in a bi-variate distribution. In case, the distribution involves more than two variables, e.g. in tri-variate or multivariate distributions, the relationship among the variables is studied in terms of partial or multiple correlation.

In a tri-variate or multivariate distribution, the relationship between any two variables, keeping other variables constant is studied in terms of partial correlation. Multiple correlation studies the mutual relationship among all variables in a tri-variate or multivariate distribution.

8.1.4 Methods of studying correlation

The commonly used methods for studying correlation between two variables are-

(i) Scatter diagram method.

(ii) Kart Pearson's coefficient of correlation.

(iii) Spearman's Rank correlation method.

(iv) Concurrent deviation method.

8.1.4.1 Scatter Diagram Method

Scatter diagram is the simplest tool of studying correlation. The scatter diagram indicates the rough idea about whether the variables are related or not. The diagram is obtained by plotting the variable values (the pairs of x, y values). For example if the varibale x and y denote height and weight respectively, then the pair (x, y), (x_2, y_2) .... (x_n, y_n) represent the heights and weights of n individuals. The n points are plotted as the x y plane. The diagram of the dots so obtained is known as Scatter Diagram.

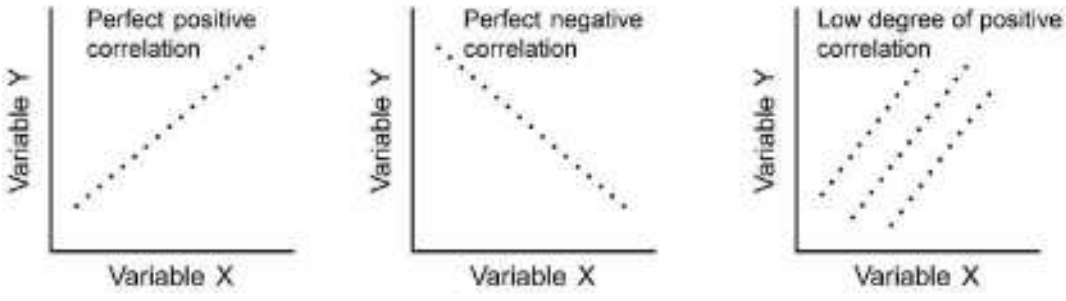
From scatter diagram fairly good, though rough idea about the relationship between the two variable can be formed.

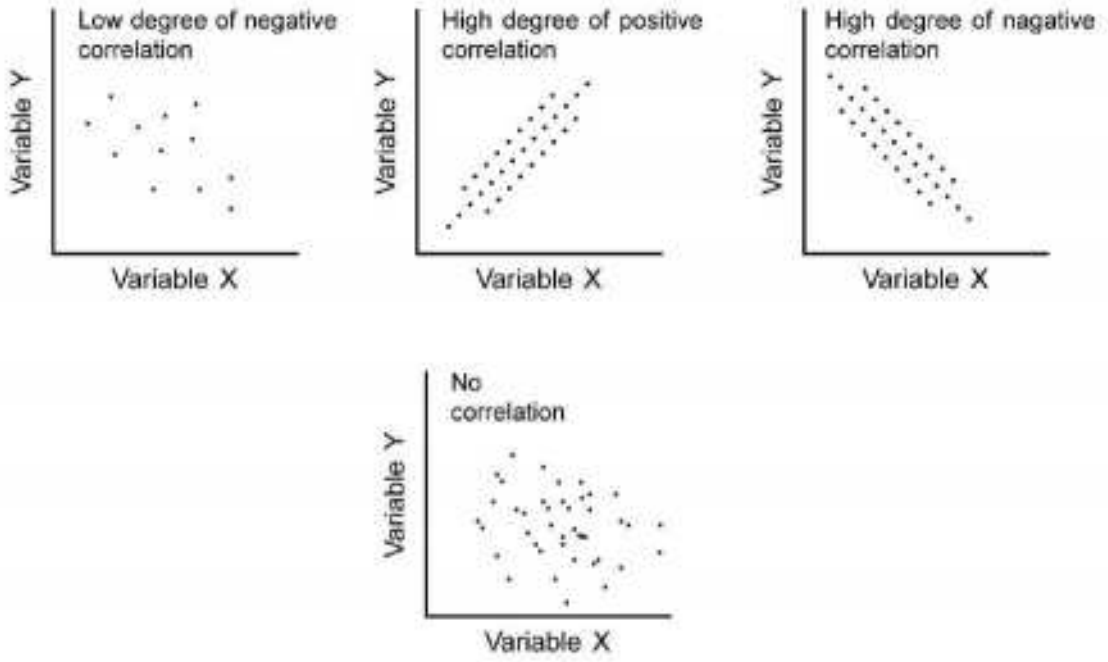
(i) If the points are very close to each other high degree of correlation is expected. On the otherhand, if points are widely scatter, then low degree of correlation is expected to exist.

(ii) If the points show upward trend from left to right then positive correlation and if shows downward trend, negative correlation is revealed.

(iii) In particular, if all the points lie on a straight line from left to right and show upward trend then correlation is perfect positive and if all the points lie on a straight line from top to bottom showing downsard trend then perfect negative correlation is said to exist.

(iv) If the points show no trend then existence of no correlation is interpreted.





8.1.5 Uses of correlation

1. Correlation analysis is used to study the nature, extent and direction of the relationship that exists between the variables.
2. Correlation analysis serves as the basis for regression analysis.
3. Study of correlation reduces the amount of uncertainty in the determination of future values.
4. Correlation studies the relationship between various economic variables e.g. sales and advertising expenditure, price and demand etc and helps in formulation and implementation of economic policies.
5. Correlation analysis also helps in formulation of various business policies after studying and analysing the relationship amongst the variables related to business.

6. Coefficient of determination (R) which is used to determine the amount of explained variation is based on the value of correlation coefficient (r).

   $R = r^2$

7. Correlation coefficient (r) is used in the determination of probable error of estimation (P.E.) and standard error of estimate (S.E.)

   $$P.E. = 0.6745 \frac{1-r^2}{\sqrt{n}}$$

   $$S.E. = 0.6745 \frac{1-r^2}{\sqrt{n}}$$

   Where n represents the number of observations.

   (i) If r < P.E. then correlation is not significant

   (ii) If r > 6 P.E. then correlation is significant

   (iii) If P.E. < r > 6 P.E. medium degree of correlation exists.

8. From the value of sample correlation coefficient (r) the range in which population correlation coeffient (P) lies can be determined.

   Range of popluation correlation coefficient = p = r ± P.E.

8.2 REGRESSION

8.2.1 Meaning

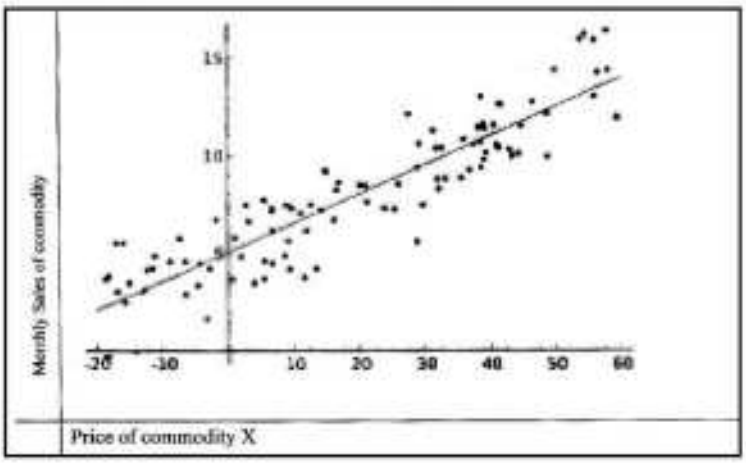
The word 'Regression' means stepping back or returning to the average value. Sir Francis Galton first used this word in 19th century in connection with his studies concerning the heights of fathers and their sons and concluded that heights of sons of tall parents regresses back to the mean height of the population. While the reverse is true for offsprings of short persons. Later on yule and pearson extended the scope of regression to various fields.

Now a days the word regression is used in a much wider perspective. In general regression, means the estimation or prediction of the unknown value of one variable from the known values of the other valuable. In the words of Blair "Regression analysis is a mathemetical measure of the average relationship between two or more variables in terms of the original units of the data."

Regression analysis is used in business and economics to study the relationship between two or more variables which have cause and effect relationship. We come across a number of inter related events e.g. the yield of a crop and rain fall, cost of a product and advertising expenditure, income and expenditure levels of individuals etc. Regression analysis is used to study the causal relationship that exists between the variables. The variable whose value is influenced (effect) is called dependent variable or explained variable and the variable which influences (cause) is the independent variable or explantory variable.

The regression analysis if confined to the study of only two variables at a time is called simple regression and it studies more than two variables at a time is known as multiple regression.

In regression analysis we are required to distinguish between a dependent variable and an independent variable. If y is the dependent and x is independent variable then y = f(x) expresses the relationship between y and x.



8.2.2 Correlation and Regression

Correlation and regression analysis are related in the sense that both deal with relationships among variables.

The goal of a correlation analysis is to see whether two variables co vary, and to quantify the strength of the relationship between the variables, whereas regression expresses the relationship in the form of an equation and determines the direction of relation.

For example, in students taking a Mathematics and English test, we could use correlation to determine whether students who are good at Mathematics tend to be good at English as well, and regression to determine whether the marks in English can be predicted for given marks in Mathematics.

Correlation does not establish cause-and-effect relationships. It can indicate only how or to what extent variables are associated with each other. The correlation coefficient measures only the degree of linear association between two variables. But in Regression analysis we assume the independent (explanatory) variable is the cause and the dependent (explained) variable is the effect.

Both Correlation and regression are product of stochastic processes in which both X and Y have to vary. In case of regression, Y has a distribution for a given value of X, but in case of correlation, X and Y have a joint distribution.

8.2.3 Uses

1. Regression analysis is also used to understand which among the independent variables are related to the dependent variable, and to explore the forms of these relationships. In restricted circumstances, regression analysis can be used to infer causal relationships between the economic variables that constitutes the essence of economic theory. It is used in estimation of demand curves, supply curves, production functions , cost functions etc. Regression analysis is also used to understand which among the independent variables are related to the dependent variable, and to explore the forms of these relationships. In restricted circumstances,

regression analysis can be used to infer causal relationships between the independent and dependent variables.

2. Regression provides a functional relationship between the dependent and independent variables and then use this to predict the values of the dependent variables given a set of values of the independent variables. Thus Regression analysis is widely used for prediction and forecasting future events in the field of business and commerce.

3. It provides a measure of coefficient of correlation as coefficient of correlation is the squre root of the product of two regression coefficients.

$$R=(bxy.byx)^{1/2}$$

Where r is the correlation coefficient, bxy and byx are regression coefficients.

4. Regression methods continue to be an area of active research. In recent decades, new methods have been developed for regression involving correlated responses such as time series and growth curves, or other complex data objects

5. Regression models predict a value of the 'Y' variable given known values of the 'X' variables. Prediction *within* the range of values in the dataset used for model-fitting is known as interpolation. Prediction *outside* this range of the data is known as extrapolation.

8.3 INDEX NUMBER

8.3.1 Meaning

Index Numbers are statistical measures designed to show changes in a variable or group of related variables with respect to time, geographic location or other characteristics such as income, profession etc. Index number are commonly used statistical device for measuring combined fluctuations in a group of related variables.

Value of economic variables such as price, quantities of commodities usually change over time. When just one variable changes measurement of change over time

can be easily done. But problem arises when a group of variables are involved. For example to know the change of general price level of a country over a time period is difficult to measure as prices of different commodities, may change at different rates and also may be in different directions, while some prices rise, some prices may fall. How to obtain a composite measure? This composite measure is provided by index numbers. This index number may be defined as a device for combining the variations that have come in group of related variables over a period of time. An index number is a number which indicates the overall change in a set of variables over a period of time.

Some important definitions of index numbers are given below.

1. According to Bowley, "Index numbers are used to measure the changes in some quantity which we can not measure directly."
2. "An index number is a statistical measure designed to show changes in a variable or a group of related variables in the respect of time, geographic location or other characteristics such as income, profession, etc."– Spigel.
3. "An index number is a single ratio (usually a percentage) which measures the combined (ie. averaged) change of several variables between two different times, places or situations."– A.M. Tuttle.
4. "Index numbers are devices for measuring differences in the magnitude of a group of related variables."– Croxton & Cowden.

Thus index numbers are certain type of rates or ratios, usually expressed as percentages, designed to measure the changes in a group of distinct but related variables. Being ratio, an index number measures relative change rather than absolute change and it is free from unit of measurement of the concerned variables.

Index number is a specialised average which is a pure number which helps us to measure and also to compare changes.

Index numbers measures net change in a group of variable.

Index numbers measure effect of changes either with respect to time or region.

8.3.2 Types of Index Numbers

Index numbers can be classified into different types depending on the type of phenomenon it studies. Index numbers are broadly classified as

(i) Price index numbers
(ii) Quantity index numbers
(iii) Value index numbers
(iv) Special purpose index numbers

Price index numbers are the most widely used index numbers. They compare the changes in price level of one commodity or a group of commodites from one period to another. These price index numbers can again be classified as

(1) Wholesale price index numbers
(2) Consumer price index numbers.

The wholesale price index is the price of representative basket of wholesale goods. WPI represents the price of goods at a wholesale stage i.e. goods that are sold in bulk and traded between organisations instead of to consumers. Secondly WPI is based on prices of all types of goods rather than only on prices of consumber goods. WPI is used to estimate the changes in general price level.

The statement "WPI with 2000-2001 as base is 209 in march 2016" means that the general price level has risen by 109 percent during this period i.e. the commodities costing ₹ 100 in 2000-2001 will cost ₹ 209 in 2016.

8.3.3 Steps in construction of Index number

The construction of Index number involves the following basic steps.

1. **The purpose of Index number -** The first steps in the construction of an Index number is to clearly define the purpose of construction as the other steps like selection of commodities assignment of weights etc. depend on the purpose of constructing index number.

2. **Selection of Base year -** The base year of an Index number is the reference year on the basis of which comprison is made. So the base year

   (i) Must be a normal year not be a year of war, depression, boom, labour strikes, emergency etc.

   (ii) It should not be a year too distant in the past that nature of the commodities, habits, customs, pattern, quality of goods should not change much.

   (iii) While selecting the base whether a chain base or fixed base method will be adopted is to be decided.

3. **Selection of commodities -** Every item can not be included while constructing an index number. The commodities should be selected in such a manner that they are

   (i) Representative of the class for which index number is constructed.

   (ii) Number should be adequate and reasonable; adequate so as to make sample representative of all required items; reasonable so that should not be too high to involve heavy calculation.

4. **Collection of Data -** Relevant price quotations, whether wholesale or retail for the selected commodities are to be collected depends on the purpose of the index number. Price quotation should be uniform and accurate.

5. **Selection of an Average -** Theoretically any average can be used for the purpose but a choice has to be made from amongst the arithmetic mean, gerometric mean and median. Theoretically geometric mean is the most appropriate average as unlike mean and median it is not affected by extreme observations, it gives equal weights to equal ratios and it is reversible means base year and current year can be interchanged.

6. **System of Weighting -** The commodities taken are not of equal importance and are not marketed in same quantity. So assignment of appropriate weights

to the selected commodities is an important aspect of the construction of an index number.

7. **Selection of appropriate formula -** A number of formulae are available depending on the type of average used and the weight, assigned. So choice of an appropriate formula is of great importance depending on the purpose of I.N. and availability of data.

8.3.4 Uses of WPI

Wholesale price index

1. Is used to estimate the general price level.
2. It helps in studying trends and tendencies.
3. It helps in adjusting real values of aggregate output.
4. It acts as economic barometer to find out the ups and downs in the general economic conditions of a country.

8.3.5 Consumer price index number

Consumber price index number is also known as cost of living index number or Retail price index number. Consumer price index number measures the changes in the prices paid by the consumbers for purchasing a special 'basket' of goods and services during the current year as compared to the base year. This index number tells us how much the consumber of a particular section or class of people have to pay for the specific basket of goods at a particular point of time (current year) in comparison to what they paid for the same basket of goods in the base year. That consumer price index number reflects the average change in the cost of commodities consumed by the class of people over the period of time. The consumer price index (CPI) is calculated by taking price changes for each item in the predetermined baset of goods and averaging them. The basket of goods and services will contain items like (i) food (ii) house rent (iii) clothing (iv) fuel and lighting (v) education (vi) miscellaneous like washing, transport, newspaper, entertainment etc. The goods are weighted according

to their importance. Thus CPI is the statistical estimate constructed using the prices of a sample of representative items consumed by the particular class of people for whom it is constructed.

A number of CPIs are to be constructed depending on the group for whom it is needed e.g. CPI for industrial worker, for agricultural labourers, for people of higher income group etc. Even CPI for the same group of people residing at different places will be different.

The need for the construction of CPI arises because the general or wholesale price index number does not throw light on the effect of rise or fall in prices an the cost of living of different classes of people in the society; because different class of people consume different commodities and even if they consume same commodity they consume it in different proportions.

8.3.6 Construction of consumber price index number (CPI)

The following steps are involved in the construction of consumber price index number.

(1) Class of people (Scope and coverage) : The first step is the construction of consumber price index (CPI) is that class of people should be defined clearly. It should be decided whether the cost of living index number is being prepared for the industrial workers as per the middle or lower class salaried people living in a particular area. It is therefore necessary to specify the class of people and locality where they reside.

(2) Family budget enquiry : The next step in the construction of CPI is that some family should be selected randomly from the class for which index number is to be constructed. Information regarding food, clothing, house rent, education etc. should be collected from these families. The enquiry includes questions on family size, income, the quality and quanity of different goods and services consumed and the money spend on them. Those commodities which the people belonging to the class

generally consume are only taken into consideration. Accordingly weights are assigned in proportion to the expenditure on different items.

(3) Price quatations : The next step is to collect data on retail prices of the selected commodities for the current period and the base period. The prices should be obtained from local makets where the class of poeple reside i.e. from the shops form which they usually do their purchase.

(4) Method of construction : Consumber price indeces are usually obtained as weighted indices by taking into consideration the relative importance of the commodities. From the family budget enquiry, the amount spent on each commodity by an average family is calculated and these constitute the weights and depending on the weights assigned (whether the base year or current year, or average of bothe the years quantity consumed will be weight) the formula for construction of index number varies.

Difficulty arises in the selection of commodities which are consumed by all the families under the same group. The collection of retail prices from a sample of shops is also difficult as retail prices also vary from shop to shop.

8.3.7 Uses of CPI

The cost of living index numbers or the consumer price index numbers are-

1. used to determine the purchasing power of money

   $$\text{Puchasing power of money} = \frac{100}{\text{CPI}}$$

2. used to determine the real wages

   $$\text{Real wage} = \frac{\text{Money Wage}}{\text{CPI}} \times 100$$

3. used to frame polices on wage, price, rent, tax etc. at the government level.
4. used by the government to regulate dearness allowances.
5. used by the business houses to grant bonus to the employees.
6. used in wage negotiations and wage contracts.

CPI for agricultural labourer and rural workers is prepared and published by Labour Bureau, GOI. For urban non-manual employees is prepared and publishedj by Ministry of Statistics and Programme Implementation, Government of India (GOI)

8.3.8 Importance of Index Number

Index number possess much practical importance in measuring changes in the cost of living production trends, trade, income variations etc. A close study of such changes helps the government to adopt appropriate monetary and fiscal measures.

(1) Serves as important Economic Barometer : A study of the rise or fall in the value of money is essential for determining the direction of production and employment and to know the changes in the real income of different groups of people at different places and times index numbers are computed to study changes in volume of trade, production, sales, profits etc. over a period of time. For the above important activities the index numbers are termed as economic barometers.

(2) Important in helping formulation and adoption of appropriate economic policies : The change in the value of money has a direct effect on the public. So Government adopts fiscal and monetary policy according to the results of index number.

(3) Throws light on economic condition : Index number are very helpful in comparing the economic conditions of a particular group at two different periods. The indices of agricultural production, industrial production are important in showing the economic wealth of the country. Index numbers of wholesale prices also indicate about regional disparity.

(4) Studies consumption standard : Consumer price index numbers show the true consumption standard of a class in a locality. Through health and family welfare indices, the level of available medical facilities and family welfare programmes can be better evaluated.

(5) Important for producers : Price index numbers, production index numbers guide the producer to take business decisions.

(6) Important in wage determination and allotment of dearness allowances : Wages are determined, dearness and other allowances are granted to employees on the basis of the value of the cost of living index numbers.

(7) Important for comparing different countries : International price index number are important for comparing the general price level of different countries.

(8) Efficiency of labour and per capita output of labour can be studied with the help of index numbers.

8.3.9 Use of Index Number

Index numbers are used to measure all types of quantitative changes in the agricultural, industrial and commercial fields, as also in economic magnitudes as income, employment, exports, imports, prices etc. As index numbers are devices to measure changes which can not be measured directly they are widely used not only in analysis of economic data and business situations, they are also used in many other social and natural sciences where the study of relative changes are important.

(1) Measuers change in wholesale price level : Index numbers are used to measure the changes in the wholesale price level of a country over a period of time.

(2) Measures changes in the value of money : Index numbers are used to measure the changes different aspects of the value of money, each particular aspect being relevant to a different purpose. A study in the rise or fall in the value of money is essential for determining the direction of production and employment.

(3) Helpful in policy formulation : Index number are helpful to the state in formulating and adopting appropriate economic polices. Index numbers measure change in prices, incomes, wages, production, employment, products, exports, imports etc. By comparing the index numbers, the present trend of economic activities can be studied and accordingly policies can be formulated.

(4) In computing real wage : Index numbers are used in computing the real wages through the process of deflating to determine the purchasing power of money. Cost of living index form the basis of wage negotiations and wage contracts.

(5) In analysing markets for goods and services : Consumer price index numbers are used in analysing markets for particular kinds of goods and services. Index numbers for industrial production measure changes in industrial production over a period of time. Similarly different index numbers show changes in the values of the different variables.

(6) In Trade : Internal and external trade conditions can be studied with the help of index numbers. Different wholesale price indices are used to study the conditions of internal trade while export and import indices are used to study the foreign trade condition of the country.

(7) In determining Exchange Rates : Wholesale price index number are used to determine the foreign exchange rate.

(8) Help in studying Trend and Tendencies : Since the index numbers reflect relative changes in a level of phenomenon, they are very much useful in studying the general trend and tendencies of a time series and in forecasting the future events.

8.4 TIME SERIES ANALYSIS

8.4.1 Meaning

Time series is a set of observations taken at different points of time, usually at equal intervals. It relates to a variable which can be measured over time. The time series indicates the relationship between two variables one of which is time e.g. price level of a commodity in different years, average temparature of a locality in different days, sales of a commodity in different months constitute time series data. In time series time acts as an independent variable. According to Moris Hamburg, "A time series is a set of statistical observations arranged in chronological order."

The essential requirements of the time series are-

(i) the observed values should be available over a period of time.

(ii) The time period should be definite according to calender.

(iii) The data should be homogeneous with respect to time and unit of measurement.

Mathemetically a time series is defined by the values Y_1, Y_2, ... Y_n of a variable Y at times t_1, t_2, ... t_n etc.

Thus Y = f(t), symbolically 't' stands for time and Y_t represent the value at a time t, then the paired value $\{t, Y_t\}$ represent time series data.

Thus time series is a sequence of measurements of a single variable, taken over a period of time e.g. the population of a country in different years, production of steel in different years, stock prices on different days of a week, exchange rate in different months of a year, interest rates on different months. Price level of cereal in different years, number of road accidents a different days of a week etc.

8.4.2 Uses

The study of time series is of interest to people belonging to all facets of life, like economists, statisticians, businessmen, scientists, sociologist, politicians etc. It has found to be useful in every field as it is helpful in studying the past behaviour of the process which helps in predicting the future behaviour, thus helps in future planning, operations and formulation of appropriate polices, thus

1. The time series analysis descovers the causes of short-term and long-term fluctuations, finds irregularities if any and studies the inter relationship among fluctuations.
2. Plays an important role in studying movements of economic and business data and acts as a popular tool for business forecasting.
3. Major use of time series is in the theory of forecasting by analysing the past behaviour through determination of trend.
4. Time series forecasts are useful in planning and allocating budgets for different sectors of the economy.
5. The study of cyclical and seasonal fluctuations help in economic and business planning.
6. Time series analysis is used to evaluate current accomplishment and performances.

7. Time series analysis is used to compare the current performance on the basis of the past and is used for future improvements in a systematic manner.

8. Time series data of the same phenomenon over different places may be compared to know the peculiarities embeded in their nature.

9. Time series data for different phenomenon are used to compare the occurence and working of different phenomenon.

8.4.3 Components of Time Series

A time series is the result of the combined effects of different forces. The changes in the time series is due to the changes in the effects of various forces. The effects of these forces can be classified into some major categories. The categories or classes are called components of a time series-

The components of time series are as follows :

(a) Secular trend or long term variations (T)

(b) Seasonal variations (S)

(c) Cyclical variations (C)

(d) Random or irregular variations (I)

The value of Y at anytime t (i.e. Y_t) is regarded as the resultant of the combined effects of the above four components.

If the components of time series are assumed to be independent of each other, it gives an additive model, where time series data are the sum of its components.

$Y = T + S + C + I$

and when the components are not independent of each other, it gives a multiplicative model; $Y = T \times S \times C \times I$

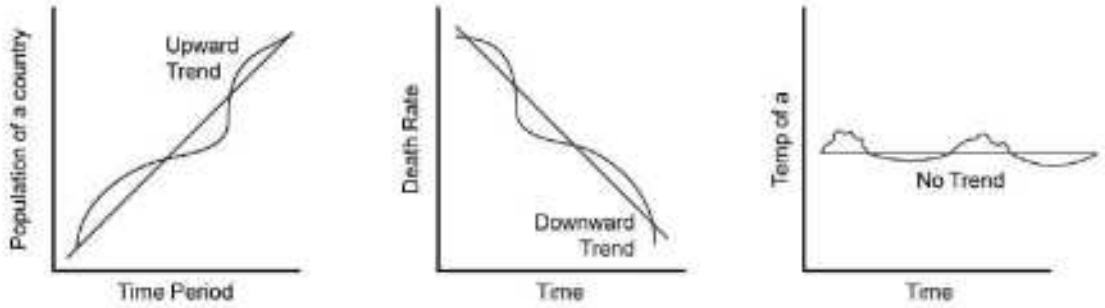
8.4.3.1 Secular Trend

The general tendency of the data to grow or decline over a period of time is revealed by secular trend. The secular trend is the effect of forces which are constant over a long period of time or even if they vary they do so slowly and gradually. For

example the effect of increase in population on price cannot be sudden or irregular, but is slow and regular.

Secular trend can be upward or downward. Upward trend is seen in the data relating to population, agricultural production, money supply in the economy etc. While the data relating to death rate, infant mortality rate, occurrence of deaths in epidemics etc. show downward trend.

Trend value indicates the smooth, regular and long ter movement of a series but it may not show a definitely rising or falling trend. Values may fluctuate around a cnstant value e.g. temperature and barometric readings of particular locality in various seasons.



Characteristics of Trend

1. Trend relates to a long period of time.
2. It occurs as a result of forces which are more or less stable.
3. It may be upward or downward.
4. It may be linear or non-linear.
5. It may no show any definite trend.
6. It indicates the smooth, regular and longterm movement of a series.

Uses of Trend

1. Analysis of trend is used to get general idea about the pattern and behaviour of the phenomenon under study.

2. Trend is used to make comparison of two or more time series.
3. Trend is used to predict the future value of the variable under study.
4. Trend is widely used in business forecasting.
5. Short term fluctuations are studied by isolating the trend value from the time series data.

8.4.3.2 Sesonal Variation

The term 'seasonal' is meant to include any kind of variation which is of periodic in nature and whose repeating cycles are of relatively short duration. Seasonal variation is responsible for the regular rise or fall in the time series during a period not more than one year. Fluctuations occur in regular sequence (periodical). The period may be a year, a month, a week, a day or even a fraction of the day, an hour etc.

The factors that cause seasonal variation may be (i) natural factors like climate and weather conditions or (ii) manmade factors like customs, habits and traditions.

Some examples of seasonal variations are

(i) increase in demand for agricultural labour during sowing and harvesting season.
(ii) increase in demand for cold drinks during summer.
(iii) increase in sales of woolen clothes during winter.
(iv) increase in prices of commodities during festivals.
(v) more withdraws from banks during first week of the month.

Characteristics of seasonal variation

Seasonal variations are-

1. the result of such factors which are regular and periodic in nature.
2. they can be foreseen
3. they repeat themselves in less than one year of time.

and 4. the annual time series data does not contain seasonal variation.

Uses

The knowledge of seasonal variation

(i) is used by the producers and businessmen in scheduling their production plans and formulating policies relating to sale, production, advertising etc.

(ii) is used by consumers to make purchaser.

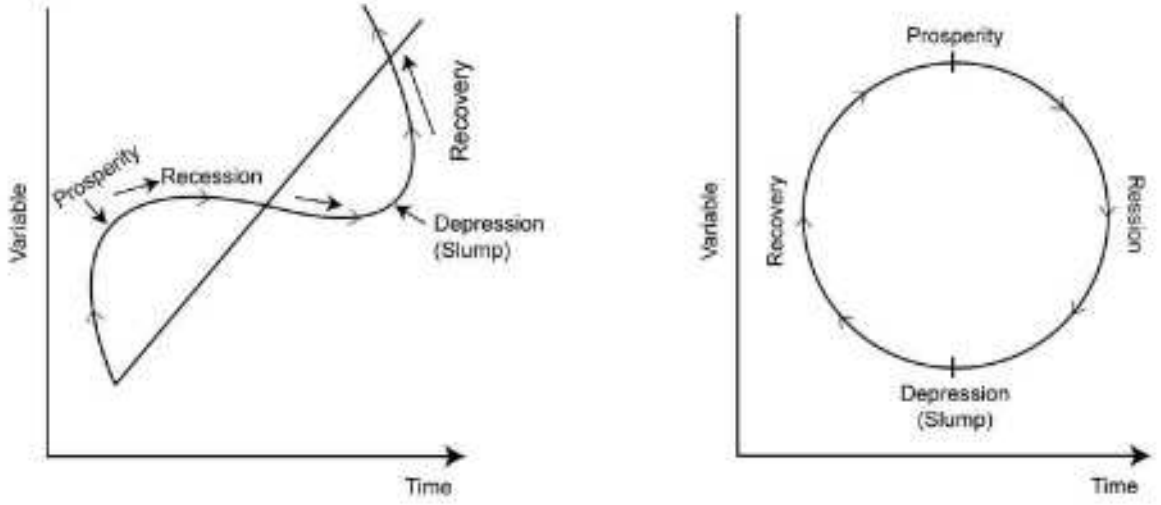
(iii) used in short-term forecasts.

(iv) is used to find cyclical fluctuation by subtracting it from total short-term fluctuations.

8.4.3.3 Cyclical Variation

Cyclical variations are regular but their period of occurrence is more than one year. Cyclical variations unlike seasonal variation may not be of fixed period. The average length of the cycles is longer than the length of the period of the seasonal variation but the variation in the values of the series tend to repeat after a roughly definite period.

The cyclical varations are clearly exemplified in business cycles or trade cycles as phases of (i) Prosperity (Boom), (ii) Recession, (iii) Depression (Slump) and (iv) Recovery. Each phase gradually changes into the next phase in a definite order from prosperity to recession to depression to recovery to prosperity.



In the prosperity phase business prosper, prices, increase and profits are multiplied while in depression business slows down, unemployment spreads and

production falls etc. Occurrence of business cylces in relation to prices, income, production, investment, wage etc. are examples of cyclical variation.

Characteristics of cylical variation – Cyclical Variations

1. Are regular and repetitive in nature.
2. Time period of a cylce in more than one year.
3. Periods of cylces may or may not be uniform in duration.
4. Order of occurrence of different phases is definite.

Uses :

Study and analysis of cyclical variations are

1. Used for predicting the business activities.
2. Used for formulating policies to stabilise the business fluctuations.
3. Used for finding other variation.

8.4.4.4 Irregular Variation (Random Variation)

Irregular variation is also called erratic, random or accidental variation. They include all types of variations in a time series which are not attributed to trend, seasonal or cyclical fluctuations. They do not repeat in a definite pattern and are caused by purely random factors like earthquake, floods, famines, wars, strikes, lock-outs, epidemics etc. There is no regular period or time of their occurrences. So the effect and occurrences of irregular variation is unpredicatable.

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SUMMARY

CORRELATION

1. Correlation is a statistical device to determine the association between variables in a distribution.
2. Correlation does not necessarily imply causation, but causation always results in correlation.
3. Correlation may be positive or negative, linear or non linear, simple, partial or multiple.
4. If both the variables change in the same direction, then correlation between them is positive e.g. height and weight of individuals.
5. If the variables change in opposite direction, the correlation between them is negative e.g. price and quantity demanded of a commodity.
6. If change in one variable results in a constant rate of change in the other variable, then there exists linear corrleationship between them and if the variable values are plotted on a graph paper it gives a straight line.
7. Scatter diagram is the simplest method of studying correlation.
8. From scatter diagram only rough idea about the relationship between the two variables can be formed.
9. Correlation analysis is used to serve as a basis for regression analysis.
10. Correlation analysis helps in formulation of economic and business policies.
11. The square of the correlation coefficient is known as coefficient of determination which represents the explained variation.
12. Probable error which studies the significance of relationship between the variable can be calculated from the correlation coefficient.
13. The sample correlation coefficient is also used to know the range within which the population correlation coefficient will lie.

REGRESSION

1. The word regression means stepping back or returning to the average value.
2. Sir Francis Galton first used this word regression in 19th century.
3. Later Yule and Pearson extended the scope of regression to various fields.
4. In general regression means the estimation or prediction of the unknown value of one variable from the known values of the other variable.
5. Regression analysis is used to study the relationships which have cause and effect relationship.
6. The regression analysis if confined to the study of only two vairables at a time is called simple regression.
7. In regression analysis we have two variables; one is dependent or explained variable and the other is independent or explanatroy variable.
8. Dependent variable is the effect and independent variable is the cause.
9. While correlation analysis only studies the existence of relationship between the variables but regression analysis studies the cause and effect relationship between them.
10. Regression analysis is widely used in prediction and forecasting of future events.

INDEX NUMBER

1. Index numbers are statistical measures designed to study the changes in a variable or group of variables with respect to time, gerographic location or other characteristics.
2. Index number are used to measure the changes in some quantity which can not be measured directly.
3. Index number are broadly classified as price index number, quantity index number and value index numbers.

4. Price index numbers can again be classified as wholesale price index number and consumer price index numbers (or retail price index numbers).
5. Wholesale price index is used to estimate the general price level.
6. WPI represents the price of goods at a wholesale stage i.e. goods that are sold in bulk and traded between organisations.
7. Consumber price index number is also known as cost of living index number.
8. Consumer price index reflects on the average change in the cost of commodities consumed by the class of people over a period of time.
9. The construction index number involves the steps like
   (i) Determination of the purpose of index number.
   (ii) Selection of base year.
   (iii) Selection of commodity.
   (iv) Collection of data.
   (v) Selection of an average.
   (vi) System weightting.

and (vii) Selection of appropriate formulae.

10. Wholesale price index is used to estimate the general price level, helps in studying trends and tendencies, helps in adjusting real values of aggregate output and acts as economic barometer.
11. Cansumer price index is used to
   (i) determine purchasing power of money.
   (ii) determine the real wages.
   (iii) frame policies on wages, price, rent, tax etc.
   (v) grant bonus to employees.
   (vi) negotiate wage and wage contracts.

TIME SERIES ANALYSIS

1. A time series is a set of statistical observations arranged in chronological order.
2. A time series has four components- Trend, seasonal variation, cyclical variation and random variation.
3. Trend is the long term component of time series.
4. Secular trend is the effect of forces which are constant or change slowly over a period of time.
5. Seasonal variation is responsible for the regular rise or fall in the time series during a period not more than one year.
6. Cyclical variations are regular but their period of occurrence is more than one year.
7. Random variation is also called irregular, erratic or accidental variation. They include all types of variations in a time series which are not attributable to trend, seasonal or cylical fluctuations. They are the result of factors like earthquake, flood, famine, war, strikes etc.
8. Analysis of trend is used
   (i) to get general idea about the pattern of behaviour of the phenomenon under study
   (ii) to predict future value of the variable
   (iii) to do business forecasting and
   (iv) to make comparison of two or more time series
9. Seasonal variable may be due to
   (i) natural factors like climate and weather and
   (ii) man made factors like customs, habits and traditions.
10. Cyclical variation are clearly exemplified in business cycles as phases of (i) Boom (ii) Recession (iii) Slump and (iv) Recovery.

MODEL QUESTIONS

CORRELATION

I. Multiple choice questions :

(Find the correct answer choosing from the given alternatives)

1. When two variables change in the same direction, then such correlation is called.
   (a) negative (b) positive
   (c) no correlation (d) all of the above
2. When the relation of three or more variable is studied simultaneously, it is called
   (a) simple correlation (b) partial correlation
   (c) multiple correlation (d) none of these
3. Correlation between price and demand is generally
   (a) positive (b) negative
   (c) one to one (d) no relationship
4. When two variables change in a constant proportion, it is called
   (a) linear correlation (b) non-linar correlation
   (c) partial correlation (d) multiple correlation
5. How many variables are there in a Bivariate frequency distribution
   (a) one (b) two
   (c) three (d) four

II. Fill in the blanks :

1. ——— studies the degree of relationship between two variables.
2. When two variables do not change in any constant proportion the relationship is said to be ———.
3. Whe the dots of the scatter diagram fall on on strait line the correlation is —.
4. The diagramatic presentation of paired values of the bivariate frequency distribution is called.
5. When the dots on the scatter diagram show an upward trend from left to right it represents ———

III. Answer in one sentence (2 marks) :

1. What is correlation?
2. What is positive correlation?
3. What is nagative correlation?
4. What is spurious correlation?

IV. Answer in 2 to 3 sentencess :

1. Name principal methods of measuring correlation.
2. Distinguish between positive and negative correlation.
3. Distinguish beween linear and non-linear correlation.
4. Distinguish between simple, partial and multiple correlation.
5. What does a scatter diagram indicate?

V. Long answer type questions :

1. Define correlation and give its importance and uses as a statistical tool.
2. What is correlation? Explain the different types of correlation.
3. What are the various methods of measuring correlation? Discuss scatter diagram method of measuring correlation.
4. Causation implies correlation, but not vice versa. Discuss.

REGRESSION

I. Multiple choice questions
(Find the correct answer choosing from the given alternatives) :

1. Regression analysis studies
   (a) relationship between the variables
   (b) the cause and effect relationship between the variables
   (c) variability of items
   (d) the average value of the variables

2. Regression analysis has
   (a) one dependent and one independent variable
   (b) two dependent variables
   (c) two in depdendent variables
   (d) none of the above
3. In the equation of regression $y = a + bx$
   (a) x is dependent and y is independent variable
   (b) x is independent and y is dependent variables
   (c) both x and y are dependent variables
   (d) both x and y are independent variables
4. Regression analysis is used
   (a) for prediction
   (b) for forecasting
   (c) cause and effect relationship between the variables
   (d) all of the above
   (v) none of the above
5. The relationship between regression coefficient and correlation coefficient is given by

   (a) $r = \sqrt{byx \times bxy}$ (b) $r = bxy \times byx$

   (c) $r = byx + bxy$ (d) $r = byx \pm bxy$

II. Answer the following questions :

1. What is regression?
2. Which is the independent variable in the regression equation $y = a + bx$?
3. What do you mean by linear regression?
4. What do you mean by non-linear regression?
5. Independent variable is otherwise known as what?

III. Long questions :

1. Wha is regression and what are the uses of regression analysis?
2. What is regression and distinguish between regression and correlation analysis.

INDEX NUMBERS

I. Answer in one sentence :

1. What is an index number ?
2. Mention two uses of index numbers.
3. What is a base year?
4. What is current year?
5. What is the unit of measurement of an index number?
6. 'Index number of prices for 2016 taking 2010 as base year is 150'. White down the meaning of this statement.
7. What does an index number measure?

II. Answer in two or three sentences :

1. What are the important characteristics of a base year.
2. What consideration influence the selection of items for the construction of a price index numbers?
3. What do you mean by wholesale price index number?
4. What is cost of living index number?
5. Indicate some commodities which should be included in the construction of a cost of living index number for agricultural labourers.

III. Distinguish between :

1. Price index and quanitty index number.
2. Wholesale price index and consumer price index.

IV. Write short notes on :

1. Problems in selection of commodities for construction of index number.
2. Selection of base year for index number.

3. Uses of index number.
4. Cost of living number
5. Uses of wholesale price index
6. Uses of cost of living index

IV. Long answers :

1. What is an index number ? Describe the uses of index numbers.
2. What points should be taken into consideration in the construction of index numbers?
3. Discusss the various problems that arise in connection with the construction of a cost of living index number.
4. What is an index number, what are the different types of index numbers. Discuss the importance of index number.
5. Discuss the various steps in the construction of an index number.

TIME SERIES ANALYSIS

I. Answer the following in one sentences :

1. Sales of a business house relates to which component of time series?
2. Which component of a time series is associated with long term variations?
3. Give two examples of seasonal variation.
4. What is the value of seasonal variation in Annual Time Series data?
5. What factors are responsible for the occurrence of cyclical fluctuation?
6. Give two examples of ireegular variation.

II. Choose the correct answer :

1. Which one of the following is not a time series?
   (a) A record of the annual production of rice in Odisha for ten consecutive years.
   (b) Record of the names of districts in Odisha where death due to malaria has occurred in last 10 years.

(c) Number of babies born in a maternity home, for 10 consecutive years.

(d) The number of readers using a library recorded weekly for 52 consecutive weeks.

2. Which one of the following is not a component of time series?

(a) Trend (b) Cyclical fluctuations

(c) Rhythmic movements (d) Seasonal variations

3. Data collected an annual basis is free from

(a) Trend (b) Cyclical fluctuation

(c) Random fluctuation (d) Seasonal fluctuation

4. The multiplicative model of time series is expressed as

(a) T × S × C × I (b) T + S + C + I

(c) T × S + C + I (d) T × S × C + I

5. The additive model of time series is expressed as

(a) T × S × C × I (b) T + S + C + I

(c) T × S + C + I (d) T × S × C + I

6. The sum of the values of the monthly seasonal indices is

(a) 1 (b) 100

(c) 1200 (d) 400

7. The celebration of Rath Yatra is associated with which component of time series.

(a) Trend (b) Seasonal variation

(c) Cyclical variation (d) Random variation

III. State whether the statements are true of false if false correct

1. A time series has five components
2. The long term changes of time series are called its basic component.
3. Annual data are free from cyclical fluctuations
4. Natural calamities are not included in any component of time series.

5. The cyclical component makes a time series oscillatary, but the period of oscillation may not be fixed.
6. Elimination of random fluctuation is necessary to study the seasonal and cyclical fluctuations of a time series.

IV. Answer the following questions :

1. Give examples of time series which are likely to show increasing trend.
2. What is trend?
3. What is irregular variation of time series?
4. What is cyclical movement of time series?
5. What do you mean by seasonal variation?
6. Give examples of man-made and nature made random variation.

V. Write short notes on :

1. Time series Analysis.
2. Secular trend.
3. Cyclical variation
4. Seasonal variation
5. Random variation
6. Additive and multiplicative models of time series.

VI. Long answer type questions :

1. Define a time series and discuss its main components.
2. What is time series ? Discuss its importance in business and economics.
3. Discuss the uses of time series analysis.
4. What is Trend ? What are the basic characteristics and uses of trend.
5. What is cyclical fluctuation? How it is different from seasonal fluctuation?

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