Syllabus

B. Tech. Artificial Intelligence / Data Science

(With effect from Academic Year 2021 - 22)

ENGINEERING MATHEMATICS-I

Teaching Scheme:	Credits	Examination Scheme:
Lectures: 3 Hours/Week	03	Theory: 100 Marks

Unit I: Univariate calculus **Hours 4**

Review of differentiability, Mean value theorems and Taylor's theorem (without proofs). Integrals as limits of Riemann sums, fundamental theorem of calculus (without proof), integrals by special techniques: reduction formulae, improper integrals, Gamma and Beta functions.

Unit II: Multivariate calculus **Hours 9**

Functions of several variables, partial and directional derivatives, differentiability, chain rule, local extreme values and saddle points, constrained optimization. Double and triple integrals, change of order of integration, change of variables, application to area, volumes.

Unit III: Vector Calculus **Hours 7**

Vector differentiation, gradient, divergence and curl, line and surface integrals, path independence, Green, Stokes and Gauss theorems (statements and illustrations).

UNIT IV: Complex Variables **Hours 4**

Functions of a complex variable – Analytic function – Cauchy - Riemann equations (Statement only) – Properties of analytic function (Statement only) – Construction of Analytic functions by Milne – Thomson method

Unit IV: Fourier Series and Fourier Transform **Hours 8**

Fourier series (definition), full and half range expansions of functions of arbitrary period. Fourier Integral Theorem (without proof), Fourier sine integral, Fourier cosineintegral, Fourier Transform and its properties, Fourier sine and cosine transform, Inverse Fourier Transform.

Text Books

1. Thomas' Calculus (12th edition) by Maurice D. Weir, Joel Hass, Frank R. Giordano, Pearson Education.
2. Advanced Engineering Mathematics (10th edition) by Erwin Kreyszig, Wiley eastern Ltd.

Reference Books

1. Calculus for Scientists and Engineers by K.D Joshi, CRC Press.
2. A Course in Calculus and Real Analysis (1st edition) by SudhirGhorpade and BalmohanLimaye, Springer-Verlag, New York.
3. Advanced Engineering Mathematics by C.R. Wylie, McGraw Hill Publications, New Delhi.
4. Advanced Engineering Mathematics (7th edition) by Peter V. O' Neil, Thomson.Brooks /Cole, Singapore.

LEARNING PROGRAMMING CONCEPTS WITH C

Teaching Scheme:	Credits	Examination Scheme:
Lectures: 3Hours/Week Practical: 2Hours/Week	04	Theory: 100Marks Practical: 100Marks

Unit I: Introduction to Programming — 08 Hours

Basics: Basic program structure; Variables, Constants, I/O Operators; Decision control and blocks; Loop control; Problems using basic concepts.

Unit II: Introduction to Problem Solving — 04 Hours

Understanding a problem; Framing a problem in simple terms – mathematical, graphical, other abstractions; Problem solving heuristics; Conveying the solution in a formal language – using pseudo-code, unplugged exercises Decisions and loops in pseudo-code and flowcharts; Sub-program concept and its representation in pseudocode and flow-charts.

Unit III: Array and Strings — 08 Hours

Concept and requirement of arrays; Defining arrays –one, two and multi-dimensional; Problems using arrays; Strings as arrays of characters; Implementing important string functions; Problems using strings; String library functions.

Unit IV: Function and Recursion — 08 Hours

Concept of subprogram: Declaration, Definition, Calling, Arguments, Local variables; Global and Static variables; Pre and Post conditions; Important problems using functions; Parameter passing mechanisms, Concept of recursion; Essential components of a recursive program; Recursion v/s iteration; Factorial, fibonnaci, towers of hanoi, permutations, combinations using recursion.

Unit V: Pointers — 06 Hours

Pointers and addresses; Types of pointers; Pointer arithmetic; Dangling pointers; Use of pointers for passing variables; Pointers and arrays; Dynamic allocation and its application; Garbage memory.

Unit IV: Structures and File Handling — 06 Hours

Structures; Pointers and structures; Structures and Functions; Self-referential structures; Introduction to linked lists and data structures; Concept of a file. Basics of file handling (Text files); Command line Arguments.

Text Book

1. B. Kernighan, D. Ritchie, “The C Programming Language”, Prentice Hall of India, Second Edition, ISBN 81-203-0596-5

Reference Books

1. How to solve it by Computer by R.G. Dromey, Pearson Education
2. Programming in ANSI C by E. Balguruswamy, Tata Mc-Graw Hill
3. Problem Solving Techniques , Stephen G. Krantz, Universities Press.
4. Computer Programming in ‘C’ by V. Rajaraman , Prentice Hall

C PROGRAMMING LABORATORY

List of Assignments:

Basic problem solving – (Various ``unplugged'' exercises)

-Basic C program -- (Using variables, constants and simple I/O statements)

-Arithmetic operators and simple arithmetic expressions – (Unit Conversion, Simple Interest, Basic Physics and Mathematics Formulae)

-Swapping two values, rotating three values.

-Simple character handling – (Recognition, Case change, Counting)

-Decision control and blocks – (Tests of Divisibility, Triangularity, Nature of Quadratic Roots, Leap year, Calculator)

-Loop control – (Arithmetic and geometric progressions, Trigonometric ratios using power series, Power, Factorial, Fibonacci series, Pattern generation)

-Arrays – (Declaration, Initialisation and Access, Generating value tables, Simple Data processing – Summation of array elements, Average of elements, Maximum and Minimum.)

-Sorting -- (Bubble, Insertion and Selection sorting algorithms)

-Searching -- (Linear and Binary search)

-2-D Arrays – (Basic matrix operations, Matrix multiplication)

-Strings – (Initialization and usage, Important string functions, String matching, String reversal)

-Basics of functions -- (Declaration, Definition and Usage – previously solved problems like unit conversion, trigonometric ratios, etc. can be re-done using functions)

-Arrays and functions – (Sorting and Searching with functions)

-Recursive Functions -- (Summation, Power, Fibonacci series)

-Use of Pointers for Indirect Access

-Use of Pointers for passing variables

-Use of Pointers for passing arrays and strings.

-Dynamic memory allocation

-Structures – (Basics of Structures -- definition, declaration and usage)

-Arrays of Structures -- (Student Database, Telephone Directory)

-Passing Structures to Functions

-Pointer to Structure and Passing Structure using Pointers

-Self-Referential Structure (Basics – definition, declaration and usage)

-File Handling – (Reading and Writing into Text Files with standard functions)

FOUNDATIONS OF ELECTRONICS ENGINEERING

Teaching Scheme:
Lectures: 3Hours/Week
Practical: 2Hours/Week

Credits
04

Examination Scheme:
Theory: 100Marks
Practical: 100Marks

Modeling devices: Static characteristics of ideal two terminal and three terminal devices; Small signal models of non-linear devices. Introduction to semiconductor equations and carrier statistics: poisson's and continuity equations, Fermi-Dirac statistics and Boltzmann approximation to the Fermi-Dirac statistics. Semiconductor Diodes: Barrier formation in metal-semiconductor junctions, PN homo- and hetero- junctions; CV characteristics and dopant profiling; IV characteristics; Small signal models of diodes; Some Applications of diodes. Field Effect Devices : JFET/HFET, MIS structures and MOSFET operation; JFET characteristics and small signal models; MOS capacitor CV and concept of accumulation, depletion and inversion; MOSFET characteristics and small signal models. Bipolar transistors : IV characteristics and elers-Moll model; small signal models; Charge storage and transient response. Discrete transistor amplifiers : Common emitter and common source amplifiers; Emitter and source followers.

Text/Reference Books

1. D. A. Neamen, Semiconductor Physics and Devices (IRWIN), Times Mirror High Education Group, Chicago) 1997
2. E.S. Yang, Microelectronic Devices, McGraw Hill, Singapore, 1988
3. B.G. Streetman, Solid State Electronic Devices, Prentice Hall of India, New Delhi, 1995
4. J. Millman and A. Grabel, Microelectronics, McGraw Hill, International, 1987. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College Publishing, 1991
5. R.T. Howe and C.G. Sodini, Microelectronics : An integrated Approach, Prentice Hall International, 1997

ELECTRONICS ENGINEERING LABORATORY

1. P-N Junction Diode Characteristics Part A: Germanium Diode (Forward bias & Reverse bias) Part B: Silicon Diode (Forward bias only)
2. Zener Diode Characteristics Part A: V-I Characteristics Part B: Zener Diode act as a Voltage Regulator
3. Rectifiers (without and with c-filter) Part A: Half-wave Rectifier Part B: Full-wave Rectifier
4. BJT Characteristics (CE Configuration) Part A: Input Characteristics Part B: Output Characteristics
5. FET Characteristics (CS Configuration) Part A: Drain (Output) Characteristics Part B: Transfer Characteristics
6. SCR Characteristics
7. UJT Characteristics
8. CRO Operation and its Measurements
9. BJT-CE Amplifier
10. Emitter Follower-CC Amplifier
11. FET-CS Amplifier

PYTHON FOR DATA SCIENCE

Teaching Scheme:	Credits	Examination Scheme:
Lectures: 2Hours/Week	02	Theory: 100Marks
Practicals: 2Hours/Week	01	Practical: 100 Marks

UNIT 1: INTRODUCTION TO DATA SCIENCE AND PYTHON PROGRAMMING

Introduction to Data Science - Why Python? - Essential Python libraries - Python Introduction- Features,Identifiers, Reserved words, Indentation, Comments, Built-in Data types and their Methods: Strings, List,Tuples, Dictionary, Set - Type Conversion- Operators.

Decision Making- Looping- Loop Control statement- Math and Random number functions. User definedfunctions - function arguments & its types.

UNIT 2: FILE, EXCEPTION HANDLING AND OOP

User defined Modules and Packages in Python- Files: File manipulations, File and Directory related methods- Python Exception Handling.

OOPs Concepts -Class and Objects, Constructors – Data hiding- Data Abstraction- Inheritance.

UNIT 3: INTRODUCTION TO NUMPY

NumPy Basics: Arrays and Vectorized Computation- The NumPyndarray- Creating ndarrays- Data Types forndarrays- Arithmetic with NumPy Arrays- Basic Indexing and Slicing - Boolean Indexing-Transposing Arraysand Swapping Axes.

Universal Functions: Fast Element-Wise Array Functions- Mathematical and Statistical Methods-Sorting-Unique and Other Set Logic.

UNIT 4: DATA MANIPULATION WITH PANDAS

Introduction to pandas Data Structures: Series, DataFrame, Essential Functionality: Dropping Entries-

Indexing, Selection, and Filtering- Function Application and Mapping- Sorting and Ranking.

Summarizing and Computing Descriptive Statistics- Unique Values, Value Counts, and Membership.

Reading and Writing Data in Text Format.

UNIT 5: DATA CLEANING, PREPARATION AND VISUALIZATION

Data Cleaning and Preparation: Handling Missing Data - Data Transformation: Removing Duplicates,

Transforming Data Using a Function or Mapping, Replacing Values, Detecting and Filtering Outliers- StringManipulation: Vectorized String Functions in pandas.

Plotting with pandas: Line Plots, Bar Plots, Histograms and Density Plots, Scatter or Point Plots.

Text Books:

1. Y. Daniel Liang, “Introduction to Programming using Python”, Pearson,2012.
2.Wes McKinney, “Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython”,O’Reilly, 2nd Edition,2018.
3.Jake VanderPlas, “Python Data Science Handbook: Essential Tools for Working with Data”, O’Reilly,2017.
4. Miller, Bradley, and David Ranum. Problem Solving with Algorithms and Data Structures Using Python. 2nd ed. Franklin, Beedle& Associates, 2011. ISBN: 9781590282571.

Reference Books:

1. Wesley J. Chun, “Core Python Programming”, Prentice Hall,2006.
2. Mark Lutz, “Learning Python”, O’Reilly, 4th Edition, 2009.

E Books

1. https://www.programmer-books.com/introducing-data-science-pdf/
2. https://www.cs.uky.edu/~keen/115/Haltermanpythonbook.pdf
3. http://math.ecnu.edu.cn/~lfzhou/seminar/[Joel_Grus]_Data_Science_from_Scratch_First_Princ.pdf

MOOC

1. https://www.edx.org/course/python-basics-for-data-science
2. https://www.edx.org/course/analyzing-data-with-python
3. https://www.coursera.org/learn/python-plotting?specialization=data-science-python

PYTHON PROGRAMMING LABORATORY

UNIT 1: INTRODUCTION TO DATA SCIENCE AND PYTHON PROGRAMMING

1. Implement basic Python programs for reading input from console.
2. Perform Creation, indexing, slicing, concatenation and repetition operations on Python built-in datatypes: Strings, List, Tuples, Dictionary, Set
3. Solve problems using decision and looping statements.
4. Apply Python built-in data types: Strings, List, Tuples, Dictionary, Set and their methods to solve anygiven problem
5. Handle numerical operations using math and random number functions
6. Create user-defined functions with different types of function arguments.

UNIT 2: FILE, EXCEPTION HANDLING AND OOP

1. Create packages and import modules from packages.
2. Perform File manipulations- open, close, read, write, append and copy from one file to another.
3. Handle Exceptions using Python Built-in Exceptions
4. Solve problems using Class declaration and Object creation.
5. Implement OOP concepts like Data hiding and Data Abstraction.
6. Solve any real-time problem using inheritance concept.

UNIT 3: INTRODUCTION TO NUMPY

1. Create NumPy arrays from Python Data Structures, Intrinsic NumPy objects and Random Functions.
2. Manipulation of NumPy arrays- Indexing, Slicing, Reshaping, Joining and Splitting.
3. Computation on NumPy arrays using Universal Functions and Mathematical methods.
4. Import a CSV file and perform various Statistical and Comparison operations on rows/columns.
5. Load an image file and do crop and flip operation using NumPy Indexing.

UNIT 4: DATA MANIPULATION WITH PANDAS

1. Create Pandas Series and DataFrame from various inputs.
2. Import any CSV file to Pandas DataFrame and perform the following:
(a) Visualize the first and last 10 records
(b) Get the shape, index and column details
(c) Select/Delete the records(rows)/columns based on conditions.
(d) Perform ranking and sorting operations.
(e) Do required statistical operations on the given columns.
(f) Find the count and uniqueness of the given categorical values.
(g) Rename single/multiple columns.

UNIT 5: DATA CLEANING, PREPARATION AND VISUALIZATION

1.Import any CSV file to Pandas DataFrame and perform the following:
(a) Handle missing data by detecting and dropping/ filling missing values.
(b) Transform data using apply() and map() method.
(c) Detect and filter outliers.
(d) Perform Vectorized String operations on Pandas Series.
(e) Visualize data using Line Plots, Bar Plots, Histograms, Density Plots and Scatter Plots.

LANGUAGE AND WRITING SKILLS

Teaching Scheme:	Credits	Examination Scheme:
Lectures: 2 Hours/Week	02	Theory: 100 Marks

Unit 1: **02 Hours**

Communication as a skill: types of communication, barriers to communication, need for effective communication in English for Engineers.

Unit 2: **06 Hours**

Foundation of language: Communicative Grammar and its appropriateness, Revision of Tenses, use of conjunctions, use of prepositions, speech, word order, sentence structure.

Unit 3: **04 Hours**

Listening: nature of listening, stages of listening (pre, while and post), types of listening, barriers to listening, ways to overcome barriers, ways to practice effective listening, practice listening comprehension.

Unit 4: **02 Hours**

Vocabulary Building and Enhancement of word power, idiomatic expressions, Business English vocabulary, activities on synonyms/antonyms/homonyms/newly coined words.

Unit 5: **04 Hours**

Speaking: Aspects of Speech like pronunciation, stress, intonation and pauses and their need, formal and informal speeches, various expressions used in speech, situational speech, general discussions, group discussions, basics of presentation skill, practice one minute speech, impromptu speeches, prepared speeches.

Unit 6: **06 Hours**

Reading: Types of reading, reading between and beyond the lines, importance of reading for effective communication, practice loud reading and reading comprehension

Writing: nature of writing, stages of writing (pre, while and post), qualities of effective writing, developing drafting and summarizing, format for formal letters, practice writing formal letters, formal report writing.

Text Books:

1. Enhancing employability at soft skills by ShaliniVerma, Pearson publications.

Reference Books:

1. Essential English Grammar (Intermediate) Raymond Murphy (CUP)
2. Communication for Business: A Practical Approach by Shirley Tailor (Longman)
3. Written Communication in English by Saran Freeman (Orient Longman)
4. Business Correspondence and Report Writing, R. C. Sharma & Krishna Mohan (Tata McGraw Hill)

PROFESSIONAL ETHICS AND LIFE SKILLS

Teaching Scheme:	Credits	Examination Scheme:
Lectures: 2 Hours/Week	02	Theory: 100 Marks

UNIT 1: HUMAN VALUES

Definition of ethics-Morals values and ethics – integrity-Work ethics- Service Learning-Civic Virtue-Respect for others- Caring-Sharing-Honesty-Courage - Valuing time-Cooperation-Commitment-Empathy-Self-confidence-Character-Spirituality-Introduction to Yoga and meditation for professional excellence and stress management.

Self-Study: Case study of Discovery failure

UNIT 2: ENGINEERING ETHICS

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

Self-study: Study the Bhopal gas tragedy

UNIT 3: SAFETY, RESPOSIBILITIES AND RIGHTS

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

Self-study: Chernobyl explosion, Nuclear and thermal power plant issues

UNIT 4: LIFE SKILLS

Definition, Relevance, Types of values, changing concepts of values-aims and values of value education- basic etiquette-morals and values in life-dealing with people. Personal values – Self – Strengths (self-confidence, self-assessment, self-reliance, self-discipline, determination, self-restraint, contentment, humility, sympathy and compassion, gratitude, forgiveness) Weaknesses.

Self-study: Influences - Peer pressure, familial and societal expectations, media

UNIT 5: SOCIETIES IN PROGRESS

Definition of society; Units of society; Communities – ancient and modern – Agents of change – Sense of survival, security, desire for comfort and ease sense of belonging, social consciousness and responsibility.

Self-study: Personal value and professional value of Engineers on societies perception

Text Books

1. Subramanian R., Professional ethics, Oxford University press, 2010.
2.Manoharan P.K., Education and Personality Development, APH Publishing Corporation, New Delhi, 2008

Reference Books

1.Megan J. Murphy (Editor), Lorna Hecker (Editor), Ethics and Professional Issues in Couple and Family Therapy.
2. Andrew Belsey (Editor), Ruth Chadwick (Editor), Ethical Issues in Journalism and the Media (Professional Ethics).
3. Warwick Fox (Editor), Ethics and the Built Environment (Professional Ethics).
4. RuchikaNath, Value Education, APH Publishing Corporation, New Delhi, 2008.

ENVIRONMENTAL SCIENCE

Teaching Scheme:	Credits	Examination Scheme:
Lecture : 2 Hours/Week	02	Theory: 100 Marks

Unit 1: The Global environmental issues **02 Hours**

Human population and environment : Population growth, Environment and human health, Women andchild welfare, Social issues and environment : People and environment, Social consequences ofdevelopment and Environmental changes

Unit : 2 Natural resources **02 Hours**

Concept, spheres, Direct & Indirect utilization of natural resources, Types - Renewable and nonrenewable,Overexploitation & pollution, Conservation - 3R principle

Unit :3 Ecosystem **04 Hours**

Concept, Types – Terrestrial & aquatic with subtypes, Function, Food chain & web, Energy pyramid,Niche, Ecotone

Unit :4 Biodiversity **04 Hours**

Introduction, levels, Types, Distribution & Magnitude, Threats, Conservation.

Unit :5 Pollution **04 Hours**

Concept, Types & Sources, Direct & indirect Impacts, Prevention, control and mitigation measures,Disaster management

Unit :6 Environmental rules and regulations **04 Hours**

Concepts, Local, national and Global level framework, tools like Environmental Impact Assessment,Environmental Management System, Certifications, Role of an engineer in environmentalmanagement

Reference books:

1) Bharucha E. (2013) Textbook of Environmental Studies for Undergraduate Courses.
2) Carson, Rachel (1962) The Silent Spring
3) Leelakrishnan, P. (2006) Environmental Law Case Book (IInd Edition) LexisNexis Butterworths (Student Series) 466 p.
4) McKibben, Bill (1989) The end of Nature

INNOVATION

Teaching Scheme:	Credits	Examination Scheme:
Lecture : 1 Hour/Week	01	Theory: 100 Marks

Assessment: Group based formative and summative assessments

Introduction
Discuss innovation definitions, Role of research in innovation, Importance of a precise research problem, Role of critical evidence in innovation, Assessment of the needs of the target population, solution feasibility, importance of pilot studies and feedback from users.

Health Care Innovation
What is innovative technology, Process of innovation (Awareness, Identification, Implementation, Institutionalization), Types of innovation (Product, Process, Position, Paradigm), Health framework for innovation, Challenges in Health care innovation, Health care innovation in Indian context.

Wearable Technology
Wearable introduction, history of wearable technology, Evolution of wearables into fitness, Promotion of fitness devices (pedometer, fitness bands), Wearables market and business, Market key segment, Wearable market players, Themes to explore innovation in the wearables.

Geriatric Care Innovation
Problems of elderly population (Theory and Statistical evidence), Medico-social problems, Elderly care companies, Role of technology in elderly care, Health care and wellness among elderly, Long-term care innovation, Indian context for elderly care: opportunities.

Mental Health Care Innovation
Global burden of mental health (Theory and Statistical evidence), Current solutions to tackle mental health, Discussion of several products, Role of technology in mental health improvement, Indian scenario.

Internet of Things (IoT)
Introduction, Importance of IoT, How IoT works, Technologies behind IoT, Consumer benefit for IoT, IoT Applications, Industrial use of IoT, Security issues, Privacy concerns, IoT and Big Data, Concerns in IoT domain.

Data Analysis and Innovation
What is data? Basics of statistics, Types of Data Format, Introduction to Descriptive and Inferential statistics, Real world data analysis challenges.

Ethics in Innovation
What is ethical behaviour? Ethics and academic setting. Discussion of major ethical breaches in history, Best practices in Innovation, Ethical framework for Innovation, User data and ethics.

Text Books:

Health care innovation

1. Charlton, V. and Rid, A. (2019), 'Innovation as a value in healthcare priority-setting: the uk experience.', Social justice research 32(2), 208-238.
2. Kennedy, I. (2009), 'Appraising the value of innovation and other benefits: A short study for nice.', NICE ORG .
3. Mittal, K. and Goel, M. (2010), 'Knowledge regarding reproductive health among urban adolescent girls of haryana.',

Indian J Community Med 35(529- 530).
4. Ness, R. (2012), 'Innovation generation: How to produce creative and useful scientific ideas.', Oxford: Oxford University Press .
5. Pacifico Silva, H., Lehoux, P., Miller, F. A. and Denis, J. L. (2018), 'Introducing responsible innovation in health: a policy-oriented framework.', Health research policy and systems 16(1).
6. Palanica, A. and Fossat, Y. (2020), 'Covid-19 has inspired global healthcare innovation.', Canadian journal of public health = Revue canadienne de santepublique 111(5), 645-648.
7. Weintraub, P. and McKee, M. (2019), 'Leadership for innovation in healthcare: An exploration.', International journal of health policy and management 8(3), 138-144

Wearable innovation (NCBI Scientific articles)

1. Wearable Health Technology and Electronic Health Record Integration: Scoping Review and Future Directions
2. Wearable Technology and How This Can Be Implemented into Clinical Practice
3. Evolution of Wearable Devices with Real-Time Disease Monitoring for Personalized Healthcare
4. Wearable Health Devices|Vital Sign Monitoring, Systems and Technologies
5. Review on Wearable Technology Sensors Used in Consumer Sport Applications
6. Monitoring Physical Activity with Wearable Technologies
7. The Rise of Consumer Health Wearables: Promises and Barriers
8. Data Analytics and Applications of the Wearable Sensors in Healthcare: An Overview
9. The utility of wearable fitness trackers and implications for increased engagement: An exploratory, mixed methods observational study

Geriatric Innovation

1. Allen, K., Hazelett, S., Martin, M. and Jensen, C. (2019), 'An innovation center model to transform health systems to improve care of older adults.', Journal of the American Geriatrics Society 68.
2. Dror, D., Putten-Rademaker, O. and Koren, R. (2008), 'Cost of illness: Evidence for a study of five resource-poor locations in india.', Indian Journal of Medical Research. 127, 347-361.
3. Goswami, A., Reddaiah, V., Kapoor, S., Singh, B., Dwivedi, S. and Kumar, G. (2005), 'Tobacco and alcohol use in rural elderly indian population.', Indian Journal of Psychiatry 47(4), 192-197.
4. Government of India (2011), 'National programme for the health care of the elderly (nphce), operational guidelines.', New Delhi: Government of India .
5. Gupta, P., Maulik, P., Pednekar, P. and Saxena, S. (2005), 'Concurrent alcohol and tobacco use among a middle-aged and elderly population in mumbai.', National Medical Journal of India. 18(2), 88-91.
6. Ingle, G. K. and Nath, A. (2008), 'Geriatric health in india: concerns and solutions. Indian journal of community medicine', Indian Association of Preventive and Social Medicine 33(4), 214-218.
7. Lena, A., Ashok, K., Padma, M., Kamath, V. and Kamath, A. (2009), 'Health and social problems of the elderly: A cross-sectional study in udupi taluk, karnataka.', Indian Journal of Community Medicine. 34, 131-134.

Innovation and Data Analytics

1. Python Vs. R for Data Science
2. The most desired skill in data science.
3. Data Dredging
4. UCI Machine Learning Repository
5. Kaggle: Machine Learning and Data Science Community

Ethics in Innovation

1. When Innovation and Ethics Collide
2. America Needs to Align Technology With a Public Purpose
3. Cell-Phone Addiction: A Review
4. Apple's Unethical Innovation
5. Unethical Innovation: On the Technocracy and Uneducated Engineers via Medium
6. Organizations Appear More Unethical than Individuals

OBJECT ORIENTED PROGRAMMING

Teaching Scheme:
Lectures: 3Hours/Week
Practical: 2Hours/Week

Credits
04

Examination Scheme:
Theory: 100Marks
Practical: 100Marks

UNIT – I INTRODUCTION 06 HOURS

Object oriented programming, Introduction, Application, characteristics, difference between object oriented and procedure programming, Comparison of C and C++, Cout, Cin, Data Type, identifiers

UNIT – II OBJECT AND CLASSES 08 HOURS

Implementation of class and object in C++, access modifiers, object as data type, constructor, destructor, Object as function arguments, default copy constructor, parameterized constructor, returning object from function,Structuresandclasses,Classesobjectsandmemory,staticclassdata,Arraysofobject,Arraysasclass Member Data, the standard C++ String class, Run time and Compile timepolymorphism.

UNIT – III OPERATOR OVERLOADING AND INHERITANCE 08 HOURS

Overloading unary operators, overloading binary operators, data conversion, pitfalls of operators overloading, Concept of inheritance, Derived class and base class, access modifiers, types of inheritance, Derived class constructors, member function, public and private inheritance.

UNIT – IV POINTER AND VIRTUAL FUNCTION 08 HOURS

Addresses and pointers, the address-of operator & pointer and arrays, Pointer and Function pointer, Memory management:NewandDelete,pointerstoobjects,debuggingpointers,VirtualFunction,friendfunction,Static function, friend class, Assignment and copy initialization, this pointer, dynamic typeinformation.

UNIT – V STREAMS AND FILES 08 Hours

Streams classes, Stream Errors, Disk File I/O with streams, file pointers, error handling in file I/O with member function, overloading the extraction and insertion operators, memory as a stream object, command line arguments, printer output, Function templates, Class templates Exceptions, Containers, exception handling**.**

Text Books

1. E. Balaguruswami," Object Oriented Programming in C++",TMH.
2. Robert Lafore, "Object Oriented Programming in C++",Pearson.

Reference Books

1. M.T. Somashekare, D.S. Guru, "Object-Oriented Programming with C++",PHI.
2. Herbert Shildt, "The Complete Reference C++", Tata McGraw Hillpublication.

OBJECT ORIENTED PROGRAMMING LABORATORY

List of Assignments:

1. Write a program to find out the largest number usingfunction.
2. Write a program to find the area of circle, rectangle and triangle using functionoverloading.
3. Write a program to implement complex numbers using operatoroverloading.
4. Write a program using class and object to print bio-data of thestudents.
5. Write a program which defines a class with constructor and destructor which will count number of object created anddestroyed.
6. Write a program to show applications of different types ofinheritances.
7. Write a program to add two private data members using friendfunction.
8. Write a program using dynamic memory allocation to perform 2x2 matrix addition andsubtraction.
9. Write a program to show the application of virtualfunction.
10. Write a program that store five student records in afile.
11. Write a program to show the application of class/functiontemplate.
12. Write a program to show the application of exceptionhandling.

ENGINEERING MATHEMATICS-II

Teaching Scheme:	Credits	Examination Scheme:
Lectures: 3 Hours/Week	03	Theory: 100 Marks

UNIT – I LINEAR ALGEBRA **8 Hours**

Systems of linear equations and their solutions using Gauss-elimination; vector space, subspace, spanning sets, linearly independence and dependence, basis and dimension, Rank of matrix; inner product, Gram - Schmidt process.

Linear Transformation, Kernel and images of a linear map, Rank-Nullity Theorem (statement and illustration); eigenvalues and eigenvectors, diagonalization of matrices, Jordan canonical form, quadratic forms: positive definiteness

UNIT-II MULTIPLE INTEGRALS4 Hours

Double integration – Cartesian and polar co-ordinates – Change of order of integration. Area as a double integral – Triple integration in Cartesian coordinates – Volume as a triple integral – Change of variables between Cartesian and polar coordinates.

UNIT – IIIORDINARY DIFFERENTIAL EQUATIONS **08 Hours**

Review of first order differential equations, linear differential equations, homogeneous higher order linear differential equations, non- homogeneous higher order linear differential equations with constant coefficients and reducible to differential equations with constant coefficients (method of undetermined coefficients and method of variation of parameters), systems of differential equations, applications to electrical circuits.

UNIT – IVPARTIAL DIFFERENTIAL EQUATIONS **5 Hours**

Introduction to the partial differential equations, classification of second order PDE, method of separation of variable, solution of one dimensional heat equation and wave equation.

UNIT V LAPLACE TRANSFORMS **07 Hours**

Laplace transforms its properties, Unit step function, Dirac delta functions, Convolution theorem, Inverse Laplace transform and its properties, solving differential equations using Laplace transform.

Text Books

1. Introduction to Linear Algebra (2nd edition) by Serge Lang,Springer.
2. Advanced Engineering Mathematics (10th edition) by Erwin Kreyszig, Wiley easternLtd.

Reference Books

1. Schaum's outlines of Linear Algebra (5th edition) by Seymour Lipschutz, Marc Lipson, McGraw-Hill Education (India) Private Limited, NewDelhi.
2. LinearAlgebrabyHoffmanandKunze,(2ndedition)PrenticeHallPublication,NewDelhi.
3. Differential Equations with Applications and Historical notes by George Simmons, Tata Mc-Graw Hill publishing company Ltd, NewDelhi.
4. AdvancedEngineeringMathematicsbyC.R.Wylie,McGrawHillPublications,NewDelhi.
5. AdvancedEngineeringMathematics(7^{th}edition)byPeterV.O'Neil,Thomson.Brooks/Cole,Singapore.

DATA STRUCTURES USING C

Teaching Scheme:
Lectures: 3Hours/Week
Practical: 2Hours/Week

Credits
04

Examination Scheme:
Theory: 100Marks
Practical: 100Marks

Prerequisites:
1. C Programming
2. Foundations of ComputerScience

Course Objectives :
1. To teach how to design a new user defined, efficient, data types array, stack, queue, list, tree,graph, etc. abstract data types and reusable code using object based design techniques.
2. To demonstrate good programming practices, coding standards, modular programming, procedural and object-based way ofthinking.
3. To emphasize the design aspects of a new data structure for solving any real lifeproblems.
4. To lay strong emphasis on time complexity analysis techniques and algorithm designtechniques.

Course Outcomes :
Student will be able to
1. Analyze data objects, data structures and relatedconcepts.
2. Implement problems using different datastructures.
3. Design and implement a database schema for a givenproblem-domain.
4. Understand and implement trees andgraphs.
5. Do Programming in PL/SQL including stored procedures, stored functions, cursors andpackages.
6. To appreciate the impact of analytics and big data on the information industry and the external ecosystem for analytical and dataservices.

UNIT – I FUNDAMENTAL CONCEPTS **04 Hours**

IntroductiontoDataStructures:Data,DataObjects,DataTypes,AbstractDataType(ADT)anddatastructures, Concepts of static and dynamic, linear and nonlinear data structures. Introduction to Algorithms: Definition and Characteristics of an algorithm. Algorithm design tools – flowcharts and pseudo code, notations – algorithm header, purpose, conditions and selection, loops, procedures and sub-algorithms.
Program development: Analysis, Design, Coding, Testing and Verification.

UNIT – II LINEAR DATA STRUCTURES USING SEQUENTIAL ORGANIZATION, SEARCHING AND SORTING **07 Hours**

Concept of sequential organization, arrays as ADT, Storage representation of array, Matrix operations using arrays, String operations (Length, Concatenation, Copy, Palindrome, Reverse, Compare, Substring) without usinglibraryfunctions,Searching:linearandbinarysearchalgorithms.Sorting:Generalconcepts–Bubblesort, Insertion sort, Selection sort, Heap sort, Merge sort, Quicksort.

UNIT – III LISTS **08 Hours**

ListasADT,Conceptoflinkedorganizationofdataagainstlinkedlist.Singlylinkedlist,doublylinkedlist,circular linked list. Representation & manipulations of polynomials/sets using linked lists. Dynamic memory management. Representation of sparse matrix. Addition and transpose of sparse matrix.

UNIT – IV STACKS AND QUEUES **08 Hours**

Stack and queue as ADT. Operations on stack and queue. Implementations using arrays and dynamic memory allocation. Application of stack for expression evaluation, expression conversion. Recursion and stacks.

UNIT – V TREES AND GRAPHS **08 Hours**

Basicterminology.Binarytreesanditsrepresentation.Binarytreetraversals(recursiveandnon-recursive)and various operations. Insertion and deletion of nodes in binary search tree. Representation of graphs using adjacency matrix, adjacency list. Implementation of algorithms for traversals; implementing Kruskal's, Prim's algorithms. Single source shortest paths using Dijkstra's algorithm. Applications of graphs and trees.

UNIT – VI ALGORITHM ANALYSIS AND ALGORITHM DESIGN STRATEGIES **08 Hours**

AlgorithmAnalysis:TimeComplexity–Bigoh'O',Omega'Ω',Theta'θ',Best,AverageandWorstcaseanalysis: binary search, quick sort, merge sort, insertion sort.
AlgorithmicStrategies:DivideandConquer(quicksortandTowerofHanoi),Backtracking(n-queensproblem), greedy (job scheduling), dynamic programming, branch andbound.

TextBooks

1. Y. Langsam, M. Augenstin and A. Tannenbaum, "Data Structures using C", Pearson Education Asia, First Edition, 2002, ISBN 978-81-317-0229-1.

Reference Books

1. E.Horowitz,S.Sahni,S.Anderson-freed,"FundamentalsofDataStructuresinC",SecondEdition, University Press, ISBN 978-81-7371-605-8
2. c, Prentice Hall of India, Second Edition, ISBN81-203-0596-5
3. Ellis Horowitz, S. Sahni, D. Mehta "Fundamentals of Data Structures in C++", Galgotia Book Source, NewDelhi.
4. Jean-PaulTremblay,Paul.G.Soresan,"AnintroductiontodatastructureswithApplications",TataMc- Graw Hill International Editions, 2nd edition 1984,ISBN-0-07-462471-7.

DATA STRUCTURES LABORATORY

List of Assignments:

1. Write a program to perform various string operations such as copy, length, reversing, palindrome, concatenation and to find occurrence of a sub-string using and without using libraryfunctions.
2. Implement the following Searching and Sorting methods:
   Searching: Sequential/Linear Search and BinarySearch
   Sorting: Bubble Sort, Insertion Sort, Selection Sort, Merge Sort, Heap Sort and Quick Sort.
3. Implementation of Expression conversion and Evaluation usingStack.
4. Implementation of operations on PriorityQueue.
5. Implementation of operations on Binarytree.
6. Implementation of Expression TreeTraversals.
7. Implementation of operations on Binary searchtree.
8. Implementation of DFS & BFS Graph Traversalstechniques.
9. Implementation of minimum spanning tree using Prime's, Kruskal's and Dijkstra'salgorithm.
10. Implementation of operations on sequentialfile.

DIGITAL LOGIC AND DESIGN

Teaching Scheme:
Lectures: 3Hours/Week
Practical: 2Hours/Week

Credits
04

Examination Scheme:
Theory: 100Marks
Practical: 100Marks

UNIT – I

BooleanAlgebraandDeMorgan'sTheorem,LogicSimplificationSOP&POSforms,Canonicalforms,Karnaugh maps, Binary codes, Code Conversion.

UNIT – II

Combinational Logic Design: Half and Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Comparators, Multiplexers, Demultiplexers, Encoder, Decoder, Display, Barrel shifter and ALU. Concept of PLDs like PAL, PLA, CPLDs, FPGA etc. Logic implementation using Programmable Devices (ROM, PLA)

UNIT – III

Sequential Logic Design: Building blocks like S-R, JK and Master-Slave JK FF, Edge triggered FF, Ripple and Synchronous counters, Shift registers, Finite state machines, Design of synchronous FSM, Algorithmic State Machines charts. Designing synchronous circuits like Pulse train generator, Pseudo Random Binary Sequence generator, Clock generation.

UNIT – IV

LogicFamiliesandSemiconductorMemories:TTLNANDgate,Specifications,Noisemargin,Propagationdelay, fan-in, fan-out, Tristate TTL, ECL, CMOS families and their interfacing, Memory elements.

UNIT – V

VLSI Design flow: Design entry: Schematic, FSM & HDL, different modeling styles in Verilog HDL, Data types and objects, Dataflow, Behavioral and Structural Modeling, Synthesis and Simulation. Verilog constructs and codes for combinational and sequential circuits.

Text Books/ Reference Books:

1. M. Morris Mano, "Digital Design with Verilog HDL" PearsonEducation.
2. Stephan Brown, "Fundamentals of Digital Logic with Verilog Design", Tata McGrawHill.
3. R.P. Jain, "Modern digital Electronics", Tata McGrawHill.
4. Gothman, "Digital Electronics-An introduction to theory and practice", PearsonEducation
5. Douglas-Hall, "Digital Circuits and Systems", Tata McGrawHill
6. Samir Palnitkar, "Verilog HDL: A guide to Digital Design and Synthesis", SunsoftPress.

DIGITAL LOGIC AND DESIGN LABORATORY

List of Assignments:

1. To verify
   a) DeMorgan's Theorem for 2variables
   b) The sum-of product and product-of-sum expressions using universalgates
2. To design and implement
   a) Full Adder using basic logicgates.
   b) Full Subtractors using basic logicgates.
3. To design and implement 4-bit Parallel Adder/ Subtractors using IC7483.
4. Design and Implementation of 4-bit Magnitude Comparator using IC7485.
5. To realize
   a) 4:1 Multiplexer usinggates
   b) 3-variable function using IC 74151(8:1MUX)
6. Realize 1:8 Demultiplexers and 3:8 Decoder usingIC74138
7. To realize the following flip-flops using NANDGates.
   a) Clocked SR Flip-Flop
   b) JK Flip-Flop
8. To realize the following shift registers usingIC7474
   (a) SISO (b) SIPO (c)PISO
9. To realize the Ring Counter and Johnson Counter usingIC7476.
10. To realize the Mod-N Counter usingIC7490.
11. Simulate Full- Adder using simulationtool.
12. Simulate Mod-8 Synchronous UP/DOWN Counter using simulationtool.

ENTREPRENEURSHIP

Teaching Scheme:	Credits	Examination Scheme:
Lectures: 2 Hours/Week	02	Theory: 100 Marks

Assessment Criteria: Individual and Group Assignments.

Week I: Negotiation
Fundamentals of principled negotiations, Three basic people problems, Objective Criteria for negotiations, Common obstacles in negotiation.

Week II & III: Market Structures
Rationale behind studying market structures, Economic definition of market, Determinants of market structure, Economies of scale, Types of market structures.

Week IV: Market Segmentation
Target Market, Benefits of market segmentation, Types of market segmentation, Market Segmentation Strategy Creation.

Week V: Competitive Analysis
Basics of Competitive Analysis, Kinds of competitors, Selection of competitors for analysis, Competitive analysis framework.

Week VI & VII: Questionnaire Design Methods and Concerns
Qualities of a good questionnaire, Preliminary decisions in questionnaire design, Measuring change over time, Open- and closed-ended questions, Question wording, Question order, Pilot Tests and Focus Groups, Pretests.

Week VIII: Seeking Criticism and Constructive Feedback
Writing to venture capitalists, handling professional correspondence, Networking (offline and online), Participation in Business Plan Competitions to raise funding.

Week IX: Social Psychology and Entrepreneurship
Human mind and decision making, Psychological Paradoxes, Human purchase behaviour and business, Customer incentivization.

Week X: Social Entrepreneurship
Social entrepreneur and the power of new ideas, Articulation of a social problem, Understanding beneficiary experience, importance of ethnographic studies, Operation Realities Analysis, Socio-politics, Scope of venture.

Week XI: People Analytics
Data-based human resource improvement in organization, Measuring and managing performance, Engagement, Culture and Attrition, Informal Communication Management, Law and Ethics of People Analytics.

Week XII: Diversity in Workplace
Importance of Diversity in an organization, Diversity and Performance, Measurement of Diversity, Workplace discrimination, Case study.

Text Books:

1. Mindset, Carol Dweck
2. Leaders: Myth and Reality, General Stanley McCHRYSTAL
3. Outliers, Malcom Gladwell
4. Good to Great, Jim Collins
5. Steve Jobs, Walter Isaacson
6. The 7 habits of highly effective people, Stephen Covey
7. Thinking Fast and Slow, Daniel Kahneman

FUNDAMENTALS OF COMPUTATIONAL BIOLOGY

Teaching Scheme:	Credits	Examination Scheme:
Lectures: 3Hours/Week	03	Theory: 100Marks

Compositions of functions, Modeling basic life science scenarios (Implement basic functions, expressing basic operations as functions of time like cost functions, study variations etc.) in calculus like simple cases of drug concentration, energy consumption, Fick's law, Flow of blood, growth of bacteria, estimates of inoculation, poiseuille's law, population growth(link is external), recall rate of memory, respiration, spread of an epidemic, air and water pollution. Concepts of differentiation, anti-differentiation, differential equations, functions of several variables as needed to study population dynamics, biophysical models etc.. Visualization: Graph Types in Biology -bar graphs, line graph, area graph, scatter plot, pie and 3-dimensional graphs and generation using simple programs like Excel, Octave or Matlab. Advanced use of computers like scientific libraries, scripting etc. Scope of cellular dynamics, Computational modeling in biology-Cartoons, Mechanisms, and Models, role of mathematics and role of computation, simple molecular switch. CUDA and computational biology – getting started with CUDA, memory, multiple GPUs.

Text Books

1. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley and Sons, 2001.
2. Computational Cell Biology, Christopher Fall, Springer, 2000.
3. Mathematical models in biophysics, Riznichenko Galina Yur'evna, Book Online, Biophysical society.
4. NVIDIA CUDA C Programming Guide available at Weblink(link is external)

Reference Book:

1. Calculus: for the social, managerial and life sciences – Laurence D. Hoffmann, McGraw Hill, 1980