Hall Ticket Number :										

R-15

Code: 5G263

III B.Tech. II Semester Supplementary Examinations Nov/Dec 2019

Power System Operation and Control

(Electrical and Electronics Engineering)

Max. Marks: 70 Time: 3 Hours

Answer *all five* units by choosing one question from each unit (5 x 14 = 70 Marks)

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UNIT–I

1. a) Derive the transmission loss formula of a power generator system. 7M

   b) Consider a Two Bus system in which plant1 and plant2 are connected to each bus and load is connected to bus2.If a load of 125 MW is transmitted from plant1 to the load a loss of 15.625MW in incurred. Determine the generation schedule and the load demand if the cost of received power is Rs.24 /MWhr. The incremental production costs of the plants are:

   $dF1/dP1 = 0.025\ P1 + 15$,

   $dF2/dP2 = 0.05\ P2 + 20$, 7M

OR

2. a) Derive the expression for loss coefficients and state the assumptions made in deriving the same. 7M

   b) Incremental fuel costs in rupees per MWh for a plant consisting of two units are:

   $dC1/dPG1 = 0.2\ PG1 + 40.0$,

   $dC2/dPG2 = 0.2\ PG2 + 30.0$,

   Assume that both units are operating at all times and total load varies from 40MW to 250 Mw and the maximum and minimum loads on each unit are to be 125 and 120 MW respectively. How will the load be shared between the two units as the system load varies over the full range? What are the corresponding values of the plant incremental costs? 7M

UNIT–II

3. a) Write the optimal scheduling of hydro thermal system. 7M

   b) Explain hydroelectric power plant models. 7M

OR

4. A Two-Plant system having a steam plant near the load centre and a hydro-plant at a remote location. The load is 500MW for 16 hours a day and 350 MW, for 8 hours a day. The characteristics of the unit are:

   $C1 = 120 + 45\ PGT + 0.075\ P^2GT$,

   $W2 = 0.6\ PGH + 0.00283\ P2GH \quad m^3/s$

   Loss co-efficient, $B_{22} + 0.001 \quad MW^{-1}$

   Find the generation schedule, daily water used by the hydro plant, and daily operating cost of the thermal plant for $_j = 85.5$ Rs./ m^3 - hr 14M

UNIT–III

5. a) With the help of neat sketch, explain about various parts of speed-governing system. 8M

   b) Write about modeling of excitation systems? 6M

OR

6. a) Write the block diagram representation of steam turbines and approximate linear models. 8M

   b) Write about the modeling of governor. 6M

UNIT–IV

7. a) Discuss the merits of proportional plus integral LFC of a system with a neat block diagram. 5M

   b). with a neat block diagram explain dynamic response and the steady state analysis of isolated power system 9M

OR

8. a) Explain Tie-line bias control. 4M

   b) Explain optimal two area load frequency control. 10M

UNIT–V

9. a) Explain about compensated transmission lines? 8M

   b) A 3-Phase 5kW induction motor has a power factor of 0.85 lagging. A bank of capacitor is connected in delta across the supply terminal and power factor raised to 0.95 lagging. Determine the KVAR rating of the capacitor in each phase. 6M

OR

10. a) Write the advantages and disadvantages of different types of compensating equipment for transmission systems? 7M

    b) Discuss the effects of reactors and capacitors in reactive power control. 7M

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Hall Ticket Number :										

R-14

Code: 4G264

III B.Tech. II Semester Supplementary Examinations May 2019

Power System Operation and Control

(Electrical and Electronics Engineering)

Max. Marks: 70 Time: 3 Hours

Answer *all five* units by choosing one question from each unit (5 x 14 = 70 Marks)

****

UNIT–I

1. a) Explain the following
   i) incremental fuel rate curves,
   ii) Input–Output operational characteristics of thermal plant.
   iii) Input–Output operational characteristics of Hydro power plant 9M

   b) Incremental fuel cost in Rs/MWh for a plant consisting of two units are
   $dc1/dPG1 = 0.2PG1 + 40$, $dc2/dP/G2 = 0.25\,PG2 + 30$, find the savings in fuel cost in Rs/hr for the optimal scheduling of a total load of 130 MW as compared to equal distribution of the same load between the two limits. 5M

OR

2. a) Derive the mathematical determination of optimal allocation of total load among different units. 8M

   b) The fuel cost of two units are given by
   $C1 = 0.1\,PG^21 + 25\,PG1 + 1.6$ Rs/hr
   $C2 = 0.1\,PG^22 + 32\,PG2 + 2.1$ Rs/hr
   If the total demand on the generators is 250 MW, find the economical load distribution of the two units. 6M

UNIT–II

3. a) Explain the hydro- thermal scheduling 6M

   b) Write about incremental production costs for hydro power plants.. 4M

   c) Write classical methods for economic operation of systems plants. 4M

OR

4. a) A Two-plant system that has a thermal station near the load center and a hydro-power station at a remote location is shown in fig(1). The characteristics of both stations are:
   $C_1 = (26 + 0.045PG_T)\,PG_T$ .... Rs/hr
   $W_2 = (7 + 0.004PG_H)\,PG_H$ ... m3/s
   and γ_2 = Rs. 4×10^{-4} / m^3
   The transmission loss coefficient $B_{22}=0.0025MW^{-1}$. Determine the power generation at each station and power received by the load when λ=65 Rs/MWh

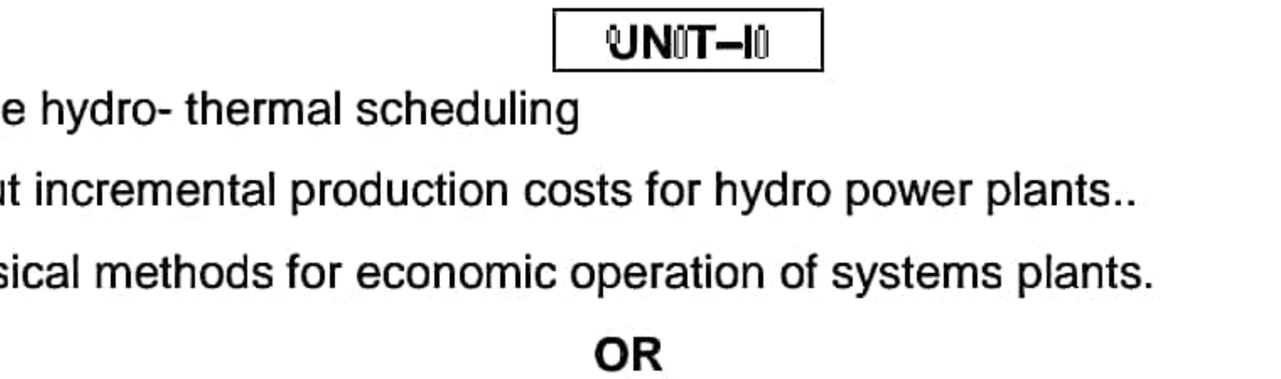

Fig 1 Two Plant System 8M

   b) Explain optimal power flows. 6M

UNIT–III

5. a) Derive the transfer function of a single area system with a block diagram. 8M

   b) Explain the flat frequency control. 6M

OR

6. a) Explain Turbine-speed governing system with a neat diagram? 8M

   b) Explain the modeling of excitation systems? 6M

UNIT–IV

7. a) Explain the LFC of an Isolated power system. 8M

   b) Two Turbo-alternators rated for 110 MW and 210 MW have governor droop characteristic of 5% from No load to Full load. They are connected in parallel to share a load of 250 MW. Determine the load shared by each machine assuming free governor action. 6M

OR

8. Explain LFC of a Two area system in both uncontrolled case and controlled case. 14M

UNIT–V

9. a) Describe the effect of connecting series capacitors in the transmission system. 6M

   b) Explain over voltages on sudden loss of loads. 4M

   c) List out various loads which require compensation. 4M

OR

10. Briefly write about any three of the following

    a) Shunt compensator

    b) Thyristor controlled reactor

    c) Thyristor switched capacitor

    d) Series compensator

    e) Unified power flow controller. 14M

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Hall Ticket Number :										

R-15

Code: 5G263

III B.Tech. II Semester Supplementary Examinations Nov/Dec 2018

Power System Operation and Control

(Electrical and Electronics Engineering)

Max. Marks: 70 Time: 3 Hours

Answer *all five* units by choosing one question from each unit (5 x 14 = 70 Marks)

****

UNIT–I

1. a) Explain the significance of equality and inequality constraints in the economic allocation of generation among different plants in a system 7M

   b) A system consists of three generating plants with fuel costs of:
   $C_1=0.04P_1^2+20P_1+230$ Rs./h
   $C_2=0.06P_2^2+18P_2+200$ Rs./h
   $C_3=0.15P_3^2+15P_3+180$ Rs./h
   Determine the optimum sharing of a total load of 180MW for which each plant would take up for minimum input cost of received power in Rs/MWh. 7M

OR

2. a) What are Loss coefficients? Derive the expressions for Loss coefficients of a two generator system. 7M

   b) Draw the flow chart for obtaining optimal scheduling of generating units by neglecting the transmission losses. 7M

UNIT–II

3. a) Explain problem formation and solution procedure of optimal scheduling for hydro thermal plants. 7M

   b) A load is fed by two plants, one is thermal and other is a hydro plant. The load is located near the thermal plant. The characteristics of the plants are
   $F_T = 0.04P_T^2+25PT+20$ Rs./hr; $W_H=0.0012P_H^2+7.5P_H$ m3/Sec ;
   $x_H=2.5X10^{-3}$ Rs./m^3. Determine the power generation of both plants and load connected, when λ = 20Rs./ MWh. 7M

OR

4. a) Obtain the modeling of hydro turbine and draw its block diagram. 7M

   b) With the help of a flow chart, explain the dynamic programming method in unit commitment. 7M

UNIT–III

5. a) Explain speed governing mechanism. Develop its block diagram. 7M

   b) Develop the block diagram of Generator and load. 7M

OR

6. a) Why is it necessary to maintain constant frequency and voltage profiles in a power system network? Explain. 7M

   b) Draw and explain the Block diagram of IEEE type-1 excitation system. 7M

UNIT–IV

7. a) Draw the block diagram of single area Load frequency control system. Explain the terms in it. 7M

   b) Two generators of rating 125 and 250MW are operated with droop characteristics of 4% and 5% respectively from no load to full load. Find the load sharing by each generator if a load of 300MW is connected across the parallel combination of those generators. 7M

OR

8. a) Show that steady state frequency deviation in a single area LFC is reduced to zero if the PI controller is reduced. 7M

   b) Discuss the importance of combined load frequency control and economic dispatch control with a neat block diagram. 7M

UNIT–V

9. a) What do mean by compensation of a line? Discuss briefly different methods of compensation. 7M

   b) Explain what you mean by loadability of overhead lines and discuss loadability characteristic of these lines. 7M

OR

10. a) What is sub synchronous resonance condition? How is it handled in electrical network? 7M

    b) A 35 kW induction motor has power factor 0.85 and efficiency 0.9 at full load, power factor 0.6 and efficiency 0.7 at half-load. At no-load, the current is 25% of the full-load current and power factor 0.1. Capacitors are supplied to make the line power factor 0.8 at half-load. With these capacitors in circuit, find the line power factor at (i) full load, and (ii) no-load. 7M

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Hall Ticket Number :										

R-15

Code: 5G263

III B.Tech. II Semester Regular Examinations May 2018

Power System Operation and Control

(Electrical and Electronics Engineering)

Max. Marks: 70 Time: 3 Hours

Answer *all five* units by choosing one question from each unit (5 x 14 = 70 Marks)

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UNIT–I

1. a) Explain the following terms with reference to power plants: (i) heat input – power output curve (ii) heat rate input (iii) incremental input and (iv) generation cost . 8M

   b) Obtain the condition for optimum operation of a power system with 'n' plants including the effect of transmission losses. 6M

OR

2. a) A system consists of two generating plants with fuel costs of:
   $C_1=0.03P_1^2+15P_1+1.0$
   $C_2=0.04P_2^2+21P_2+1.4$
   The system operates on economic dispatch with 120MW of power generation by each plant. The incremental transmission loss of plant-2 is 0.15. Find the penalty factor of plant-1. 8M

   b) Explain various factors to be considered in allocating generation to different power stations for optimum operation. 6M

UNIT–II

3. Explain and write the mathematical formulation for optimal scheduling of Hydro thermal system. Explain any one solution technique of solving equations with the help of an algorithm. 14M

OR

4. What is meant by optimal power flow solution? Write the equations describing an optimal power flow problem. How inequality constraints are considered on dependent variables and on control variables. 14M

UNIT–III

5. a) Write the modeling equations of turbine speed governing system. Develop the block diagram of turbine speed governing mechanism with first order equations. 7M

   b) Construct a Block Diagram for Generator Load Model and find out the transfer function. 7M

OR

6. a) Derive the first order turbine model. Represent the model in block diagram. 7M

   b) Describe various elements that are to be considered in modeling of an excitation system. 7M

UNIT–IV

7. a) Draw the LFC block diagram of an isolated power system. Write the dynamic response curve of change in frequency for a step change in load. 7M

   b) Derive the expression for change in tie line power and draw its block diagram? 7M

OR

8. a) Write the state space representation of AGC for single area. 7M

   b) How does load frequency control is achieved by considering economic dispatch. 7M

UNIT–V

9. a) Describe the performance of uncompensated transmission lines. 7M

   b) Describe the constructional features of a synchronous capacitor. Explain its operation and discuss various applications in power system operation. 7M

OR

10. a) Explain the phenomenon of sub synchronous resonance in power system operations and suggest remedies to overcome this problem. 7M

    b) Explain series and shunt compensation of lines and discuss their effect on the surge impedance loading of the lines. If shunt compensation is 100%, what happens to SIL and voltage profile. 7M

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Hall Ticket Number :										

Code: 4G264

R-14

III B.Tech. II Semester Regular Examinations May 2017

Power System Operation and Control

(Electrical & Electronics Engineering)

Max. Marks: 70 Time: 3 Hours

Answer *all five* units by choosing one question from each unit (5 x 14 = 70 Marks)

****

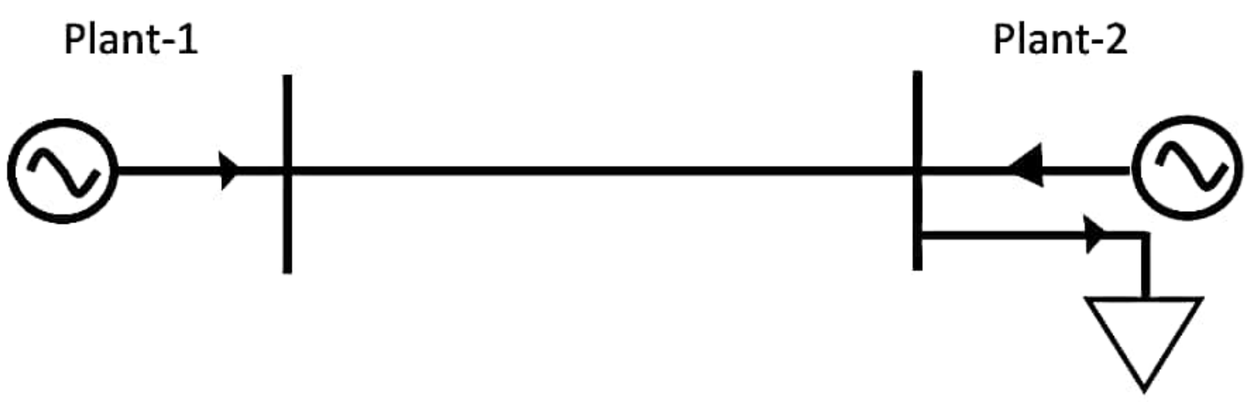
UNIT–I

1. a) Give algorithm for economic allocation of generators of thermal system taking transmission losses into account. Give steps for implementing this algorithm with necessary equations. 7M

b) If 100 MW is transmitted from plant-1 to load, which is located at plant-2, loss will be 10 MW. Find required generation and Power received by load when = 25 Rs/MWhr.

$$\frac{dC_1}{dP_1} = 16 + 0.02P_1 \text{ Rs/MWhr}$$

$$\frac{dC_2}{dP_2} = 20 + 0.04P_2 \text{ Rs/MWhr}$$



7M

OR

2. a) Explain the need of economic load dispatch for a given power system 4M

b) Derive the transmission loss formula for a system consisting of n-generating plants supplying several loads inter connected through a transmission networks. State any assumptions are made. 10M

UNIT–II

3. a) Derive the cost function of hydrothermal scheduling problem. 7M

b) A two plant system having a thermal station near the load centre and a hydro power station at remote location. The characteristics of both stations are:

$C_1 = (26+0.045\ P_{GT})\ P_{GT}$ Rs/hr

$W_2 = (7+ 0.004\ P_{GH})\ P_{GH}$ m^3 /Sec

and $_2$ = Rs. $4X10^{-4}$ /m^3

The transmission loss coefficient, $B_{22} = 0.0025$ MW^{-1}. Determine the power generation at each station and the power received by the load when = 65Rs/MWhr. 7M

OR

4. a) Obtain the condition for economic generation of steam and hydro plants for short term scheduling. State any assumptions are made. 7M

b) Discuss the optimal power flow procedures with its inequality constraints and how to handle dependent variables with penalty function. 7M

UNIT–III

5. a) Derive Small signal transfer function of speed governing system of steam turbine with a rough sketch. 7M

   b) Explain the effect of varying excitation of a synchronous generator. 7M

OR

6. a) Develop the Linearized model of the hydraulic turbine. 7M

   b) Making suitable assumptions derive the transfer function of synchronous generator and the steam turbine set. 7M

UNIT–IV

7. a) Explain the necessity of maintaining a constant frequency in power system operation 7M

   b) Draw the block diagram of single area LFC system with integral control and prove that the steady state change in frequency is zero. 7M

OR

8. Draw the block diagram for two area load frequency control with integral controller blocks and explain each block. 14M

UNIT–V

9. a) Explain about the losses that occur due to VAR flow I power system. 7M

   b) Explain how the generators act as VAR sources in a power network 7M

OR

10. What is a static compensator? Explain with diagrams working principles of various types of static compensators. 14M

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Hall Ticket Number :										

R-11 / R-13

Code : 1G263

III B.Tech. II Semester Regular & Supplementary Examinations May 2016

Power System Operation and Control

(Electrical & Electronics Engineering)

Max. Marks: 70 **Time: 03 Hours**

Answer *any five* questions

All Questions carry equal marks (14 Marks each)

****

1. a) Discuss the various factors which will decide the production cost of a thermal plant. 6M

   b) The fuel cost curve of two generators are given as under

   $C_A (P_A) = 800 + 45 P_A + 0.01 P_A^2$

   $C_B (P_B) = 2000 + 43 P_B + 0.003 P_B^2$

   and if the total load supplied is 700 MW, find the optimal dispatch with and without considering the generator limits where the limits have been expressed as :

   50 MW P_A 200 MW

   50 MW P_B 600 MW.

   Compare the systems increment at cost with & without generator limits considered. 8M

2. a) What is incremental transmission loss and derive the general transmission loss formula? 6M

   b) Two thermal plants are interconnected and following are the incremental production costs of the plants in $Rs/MWhr$.

   $$\frac{dC_1}{dP_1} = 20 + 10P_1$$

   $$\frac{dC_2}{dP_2} = 15 + 10P_2$$

   Where P1 & P2 are plant powers expressed in p.u. in 100 MVA base.

   The transmission loss is given by

   $$P_L = 0.1P_1^2 + 0.2P_2^2 + 0.1P_1P_2 \ p.u$$

   If the incremental cost of received power is 50 Rs/MWhr, find the optimal generation. 8M

3. a) Discuss the demerits of hydrothermal coordination in optimal generation scheduling. 6M

   b) Develop the hydroelectric power plant model with necessary block diagram. 8M

4. a) What is unit commitment? Explain how it can be done when only thermal power generators are available. 7M

   b) Explain the steady state analysis of an isolated power system. 7M

5. a) What is area control error? Discuss its significance. 6M

   b) Determine the area frequency response characteristics and the static frequency error for a system with the following data, when 1% load change occurs.

   B = 0.01 P.u MW/Hz

   R = 2.5 Hz/P.u MW

   Tp = 16 sec

   Kp = 100Hz/p.u MW 8M

6. Derive an expression for steady state change of frequency and the line power transfer of a two area power system. List out the assumptions made. 14M

7. a) Derive the relation between reactive power flow and the voltage of bus. 7M

   b) Explain the effect of shunt compensation on the transmission line performance. 7M

8. a) Explain briefly about the reasons for restructuring / deregulation of power industry 7M

   b) Discuss briefly the significant benefits of power industry deregulation. 7M

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Code : 1G263

R11

III B.Tech II Semester Regular & Supplementary Examinations May 2015

Power System Operation and Control

(Electrical & Electronics Engineering)

Time: 3 hours **Max Marks: 70**

Answer any FIVE of the following

All questions carry equal marks (14 Marks each)

* * * * *

1. a) What is an incremental fuel cost? How is it used in thermal plant operation? 7M

   b) Name the components of production cost and explain. 7M

2. a) Give various uses of general loss formula and state the assumptions made for calculating B_{mn} coefficients. 7M

   b) The fuel cost for a two unit steam power plant are given by

   $$C_1 = 0.1\ P_1^2 + 25\ P_1 + 1.6 \text{ Rupees/hour}$$

   $$C_2 = 0.1\ P_2^2 + 32\ P_2 + 2.1 \text{ Rupees/hour}$$

   Where p's are in megawatt. If there is an error of 1% in the representation of the input data, find the loss in operating economy for a load of 250 MW. 7M

3. Explain about Hydro thermal co-ordination with necessary equations. 14M

4. a) Derive the small signal transfer function with block diagram of speed governing system. 7M

   b) Draw the block diagram of IEEE type-I excitation model and explain. 7M

5. a) With a first order approximation explain the dynamic response of an isolated area for load frequency control. 7M

   b) Develop the model of single control area and obtain its block diagram representation. 7M

6. a) For two-area load frequency control with gain blocks, derive an expression for steady values of change in frequency and tie line power for simultaneously applied unit step load disturbance inputs in the two areas. 7M

   b) Explain load frequency control problem in a Multi-area power system. 7M

7. a) Explain series and shunt compensation in power system. 7M

   b) Compare the different types of compensating equipment for transmission systems. 7M

8 a) Explain about restructuring power system. 7M

   b) Write the key issues of the deregulation of the power systems. 7M

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R11

Code : 1G263

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES :: RAJAMPET

(AUTONOMOUS)

III B.Tech. II Semester Regular Examinations, June 2014

Power System Operation and Control

(Electrical & Electronics Engineering)

Time: 3 hours **Max Marks: 70**

Answer any FIVE of the following

All questions carry equal marks (14 Marks each)

* * * * *

1. a) Discuss about the incremental fuel cost and production cost. 7M

   b) Explain the various factors to be considered in allocating generation to different power stations for optimum operation. 7M

2. a) Derive the transmission loss formula and states the assumptions of the system. 7M

   b) A system consisting of two generating plants. The incremental costs in Rs/ MWh with P_{G1}^2 and P_{G2}^2 in MW are $\frac{dC_1}{dP_{G1}} = 0.006P_{G1} + 7.2$ and $\frac{dC_2}{dP_{G2}} = 0.01P_{G2} + 5$

   The system is operating on economic dispatch with $P_{G1} = P_{G2} = 330$MW and $\frac{\partial P_L}{\partial P_{G2}} = 0.3$. Find the penalty factor of plant 1. 7M

3. a) What do you mean by unit commitment problem and discuss various constraints related to UCP. 7M

   b) A two-plant system having a steam plant near the load centre and a hydro plant at a remote location. The load is 520MW for 15 hrs a day and 330 MW, for 9 hrs a day.

   The characteristics of the units are

   $C_1 = 120 + 45\ P_{GT} + 0.075\ P_{GT}^2$ Rs./hr

   $w_2 = 0.6\ P_{GH} + 0.00283\ P_{GH}^2$ m^3/sec

   Loss co-efficient, $B_{22} = 0.001\ MW^{-1}$

   Find the generation schedule, daily water used by hydro plant and daily operating cost of thermal plant for γ_j =80 Rs./ m^3-hr 7M

4. a) Draw the block diagram representation of steam turbine and obtain the approximate linear model 7M

   b) Draw the block diagram of IEEE type-I excitation model and explain. 7M

5. a) What are the basic requirements needed for control strategy in LFC system. 7M

   b) Two generating stations *A* and *B* have full load capacities of 200 MW and 70 MW respectively. The interconnector connecting the two stations has an induction motor/ synchronous generator (plant *C*) of full load capacity 20 MW. Percentage changes of speeds of *A*, *B* and *C* are 5, 4 and 3 respectively. The loads on bus bars *A* and *B* are 60MW and 35MW respectively. Determine the load taken by the set *C* and indicate the direction in which the energy is flowing. 7M

6. Give a typical block diagram for a two-area system inter connected by a tie line and explain each block. Also deduce relations to determine the frequency of oscillations of tie line power and static frequency drop. List out assumptions made. 14M

7. a) Explain about shunt compensation 5M

   b) The load at the receiving end of a three-phase, overhead line is 30 MW, power factor 0.82 lagging, at a line voltage of 33 kv. A synchronous compensator is situated at the receiving end and the voltage at both ends of the line is maintained at 33 kV. Calculate the MVAr of the compensator. The line has resistance 5 Ω per phase and inductive reactance (line to neutral) 20 ohm per phase. 9M

8. a). Write the reasons for deregulation. 7M

   b). Write the key issues of the deregulation of the power systems. 7M

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Hall Ticket Number :										

R-11

Code : 1G263

III B.Tech. II Semester Supplementary Examinations December 2015

Power System Operation and Control

(Electrical & Electronics Engineering)

Max. Marks: 70 **Time: 03 Hours**

Answer *any five* questions

All Questions carry equal marks (14 Marks each)

****

1. a) Explain the significance of the heat rate curve and cost curve of thermal power plants with neat diagrams. 8M

   b) The fuel cost in Rs/ hr of two units in a plant are given by

   $C1 = C1\ (P1) = 1.0 + 25\ P1 + 0.25\ P_1^2$

   $C2 = C2\ (P2) = 1.5 + 45\ P2 + 0.2\ P_2^2$

   If the total demand on the generators is 250MW, calculate the economic load scheduling of the two units. 6M

2. a) Derive the expressions for loss coefficients. 6M

   b) The cost characteristics of two power plants connected together by a transmission line and load at plant 2 are given below. When 100 MW are transmitted from plant-1, the transmission loss is 12MW.

   $C1 = 0.05\ P_1^2 + 15\ P1$ Rs/hr

   $C2 = 0.06\ P_2^2 + 18\ P2$ Rs/hr

   Find the optimum generation when = 22 8M

3. a) What are the advantages of operation of hydro thermal combinations? 6M

   b) What is short term hydro thermal scheduling? Explain the difficulties present in the short term hydro thermal scheduling. 8M

4 a) Explain the block diagram representation of an isolated power system with diagram. 7M

   b) Derive the generator load model and represent it by a block diagram. 7M

5. a) Discuss in detail the importance of load frequency control. 7M

   b) Draw and explain the block diagram of the load frequency control for a single area system. 7M

6. a) Explain the significance of tie-line bias control in multi-area Load Frequency Control system. 6M

   b) Two control areas having the following characteristics

   Area-1

   R1 = 0.01 p.u

   B1 = 0.8 p.u

   Base MVA = 1000

   Area-2

   R2 = 0.015 p.u

   B2 = 0.9 p.u

   Base MVA = 1000

   A load change of 150 MW occurs in area -2. Find the tie line power deviation 8M

7. a) Discuss the merits and demerits associated with series compensators.

   b) What is load compensation? Describe briefly different compensation methods in power system.

8. a) What is deregulation of electric power system and explain its advantage over normal power systems? 8M

   b) What are the key issues in deregulation of power system? 6M

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Hall Ticket Number :										

Code : 1G263

R-11/R-13

III B.Tech. II Semester Supplementary Examinations Nov/Dec 2016

Power System Operation and Control

(Electrical and Electronics Engineering)

Max. Marks: 70 **Time: 03 Hours**

Answer *any* ***five*** questions

All Questions carry equal marks (14 Marks each)

****

1. a) Explain the following i) Heat rate Curve ii) Input –Output Curve 6M

   b) Three power plants of total capacity 425MW are scheduled for operation to supply total load of 300MW.Find the optimum load scheduling if the plants have the following incremental cost characteristics and the generator constraints

$$\frac{dc_1}{dP_{G_1}} = 30 + 0.15P_{G_1} \quad 25 \le P_{G_1} \le 125 \qquad \frac{dc_3}{dP_{G_3}} = 15 + 0.18P_{G_3} \quad 50 \le P_{G_3} \le 200$$

$$\frac{dc_2}{dP_{G_2}} = 40 + 0.20P_{G_2} \quad 30 \le P_{G_2} \le 100$$

   8M

2. a) Derive the expression for loss coefficients and state the assumptions made in deriving the same 7M

   b) Two power plants are connected together by a transmission line and load is at power plant 2.When 100MW are transmitted from plant 1 ,the transmission loss is 10MW in the transfer of power from plant1 to plant2 .The incremental fuel cost characteristics of plants 1 and 2 are given by

$$\frac{dc_1}{dP_{G_1}} = 13 + 0.1P_{G_1} \text{ Rs/MWh} \qquad \frac{dc_2}{dP_{G_2}} = 12 + 0.12P_{G_2} \text{ Rs/MWh}$$

   7M

3. a) Explain in detail about short-term hydro thermal scheduling problem 8M

   b) What is the objective of Unit Commitment problem? What are the various items that must be considered while making a unit commitment problem? 6M

4. a) Explain the mathematical modeling of speed governing system 7M

   b) Explain IEEE type-1 excitation system with a block diagram 7M

5. a) Explain the necessity of keeping frequency constant in a power system network. 4M

   b) For a single area load frequency control derive the expression for steady state frequency and prove that $f_{static}=0$ when the incremental control input is equal to incremental disturbance input. 10M

6. a) What is the importance of tie-line bias control? When can we say that the tie line is weak or strong? 7M

   b) Explain the steady state response uncontrolled case of a two area load frequency control system 7M

7. a) What is reactive power and explain the reactive power balance and its effect on system voltage 7M

   b) Explain briefly the specifications and objectives of load compensation 7M

8. a) What is the role of modern technology in deregulated power market 7M

   b) Explain how deregulation can be implemented in our country? 7M

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Hall Ticket Number :										

R-11 / R-13

Code: 1G263

III B.Tech. II Semester Supplementary Examinations May 2017

Power System Operation and Control

(Electrical & Electronics Engineering)

Max. Marks: 70 Time: 3 Hours

Answer any **Five** questions
All Questions carry equal marks (**14 Marks** each)

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1. A power System consists of two, 125 MW units whose input costs are represented by the equations:
   $C1 = 0.04 P_1^2 + 22 P_1 + 800$ Rupees/hour
   $C2 = 0.045 P_2^2 + 15 P_1 + 1000$ Rupees/hour
   If the total received power $P_R = 200$ MW. Determine the load sharing between them for most economic operation. 14M

2. Briefly explain about the exact co-ordination equation and derive the penalty factor. 14M

3. a) Discuss the demerits of hydrothermal coordination in optimal generation scheduling. 6M
   b) Develop the hydroelectric power plant model with necessary block diagram. 8M

4. What is the need of Reheat type steam turbines for the modern large power systems? Explain with a neat sketch. 14M

5. An isolated power system has following parameters:
   Turbine rated output: 300 mw
   Nominal frequency: 50 Hz
   Governor speed regulation: 0.05 pu
   Inertia constant: 5
   Turbine time constant: 0.5 sec
   Governor time constant: 0.2 sec
   Load change: 60 mw
   The load varies by 0.8 percent for a 1 percent change in frequency. Determine the steady state frequency deviation in HZ. 14M

6. Draw the block diagram of proportional plus integral controller and show the steady state frequency error is zero. 14M

7. a) Explain the working of shunt capacitor as compensator. Why its effect is uniform throughout the line? 7M
   b) Why the fixed shunt compensation is preferred for base reactive loads? 7M

8. Differentiate the regulated and deregulated power systems with the help of block diagram. 14M

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Hall Ticket Number :										

R-11 / R-13

Code: 1G263

III B.Tech. II Semester Supplementary Examinations December 2017

Power System Operation and Control

(Electrical and Electronics Engineering)

Max. Marks: 70 Time: 3 Hours

Answer any **five** questions

All Questions carry equal marks (**14 Marks each**)

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1. a) What are the advantages of dynamic programming approach for unit commitment problem over priority list method? Explain the dynamic programming approach to solve unit commitment problem. 6M

   b) The fuel cost of two units are given by C1=0.1P2G1+25PG1+1.6 Rs/hr C2=0.1P2G2+32 PG2+2.1 Rs/hr. If the total demand on the generators is 250MW, find the economical load distribution of the two units. 8M

2. a) Explain inequality constraints and penalty function 6M

   b) The fuel cost function in Rs/hr for two thermal plants are given by C1=0.004P2G1+9.2PG1+420 Rs/hr C2=0.002P2G2+8.5PG2+350 Rs/hr. Where PG1, PG2 are in MW. Determine the optimal scheduling of generation if the total load is 640.82 MW. Estimate value of =12Rs/MWh. The transmission power loss is given by the expression

   PL(pu)=0.0346P12(pu)+0.00643P22(pu). 8M

3. a) Briefly explain control area concept and control area error. 6M

   b) An isolated generator and its control have the following parameters: Generator inertia constant=5 second; Governor time constant g =0.25 seconds; Turbine time constant T =0.6 seconds; Governor speed regulation=0.05 p.u; Load damping constant B=0.8. The turbine rated output is 200 MW at 50 Hz. The load suddenly increases by 50 MW. Find the steady state frequency deviation. 8M

4. a) Derive mathematical formulation of long and short term hydrothermal scheduling. 6M

   b) Draw the block diagram of IEEE type-1 excitation model and explain its functioning 8M

5. a) Explain proportional plus integral control of single area system with neat block diagram. Derive the necessary equations 6M

   b) An area consists of two generating units rated 400 MVA and 800 MVA with speed regulations 4 % and 5% respectively on their ratings. The units are operating in parallel, sharing 700 MW. Unit 1 supplies 200 MW and unit 2 supplies 500 MW at 1.0 p.u. (50 Hz) frequency. The load now increases by 130 MW. If B=0, find the steady state frequency deviation and new generations. If B= 1.8, find the steady state frequency deviation and new generations. 8M

6. a) Draw the block diagram LFC of two area system. 6M

   b) Give the typical block diagram of two area system interconnected by a tie line .Deduce relations to determine the frequency of oscillations of tie line power and static frequency drop with assumptions made. 8M

7. a) What is series compensation? Explain the advantages 6M

   b) Explain the reason for variations of voltages in power systems and explain any one method to improve voltage profile. 8M

8. a) What is the need of deregulation? 6M

   b) What is the role of modern technology in deregulated power market? 8M

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Hall Ticket Number :										

R-14

Code: 4G264

III B.Tech. II Semester Supplementary Examinations December 2017

Power System Operation and Control

(Electrical & Electronics Engineering)

Max. Marks: 70 Time: 3 Hours

Answer all five units by choosing one question from each unit (5 x 14 = 70 Marks)

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UNIT–I

1. a) Explain the following terms with reference to the power plants: Heat input, Power output curve, Heat rate input, Incremental input, Generation cost and Production cost. 7M

   b) The cost curves of two generators may be approximated by second degree polynomials:

$$C_1 = 0.1\,P_{G1}^2 + 20\,P_{G1} + \gamma_1$$

$$C_2 = 0.1\,P_{G2}^2 + 30\,P_{G2} + \gamma_2$$

   Where γ_1 and γ_2 are constants.

   If the total demand on the generators is 200 MW, find the optimum generator settings. How many rupees per hour would be losing if the generators were operated about 15% of the optimum setting? 7M

OR

2. a) What are the methods of scheduling of generation of steam plants? Explain their merits and demerits. 7M

   b) The incremental production cost of two plants are given by:

$(IPC)_1 = (0.07)P_1 + 16$ *Rs./MWh*

$(IPC)_2 = (0.08)P_2 + 12$ *Rs./MWh*

   The loss coefficients of the system are given by $B_{11} = 0.001$; $B_{12} = B_{21} = -0.005$ and $B_{22} = 0.0024$. The total load to be met is 150 *MW*, determine the economic operating schedule if the transmission line losses are coordinated and the losses are included but not co-ordinate. 7M

UNIT–II

3. a) Derive the transfer function of an overall excitation system. 7M

   b) In a two plant operating system, hydro plant operates for 12 hours during each day and steam plant operates all the day. Characteristics of steam and hydro plants are given below. When both plants are operating, power flow from steam plant is 300MW. Total water used by hydro plant during 12 hrs of operation is $180X10^6$ m^3. Determine the generation of hydro power plant & ".[assume constant load, no losses]

$$C_T = 0.3P_T^2 + 20P_T + 5\ \frac{Rs}{hr}$$

$$W_H = 0.4P_H^2 + 20P_H\ m^3/sec$$

7M

OR

4. a) What are the advantages of operation of Hydrothermal combinations? 7M

   b) Discuss optimal power flow problems with and without inequality constraints. How are these problems solved? 7M

UNIT–III

5. a) Develop the Linearized modeling of a hydraulic turbine. 7M

   b) Explain the operation of Speed- Governing System with neat sketch and develop the mathematical model. 7M

OR

6. a) Explain the methods of providing excitation system. 7M

   b) Derive the transfer function and block diagram of IEEE Type-1 model. 7M

UNIT–IV

7. a) What is meant by tie line bias control? 4M

   b) Two generating stations A and B have the capacities 400MW and 700MW respectively are interconnected by a short line. The percentage speed regulations from no load to full load of the two stations are 2 and 3 respectively. Find the power generation at each station and power transfer through the line if the load on bus of each station is 200MW. 10M

OR

8. a) Derive the transfer function for proportional integral control of a single area system 7M

   b) What are the requirements of the control strategy in LFC? 7M

UNIT–V

9. a) How the following devices generate/absorb reactive power.
      i) Synchronous machine
      ii) Over head lines
      iii) Shunt reactor 7M

   b) What is meant by compensation of line and discuss briefly different methods of compensation 7M

OR

10. a) Compare the different types of compensating equipment for transmission systems. 7M

    b) Explain the effect of uncompensated line under no load and load condition. 7M

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Hall Ticket Number :										

R-14

Code: 4G264

III B.Tech. II Semester Supplementary Examinations May 2018

Power System Operation and Control

(Electrical and Electronics Engineering)

Max. Marks: 70 Time: 3 Hours

Answer *all five* units by choosing one question from each unit (5 x 14 = 70 Marks)

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UNIT–I

1. a) Explain the following terms with reference to power plants: (i) heat input – power output curve (ii) heat rate input (iii) incremental input and (iv) generation cost . 8M

   b) Obtain the condition for optimum operation of a power system with 'n' plants including the effect of transmission losses. 6M

OR

2. a) A system consists of two generating plants with fuel costs of:
   $C_1=0.03P_1^2+15P_1+1.0$
   $C_2=0.04P_2^2+21P_2+1.4$
   The system operates on economic dispatch with 120MW of power generation by each plant. The incremental transmission loss of plant-2 is 0.15. Find the penalty factor of plant-1. 8M

   b) Explain various factors to be considered in allocating generation to different power stations for optimum operation. 6M

UNIT–II

3. Explain and write the mathematical formulation for optimal scheduling of Hydro thermal system. Explain any one solution technique of solving equations with the help of an algorithm. 14M

OR

4. What is meant by optimal power flow solution? Write the equations describing an optimal power flow problem. How inequality constraints are considered on dependent variables and on control variables. 14M

UNIT–III

5. a) Write the modeling equations of turbine speed governing system. Develop the block diagram of turbine speed governing mechanism with first order equations. 7M

   b) Construct a Block Diagram for Generator Load Model and find out the transfer function. 7M

OR

6. a) Derive the first order turbine model. Represent the model in block diagram. 7M

   b) Describe various elements that are to be considered in modeling of an excitation system. 7M

UNIT–IV

7. a) Draw the LFC block diagram of an isolated power system. Write the dynamic response curve of change in frequency for a step change in load. 7M

   b) Derive the expression for change in tie line power and draw its block diagram? 7M

OR

8. a) Write the state space representation of AGC for single area. 7M

   b) How does load frequency control is achieved by considering economic dispatch. 7M

UNIT–V

9. a) Describe the performance of uncompensated transmission lines. 7M

   b) Describe the constructional features of a synchronous capacitor. Explain its operation and discuss various applications in power system operation. 7M

OR

10. a) Explain the phenomenon of sub synchronous resonance in power system operations and suggest remedies to overcome this problem. 7M

    b) Explain series and shunt compensation of lines and discuss their effect on the surge impedance loading of the lines. If shunt compensation is 100%, what happens to SIL and voltage profile. 7M

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Hall Ticket Number :										

R-11 / R-13

Code: 1G263

III B.Tech. II Semester Supplementary Examinations Nov/Dec 2018

Power System Operation and Control

(Electrical and Electronics Engineering)

Max. Marks: 70 Time: 3 Hours

Answer any **five** questions

All Questions carry equal marks (**14 Marks** each)

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1. a) What is an incremental fuel cost? Explain its significance in thermal plant operation? 6M

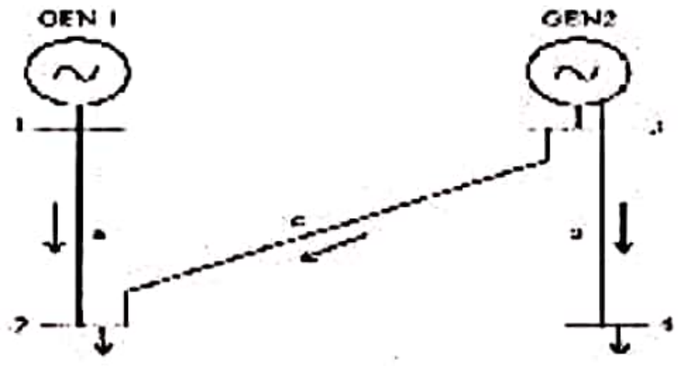
   b) The fuel cost functions in Rs./hr. for two thermal plants are given by:

$$C_1 = 400 + 8.4P_1 + 0.006P_1^2 \; ; 100 \le P_1 \le 600$$

$$C_1 = 600 + 8.93P_2 + 0.006P_2^2 \; ; 60 \le P_2 \le 300$$

   Where P_1, P_2, are in MW. Neglecting line losses and including generator limits, Determine the optimal generation scheduling where P_D = 820MW. 8M

2. Given the network in the figure shown along with the currents flowing in the lines and the impedances of the lines in per unit on a 100MVA base. Compute the B. coefficients for the network when the voltage at bus 1 is 1.0 p.u.



Current in line a = 1.5 – j0.3 p.u.

Current in line b = 2 – j0.3 p.u.

Current in line c = 1 – j0.2 p.u.

Load current at bus2 = 2.5 – j0.5 p.u.

Impedance of lines

a = 0.01 + j0.06 p.u.

b 0.01 + j0.05 p.u.

c = 0.01 + j0.04 p.u.

14M

3. a) Explain the short term Hydro-thermal scheduling problem with necessary expressions. 6M

   b) A two plant system having a thermal and hydro station interconnected. The characteristic of each station is

$$F = (20 + 0.03P_1)P_1 \; Rs/h$$

$$W = (8 + 0.002P_2)P_2 \; m^3/Sec; \quad and \; x = Rs \; 5X10^{-4}/m^3$$

   The transmission loss coefficient is B_{22}=0.0005, Determine the generation of each station when the system is 50 Rs/h. 8M

4. a) Derive the transfer function model for typical generator load model. 6M

   b) Two turbo-alternators rated for 110 MW and 210 MW have a governor droop characteristics of 5% from no load to full load. They are connected in parallel to share the load of 250 MW. Determine the load shared by each machine assuming free governor action. 8M

5. a) Obtain the steady state error in load frequency control with an integral controller in an isolated power system. 6M

   b) A 80 MVA synchronous generator operates on full load at a frequency of 50 Hz. A load 40 MW is suddenly removed from the machine. Due to time lag in the governor system, the steam valve begins to operate after 0.3 sec. Determine the change in frequency that occurs in this time. H=4 KW-s/KVA of generator capacity. 8M

6. a) Discuss the importance of maintaining the load frequency control in an inter connected power system 6M

   b) Two areas of a power system network are interconnected by a tie-line, whose capacity is 500 MW, operating at a power angle of 35^0. If each area has a capacity of 5000 MW and the equal speed regulation of 3 Hz/pu MW, determine the tie line power deviation for step change in load of 85 MW occurs in one of the areas. Assume that both areas have the same inertia constants of H = 4 sec. 8M

7. a) With relevant equations, prove that the shunt compensation will improve the power transfer capabilities and stability margin. 6M

   b) A 3 Phase overhead line has resistance and reactance per phase of 25 and 90 respectively. The supply voltage is 145 kV while the load end voltage is maintained at 132 kV for all loads by an automatically controlled synchronous phase modifier. If the kVAR rating of the modifier has the same value for zero loads as for a load of 50 MW, find the rating of the Synchronous Phase modifier. 8M

8. a) Explain the need for deregulation in Power systems. 6M

   b) Explain the deregulation process in power systems and detail about the various operational entities in a deregulated power system. 8M

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Hall Ticket Number :										

R-14

Code: 4G264

III B.Tech. II Semester Supplementary Examinations Nov/Dec 2018

Power System Operation and Control

(Electrical and Electronics Engineering)

Max. Marks: 70 Time: 3 Hours

Answer *all five* units by choosing one question from each unit (5 x 14 = 70 Marks)

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UNIT–I

1. a) Explain the significance of equality and inequality constraints in the economic allocation of generation among different plants in a system 7M

   b) A system consists of three generating plants with fuel costs of:
   $C_1=0.04P_1^2+20P_1+230$ Rs./h
   $C_2=0.06P_2^2+18P_2+200$ Rs./h
   $C_3=0.15P_3^2+15P_3+180$ Rs./h
   Determine the optimum sharing of a total load of 180MW for which each plant would take up for minimum input cost of received power in Rs/MWh. 7M

OR

2. a) What are Loss coefficients? Derive the expressions for Loss coefficients of a two generator system. 7M

   b) Draw the flow chart for obtaining optimal scheduling of generating units by neglecting the transmission losses. 7M

UNIT–II

3. a) Explain problem formation and solution procedure of optimal scheduling for hydro thermal plants. 7M

   b) A load is fed by two plants, one is thermal and other is a hydro plant. The load is located near the thermal plant. The characteristics of the plants are
   $F_T = 0.04P_T^2+25PT+20$ Rs./hr; $W_H=0.0012P_H^2+7.5P_H$ m3/Sec ;
   $x_H=2.5X10^{-3}$ Rs./m^3. Determine the power generation of both plants and load connected, when
   λ = 20Rs./ MWh. 7M

OR

4. a) Obtain the modeling of hydro turbine and draw its block diagram. 7M

   b) With the help of a flow chart, explain the dynamic programming method in unit commitment. 7M

UNIT–III

5. a) Explain speed governing mechanism. Develop its block diagram. 7M

   b) Develop the block diagram of Generator and load. 7M

OR

6. a) Why is it necessary to maintain constant frequency and voltage profiles in a power system network? Explain. 7M

   b) Draw and explain the Block diagram of IEEE type-1 excitation system. 7M

UNIT–IV

7. a) Draw the block diagram of single area Load frequency control system. Explain the terms in it. 7M

   b) Two generators of rating 125 and 250MW are operated with droop characteristics of 4% and 5% respectively from no load to full load. Find the load sharing by each generator if a load of 300MW is connected across the parallel combination of those generators. 7M

OR

8. a) Show that steady state frequency deviation in a single area LFC is reduced to zero if the PI controller is reduced. 7M

   b) Discuss the importance of combined load frequency control and economic dispatch control with a neat block diagram. 7M

UNIT–V

9. a) What do mean by compensation of a line? Discuss briefly different methods of compensation. 7M

   b) Explain what you mean by loadability of overhead lines and discuss loadability characteristic of these lines. 7M

OR

10. a) What is sub synchronous resonance condition? How is it handled in electrical network? 7M

    b) A 35 kW induction motor has power factor 0.85 and efficiency 0.9 at full load, power factor 0.6 and efficiency 0.7 at half-load. At no-load, the current is 25% of the full-load current and power factor 0.1. Capacitors are supplied to make the line power factor 0.8 at half-load. With these capacitors in circuit, find the line power factor at (i) full load, and (ii) no-load. 7M

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