Hall Ticket No | | | | | | | | | | | Question Paper Code: AEEB28

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal-500043, Hyderabad

B.Tech VII SEMESTER END EXAMINATIONS (REGULAR/SUPPLEMENTARY) - DECEMBER 2022

Regulation: R18

POWER SYSTEM OPERATION AND CONTROL

Time: 3 Hours (ELECTRICAL AND ELECTRONICS ENGINEERING) Max Marks: 70

Answer FIVE Questions choosing ONE question from each module
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

MODULE – I

1. (a) List out the methods of scheduling of generation of steam plants. Develop loss formula coefficients for a two plant system. State the assumption made. [BL: Understand| CO: 1|Marks: 7]

   (b) Incremental fuel cost in Rs/MWhr for a plant of a two units is given.
   $\frac{dC_1}{dP_1} = (0.2P_1 + 30) Rs/MWhr$; $\frac{dC_2}{dP_2} = (0.3P_2 + 25) Rs/MWhr$
   Find the savings in fuel cost in rupees annually for optimal scheduling of a total load of 140 MW, as compared to equal distribution of the same load between the two units.
   [BL: Apply| CO: 1|Marks: 7]

2. (a) Decribe clearly the mathematical formulation of optimal scheduling of hydrothermal system with a typical example. write the advantages of hydrothermal system.
   [BL: Understand| CO: 1|Marks: 7]

   (b) The fuel inputs per hour of plants 1 and 2 are given as
   $F_1 = 0.2P_1^2 + 40P_1 + 120$ Rs/hr; $F_2 = 0.25P_2^2 + 30P_2 + 150$ Rs/hr
   Determine the economic operating schedule and the corresponding cost of generation if the maximum and minimum loading on each unit is 100 MW and 25 MW, the demand is 180 MW, and transmission losses are neglected. If the load is equally shared by both the units, determine the saving obtained by loading the units as per equal incremental production cost.
   [BL: Apply| CO: 1|Marks: 7]

MODULE – II

3. (a) Discuss the modelling and dynamic response of the steam turbine and derive the transfer function of the steam turbine. [BL: Understand| CO: 2|Marks: 7]

   (b) A 100 MVA synchronous generator operates at 50 Hz, runs at 3000 rpm under no load. A load of 25 MW is suddenly applied to the machine. Due to the time lag in the governor system the turbine commences to open after 0.6 sec. Assuming inertia constant H= 5 MW- sec per MVA of generator capacity, calculate the frequency of the system before steam own commences to increase to meet the new load. [BL: Apply| CO: 2|Marks: 7]

4. (a) Draw the block diagram of an isolated power system and explain the modeling of each block.
   [BL: Understand| CO: 2|Marks: 7]

   (b) Two turbo alternators rated for 150 MW and 250 MW have governor drop characteristics of 8% from no load to full load. They are connected in parallel to share a load of 300 MW. Determine the load shared by each machine assuming free governor action. [BL: Apply| CO: 2|Marks: 7]

MODULE – III

5. (a) Elucidate the need for maintaining constant frequency. Explain automatic load frequency control with block diagram. [BL: Understand| CO: 3|Marks: 7]

   (b) Two generators rated 250 MW and 500 MW are operating in parallel. The droop characteristics are 4% and 6% respectively. Assuming that the generators are operating at 50 HZ at no load, how a load of 750 MW would be shared. What is the system frequency? Assume free governor action. [BL: Apply| CO: 3|Marks: 7]

6. (a) Interpret the function of load frequency. Explain LFC control of single area and derive the steady state frequency error. [BL: Understand| CO: 4|Marks: 7]

   (b) Two generating stations A and B have full load capacities of 350 and 500MW, respectively. The interconnector connecting the two stations has an induction motor/synchronous generator of full load capacity 40 MW; If the load C is connected and percentage changes of speeds of A, B and C are 5, 4 and 2 respectively. Determine the load taken by plant C and indicate the direction of the power flow. [BL: Apply| CO: 4|Marks: 7]

MODULE – IV

7. (a) Demonstrate the need for compensation. Illustrate the working of series and shunt compensators with neat sketch and compare them. [BL: Understand| CO: 5|Marks: 7]

   (b) A 3 phase transformer rated 7000kVA has a over load capability of 125% of the rating. If the connected load is 1150 kVA with a 0.8 p.f(lag). Determine the following:

   i) The kVAR rating of shunt capacitor bank required to decrease the kVA load of the transformer to its capability level ii) The kVAR raring of the shunt capacitor bank required to correct the load p.f. to unity. iii) The p.f. of the corrected level. [BL: Apply| CO: 5|Marks: 7]

8. (a) List the methods of voltage control. Explain the design and working of static VAR compensators. [BL: Understand| CO: 5|Marks: 7]

   (b) A 400 V 50 cycles three phase line delivers 207KW at 0.8 p.f lag. It is desired to bring the line p.f to unity by installing shunt capacitors, calculate the capacitance if they are

   i) Star connected ii) Delta connected. [BL: Apply| CO: 5|Marks: 7]

MODULE – V

9. (a) Outline the characteristics of ideal load compensation and list the typical loads requires compensation. [BL: Understand| CO: 6|Marks: 7]

   (b) Assume that the annual peak load of a primary feeder is 2000 kw, at which the power is 80 kw per three phase. Assuming an annual loss factor of 0.15, determine

   i) The average annual power loss. ii) The total annual energy loss due to the copper loss of the feeder.

   [BL: Apply| CO: 6|Marks: 7]

10. (a) Describe why distribution system is specified with voltage ratings but not with current ratings? [BL: Understand| CO: 6|Marks: 7]

    (b) A small city experiences an annual peak load of 3500 kw. The total annual energy supplied to the primary feeder's circuits is $10 * 10^6$ kwh. The peak demand occurs in July/August and is due to air conditioning load. i) Find the annual average power demand ii) Find the annual load factor iii) Find the annual loss factor [BL: Apply| CO: 6|Marks: 7]