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Paper Code : PE-EE 701 C Power Generation Economics

UPID : 007704

Time Allotted : 3 Hours   *Full Marks :70*

The Figures in the margin indicate full marks.

Candidate are required to give their answers in their own words as far as practicable

Group-A (Very Short Answer Type Question)

1. Answer *any ten* of the following :   [1 x 10 = 10]

   (I)   The reserve capacity which is available for operation and ready to use is called _____

   (II) B-coefficients in economic operation of generating systems represent _____

   (III) State estimation is used in power system to mainly obtain best values of _____

   (IV) The salaries of high officials come under the category of _____ (Fixed cost / *Semi fixed cost*)

   (V)   The electrical consumers may not be under the category of
   Rich consumers
   Industrial consumers
   Domestic consumers
   Commercial consumers

   (VI) The reserve capacity which is available for service but not normally ready to use is called _____

   (VII) The matrix configuration for loss coefficients may be
   M X N
   P X P
   N X M
   Is not defined

   (VIII) Method of extrapolation is used for _____

   (IX) Load factor of a peak load plant is always _____

   (X)   The practice of sharing of prices is adopted usually in _____ tarrif.

   (XI) The expression of incremental fuel cost having cost function of $F(PI) = (225 + 63Pi + 0.04Pi^2)$ Rs/hr will be given by

   (XII) The change in cost function for a change in generation is dependent on_____

Group-B (Short Answer Type Question)

Answer *any three* of the following :   [5 x 3 = 15]

2. A 100 MW power station delivers 100 MW for 2 hours, 75 MW for 6 hours and 60 MW for 4 hours. Find the energy supplied by it.   [5]

3. What is load forecasting? List two techniques for load forecasting   [5]

4. What is diversity factor? If a system has overall diversity factor of 1.35 with maximum demands of different consumers as 1.5 MW, 2 MW and 10 MW respectively, what would be the maximum demand on the system?   [5]

5. State how the transmission loss formula could be used to find economic operation schedule of a system with thermal generators   [5]

6. What is meant by subsidization and cross subsidization? Which class of consumers are benefited by this system and how?   [5]

Group-C (Long Answer Type Question)

Answer *any three* of the following :   [15 x 3 = 45]

7. (a) What is capacity charge tariff?   [5]

   (b) Two systems of tariff are available for a factory working 8 hours a day for 300 working days in a year.   [10]
   (i) HV supply at 5 paise per unit plus Rs 4.5 per month per kVA of maximum demand
   (ii) LV supply at Rs 5 per month per kVA of maximum demand plus 5.5 paise per unit.

https://www.makaut.com

The factory has an average load of 200kW at 0.8 p.f. and a maximum demand of 250 kW at the same p.f. The HV equipment costs Rs 50 per kVA and the losses can be taken as 4%. It's interest and depreciation charges are 12%. Calculate the difference in annual costs between the two systems.

8. (a) Explain the factors affecting the voltage stability of a linear system. [7]

   (b) What is loss coefficient? Write how power loss could be expressed in terms of these coefficient for economic operation. [8]

9. (a) Derive the coordination equation for economic operation of thermal units, neglecting losses. [7]

   (b) Four generators are available to supply a peak load of 472.5 MW. The cost of power generation from each generator and the corresponding maximum power output of each unit is given as: [8]

   $C_1 = 200 + 15P_1 + 0.2P_{12}$:P1max = 100 MW

   $C_2 = 300 + 17P_2 + 0.1P_{22}$:P2max = 120 MW

   $C_3 = 150 + 12P_3 + 0.15P_{32}$:P3max = 100 MW

   $C_4 = 500 + 2P_4 + 0.07P_{42}$:P4max = 100 MW

   Neglecting the transmission losses, calculate the optimal loading of each generator and the cost of operating the system for 1 hour at peak.

10. (a) Which power plants are best suited for base load plants and why? [5]

    (b) A base load plant having a capacity of 18 MW and a standby station having a capacity of 20 MW share a common load. Find the annual load factors and capacity factors of the two power stations from the given data: https://www.makaut.com [10]

    Annual standby station output = 7.35 X 10^6 kWh

    Annual base load station output = 101.35 X 10^6 kWh

    Peak load on standby station = 12 MW

    Hours of use by standby station per year =2190 hours

11. (a) What are the methods of meeting the variable load in a power station? [7]

    (b) The load duration curve for a typical load being served by a combined hydro-steam system may be approximated by a straight line with maximum load of 60 MW and minimum load of 20 MW. The hydro station available at the time of minimum regulated flow is just sufficient to take a peak load of 50 MWh per day. It is observed that it will be economical to pump water from the tail race to the reservoir by utilising the steam power plant during the off-peak periods and thus running the station at 100% load factor. Determine the maximum capacity of each type of plant assuming the efficiency of steam conversation to be 60%. [8]

*** END OF PAPER ***