BACHELOR OF ENGINEERING(ELECTRICAL ENGINEERING) SECOND YEAR FIRST SEMESTER SUPPLEMENTARY EXAMINATION - 2023

Subject: **POWER SUPPLY SYSTEMS**

Time: Three hours   Full Marks: 100

Part-I   (50 Marks for part-I)

Use separate answer-Script for each part

Question no.   *Answer question no. 1 and any two from the rest*   Marks

1. *Write short notes on any six*   **6×3**
    i)   ESP
    ii)   Deaerator of a steam power plant
    iii) Reaction turbine
    iv)   Condenser in a steam power plant
    v)   Valve house in a hydroelectric power plant
    vi)   Forebay in a hydroelectric power plant
    vii) Draft tube of a hydroelectric power plant
    viii) Relector of a nuclear power plant
    ix)   Load factor
    x)   Demand factor

2. a) Draw a typical layout of a thermal power plant and describe the function of a coal and ash handling plant.   **8**

    b) A thermal power plant spends Rs. 50 lakhs in one year on coal consumption. The coal has a calorific value of 5700 kcal/kg and costs Rs. 2000 per tonne. If the thermal efficiency is 35% and the electrical efficiency is 90%, find the average load on the power plant. [Heat equivalent of 1kwh=860 kcal]   **8**

3. a) Discuss briefly the main parts of a nuclear power plant.   **8**

    b) Explain the working principle of a closed cycle gas turbine power plant.   **8**

4. a) What is water hammer? How is it avoided in a hydel power plant? What are the factors to be considered in the site selection of a hydroelectric power plant?   **2+1+3**

    b) Why is hydrograph important for designing hydroelectric power plants?   **4**

    c) In a reservoir, water flow from January to December in a year is as follows: 150/250/700/1600/1450/1850/2200/1600/800/650/250/250 cu.m. per sec. What will be the average power generation throughout the year if the the available head is 50 m?   **6**

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5. a) Discuss the requirements of a power plant to serve as a peak load plant. Is it possible to operate a thermal power plant as a peak load plant? **2+2**

b) A certain region has a peak demand of 500 MW and an annual requirement of 3×10^6 MWh. The supply utility has to meet the demand by setting up a gas-turbine and a coal fired thermal power plant. The installation and operating costs of the two kinds of plants are as follows: **12**

1. Gas-turbine plant: Rs. 80 lakhs, Rs. 1000 per kW, and Rs. 2.00 per kWh
2. Coal-fired plant: Rs. 100 lakhs, Rs. 6000 per kW, and Rs. 1.20 per kWh

Determine the (i) capacity of each plant, (ii) annual generation of each plant, and (iii) overall unit cost per MWh for the peak load. Assume that the demand decreases linearly with time.

BACHELOR OF ENGINEERING (ELECTRICAL ENGINEERING) EXAMINATION, 2023

(2nd Year, 1st Semester, Supplementary)

POWER SUPPLY SYSTEMS

Time: Three Hours   Full Marks: 100

(50 marks for each part)

Use a separate Answer-script for each Part

PART-II

Answer any _three questions_

(Two marks are reserved for neatness and well organized answers)

1. a)   State and prove Kelvin's law.   2+4

   b)   The cost of a 3-phase overhead transmission line is Rs (25000 a + 2500) per km where 'a' is the area of cross-section of each conductor in cm^2. The line is supplying a load of 5 MW at 33kV and 0·8 p.f. lagging assumed to be constant throughout the year. Energy costs 4P per kWh and interest and depreciation total 10% per annum. Find the most economical size of the conductor. Given that specific resistance of conductor material is 10^{-6} Ω cm.   10

2. a)   Determine the expression for voltage drop in a uniformly loaded d.c. distributor fed at both ends with equal voltages. Draw the current loading and voltage drop diagrams.   8

   b)   A 2-wire d.c. distributor 200 metres long is uniformly loaded with 2A/metre. Resistance of single wire is 0·3 Ω/km. If the distributor is fed at one end, calculate:

      (i)   the voltage drop up to a distance of 150 m from the feeding point

      (ii)   the maximum voltage drop   8

3. a)   Compare the volume of conductor material required for d.c. two-wire system with mid-point earthed with a.c. single phase, three-wire system in overhead transmission line. State the assumptions.   8

   b)   Calculate the voltage at a distance of 200 m of a 300 m long distributor uniformly loaded at the rate of 0.75 A per metre. The distributor is fed at one end at 250 V. The resistance of the distributor (go and return) per metre is 0·00018 Ω. Also find the power loss in the distributor.   8

4. a)   Draw the layout and schematic connection of a pole-mounted sub-station.   8

   b)   What are the different types of bus-bar arrangements used in sub-stations? Describe one bus-bar arrangements with suitable diagrams.   8

5. a) What do you understand by earthing? Briefly discuss any two methods of earthing. 2+4

   b) Write a short note on the sub-station equipment. 10

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