

B.E. ELECTRICAL ENGINEERING SECOND YEAR SECOND SEMESTER EXAM 2024**POWER SUPPLY SYSTEMS**

Time: Three hours

(50 marks for each part)

Full Marks: 100

Use separate answer script for each part.

PART IAnswer **any five** questions (All CO1).

Figures in the margin indicate full marks

1. With suitable diagram discuss feed water and steam flow circuit. 10
2. Justify or correct the following sentences with reasons 5×2
 - a) Pumped storage plants are economic as peak load plant.
 - b) Balanced draught must be used in thermal power plants.
3. a) Derive an equation for air required for complete combustion of solid fuel 6+4
considering the elements of that fuel C, H₂, O₂ and S.
b) A thermal power plant spends Rs. 25lakhs in one year as coal consumption.
The coal has calorific value of 5000kcal/kg and costs Rs. 500 per ton. If the thermal efficiency is 35% and electrical efficiency is 90%, find average load on the power plant.
4. Discuss the functions of (i) dam (ii) penstock (iii) spillway (iv) valve house (v) tail race of a hydroelectric plant 10
5. Write short notes on 4 +6
 - a) Starting motor of gas turbine plant
 - b) Fast breeder reactor

[Turn over

6. The data given in table refers to the average monthly flow available in a stream 10 over a year at an average head of 100m at a particular site. Draw flow duration curve and mass curve. Show average water flow required in the flow duration curve. Calculate average hydro power generated assuming an overall efficiency of 85%. Also, calculate the appropriate capacity of the reservoir to be set-up for this purpose if the minimum stored volume of water to be maintained in the reservoir is 500 month-sec-meter.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
discharge (m ³ /s)	400	200	600	1500	1000	2500	2300	2000	1200	1900	800	400

7. a) Distinguish between load curve and load duration curve. 2+8
- b) There is a peak load plant and a base load plant in a power supply system. Write annual operating cost functions of the plants and justify them. Deduce the expression of optimum operating time of the peak load plant.

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PART – II

(2 marks reserved for well-organized answers)

Group A

Answer any three of the following questions.

1. i) Explain why loop arrangement is better than radial arrangement in distribution systems (4)
ii) What do you understand by feeders, distributors and service mains? (4)
iii) Derive the generalized expression for voltage drop and point of minimum potential in a two wire distributor having uniform distributed loading and fed at one end. (4)
2. i) Compare the volume of conductor material required for dc two wire system (one conductor earthed) with ac two phase four wire system in underground lines with the assumption that transmitted power, maximum voltage between conductors, length of transmission line, power factor and transmission efficiency remain same for both the cases. (6)
ii) A single phase ac system supplies a certain power, and if this system is converted to a three phase ac system by running a third similar copper conductor, calculate the percentage additional load that can be supplied, for the same voltage between the conductors, the same power factor and the same percentage copper loss. (6)
3. a) Prove Kelvin's law for economic size of conductor. (4)
b) A two conductor cable is required to supply a constant load of 200A throughout the year. The cost of the cable is Rs. $(50a+25)/m$, where 'a' is the area of the conductor in cm^2 . The line is in operation for 250 days in a year. Find the most economical cross section of the conductor assuming interest and depreciation of 10% per annum and energy cost to be 5 paise per unit. Specific resistivity of the conductor is $1.85\mu\Omega \text{ m}$. (8)

4. i) A D.C ring main distributor ABCDA is fed from point A from a 250 V supply and the resistances (including both go and return) of various sections are as follows:

$$AB = 0.02 \, \Omega; BC = 0.018 \, \Omega; CD = 0.025 \, \Omega \text{ and } DA = 0.02 \, \Omega.$$

The main distributor supplies loads of 150 A at B; 300 A at C and 250 A at D. Determine the voltage at each load point.

If the points A and C are linked through an interconnector of resistance $0.02 \, \Omega$, determine the new voltage at each load point. (8)

- ii) Show that transmission line efficiency increases with the increase in transmission line voltage. (4)

5. i) Write the main advantages of ac transmission over dc transmission. (4)

- ii) A dc distributor shown in the fig. Q5 (ii) below is fed at both ends with 200V. The resistance of the distributor (go and return) is $0.001 \, \Omega/\text{m}$. Determine the point of minimum voltage and the value of the minimum voltage. (8)

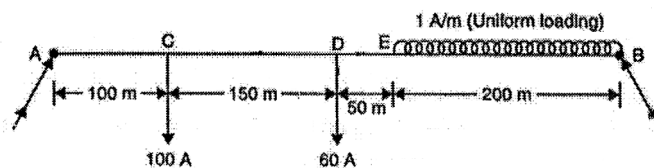


Fig. Q 5.(ii)

Group B

Answer any one of the following questions

6. i) Why circuit breakers and isolators are used in substations? (3)
- ii) Explain the operation of relay in power system. (6)
- iii) Mention the factors on which earth resistance depends. (3)
7. i) What do you understand by stranded conductor? What are its advantages? (4)
- ii) Discuss the major tasks performed by a substation. (5)
- iii) What do you understand by double bus bar arrangement in a substation? (3)