

## II B. Tech II Semester Regular Examinations, June/July - 2022

## POWER SYSTEM-I

(Electrical and Electronics Engineering)

Time: 3 hours

Max. Marks: 70

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Answer any **FIVE** Questions each Question from each unit  
All Questions carry **Equal** Marks

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**UNIT-I**

- 1 a) Explain the principle of operation of hydro power plant with neat diagram? [7M]  
b) Enumerate essential elements of hydro electric power plant. [7M]

**Or**

- 2 Briefly describe the main parts and the working of a steam power station with neat diagram. [14M]

**UNIT-II**

- 3 a) What are the merits and demerits of nuclear power plants? [7M]  
b) Enumerate and explain essential components of a nuclear reactor. [7M]

**Or**

- 4 a) What are the factors to be considered for the selection of site of a nuclear power stations? [7M]  
b) Describe with the help of a neat sketch the working principle of a pressurized water reactor. [7M]

**UNIT-III**

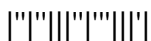
- 5 a) State the advantages of outdoor substations over indoor substations [7M]  
b) Explain the constructional aspects of GIS. [7M]

**Or**

- 6 a) What are the merits and demerits of a gas insulated substations? [7M]  
b) Draw and explain the sectionalized single bus bar system? List out its merits and demerits [7M]

**UNIT-IV**

- 7 a) Briefly discuss the types of insulating materials used in cables? [7M]  
b) The capacitance of 3-core cable belted type has the following data [7M]  
i. Between three cores bunched together and the earthed sheath  $6.6\mu\text{F}$   
ii. Between the conductor and the other two connected together to the sheath  $4\mu\text{F}$ .  
Determine the capacitance to neutral and the total charging current drawn by the cable, when the cable is connected to a 66 kV, 50Hz, 3-phase supply.

**Or**

- 8 a) What do you understand by grading of cable? Explain why grading is more of theoretical interest than practical? [7M]
- b) Determine the thickness of insulation and operating voltage of a single core cable if the maximum and minimum stress in the dielectric is 38 kV/cm (r.m.s) and 12 kV/cm (r.m.s) respectively and the diameter of core is 3 cm. [7M]
- 9 a) Explain the following: [7M]  
(i) load curve and (ii) load duration curve
- b) Calculate the annual load factor of 120 MW power station deliver 110MW for 4 hours, 60MW for 10 hours and is shut down for the rest of each day. For general maintenance, it is shut down for 60 days per annum. [7M]

Or

- 10 a) What are the objectives and requirements of tariff [7M]
- b) A thermal power station fixed costs is Rs. 600 per kW of installed capacity per annum. The fuel and operating costs are 12 paise per kWh generated. Calculate cost of energy generated per kWh at the following station load factor (i) 25% , (ii) 50% and (iii)100%. Comment on the results. [7M]



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**UNIT-I**

- 1 a) Compare hydro and thermal power plants. [7M]  
b) Explain the general arrangement and operation of hydroelectric power plant. [7M]

**Or**

- 2 a) What are the factors to be considered for selection of the site for a thermal power station. [7M]  
b) Describe the function of ESP and condenser in thermal power plants? [7M]

**UNIT-II**

- 3 a) What is nuclear fusion? How does it differ from nuclear fission? [7M]  
b) What is a moderator? Name commonly used moderators and discuss their merits and limitations [7M]

**Or**

- 4 a) What is boiling water reactor? How does it differ from a pressurized water reactor? [7M]  
b) Explain the nuclear waste disposal in nuclear power plants? [7M]

**UNIT-III**

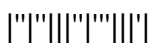
- 5 a) Draw and explain the substations layouts of 33/11 kV showing the location of all the substation equipment. [7M]  
b) Give the comparison of outdoor and indoor substations. [7M]

**Or**

- 6 a) Draw and explain the main and transfer bus bar system? List out its merits and demerits. [7M]  
b) What are the advantages of gas insulated substations? [7M]

**UNIT-IV**

- 7 a) What do you understand by the term grading of cable? Discuss briefly any one method of grading. [7M]  
b) A 33kV, 3-phase, 2.5 km long feeder consists of single-core cables having a conductor radius of 12mm and an insulation thickness of 8mm. The dielectric has a relative permittivity of 3 and the power factor of the unloaded cable is 0.3. Determine the following [7M]  
(i) capacitance per phase,  
(ii) charging current per phase,

**Or**

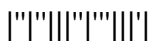
- 8 a) Show that the insulation resistance of a cable is inversely proportional to its length. [7M]  
b) A single core 3000 m long cable has a core diameter of 1.6 cm, the sheath diameter of 5 cm and an insulation resistance 1800 M  $\Omega$ . Determine the resistivity of dielectric. [7M]

**UNIT-V**

- 9 a) Define the following [7M]  
(i) maximum demand, (ii) demand factor, (iii) load factor and (iv) diversity factor  
b) A generating station supplies four feeders with the maximum demands (in MW) of 16 MW; 10 MW; 12 MW and 7 MW. The overall maximum demand on the station is 20 MW and the annual load factor is 45%. Find the diversity factor and the number of units generated annually. [7M]

**Or**

- 10 a) What are the desirable characteristics of a tariff method? [7M]  
b) The energy cost of a 120MW steam station working at 50% load factor comes out to be 15 paise/kWh of energy generated. If the load factor is improved to 75% find the cost of energy generated? The fuel cost of the power station due to increased generation increase the annual generation cost by 7.5%. [7M]



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**UNIT-I**

- 1 a) Enumerate and explain briefly the factors which should be considered while selecting the site for hydro electric plant. [7M]  
b) Explain the essential elements of hydro electric power plant. [7M]

**Or**

- 2 a) Give the layout of a modern steam power plant and explain it briefly. [7M]  
b) What is the need of cooling towers in thermal power station? Discuss its working principle? [7M]

**UNIT-II**

- 3 a) Explain with a simple block diagram working of a nuclear power station. [7M]  
b) Describe the nuclear chain reaction in nuclear power plants? [7M]

**Or**

- 4 a) Explain the working principle of fast breeder reactor with neat diagram. [7M]  
b) Discuss the radiation hazards and shielding of nuclear power plants? [7M]

**UNIT-III**

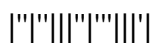
- 5 a) What is a substation? Name the factors that should be taken care of while designing and erecting a substation. [7M]  
b) What are the different types of substations? List out its major components? [7M]

**Or**

- 6 a) Draw and explain the double bus bar with one circuit breaker system? List out its merits and demerits. [7M]  
b) Describe the installation and maintenance of GIS. [7M]

**UNIT-IV**

- 7 a) Derive the expression for power factor of cable? [7M]  
b) The insulation of a single core cable is  $495 \text{ M}\Omega$  per km. If the core diameter is 2.5 cm and resistivity of insulation is  $5 \times 10^{14} \Omega\text{-cm}$ , find the insulation thickness. [7M]

**Or**

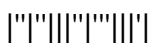
- 8 a) What are the desirable characteristics of insulating material used in cables? [7M]
- b) A single core cable has a conductor diameter of 2.5 cm and a sheath of inside diameter 6 cm. Calculate the maximum stress. It is desired to reduce the maximum stress by using two inter sheaths. Determine their best positions, the maximum stress and the voltage on each. System voltage is 66kV, 3-phase. [7M]

**UNIT-V**

- 9 a) What do you understand by the load curve? What information's are conveyed by a load curve? [7M]
- b) A 120 MW substation delivers 120 MW for 3 hours, 60 MW for 8 hours and shutdown for the rest of each day. It is also shutdown for the maintenance for 15 days each year. Calculate its annual load factor. [7M]

**Or**

- 10 a) What are the various tariff methods? Discuss the two-port tariff method? [7M]
- b) A power station has a maximum demand of 15 MW. Find the cost per units generated from the following data: [7M]  
Annual load factor =45%, capital cost =Rs.13,00,000/-, annual cost of fuel and oil = Rs. 7,50,000, taxes, wages and salaries = Rs. 6,00,000, Interest and depreciation = 12%



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## UNIT-I

- 1 a) Draw the general layout of hydro power plant? Discuss its working principle? [7M]  
b) Draw general layout of a modern thermal power plant? Explain its working? [7M]

Or

- 2 a) How the coal is utilized in power generation? Describe how it is handled starting from delivery of coal to final combustion stage [7M]  
b) What are the functions of economizer and super heater in a thermal power plant [7M]

## UNIT-II

- 3 a) What are the methods of producing nuclear reaction? What is chain reaction [7M]  
b) Explain the radiation hazards and shielding in nuclear power plant? [7M]

Or

- 4 a) Describe the need of reflectors and coolents in nuclear power plant? [7M]  
b) Explain the working of boiling water reactor with neat diagram? Listout its merits? [7M]

## UNIT-III

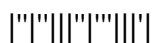
- 5 a) Discuss the different ways of classifying the substations [7M]  
b) What are the various types of bus bar arrangements in substations? Discuss the single bus bar system with neat diagram? [7M]

Or

- 6 a) Draw and explain the gas insulated substation? [7M]  
b) compare air insulated substations and gas insulated substations [7M]

## UNIT-IV

- 7 a) Show that in a three core belted cable the neutral capacitance to each conductor  $C_n$  is equal to  $C_s+3C_c$  where  $C_s$  and  $C_c$  are capacitance of each conductor to sheath and to each other respectively. [7M]  
b) A single core cable for 132 kV, 3-phase system has conductor radius 0.9cm and inside sheath radius of 6cm. It has two inter-sheaths. The stress varies between the maximum and minimum limits in the three layers of dielectric. Find the radii of the intersheaths and their voltages. [7M]



Or

- 8 a) What are the various types of cables used in underground system? Discuss construction of any one types of cable? [7M]
- b) Cable has intersheath grading that satisfies the equation,  $R/r_1 = r_1/r = \alpha$ . The core and cable radii are  $r = 1.2$  cm and  $R = 3$  cm. Determine the location of the intersheath and also calculate the ratio of maximum electric field strengths with and without intersheath grading. [7M]

UNIT-V

- 9 a) Explain the terms load factor and diversity factor? How do these factors influence the cost of generation? [7M]
- b) A customer connected loads are 10 lamps of 60W each and two heaters of 1,500W each. His maximum demand is 2kW. On the average he uses 10 lamps 7 hours a day and each heater for 5 hours a day. Determine his (i) average load, (ii) monthly energy consumption and (iii) load factor. [7M]

Or

- 10 a) What do you understand by tariff? Discuss the objectives of tariff. [7M]
- b) A power station has the following data: [7M]  
Plant capacity = 75MW, annual load factor = 50%, capital cost = Rs.  $14 \times 10^6$ , annual cost of fuel etc. = Rs.  $1.4 \times 10^6$ , interest and depreciation each 6% per annum of initial value. Determine the generation cost per kWh.

