

Total No. of Questions : 12]

SEAT No. :

P1791

[Total No. of Pages : 4

[5059] - 41
B.E. (Mechanical) (Semester - II)
POWER PLANT ENGINEERING
(2008 Pattern)

*Time :3 Hours]**[Max. Marks :100**Instructions to the candidates:-*

- 1) *Answer 3 questions from Section - I and 3 questions from Section - II.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data, if necessary.*

SECTION - I

- Q1)** a) Discuss the role and participation of private sector and Government sector in development of power sector in India. **[8]**
- b) The peak load on a power plant is 60MW. The loads having maximum demands of 30MW, 20MW, 10MW and 14MW are connected to the power plant. The capacity of power plant is 80MW and the annual load factor is 0.50. Estimate (i) the average load on the power plant, (ii) the energy supplied per year. (iii) the demand factor, (iv) the diversity factor. **[8]**

OR

- Q2)** a) Discuss in details the various factors which must be considered in selecting a site for steam power plant. **[5]**
- b) Explain the term load shedding with details. **[5]**
- c) A thermal power plant of 210MW capacity has the maximum load of 160MW. Its annual load factor is 0.6. The coal consumption is 1kg per kWh of energy generated and the cost of coal is Rs. 450.00 per tonne. Calculate (i) the annual revenue earned if energy is sold at Rs. 1 per kWh and (ii) the capacity factor of the plant. **[6]**

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- Q3)** a) Explain construction and working of fluidized bed combustion system for power plant. [5]
- b) Draw a chart showing operations and devices used in coal handling plant. [5]
- c) The following readings were taken during a test on a surface condenser:
 Mean condenser temperature = 35°C, Hot well temperature = 30 °C, condenser vacuum = 69 cm Hg. Condensate collected I 6 kg/mm. Cooling water enters at 20 °C and leaves at 32.5 °C, flow rate being 37500 kg/h. Calculate (i) mass of air present per cubic meter of condenser (ii) quality of steam at condenser inlet, (iii) vacuum efficiency, and (iv) condenser efficiency. [6]

OR

- Q4)** a) Discuss the principle of operation of overfeed and underfeed stokers with the help of simple diagrams. [5]
- b) Explain the principle of working of electro static dust collector with the help of a neat diagram. [5]
- c) In a cogeneration plant, the power load is 5.6MW and the heating load is 1.163MW. Steam is generated at 40bar and 500°C and is expanded isentropically through a turbine to a condenser at 0.06bar. The heating load is supplied by extracting steam from the turbine at 2 bar, which condensed in process heater to saturated liquid at 2 bar and then pump back to the boiler. Compute (i) the steam generation capacity of the boiler in t/h, (ii) the heat input to the boiler in kW, (iii) the fuel burning rate of the boiler in t/h if a coal of calorific value 25MJ/kg is burned and the boiler efficiency is 88%, (iv) the heat rejected to the condenser, (v) the rate of flow of cooling water in the condenser if the temperature rise of water is 6 °C. Neglect pump work [6]
- Q5)** a) What do you mean by (i) hydrograph (ii) flow duration curve and (iii) power duration curve? What is primary power and secondary power? [6]
- b) Explain with the neat sketch the governing principle of an impulse turbine, What are the function of needle valve and the deflector. [6]
- c) What are the topographical and other conditions decide the setting of turbine either vertical or horizontal (i) in case of reaction turbine (ii) in case of pelton turbine. [6]

OR

- Q6)** a) State the function of dam. How dams classified? Briefly describe the few important types of dams. How would you select the site and the type of dam? [6]
- b) Explain with a neat sketch the combustion chamber of a gas turbine plant. What are dilution holes? How is flame stabilization secured by (i) a swirler (ii) a bluff body? [6]
- c) A gas turbine power plant consists of two stage compressor and single stage turbine with a regenerator. The air is taken into the compressor at 20 °C and 1 bar. The maximum temperature of the cycle is limited to 700 °C and maximum pressure ratio is 6. The effectiveness of regenerator is 0.7. Assuming the following data, find (i) The air fuel ratio used , (ii) Thermal efficiency of the cycle and (iii) Specific fuel consumption of the plant and fuel consumption per hour. Take: Air flow through the plant is 200kh/sec. Isentropic efficiency of both compressor is 0.82, Isentropic efficiency of turbine is 0.92, combustion efficiency is 0.96, Mechanical efficiency is 0.96, Generation efficiency is 0.95, Calorific value of fuel used is 35000kJ/kg. Take : $C_p = 1 \text{ kJ/kgK}$ and $\gamma = 1.4$ for both air and gases . An intercooler is used between the two compressors and assume that there is perfect intercooling. Neglect the heat and pressure losses in the system. [6]

SECTION - II

- Q7)** a) What are the advantages and disadvantages of diesel power plant? Which factors should be considered while selecting a site for a diesel power plant? [8]
- b) What is a CANDU - type reactor? Explain with a sketch its main features. What is a calandria? [8]

OR

- Q8)** a) Why the supercharging is necessary in diesel plant? What are the methods are used for supercharging the diesel engine? What are the advantages of supercharging as fuel consumption and overall efficiency of plant are concerned? [8]
- b) Explain the terms: (i) breeding ratio, (ii) burner, (iii) converter, (iv) doubling. [8]

- Q9)** a) What are the different types of switch gear installation? Discuss their relative merits and demerits. [8]
- b) Explain with a neat sketch the geothermal power plant. [8]

OR

- Q10)** a) Why excitation is necessary for synchronous generator? Draw a neat line diagram used for excitation and explain its working. [8]
- b) What are the recent developments in methods of power generation? and explain fuel cell. [8]
- Q11)** a) What do you mean by 'Thermal pollution'? What is 'Thermal Discharge Index' (TDI) [6]
- b) Explain the meaning of greenhouse effect and how it is related with earth. Explain how CO_2 is responsible for greenhouse effect and why? [6]
- c) Explain the method suggested to reduce pollution. [6]

OR

- Q12)** a) Name important gaseous pollutants discharged by thermal power plants. How are they classified? [6]
- b) Write a short note on, "Thermal Pollution of Water and its control". [6]
- c) What are the different methods used to control NO_x in the flue gases? Explain any two. [6]

