

IV B.Tech I Semester Regular Examinations, November 2008

POWER PLANT ENGINEERING

(Common to Mechanical Engineering and Mechatronics)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions

All Questions carry equal marks

1. What are the basic energy resources in India? List out their capacities in different regions. [16]
2. (a) What are the advantages of fluidised bed combustion system?
(b) What are the various types of grates used with hand fired furnaces? [6+10]
3. Draw a neat diagram of a cooling system used for diesel power plant showing all the essential components. What are the advantages of double circuit over circuit. [16]
4. A gas turbine plant of 800 kW capacity takes the air at 1.01 bar and 15°C. The pressure ratio of the cycle is 6 and maximum temperature is limited to 700°C. A regenerator of 75% effectiveness is added in the plant to increase the overall efficiency of the plant. The pressure drop in the combustion chamber is 0.15 bar as well as in the generator is also 0.15 bar. Assuming the isentropic efficiency of the compressor 80% and of the turbine 85%, determine the plant thermal efficiency. [16]
5. (a) How hydro electric power plants are classified?
(b) Describe the advantages and disadvantages of hydroelectric power plants. [8+8]
6. Discuss the advantages and disadvantages of horizontal and vertical axis wind mills with neat sketches. [16]
7. Explain with the help of the neat diagram the construction and working of the nuclear power plant. [16]
8. (a) What do you understand by acid rains? What are the reasons of this? How are they controlled?
(b) Explain the pollution due to nuclear power plant. [8+8]

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1. What do you understand by 'output - handling of coal'? What are the different methods of output coal handling. Discuss their relative merits and demerits. [16]
2. (a) What are harmful effects caused by using impure water in the boiler?
(b) What is meant by make up water of boiler and how is the water fed into a boiler? [8+8]
3. (a) What precaution should be taken to ensure that cooling is satisfactory for diesel engines?
(b) Why the cooling and cleaning of lubricating oil is necessary. Draw a neat diagram of lubricating system used for medium capacity diesel power plant. [6+10]
4. An open cycle gas turbine power plant, working on Brayton cycle. The maximum pressure and temperature of the cycle are limited to 5 ata and 900K. The pressure and temperature of the gas entering into the compressor are 1 ata and 27⁰C. Reheating is used at a pressure of 2.5 ata, where the temperature of the gases is increased to its original turbine inlet temperature. The air flow rate is 10 kg/sec. Determine the thermal efficiency and plant capacity in MW. The exhaust pressure of the turbine is also 1 ata. Assume the compression and expansion are isentropic. Take $\gamma = 1.4$ for air and gas
 $C_P = 0.24$ k cal/ kg-k for air gas
C.V of the fuel = 8000 k.cal/ kg. [16]
5. (a) Explain hydrograph.
(b) Explain mass curve. [8+8]
6. (a) What factors are considered for selecting a suitable site for tidal power plants?
(b) Classify tidal power plants and briefly explain double basin systems. [8+8]
7. (a) Draw a neat diagram of nuclear reactor and explain the functions of different components.
(b) List out the advantages and disadvantages of nuclear plants over conventional thermal plants? [8+8]
8. (a) What are the capital cost and fixed cost to be considered for cost analysis?

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Set No. 2

- (b) A power plant has the installed capacity of 120MW. Calculate the cost of generation, if Capital cost = Rs. 120×10^6 , rate of interest and depreciation =18% Annual cost of fuel oil, salaries and taxation= Rs. 25×10^6 , load factor=40%. [6+10]

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1. (a) What is the necessity of coal storage?
(b) Discuss the various methods used for coal storage at plant. [8+8]
2. (a) Draw a neat diagram of cyclone burner and describe its working.
(b) Briefly describe merits and demerits of various types of burners. [8+8]
3. (a) What are the various factors to be considered while selecting the site for diesel engine power plant?
(b) Compare I.C engines with steam engines and state the advantages of I.C engines over steam engines. [8+8]
4. A gas turbine plant is designed to develop 5 MW power. The inlet pressure and temperature of the air to the compressor are 1 bar and 30°C. The pressure ratio of the cycle is 5. A reheater is used between two turbines at a pressure of 2.24 bar. Calculate the overall efficiency of the cycle and mass flow rate assuming the following data:
Isentropic η of the compressor = 80%
Isentropic η of the turbines = 85%
 $C_{pa} = 1$ KJ/kg-k, $C_{pg} = 1.15$ kJ/kg - k, $\gamma = 1.4$ for air $\gamma = 1.33$ for gases. Neglect the mass of the fuel. [16]
5. What are the functions of surge tank and fore bay? Describe different types of surge tanks. [16]
6. (a) Describe the basic principle of photovoltaic and list out its merits over the other systems.
(b) What are the main hurdles in the development of this mode of power generation? [8+8]
7. (a) What are the general problems of reactor operation?
(b) List out the advantages and disadvantages of pressurized water reactor. [8+8]
8. (a) What are the major sources of air pollution?
(b) What are the different methods used to control SO₂ in flue gases? [8+8]

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1. (a) Describe different equipments used for coal unloading at the plant site.
(b) Discuss different types of coal conveyors? Indicate the use of each. [8+8]
2. Describe the working of hot - lime soda process with a neat sketch giving different chemical reactions. What are the advantages and disadvantages of the system?[16]
3. (a) Explain the important functions of a lubricating system.
(b) Explain the necessity of the cooling system in a diesel engine. What are the methods of cooling the engine? [6+10]
4. (a) Draw the arrangement of combined cycle and explain its working.
(b) List out the advantages of combined cycle. [16]
5. What are the factors considered in selecting a prime mover for a hydro electric power plant? [16]
6. Explain the difference between open and closed cycle MHD systems and discuss their relative merits. [16]
7. (a) What factors are considered in selecting an economical site for nuclear power plant.
(b) List out the advantages and disadvantages of nuclear plants over conventional thermal plants. [8+8]
8. (a) What are the basic elements exhausted with flue gases? Which are hazardous to human health?
(b) Discuss the various methods of reducing SO_2 in emissions. [8+8]
