

Total No. of Questions : 8]

SEAT No. :

PD4711

[Total No. of Pages : 3

**[6404]-217**  
**B.E (Mechanical)**  
**ENERGY ENGINEERING**  
**(2019 Pattern) (Semester-VIII) (402049)**

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data wherever necessary and mention the same clearly.
- 5) Use of steam tables, Mollier chart and calculator is allowed.

- Q1) a)** Describe with simple diagram Boiling Water Reactor (BWR). Also write its advantages. **[6]**
- b)** Discuss in brief factors should be considered while selecting a site for a diesel power plant. What are applications of diesel power plant? **[6]**
- c)** The runoff data of one river at a particular site is as below. **[6]**

| Sr No. | Month | Discharge in million of Cu m per month | Sr No | Month  | Discharge in Millions of Cu m per month |
|--------|-------|----------------------------------------|-------|--------|-----------------------------------------|
| 1.     | Jan   | 80                                     | 7.    | July   | 150                                     |
| 2.     | Feb   | 40                                     | 8.    | August | 250                                     |
| 3.     | March | 50                                     | 9.    | Sept   | 200                                     |
| 4.     | April | 0                                      | 10.   | Oct    | 120                                     |
| 5.     | May   | 20                                     | 11.   | Nov    | 80                                      |
| 6.     | June  | 100                                    | 12.   | Dec    | 100                                     |

From above data

- i) Determine Mean Flow
- ii) Draw Flow Duration Curve

OR

P.T.O.

- Q2) a)** Describe construction and operation of different components of medium head hydro-electric power plant with neat diagram. [6]
- b) List the essential components of a diesel power plant and explain them briefly. [6]
- c) Write short note on: Waste disposal of nuclear power plant. [6]

**Q3) a)** Air enters the compressor of a gas-turbine power plant having capacity 10 MW at 1 bar and 27 degrees Celsius. The maximum cycle temperature, pressure is 577° C, 6.5 bar respectively. The two stage compression with perfect inter cooling arrangement is incorporated in the plant. The compression in both stages and expansion in turbine are isentropic. Take adiabatic index, specific heat for both air and gas as 1.4, 1 KJ/Kg-K respectively. Assume calorific value of fuel as 45 MJ/Kg. Draw cycle arrangement and T-s diagram and determine [9]

- i) The thermal efficiency of cycle with considering effect mass flow rate of fuel on air.
- ii) Fuel consumption on per hour basis (with inter cooling arrangement)
- b) What do you mean by Cogeneration. Describe a need of Cogeneration in gas power cycle. Explain Cogeneration in gas power cycle with suitable block diagram. [8]

OR

**Q4) a)** The air enters the compressor of gas-turbine power plant at 1 bar, 27° C. The pressure ratio is 6:1. The air after compression is passed through heat exchanger with effectiveness 0.65. Then air is passed to combustion chamber and heated to 870°C. Then gases are expanded up to 1 bar in turbine then to heat exchanger and finally to the exhaust. The isentropic efficiency of compressor, gas turbine is 80%,85% respectively. Take adiabatic index for air gas as 1.4. Take specific heat for air, gas as 1 KJ/Kg-K. Neglect mass flow rate of fuel and air mass as 5kg/sec. Draw cycle arrangement and T-s diagram and determine. [9]

- i) The thermal efficiency of cycle
- ii) Heat carried away by exhaust gases on per minute basis
- b) Explain the gas and steam combined cycle plant with cycle arrangement, T-s diagram, advantages and limitations. [8]

**Q5) a)** A 100 MW thermal power plant has peak load of 65MW. The power station supplies load to four town having their maximum demand of 20MW, 15MW, 10MW and 30 MW. The Annual load factor is 65%. Find: [6]

- i) Average load on the plant
  - ii) Energy Supplied per year
  - iii) Diversity factor
  - iv) Demand factor
  - v) Plant capacity factor
- b) Enlist the protective equipments and explain the working of switch gear in power plant. [6]
- c) Write note on: Energy demand estimation. [5]

OR

**Q6) a)** A steam power station has an installed capacity of 120 MW and maximum demand of 100 MW. The coal consumption is 0.4 kg per kWh and cost of coal is Rs. 80 per ton. The annual expenses on salary bill of staff and other overhead charges excluding cost of coal are Rs.  $50 \times 10^5$ . The power station works at a load factor of 0.5 and the capital cost of the power station is Rs.  $4 \times 10^5$ . If the rate of interest and depreciation is 10%. Determine total annual energy generation and the cost of generating per kWh. [6]

- b) State the function of relay system. How the relays classified? Explain working of any one relay with diagram. [6]
- c) Explain anyone method of thermal energy storage with simple diagram. [5]

**Q7) a)** Explain working principle of fuel cell. What are different types of fuel cells? [6]

- b) Explain superheated steam system geothermal energy system with diagram and disadvantages. [6]
- c) Describe the principle, advantages and applications of Solar Photovoltaic System. [6]

OR

**Q8) a)** Describe Anderson's Ocean Thermal Energy system with diagram. [6]

- b) Write note on-biomass gasifier. [6]
- c) Discuss Low temperature flat plate collector solar power plant with a suitable sketch. And also write their advantages. [6]

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