[6004]-617

B.E. (Semester - VIII)

MECHANICAL

Energy Engineering

(402049) (2019 Pattern)

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 of each question 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)   The runoff data of one river at a particular site is as below.   **[6]**

Sr. No.	Month	Discharge in millions 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.	Aug.	250
3.	March.	50	9.	Sept.	200
4.	Apr.	0	10.	Oct.	120
5.	May.	20	11.	Nov.	80
6.	June .	100	12.	Dec.	100

From above data Determine

i)   Mean Flow

ii)   Draw Flow Duration Curve

b)   Describe with simple diagram Plant Layout of High Capacity Diesel Engine Power Plant. **[6]**

c)   Discuss working of Sodium Graphite reactor with its diagram. **[6]**

OR

Q2) a)   Elaborate function of different components of high head hydro-electric power plant with simple diagram. **[6]**

b)   Explain following in brief related to diesel power plant **[6]**

i)   Site selection criteria

ii)   Applications

c)   Discuss working of Pressurized Water Reactor with its diagram and limitations. **[6]**

Q3) a)   The air enters the compressor of 5 MW capacity gas-turbine power plant at 1 bar, 30 degrees Celsius. The maximum cycle temperature, pressure is 550 degrees Celsius, 5 bar respectively. The two stage expansion with reheating pressure of 2.24 bar is used in the plant. In the re-heater gas is heated up to maximum cycle temperature. The gases are expanded up to 1 bar in second turbine. The isentropic efficiency of compressor, both turbines is 80%, 85% respectively. Take adiabatic index for air gas as 1.4, 1.33 respectively. Take specific heat for air, gas as 1 kJ/Kg-K, 1.15 kJ/Kg-K respectively. Neglect mass flow rate of fuel. Draw cycle arrangement and T-s diagram and determine **[9]**

i)   The thermal efficiency of cycle

ii)   Mass flow rate of air

b)   Define cogeneration. Why Cogeneration technique is used in gas power cycle? Discuss Cogeneration in gas power cycle with simple block diagram.
[8]

OR

Q4) 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 degrees Celsius, 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) Describe the Integrated Gasification Combined Cycle plant with cycle arrangement, merits and demerits. **[8]**

Q5) 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. 50×10^5. The power station works at a load factor of 0.5 and the capital cost of the power station is Rs. 4×10^5. If the rate of interest and depreciation is 10%. Determine total annual energy generation and the cost of generating per kWh. **[6]**

  b) Elaborate the typical layout of electrical equipment in power plant with diagram. **[6]**

  c) List out various methods of thermal energy storage. Describe anyone method with simple diagram. **[5]**

OR

Q6) a) A power generation station with maximum demand as 20 MW having following annual data. Capacity factor = 0.4, Load factor =0.6 and use factor = 0.45. **[6]**

Determine

    i) Annual energy produced

    ii) Reserve capacity over and above peak load

    iii) Number of hours during which plant is not working

b) State main functions of circuit breaker. Describe working of any one circuit breaker system with diagram. **[6]**

c) Describe methods of estimation of Energy pricing. **[5]**

Q7) a) Elaborate working of Low temperature flat plate collector solar power plant with diagram and advantages. **[6]**

b) Discuss the working of superheated steam geothermal energy system with diagram and disadvantages. **[6]**

c) Explain working principle of fuel cells? Enlist different types of fuel cells.**[6]**

OR

Q8) a) Explain following terms in brief related to wind power systems **[6]**

   i)   Cut-out Speed

   ii)   Cut-in Speed

   iii) Betz Limit

   iv)   Rated Speed

   v)   Blade Tip ratio

   vi)   Co-efficient of power

b) Discuss the working of Claude's Ocean Thermal Energy system with simple diagram and advantages. **[6]**

c) Write note on:- Open type MHD system. **[6]**

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