H.T.No. | | | | | | | | | | |

Code No: ME1524 **GEC-R14**

III B.Tech I Semester Regular Examinations, November 2016

THERMAL ENGINEERING-II

(Mechanical Engineering)

Time: 3 Hours **Max. Marks: 60**

Note: All Questions from **PART-A** are to be answered at one place.
Answer any **FOUR** questions from **PART-B.** All Questions carry equal Marks.

PART-A

6 × 2 = 12M

1. The values of enthalpy of steam at the inlet and outlet of a steam turbine in a Rankine cycle are 2800 kJ/kg and 1800 kJ/kg respectively. Neglecting pump work, calculate the specific steam consumption in kg/KW-hr.
2. a) Evaporative capacity of a boiler is expressed as _____.
   b) Write the condition for maximum discharge through a chimney.
3. a) Flow through nozzle is regarded as
   (i) isothermal flow (ii) isentropic flow
   (iii) constant volume flow (iv) constant pressure flow
   b) The steam leaves the nozzle at a
   (i) high pressure and low velocity (ii) high pressure and high velocity
   (iii) low pressure and low velocity (iv) Low pressure and high velocity
4. a) Write expression for blade efficiency of a Reaction Turbine.
   b) Define Gross stage efficiency of a Reaction Turbine.
5. State Daltons law of partial pressures.
6. Sketch the Bell-Coleman cycle on P-V and T-s Co ordinates

PART-B

4 × 12 = 48M

1. a) Explain the concept of mean temperature of heat addition. (6M)
   b) In a Rankine cycle, the steam at inlet to turbine is saturated at a pressure of 30 bar and the exhaust pressure is 0.25 bar. For the steam flow rate of 10 kg/sec, determine (i) the pump work (ii) the turbine work (iii) Rankine efficiency (iv) dryness fraction at the end of expansion and (v) condenser heat flow. (6M)
2. a) Explain the working of Benson boiler. (6M)
   b) A chimney of 50m height is used to discharge the flue gases at 350^0C to the atmosphere which is at 25^0C. The mass of air supplied per kg of coal burnt is 19kg. Calculate (i) The static draught in mm of water column. (ii) The velocity of flue gases passing through the chimney if the friction losses are 30% of the theoretical draught. (6M)

3. A De-Laval turbine is to develop 140 KW power with steam consumption of 6 kg/kW-hr with initial pressure of 10 bar and exhaust pressure of 0.15 bar. Assume that there is 10% of total drop is lost in the divergent portion due to friction, and taking the throat diameter of each nozzle as 6 mm, find (i) the number of nozzles (ii) the exit diameter of each nozzle. (12M)

4. a) Show that for a Parson's reaction turbine the degree of reaction is 50%. (4M)

   b) In a 50% reaction turbine stage running at 3000 rpm, the exit angles are 30^0 and the inlet angles are 50^0. The mean diameter is 1 m. The steam flow rate is 10000 kg/min and the stage efficiency is 85%. Determine (i) power output of stage (ii) The specific enthalpy drop in the stage. (8M)

5. The observations recorded during the trial on a steam condenser are given below:
   Condenser vacuum : 685 mm Hg,
   Barometer reading :765 mm Hg
   Mean condenser temperature : 34^0C,
   Hot well temperature : 28^0C
   Condensate formed per hour: 1750 Kg
   Circulating cooling water inlet temperature : 18^0C
   Circulating cooling water outlet temperature:30^0C
   Quantity of cooling water : 1300kg/min
   Determine
   i) Condenser vacuum corrected to standard barometer,
   ii) Vacuum efficiency
   ii) Under cooling of condensate
   iv) Condenser efficiency
   v) Condition of steam as it enters the condenser
   vi) Mass of air present per kg of uncondensed steam.

   Take R for air 0.287 kJ/kg K, Specific heat of water 4.186kJ/kg K (12M)

6. a) Describe working of winter air-conditioning system. (6M)

   b) The sling psychrometer in a laboratory test recorded the following readings: (6M)
   Dry bulb temperature = 35°C,
   Wet bulb temperature = 25°C.
   Calculate the following:
   (i) Specific humidity (ii) Relative humidity (iii) Vapor density in air

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