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BIME-002

B.Tech. MECHANICAL ENGINEERING (BTMEVI)

Term-End Examination

December, 2013

BIME-002 : THERMAL ENGINEERING - I

Time : 3 hours *Maximum Marks : 70*

*Note : Attempt **any seven** questions. Use of **steam tables** and **Mollier diagrams** are allowed.*

1. (a) Explain the Gibbs and Helmholtz functions and write the expressions for them. 5
   (b) Explain the Joule Thomson coefficient. 5

2. (a) 1 kg of iso-octane (C_8H_{18}) fuel is supplied to an engine with 13 kg of air. Determine the percentage by volume of CO_2 in dry exhaust gas considering exhaust gas to consists of CO_2, CO and N_2. 5
   (b) Explain 'dissociation' with examples. 5

3. (a) Explain the constructional details of locomotive Boiler with neat sketch. 5
   (b) A boiler has chimney of 30m height to produce natural draught of 12 mm of water column. Ambient air temperature is 27°C and boiler furnace requires 20 kg of air per kg of fuel for complete combustion. Determine maximum temperature of burnt gases leaving chimney. 5

4. (a) Explain Carnot Vapor power cycle on T-S diagram. 5

(b) A Carnot cycle works on steam between the pressure limits of 7MPa and 7KPa. Determine the thermal efficiency, turbine work and compression work per kg of steam. 5

5. (a) Explain regenerative cycle used in vapor power cycles on T-S diagram. 5

(b) What do you understand by binary vapor cycles ? 5

6. (a) Explain pressure compounded impulse steam turbine with neat sketch. 5

(b) Explain diagram efficiency, stage efficiency and nozzle efficiency in context with the steam turbines. 5

7. (a) Explain the assumptions made for air standard cycle analysis. 2

(b) A gas turbine plant has air being supplied at 1bar 27°C to compressor for getting compressed upto 5 bar with Isentropic efficiency of 85%. Compressed air is heated upto 1000K in combustion chamber where also occurs a presure drop of 0.2bar. Subsequently expansion occurs at 1 bar in turbine. Determine Isentropic efficiency of turbine if thermal efficiency = 20% Assume $\gamma = 1.4$ 8

8. (a) Explain the construction and working of a ram jet engine. 5

(b) Explain the principle of rocket propulsion. 5

9. A jet propulsion engine has compressor with pressure ratio 4 and compressed air enters into combustion chamber where combustion occurs so as to yield temperature of 500°C at turbine inlet. Temperature at inlet to combustion chamber is 10% more than that of the isentropic compressor. Exhaust from turbine is expanded upto atmospheric pressure of 1bar. The ambient temperature is 285K. Determine **10**

(a) Power required to drive the compressor.

(b) Air fuel ratio if calorific value of fuel is 43100 kJ/kg.

10. Write short notes on **any two**. **5x2=10**

(a) Boiler mountings and accessories

(b) Effect of friction on nozzles

(c) Equivalent evaporation

(d) Maxwell relations