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BIME-002

00170

B.Tech. MECHANICAL ENGINEERING (BTMEVI)

Term-End Examination

June, 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) What are Maxwell relations ? What is their significance ? 5

   (b) What do you understand by Joule - Thomson Coefficient ? Explain. 5

2. (a) Coal having following composition by mass is burnt with theoretically correct amount of air 5

   86%C, 6%H, 5%O, 2%N, 1%S. Determine the Air-fuel ratio.

   (b) Explain enthalpy of combustion and enthalpy of formation. 5

3. (a) Sketch and describe the working of Babcock and Wilcox boiler. 5

(b) A boiler has natural draught chimney of 20 m height. Flue gases are at temperature of 380°C and ambient temperature is 27°C. Determine the draught in mm of water column for maximum discharge through chimney and also the air supplied per kg of fuel. 5

4. (a) Explain the Rankine cycle by drawing it on T-s, h-s and p-v diagram. 5

(b) Dry steam at 10 bar and 100 m/sec enters a nozzle and leaves it with velocity of 300 m/s at 5 bar. For 16 kg/s of steam mass flow rate determine heat drop in nozzle and final state of steam leaving nozzle assuming heat loss to surroundings is 10kJ/sec. 5

5. (a) Describe reheat cycle and compare it with simple Rankine cycle. 5

(b) A steam power plant uses steam as working fluid and operates at a boiler pressure of 5 MPa, dry saturated and a condenser pressure of 5 KPa. Determine the cycle efficiency for Rankine cycle. 5

6. (a) Differentiate between impulse turbine and reaction turbine. 5

(b) Single stage impulse turbine has equal blade angles and nozzle angle of 15°. Determine the maximum possible blade efficiency if the blade velocity coefficient is 0.85. 5

7. (a) Explain Brayton cycle and derive expression for its efficiency in terms of temperatures. 5

(b) Derive optimum pressure ratio condition for minimum compression work requirement in two stage perfect inter cooled compression. 5

8. (a) Describe the principle of jet propulsion. 5

(b) Describe the working of Turboprop with neat sketch. 5

9. (a) Explain the term off design flow of nozzle. 5

(b) Discuss the effect of friction on nozzle operation. 5

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

(a) Surface condensers

(b) Clapeyron Equation

(c) Adiabatic flame temperature

(d) Carnot cycle