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**BACHELOR OF TECHNOLOGY IN
MECHANICAL ENGINEERING
(COMPUTER INTEGRATED
MANUFACTURING)
BTMEVI**

Term-End Examination

December, 2012

BME-019 : ENGINEERING THERMODYNAMICS

Time : 3 hours

Maximum Marks : 70

Note : Answer any SEVEN questions. All questions carry equal marks. Use of calculator, steam table and motion chart are permitted.

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1. (a) Classify the following properties as either intensive or extensive. 5+5
- (i) Volume (ii) Weight
(iii) Pressure (iv) Temperature
(v) Density
- (b) Describe the relationships among absolute pressure, atmospheric pressure, gauge pressure and vacuum.
2. (a) Explain the following terms with suitable examples. 5+5
- (i) Thermal Equilibrium
(ii) Zeroth law of thermodynamics.

- (b) A petrol engine, during its working stroke, rejects 450kJ/kg of heat of the working substance. The internal energy of the working substance also decreases by 800kJ/kg . Determine the work done by the engine.
3. In a steam power plant the work output of the turbine is 200 kJ while heat supplied at the boiler is 500 kJ . Given that during the same period work input to the pump is 8.0kJ , Find the heat rejected at the condenser and thermal efficiency of the plant. **10**
4. A direct heat engine A and a reversed heat engine B are operating between 177°C and 27°C . The COP of B as a heat pump is 2.5. A drives B. The magnitude of heat interaction of A and B with the reservoir at 27°C are 200kJ and 50kJ respectively. The combined work output of A and B is 20kJ . Identify whether the heat engine A is reversible or irreversible. **10**
5. 1.2m^3 of air is heated reversibly at constant pressure from 300K to 600K , and is then cooled reversibly at constant volume back to initial temperature. If the initial pressure is 1 bar , calculate : **10**
- (a) The net heat flow.

(b) The overall change in entropy.

Represent the process on T-S plot.

Take $C_p = 1.005 \text{ kJ/kg K}$ and

$R = 0.287 \text{ kJ/kg K}$.

6. (a) What is the maximum COP for a refrigeration system operating between -10°C and 40°C ? 10

(b) If the system is operating with R-12 as the refrigerant, find the refrigerating effect and the compression work.

Given : $h_1 = 177.9 \text{ kJ/kg}$

$h_2 = 203.05 \text{ kJ/kg}$

$h_3 = 74.53 \text{ kJ/kg}$

Symbols have usual meanings.

7. An air compressor has a volumetric efficiency of 70% when tested, the discharge state being 500 kPa, 150°C and the inlet state 100 kPa, 15°C . If the clearance is 4%, predict the new volumetric efficiency when the discharge pressure is increased to 700 kPa. Assume that the ratio of real to ideal volumetric efficiency and the exponent n remains constant. 10

8. (a) What are the principal characteristics of energy resources ? Explain. 5+5

(b) Explain the principles of energy conservation and barriers to energy conservation.

9. (a) Explain the concept of energy efficiency with suitable example. 5+5
- (b) Explain the differences in Carnot cycle and Rankine cycle used in steam power plants.
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