B.E. (MINING) Part-II 3rd Semester Examination, 2012-13

Thermal Engineering (ME-302)

Time-3 hours   **Full Marks: 70**

Attempt any Five questions
The questions are of equal value.
Use of Steam Table is allowed.

1. (a) What is meant by a refrigeration system? Define C.O.P. of refrigerator and heat pump, and unit of refrigeration.
   (b) Deduce an expression for the C.O.P. of a Carnot refrigerator.
   The higher temperature of the refrigerant in a refrigeration system, operating on reversed carnot cycle is 42°C and the lower is -22°C. The capacity of the system is 12 tons. Neglecting all losses determine (i) C.O.P. (ii) Power required, and (iii) Heat rejected from the system.

2. (a) What is a boiler? How are the boilers classified?
   (b) Define thermal efficiency and equivalent evaporation of boiler.
   The following observations were made in a boiler trial:
   Pressure of steam = 8 bar; Mass of water = 8000kg/h; Temperature of feed water = 32°C;
   Dryness fraction of steam = 0.75; Coal used = 720 kg/h; Calorific value of coal= 30000 kJ/kg.
   Calculate (i) Thermal efficiency of the boiler (ii) Equivalent evaporation from and at 100°C in kg/kg of coal.

3. (a) What is heat engine? What is the basic difference between E.C. Engine & I.C. Engine? Give examples of each. Compare S.I. and C.I. engines.
   (b) Explain with sketches the working of a Four-stroke S.I. Engine.

4. (a) Derive an expression for air-standard thermal efficiency of an air-standard Diesel cycle.
   (b) The compression and expansion ratio in an engine operating on Diesel cycle are 14 and 7 respectively. Determine the air-standard thermal efficiency of the engine.

5. (a) What is refrigerant? Name a few commonly used refrigerants.
   (b) Draw a schematic diagram of a Bell-Coleman refrigeration system. Explain the working and derive an expression for the C.O.P. of it.

6. (a) What is meant by steady flow of fluid? Deduce the steady flow energy equation.
   (b) A turbine operates under steady flow conditions receiving steam at the following state: pressure 1.2 MPa; enthalpy 2785 kJ/kg; velocity 33.3 m/s. The steam leaves the turbine at the following state: pressure 20 kPa; enthalpy 2512 kJ/kg; velocity 100 m/s. Heat is lost to the surroundings at the rate of 0.29 kJ/s. If the rate of steam flow is 0.42kg/s, what is the power developed by the turbine?

7. Write short notes on any **three** of the following:
   (a) Cooling of I.C.Engines.
   (b) Heat losses in boilers.
   (c) Mechanical draught systems of boilers.
   (d) Throttling process.
   (e) Comparison between Fire tube and Water tube boilers.