

B.E. (Mining) Part-II 3<sup>rd</sup> Semester Examination, 2013-14**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) With schematic diagram explain the Bell-coleman refrigeration system. Show the different processes of the system in a P-V diagram and derive an expression for the C.O.P. of the Bell-coleman cycle.
2. (a) What is the difference between boiler mountings and accessories? Discuss about the different mountings used in a boiler.  
 (b) Define Thermal efficiency and equivalent evaporation of boiler.  
 The following observations were made in a boiler trial:  
 Pressure of steam = 10 bar; Mass of water = 8000 kg/h; Temperature of feed water = 32°C;  
 Dryness fraction of steam = 0.85; 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? Make a comparison between S.I. and C.I. engines.  
 (b) Explain with sketches the working of a Four-stroke C.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 18 and 8 respectively. Determine the air-standard thermal efficiency of the engine.
5. (a) What is compressor? How do you classify compressors?  
 (b) Define the volumetric efficiency of reciprocating air compressor and find an expression for it.  
 (c) Compare between reciprocating and rotary compressors.
6. (a) What is the difference <sup>between</sup> ~~and~~ indicated power (i.p.) and brake power (b.p.) of I.C. engine? Explain the process of measurement of indicated power by Willan's line method.  
 (b) A four cylinder petrol engine, working on the four stroke cycle with a compression ratio of 6 and fitted with a rope brake dynamometer was tested and the following readings are taken:  
 Effective brake arm = 0.5 m, dead load on brake = 230 N, spring balance reading = 30 N,  
 indicated mean effective pressure = 7 bar, engine speed = 2500 r.p.m., fuel consumption = 9 kg/h,  
 calorific value of fuel = 44000 kJ/kg, cylinder bore = 85 mm, engine stroke = 100 mm.  
 Find (i) i.p. and b.p of the engine (ii) mechanical efficiency (iii) brake thermal efficiency,

7. Write short notes on any **three** of the following:
- (a) Vapour compression refrigeration system.
  - (b) Heat losses in boilers.
  - (c) Carnot refrigerator.
  - (d) Cooling of I.C. Engines.
  - (e) Comparison between Fire tube and Water tube boilers.