



SEM 2 – 4 (RC 07-08)

F.E. Semester – II Examination, Nov./Dec. 2013
(Revised in 2007-08)

BASIC MECHANICAL ENGINEERING

Duration : 3 Hours

Max. Marks : 100

- Instructions :** 1) Answer **five** questions in **all** selecting at least **one** question from **each** module.
2) **Assume** missing data, **if any** with proper justification.
3) **Appropriate visuals** will be part of the weightage assigned to a question.

MODULE – I

1. A) Answer the following to the point : (3+4+3)
- i) Gauge pressure can be negative but not the absolute pressure: explain in the light of pressure measurement.
 - ii) Heat and work are path functions: explain in the light of postulates of change of state.
 - iii) Apply first law applied to steam turbine giving the symbolic representation of turbine.
- B) 1 kg of air in a closed system expands reversibly and adiabatically from 3MPa, 200°C to two times its initial volume, and then is heated at constant volume until the initial temperature is attained. Finally, there is a process to bring the system to complete a cycle. Representing the cycle in P-V plane, compute the following :
- i) Comment on the nature of the final process
 - ii) Find heat and work transfers in each process
 - iii) Find the changes in internal energy and enthalpy in each process
 - iv) Find the ratio of heat added to the system to cyclic work transfer. 10
2. A) Answer the following : (3+3+4)
- i) Prove that $COP_{HP} - COP_{ref} = 1$.
 - ii) What is Thermal Energy Reservoir (TER) and hence highlight its importance.
 - iii) Explain the utility of Carnot engine and Carnot theorem in the establishment of absolute temperature scale.

P.T.O.



B) An air standard Otto cycle has a compression ratio of 9. At the beginning of compression process the air is at 100kPa and 27°C, and the cylinder volume is 8000cc and 7.5 kJ of heat is added during the heat addition process. Representing the cycle on P-V plane, determine the following :

- i) The net work done per cycle
- ii) Air standard efficiency.
- iii) Power developed if the engine completes 500 cycles per minute
- iv) Maximum theoretical efficiency
- v) Corner points of the cycle.

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MODULE – II

3. A) A four cylinder, four stroke, compression ignition engine has a swept volume of 300cc per cylinder. The compression ratio of the engine is 15 and runs at 2000rpm. At this speed it develops 40kW of indicated output. Assuming that the engine operates on Diesel cycle and having air standard efficiency as actual efficiency with a cut off ratio of 1.2, calculate the following :

- i) Mass rate of fuel (TFC) if the calorific value of the fuel is 42000kJ/kg
- ii) Net work done per cycle per cylinder
- iii) Mass rate of air if the air fuel ratio is 20
- iv) Specific fuel consumption (SFC)

10

B) Answer the following :

(5+5)

- i) Explain working of a 4 stroke CI engine with the help of neat sketch
- ii) Give the list of basic parts of IC engine, explain its salient nomenclature.

4. A) Answer the following :

(5+5)

- i) Define Tonne of Refrigeration (TR). Determine the refrigeration effect for a 1.0 ton air conditioner and if the power input is 1.5 kW what would be its coefficient of performance (COP).
- ii) Write a descriptive note on a basic vapour compression refrigeration system.

B) Answer the following :

(6+4)

- i) Write a descriptive note on thermal power plant.
- ii) Define dryness fraction and give the value of dryness fraction for sub-cooled liquid, saturated liquid, saturated steam and super heated steam.



MODULE – III

5. A) Explain working principle of power steering system with a neat diagram. List its advantages over manual steering system. 8
- B) Describe the construction and working of a constant mesh gear box. 8
- C) Explain the necessity of a differential in an automobile. 4
6. A) Explain the construction of propeller shaft with a neat sketch. Why is it required in an automobile ? 8
- B) Write short notes on : 8
- i) Automotive emissions and control
- ii) Universal joint.
- C) What is the function of friction plate and pressure plate assembly in a clutch ? 4

MODULE – IV

7. A) Sketch a sand mould and name its principal parts. 5
- B) What are the advantages of die casting over sand casting ? 5
- C) Write a short note on mechanical fastening. 5
- D) Explain impact extrusion with a neat sketch. 5
8. A) Describe the relative motion between work piece and tool with neat sketches for the following processes : 6
- i) Milling
- ii) Turning
- iii) Grinding.
- B) Compare hot working and cold working processes. 4
- C) Explain wire drawing operation. How is it different from extrusion. 5
- D) Explain arc welding process with a neat sketch. 5