



SEM 2-4 (RC – 07-08)

F.E. (Semester – II) Examination, Nov./Dec. 2014
(Revised 2007-08)

BASIC MECHANICAL ENGINEERING

Duration : 3 Hours

Max. Marks : 100

Instructions: 1) Answer **five** questions in **all** selecting **atleast 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 :

(3×3)

- i) State I law of thermodynamics. Can it be concluded from the expression of I law that efficiency of a heat engine is 100% ? Argue.
- ii) Define ton of refrigeration (TR). How can it be related to II law ? Explain using symbolic representation.
- iii) A heat engine while operating in a cycle gives the following information :
Heat added = 1700 kJ; heat rejected = 100kJ; work done by the system = 900kJ.
Apply first and second law on this engine and report your findings.

B) Air is initially at 1.05 bar has a specific volume of $0.1 \text{ m}^3/\text{kg}$. It is first compressed reversibly according to the law $p v^{1.4} = \text{constant}$ to a pressure of 4.2 bar, and then allowed to expand reversibly according to the law $p v = \text{constant}$. It finally follows a constant volume process to come back to the initial conditions. **11**

- i) Show the processes on P-v plane
- ii) Cardinal points (P, v and T at each point of the cycle)
- iii) Find the heat transfer and work transfer in each process
- iv) Find the changes in internal energy and enthalpy in each process
- v) Find the ratio of net work transfer to heat added to the system and hence comment on the result.

P.T.O.



2. A) An oil engine works on Diesel cycle has the following data : 10

- Compression ratio = 15
- State at commencement of compression = NTP
- Heat added per kg of air = 700 kJ

For unit mass flow, drawing P-V diagram find the following :

- a) P, v and T at various salient points of the cycle.
- b) Cut-off ratio.
- c) Air standard efficiency.
- d) Heat and work transfers in each process.

B) a) Derive process equation for Isothermal process. Investigate its nature on P-V plane and hence derive a relation for its heat transfer. (4+6)

b) What do you know from the following terms :

- i) Thermal Energy Reservoir (TER)
- ii) Cyclic device
- iii) COP

MODULE – II

3. A) A 1000 cc, 4-S, 4 cylinder SI engine has the following trial run data : 10

- Brake thermal efficiency = 30%
- Indicated power = 40 kW
- Mechanical efficiency = 65%
- Calorific value of the fuel used = 40 MJ/kg
- Compression ratio = 8

Find the following :

- i) Brake power, Brake Specific Fuel Consumption (BSFC) and Total Fuel Consumption (TFC)
- ii) Frictional power



- iii) Brake power, indicated thermal efficiency and indicated specific fuel consumption (ISFC).
- iv) Clearance volume.
- B) Explain the following terms used in I.C. engines and bring out their applicability in testing performance : 10
 - i) Compression ratio
 - ii) Piston speed
 - iii) Crank speed
 - iv) Stroke
 - v) Bore.
- 4. A) With a help of schematic diagram explain the working principle of a domestic refrigerator. (6+6+8)
- B) With a help of schematic diagram explain the working principle of a basic Rankine used in steam power plant.
- C) Write a short note on the following :
 - i) 4-S CI engine
 - ii) Refrigerants.

MODULE – III

- 5. A) What are the functional requirements of steering system in an automobile ?
Explain with a neat sketch the construction and working of hydraulic steering system. 10
- B) With the help of a neat sketch explain the working of Universal Joint. Comment on his applicability ? 6
- C) Discuss the functions of pressure plate assembly and transmission in an automobile. 4



6. A) Explain with a neat sketch the construction and working of a 3-Speed constant mesh gear box including a reverse gear. What are its advantages and disadvantages ? 10
- B) Explain with the help of a neat schematic diagram the construction and working of air brake system. 6
- C) What are the objectives of vehicle suspension system ? 4

MODULE – IV

7. A) Explain hot chamber die-casting process. Explain its limitations. 6
- B) Explain wire drawing operation with a neat sketch. 5
- C) Explain impact extrusion process. Is it direct or indirect type ? Comment. 5
- D) Explain any two types of mechanical fasteners. 4
8. A) Sketch and discuss die-casting process. What are its advantages ? 6
- B) Differentiate between :
- i) Open and closed die forging
 - ii) Brazing and soldering
- 5
- C) Elaborate stretch forming operation 5
- D) What are the advantages of adhesive bonding ? 4