

**F.E. (Semester – II) Examination, May/June 2014
(Revised 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 are part of the weightage assigned to a question.

MODULE – I

1. A) Answer the following : **(3×3)**
- Does a heat engine that has a thermal efficiency of 100% necessarily violate either :
 - the I law ? or
 - the II law ? or
 - both ? : Justify your answer.
 - Comment on the difference between a reversible cycle gets reversed and a reversible process getting reversed.
 - Explain the postulates of change of state of a system.
- B) An ideal gas with an adiabatic index 1.45 and molecular weight 30 at a given state of Pressure = 20 bar, and Temperature = 600° C undergoes an isothermal expansion to half of its pressure. Then the system follows a second process known to be reversible adiabatic till it reaches its initial pressure 20 bar. Thirdly by a process, the system returns to its initial state and thus it completes a cycle. Plotting the cycle on P-V plane find the following : **11**
- Investigate and comment on the second, third and cyclic processes.
 - Cardinal points (P, v and T at each point of the cycle).
 - Work and heat transfer during each process.
 - Change in internal energy and enthalpy during each process.
 - Ratio of heat added to the system to net work input.



2. A) A spark ignition engine working on Otto cycle has the following data : 10
- Compression ratio = 6
 - State at commencement of compression = NTP
 - Maximum pressure in the cycle = 30 bar
- For unit mass flow, drawing P-V diagram find the following :
- a) P, v and T at various salient points of the cycle
 - b) Air standard efficiency
 - c) Heat and work transfers in each process.
- B) Answer the following : (2×5)
- a) Explain the utility of Carnot engine in absolute temperature scale
 - b) List out the limitations of first law and explain how they are overcome in second law.

MODULE – II

3. A) A 4-S single cylinder engine has the following data during a trial run on a certain load : 10
- Indicated thermal efficiency = 32%
 - Mechanical efficiency = 78%
 - Total fuel consumption = 20 kg/h
 - Brake mean effective pressure (BMEP) = 6 bar
 - Mean piston speed = 12 m/s
 - Stroke to bore ratio = 1.2
 - Calorific value of the fuel = 42 MJ/kg
- Calculate the following :
- i) Brake power, Brake thermal efficiency and brake specific fuel consumption (BSFC)
 - ii) Engine speed and Engine Dimensions i.e., bore X stroke
 - iii) Indicate power, indicated mean effective pressure (IMEP) and indicated specific fuel consumption (ISFC).
- B) Explain the following terms used in I.C engines with appropriate sketch : 10
- i) Swept volume
 - ii) Clearance volume
 - iii) TDC and BDC
 - iv) Stroke
 - v) Bore.



4. A) With a help of schematic diagram explain the working principle of a vapour compression refrigeration system. (7+7+6)
- B) With a help of schematic diagram explain the working principle of a basic Rankine cycle used in steam power plant.
- C) Define the following terms and highlight their applicability :
- i) Ton of refrigeration
 - ii) Dryness fraction.

MODULE – III

5. A) What are the functions and requirements of steering system ? Explain with a neat diagram the construction and working of rack and pinion steering system. 10
- B) Discuss the functions of clutch plate, differential and slip joint in an automobile. 6
- C) Write a short note on automotive emissions and control. 4
6. A) Draw a simple diagram to show the layout of hydraulically operated four wheel brake system and explain its working. 8
- B) Draw the layout of complete transmission system of a four wheel driven automobile and label its various components. 6
- C) Discuss in detail the construction and working of a differential. 6

MODULE – IV

7. A) Sketch the various rolling stand arrangements. 6
- B) Compare between brazing and welding. 4
- C) Sketch and explain indirect extrusion process. Discuss its power requirements compared to direct extrusion process. 6
- D) State the advantages and applications of soldering. 4
8. A) With a neat sketch explain arc welding process. 5
- B) Describe the grinding process showing relative motion between work piece and tool. How does it differ from turning ? 5
- C) With neat sketches explain sheet metal bending operations. 5
- D) What are the advantages and limitations of cold working ? 5
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