F.E. (Semester – II) Examination, November/December 2015
BASIC MECHANICAL ENGINEERING (Revised 2007- 08)

Duration : 3 Hours | Max. Marks :100

Instructions : *1) Answer **five** questions in **all** selecting at least **one** question from **each** Module.*
*2) **Use** of thermodynamic tables and charts is permitted.*
*3) Assume missing data, **if any**, with proper justification.*

MODULE – I

1. A) One kg of air at 1 bar and 300 K is expanded reversible adiabatically till its volume becomes 5 times its original volume. Then it is heated at constant volume and finally compressed at constant pressure to reach the initial conditions.
   i) Show the process on P-V plane
   ii) Cardinal points (P,V and T at each point on cycle)
   iii) Find the heat and work transfer for each process
   iv) Find the change in enthalpy and internal energy in each process
   v) Find the ratio of heat added to net work transfer. Comment on the result.

   B) Compare heat and work.

   C) List down the assumptions made in air standard cycle.

   D) What is a condenser ? Apply First law of thermodynamics to it. **(10+3+3+4)**

2. A) A heat pump while operating in a cycle gives the following information :
   - Heat added = 100 kJ,
   - Heat rejected = 1100 kJ,
   - Cyclic work transfer = 1000 kJ

   Apply the first and second law to this heat pump and report your findings.

   B) Prove that $COP_{HP} - COP_{ref} = 1$, where COP is coefficient of Performance , HP is heat pump and ref is refrigerator.

C) In an air standard diesel cycle, the compression ratio is 16. The compression begins at 1 bar, 300 K. The heat added is 2MJ/kg. Representing the cycle on P-v plane, compute the following :

i) Pressure and temperature at all corner points of the cycle

ii) Air standard efficiency

iii) Net work done in a cycle per kg of air

iv) Maximum theoretical efficiency

v) Cut off ratio and hence percentage cut-off **(4 + 4 + 12)**

MODULE – II

3. A) Describe the lubrication system of internal combustion engine with the help of neat sketch.

B) Explain with a neat sketch the working of a 4 stroke SI engine.

C) A four cylinder, four stroke, compression ignition engine has a compression ratio of 15 and runs at 2500 rpm. At this speed it develops 50 kW of indicated output. The swept volume is 300 cc per cylinder. Assuming the engine operates on Diesel cycle and having air standard efficiency as actual efficiency wherein the fuel used has the calorific value of 42000 kJ/kg, with cut off ratio of 1.2, calculate the following :

i) Mass flow rate of fuel (TFC)

ii) Mass flow rate of air if air fuel ratio is 15

iii) Specific fuel consumption (SFC)

iv) Net work done per cycle per cylinder

v) Average piston speed **(6+4+10)**

4. A) Define dryness fraction and give the value of dryness fraction for sub-cooled liquid, saturated liquid, saturated steam and superheated steam with appropriate justification.

B) With the help of appropriate sketch explain the working of basic vapour compression refrigeration system employed in a domestic refrigerator.

C) Carry out a comparative analysis between two stroke and four stroke engines.

D) Describe working of a thermal power plant using a schematic diagram labelling all components. **(5+5+5+5)**

MODULE – III

5. A) Describe the main components of an automobile.

   B) Draw the layout of complete transmission system for front engine rear wheel drive vehicle.

   C) State the functions of a clutch. With a neat sketch, explain the working of a single plate clutch. **(6+6+8)**

6. A) Describe the power brake system with a neat sketch.

   B) Write short notes on the following :

      i) Propeller Shaft

      ii) Universal Joint

   C) What is friction plate ? Where is it located ? What are the functions of the pressure plate ? **(8+8+4)**

MODULE – IV

7. A) Explain with a neat sketch hot chamber die casting process.

   B) Explain the difference between brazing and soldering.

   C) Explain the following lathe operations with the help of neat sketches showing the relative motion between the work piece and tool.

      i) Turning

      ii) Taper turning

      iii) Drilling

      iv) Knurling **(8+4+8)**

8. A) What is upset forging ? Explain open and closed upset forging processes with neat sketches.

   B) Explain with a neat sketch any one of the centrifugal casting processes.

   C) Define extrusion process. Explain forward and backward extrusion processes. **(8+4+8)**
