Total No. of printed pages = 10

ME 131205

Roll No. of candidate

2017

B.Tech 2nd Semester End-Term Examination

BASIC MECHANICAL ENGINEERING

Full Marks –100   Pass Marks – 35   Time – Three hours

The figures in the margin indicate full marks
for the questions.

Answer any *five* questions.

1.   (A) Answer the following questions :   2+3+5=10

     (i)   In your own words give the concept of a thermodynamic system.

     (ii)   What are the three classes of systems ? Show that the energy of an isolated system is always constant.

     (iii) Define the terms :

       (a) State

       (b) Change of State

       (c) Path

       (d) Process

       (e) Cycle

[Turn over

(B) Answer the following questions :

2+3+(1+4)=10

(i) Giving examples, distinguish between the intensive and extensive properties.

(ii) Giving examples, distinguish between point and path function.

(iii) What is "pdv" work? Derive an expression of 'pdv' work in a reversible adiabatic (isentropic) process.

2. (A) Answer the following questions :

2+3+5=10

(i) State the Zeroth law of thermodynamics.

(ii) Give the p-v and T-s diagrams of a Carnot cycle showing the processes.

(iii) State the

(a) First law of thermodynamics for a closed system undergoing a change of state and

(b) Claussius statement of the 2nd law of thermodynamics.

(B) Answer the following questions :

2+3+5=10

(i) Define compression ratio.

(ii) Give the p-v and T-s diagrams of Otto cycle showing the processes.

(iii) In an engine working on ideal Otto cycle, the air at a temperature of 27°C is compressed isentropically until the temperature reaches 450°C. Find the compression ratio and air standard efficiency. (Take $\gamma = 1.4$).

3. (A) Answer the following questions :

2+3+5=10

(i) Name the industries that use steam for various purposes.

(ii) With a suitable diagram, explain the process of generation of steam at constant pressure.

(iii) Define the following terms associated with generation of steam :

(a) Wet steam

(b) Dry saturated steam

(c) Superheated steam

(d) Dryness fraction

(e) Degree of superheat

(B) Answer the following questions :

$$2+3+(1+4)=10$$

(i) Distinguish between boiler mountings and boiler accessories with some examples.

(ii) With the help of a diagram, explain the working principle of a steam turbine plant.

(iii) Define COP of a refrigerator. Explain the working principle of a domestic refrigerator with the help of a diagram.

4. (A) Answer the following questions :

$$2+3+5=10$$

(i) What are the various modes of heat transfer ?

(ii) State the important properties required for good heat insulators. Name a few insulating materials.

(iii) State and explain Fourier's law of heat conduction and define the term thermal conductivity specifying its SI unit.

(B) Answer the following questions :

$$2+3+5=10$$

(i) Name the air standard cycle for CI engines. What are the different processes involved in this cycle ?

(ii) With the help of the p-v diagram of a diesel cycle, define the terms compression ratio, cut-off ratio and expansion ratio.

(iii) A diesel engine operating in diesel cycle has a compression ratio of 22 and expansion ratio of 11. Find the cut-off ratio and the air standard efficiency of the engine. (Take $\gamma = 1\cdot4$).

5. (A) Answer the following questions :

$$2+3+5=10$$

(i) Explain the term "Intensity of pressure". Give the dimensional formula of pressure.

(ii) The specific gravity of a liquid is $0\cdot85$. What would be its

(a) mass density and

(b) specific volume ?

(iii) Define the following terms :

(a) Mass density

(b) Weight density

(c) Specific volume

(d) Specific gravity

(e) A pressure of 1 Pascal.

(B) Answer the following questions :

$2+3+5=10$

(i) What is viscosity ?

(ii) Define

(a) ideal fluid

(b) kinematic viscosity

(iii) State the Newton's law of viscosity and define the term — co-efficient of viscosity along with its SI unit.
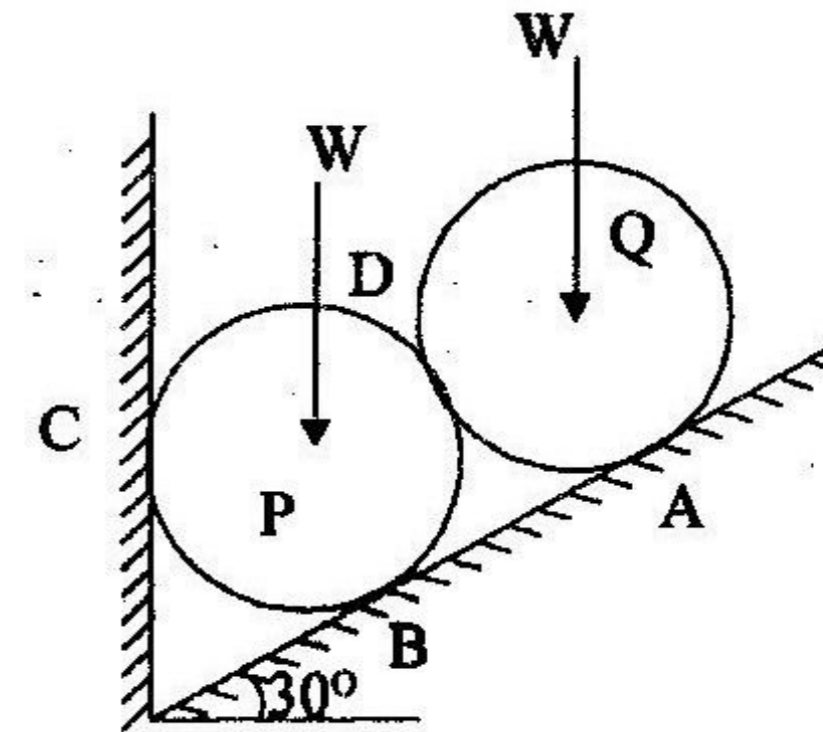
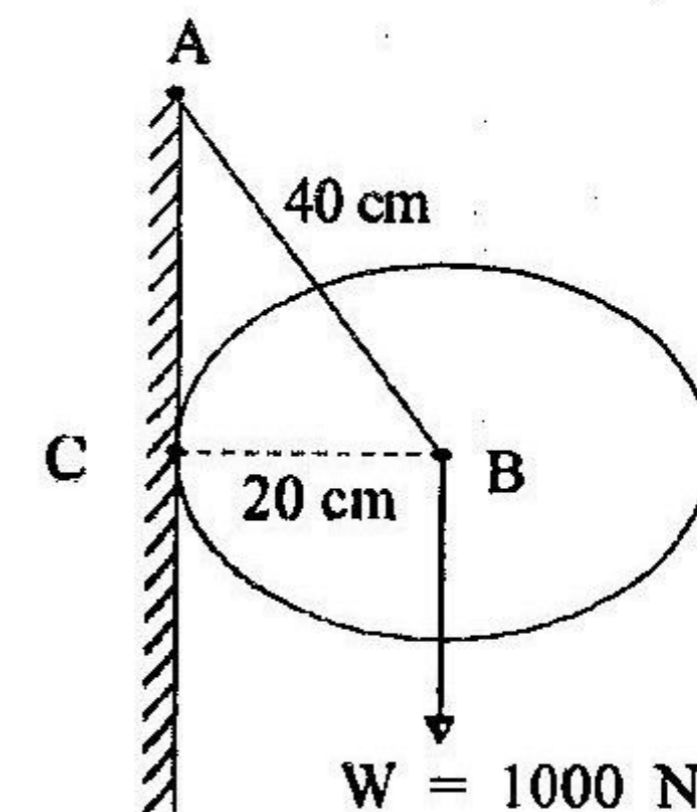6. (A) Answer the following questions :

$2+3+5=10$

(i) Define

(a) Moment and

(b) Couple.

(ii) Two identical roller P and Q, each of weight W are supported by an inclined plane and a vertical wall as shown in the figure below. Draw the free body diagram of the rollers P and Q separately.

(iii) A circular roller of weight 1000 N and radius 20 cm hangs by a tie rod = 40 cm and rests against a smooth vertical wall at C as shown in the figure below. Determine the tension in the rod AB and reaction R_c at point C.
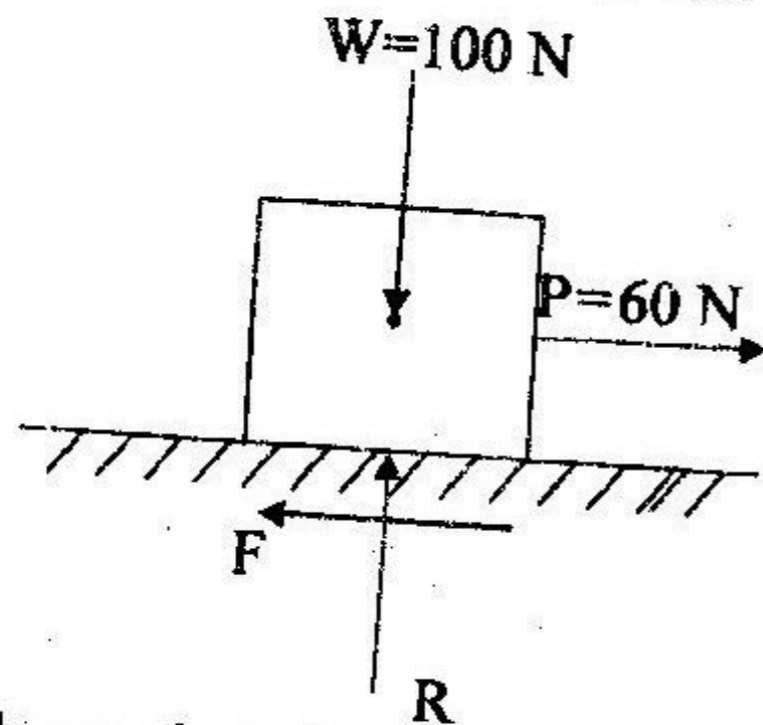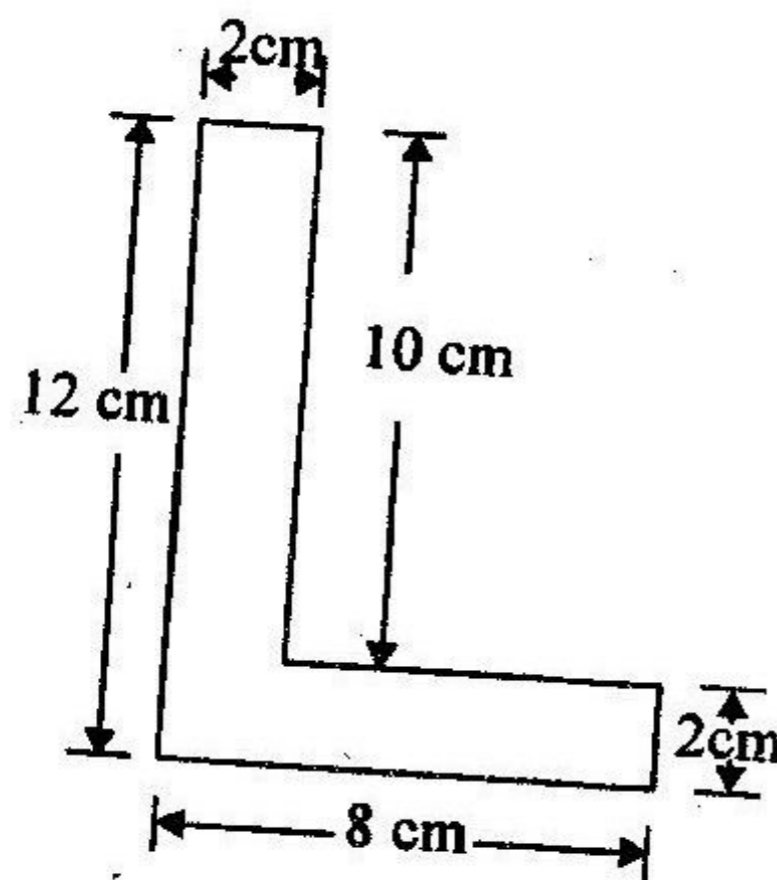
(B) Answer the following questions :

2+3+5=10

(i) A body of weight 100 N is placed on a rough horizontal plane as shown below. Determine the co-efficient of friction if a horizontal force of 60 N just causes the body to slide over the horizontal plan.

W=100 N

P=60 N

F

R

(ii) Show that the angle of repose is equal to angle of friction.

(iii) Find the center of gravity of the L-section as shown in the figure given below :

2cm

12 cm

10 cm

8 cm

2cm

(8)

1520(B)

7. (A) Answer the following questions :

2+3+5=10

(i) What is a machine ? Explain the term 'Ideal machine'.

(ii) An effort of 50 N is applied to a machine to lift a load of 450 N. The distance moved by the effort is 2m. The load is raised through a distance of 20 cm.

Determine the

(a) Mechanical advantage

(b) Velocity ratio and

(c) Efficiency of the machine.

(iii) Find the law of machine in which an effort of 11·6 N raised a load of 50 N and an effort of 17·6 N raised a load of 80 N. Find what effort will be required to lift a load of 70 N.

(B) Answer the following questions :

2+3+5=10

(i) How are belt drives classified ? Name three types of belts used in belt drive.

(ii) Derive an expression of velocity ratio for a compound belt drive.

(iii) Derive expressions of velocity ratios for

(a) Simple and

(b) Compound gear train.

8. (A) Answer the following questions : 2+3+5=10

(i) What is welding ?

(ii) What do you mean by forging ? Name some forging operations.

(iii) Describe with the help of a diagram, the process of pressure die casting.

(B) Answer the following questions (any *four*) : 2½×4=10

(i) Derive the condition for irreversibility of a lifting machine.

(ii) Distinguish between water tube and fire tube boilers. Give some other classifications of boilers.

(iii) Compare between two stroke and four stroke engines.

(iv) State the Kelvin-Planck's statement of the 2nd law.

(v) Show that energy is a property of a system.