Total No. of printed pages = 5

**Me-201/EM/2nd Sem/2015/M**

# ENGINEERING MECHANICS

Full Marks – 70

Pass Marks – 28

Time – Three hours

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

Answer question No.1 and any *five* from the rest.

1. Fill in the blanks : 1×10=10

   (i) One kilogram force is equal to ..... Newton.

   (ii) Forces whose lines of action do not lie in the same plane are known as ..... .

   (iii) The unit of moment in S.I system is ..... .

   (iv) For a reversible machine efficiency should be more than ..... .

   (v) Capacity of doing work is known as ..... .

   (vi) Maximum value of frictional force is called ..... .

   (vii) Frictional force depends upon the ..... of the contact surfaces.

[Turn over

(viii) The process of splitting up a force is called ..... .

(ix) One horsepower is equal to ..... watt.

(x) In an ideal machine mechanical advantage is equal to ..... .

2. (a) State composition and resolution of force. Define parallelogram law of forces. 3+2=5

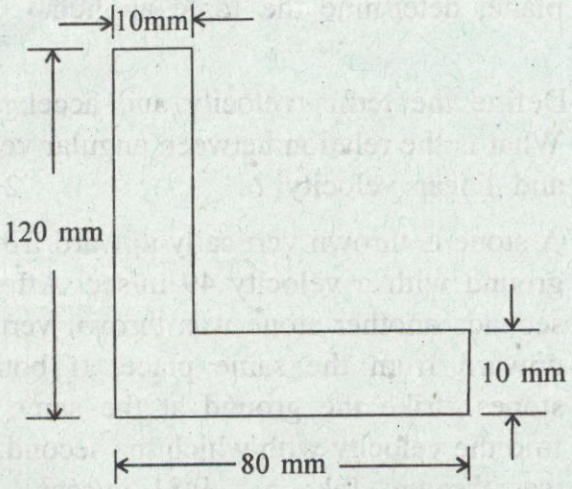
(b) Five forces of magnitude 200N, 100N, 40N, 80N and 50N are acting at a point on a body making angle of $30^{\circ}$, $90^{\circ}$, $120^{\circ}$, $230^{\circ}$ and $300^{\circ}$ respectively with the horizontal axis. All the angles are being measured anticlockwise. Find the magnitude and direction of the resultant force. 7

3. (a) With the help of a neat diagram, explain space diagram and vector diagram. Use Bow's notation to represent a force. 4

(b) The resultant of two forces when they act at an angle of $60^{\circ}$ is 14N. If the same forces are acting at right angles, their resultant is $\sqrt{136}$ N. Determine the magnitude of the two forces. 8

4. (a) Define centre of gravity of a body. Distinguish between centre of gravity and centroid. 4

(b) Determine the moment of inertia of the L-section shown in figure about an axis passing through its C.G and parallel to x-axis. 8




5. (a) State Varignon's principle of moment. Define Lami's theorem. 2+2=4

(b) A horizontal beam of 12m long is simply supported at the two ends and carries 10N, 15N and 8N loads at distances of 3m, 5m and 8m from the left hand support. Find the reactions at the support. 8

6. (a) Define co-efficient of friction and angle of friction. 4

(b) A body of weight 500N is pulled up along an inclined plane having an inclination of $30^{o}$ with the horizontal. If the co-efficient of friction between the body and the plane is ·3 and force being applied parallel to the plane, determine the force applied. 8

7. (a) Define the terms velocity and acceleration. What is the relation between angular velocity and linear velocity ? 2+2=4

(b) A stone is thrown vertically upward from the ground with a velocity 49 m/sec. After two seconds another stone was thrown vertically upward from the same place. If both the stones strike the ground at the same time, find the velocity with which the second stone was thrown. Take $g = 9{\cdot}81$ m/sec$^2$. 8

8. (a) Define mechanical advantage, velocity ratio and efficiency of a machine. 4

(b) What load will be lifted by an effort of 12N if the velocity ratio is 18 and efficiency of the machine at this load is 60% ? If the machine has a constant frictional resistance, determine law of machine. 8

9. Write short notes on any *four* : 4×3=12

(i) Vector quantity and scalar quantity

(ii) Concurrent forces and coplanar forces

(iii) Triangle law of force

(iv) Parallel axis theorem

(v) I.H.P and B.H.P.