Total No. of printed pages = 4

Me-201/EM/2nd Sem/Com/2017/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.

Any missing data may suitably be assumed.

1. Fill up the blanks with appropriate word(s). 1×10=10

   (a) The forces whose lines of action lie on the same plane, are known as ..... forces.

   (b) Two forces 3N and 4N are acting at an angle 90°. The magnitude of resultant force is ..... .

   (c) The horizontal component of force 10N is 5N. Its vertical component will be ..... N.

   (d) The centre of gravity of an equilateral triangle with each side 'a' is at a distance ..... from any of the three sides.

[Turn over

(e) The moment of inertia of a circular section of diameter 'd' is given by the relation ..... .

(f) Horse power is the unit of ..... .

(g) The efficiency of an ideal machine is ..... .

(h) Static friction is always ..... than dynamic friction.

(i) The SI unit of moment is ..... .

(j) Lami's theorem is applicable only for ..... forces.

2. (a) Explain the parallelogram law of forces. 4

(b) Four forces acting at a point as follows :

(i) 20N towards east

(ii) 30N towards north

(iii) 30N towards north west

(iv) 15N towards south.

Find the magnitude and direction of resultant force. 8

3. (a) Explain briefly the laws of static friction. 4

(b) A body of weight 450N is lying on a rough plane inclined at an angle of 25° with the horizontal. It is supported by an effort (P) parallel to the inclined plane. Determine the minimum and maximum values of P, for which the equilibrium can exist, the angle of friction is 20°. 8

4. (a) Draw the diagram of simply supported beam with two point loads, with uniformly distributed load and with uniformly varying load. 6

(b) A simply supported beam of span 6m is loaded as 4 KN at a distance 1m from left support, 3 KN at the middle of the beam and 6 KN at a distance 2m from right support. Find the reactions at the two ends. 6

5. (a) Explain briefly how the centre of gravity of a body is determined by moments. 4

(b) An I section has the following dimensions :

bottom flange : 320mm×120mm

top flange : 160 mm × 60 mm

web : 300 mm × 60mm

Determine the position of centre of gravity. 8

6. (a) Establish a relation between efficiency, mechanical advantage and velocity ratio of a lifting machine. 5

(b) The law of a certain machine is

$P = 0.02W + 8$ where P = effort, W = load lifted.

The velocity ratio of the machine is 100. Find the maximum possible mechanical advantage and maximum possible efficiency of the machine. 7

7. (a) Derive a relation for the distance travelled by a body in nth second when the body is travelling with uniform acceleration. 4

(b) A stone is dropped from the top of a tower 60m high. At the same time, another stone is thrown upward from the foot of the tower with velocity 20 m/sec. When and where the two stones will meet ? 8

8. Write short notes on any *three* : 3×4=12

(a) Polygon law of forces

(b) Vector and scalar quantity

(c) Characteristics of a couple

(d) Lami's theorem

(e) Centroid and centre of gravity.