Total No. of printed pages = 7

Me-201/EM/2nd Sem/2016/N

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. (A) Fill in the blanks : 1×5=5

(i) Unit of moment in S.I unit is ———.

(ii) Moment of force is ——— quantity.

(iii) The friction that exists when one surface slides over the other is called ——— friction.

(iv) A machine is said to be an ideal if its efficiency is ———.

(v) Rate of change of velocity of a body is called ———.

[Turn over

(B) Choose the correct answer : 1×5=5

(i) When the lifting machine is not capable of doing any work in the reversed direction, after the effort is removed, the machine is called ———.

(a) Reversible machine

(b) Non-reversible machine and

(c) Ideal machine

(d) None of the above.

(ii) The efficiency of a lifting machine is the ratio of

(a) its output to input.

(b) work done by it to the work done on it.

(c) its mechanical advantage to its velocity ratio.

(d) All of the above.

(iii) Forces whose lines of action pass through a common point are called

(a) Collinear forces.

(b) Concurrent forces.

(c) Coplanar forces.

(d) Non-coplanar forces.

(iv) The method of designating a force by writing two capital letters one on either side of force is called ————.

(a) Vector representation

(b) Lami's theorem

(c) Bow's notation

(d) None of the above

(v) The moment of inertia of a circular section of dia. 'd' is given by the relation —

(a) $\frac{\pi}{16}d^4$ (b) $\frac{\pi}{32}d^4$

(c) $\frac{\pi}{64}d^4$ (d) $\frac{\pi}{96}d^4$.

2. (a) Define force. State the characteristics of a force. 4

(b) A particle is acted upon by the following forces —

(i) 20 N inclined 30°N of East.

(ii) 25 N towards North.

(iii) 30 N towards North West.

(iv) 35 N inclined 40° South of West.

Find magnitude and direction of the resultant force. 8

3. (a) State and prove theorem of parallel axes. 4

(b) Locate the centroid of Z section as shown in fig.1 given below :

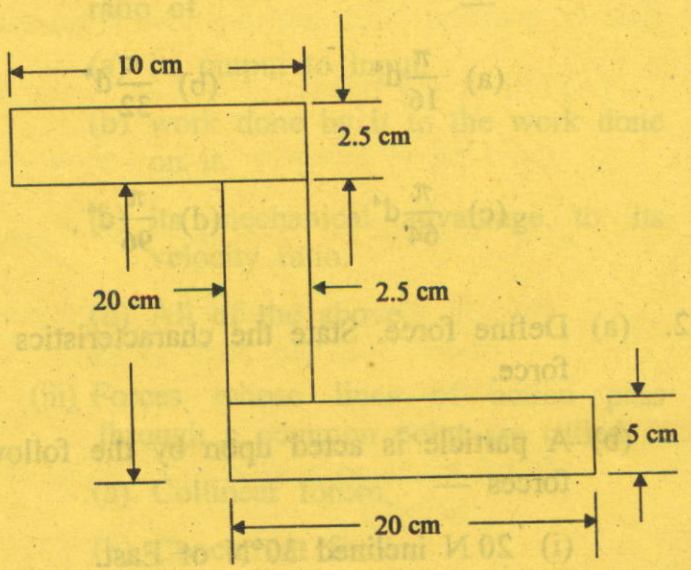


Fig-1 8

4. (a) Give two examples each where friction is desirable and where friction is undesirable. 2

(b) A uniform ladder of length 5m and weighing 20 N is placed against a smooth vertical wall with its lower end 4m away from the wall. If the ladder is just to slip, determine —

(i) Coefficient of friction between the ladder and floor.

(ii) The frictional force acting on the ladder at the point of contact between ladder and floor. 10

5. (a) Define law of machine. Explain in brief. 4

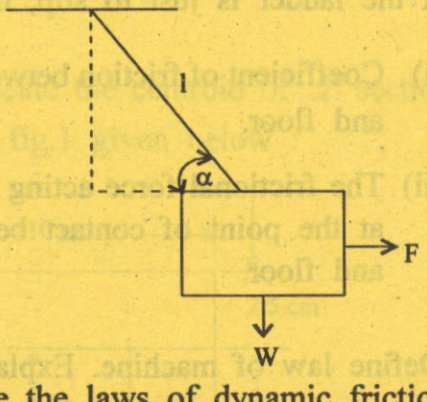
(b) In a weight lifting machine, an effort of 40 N can lift a load of 1300 N and an effort of 55 N can lift a load of 1800 N. Find the law of machine. Also find the effort to run this machine at : 8

(i) no load

(ii) a load of 100 N.

6. (a) State and prove Lami's theorem. 4

(b) Fig. below shows a weight 'W' tied to the end of cord of length *l*. Determine the magnitude of force F to pull the weight at an angle 'α' as indicated in the fig. Proceed to find the tension in the cord. 8



7. (a) State the laws of dynamic friction. 4

(b) A stone is thrown vertically upwards from the ground with a velocity of 49 ms^{-1}. After 2 secs, another stone was thrown vertically from the same place. If both the stones strike the ground at the same time, find the velocity at which the second stone was thrown. (Take g = 9.81 ms^{-2}). 8

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

(i) Super elevation or banking of roads

(ii) Polygon law of forces

(iii) Limiting friction

(iv) Irreversible machine

(v) D'Alembert's principle

(vi) Ladder friction.