



C09-M-303

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BOARD DIPLOMA EXAMINATION, (C-09)

MARCH/APRIL—2018

DME—THIRD SEMESTER EXAMINATION

ENGINEERING MECHANICS

Time : 3 hours ]

[ Total Marks : 80

PART—A

3×10=30

**Instructions** : (1) Answer **all** questions.

(2) Each question carries **three** marks.

1. What are the conditions for equilibrium of a coplanar force system?
2. A body start with a velocity of 5 m/s travels with an acceleration of 16 m/s<sup>2</sup>. Find (a) distance travelled in 8 seconds and (b) distance travelled in 8th second.
3. Explain the term super elevation.
4. Define static, limiting and kinetic friction.
5. A body of weighing 540 N is hauled along a rough horizontal plane by a pull of 180 N acting at angle of 30° with the horizontal. Find the coefficient of friction.
6. Define the terms (a) ideal machine and (b) self-locking machine.
7. In a lifting machine an effort of 50 N lifts a load of 2000 N through a distance of 0.2 m. In the process the distance moved by the effort is 16 m. Calculate the mechanical advantage and velocity ratio.
8. Define moment of inertia and radius of gyration.

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9. Find the moment of inertia of rectangle 20 mm wide and 30 mm deep about a given axis, AB which is at a distance of 45 mm from its centroid.
10. Differentiate between a machine and mechanism.

**PART—B**

10×5=50

**Instructions** : (1) Answer *any five* questions.

(2) Each question carries **ten** marks.

11. The following forces act at a point :

(a) 30 kN inclined at  $35^\circ$  towards North of East

(b) 22 kN towards North

(c) 30 kN inclined at  $30^\circ$  towards North of West

(d) 35 kN inclined at  $25^\circ$  towards South of West

Find the magnitude and direction of the resultant of force.

12. (a) A body is projected vertically upwards with a velocity of 18 m/s. Find the time required to reach the height of 10.8 m.

(b) A bullet of mass 100 grams is fired into a target with a velocity of 360 m/s. The mass of the target is 9 kg and it is free to move. Find the loss of kinetic energy.

13. An effort of 1960 N is required just to move a certain body up inclined plane of angle  $15^\circ$ , the force acting parallel to the plane. If the angle of inclination of the plane is made  $20^\circ$ , the effort required, again applied parallel to the plane, is found to be 2254 N. Find the weight of the body and the coefficient of friction.

14. The pitch of a screw jack is 20 mm. The mean diameter of the thread is 100 mm, the length of lever is one meter. If coefficient of friction is 0.075, calculate the necessary effort at end of the lever when a load of 30 MN is (a) to be lifted and (b) to be lowered.

15. (a) A point describes simple harmonic motion in a 0.4 m long. Find the maximum velocity if the time period is 0.3 second.
- (b) In a simple wheel and axle, the radius of the effort wheel is 360 mm and that of axle is 60 mm. Determine the efficiency if a load of 2352 N can be lifted by an effort of 588 N.

16. A double purchase crab winch has the following dimensions :

Effective diameter of load drum—150 mm

Length of handle—350 mm

No of teeth on pinions— 25 and 35

No of teeth of spur wheels—70 and 90

When tested, it was found that an effort of 80 N was required to lift a load of 1700 N and effort of 120 N was required to lift a load of 3000 N. Determine—

- (a) law of machine;
- (b) probable effort to lift a load of 5000 N;
- (c) efficiency in the above case;
- (d) maximum efficiency.
17. Find the moment of inertia of the angle section as shown in figure 1 about XX and YY axis is passing through its CG.

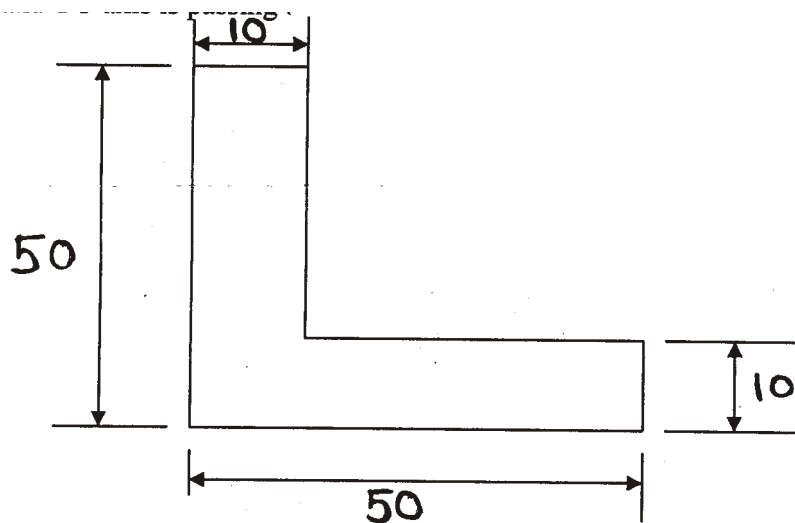


Figure 1 (All dimensions are in mm)

18. (a) Find the centroid of T section shown in Figure 2.

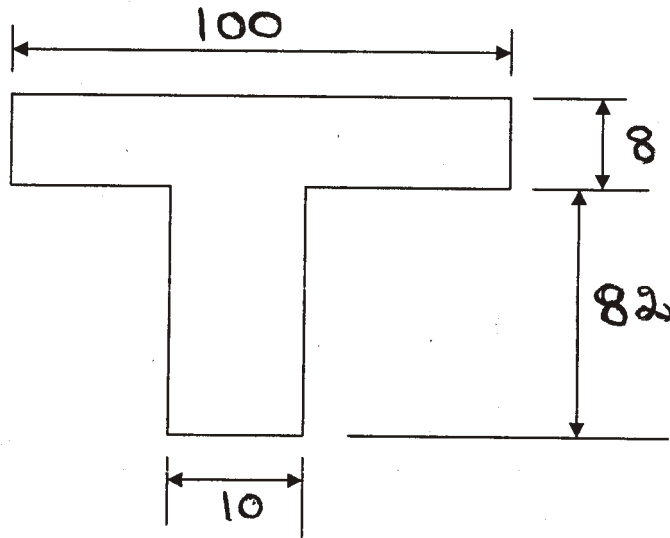


Figure 2 (All dimensions are in mm)

- (b) Explain pantograph mechanism with neat sketch.

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