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C16–M–105

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BOARD DIPLOMA EXAMINATION, (C–16)

MARCH/APRIL—2018

DME—FIRST YEAR 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. State the parallelogram law of forces.

2. What is a couple? Write any two characteristics of a couple. 1+2

3. Define *(a)* angle of friction and *(b)* angle of repose. 1½+1½

4. Determine the horizontal force required to pull a body of weight 200 N along the horizontal surface. Take coefficient of friction as 0·2.

5. State the parallel-axes theorem of moment of inertia.

6. A stone is dropped from the top of the building which is 50 meters of height. Calculate the velocity of stone with which it hits the ground.

7. Define *(a)* simple harmonic motion and *(b)* centripetal force. 1½+1½

8. Define *(a)* ideal effort and *(b)* ideal load. 1½+1½

9. The velocity ratio of a simple machine is 10. The effort applied is 150 N. Determine the load lifted, if 20% of the effort is lost in friction.

10. Define *(a)* link and *(b)* kinematic pair.

PART—B 10×5=50

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

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

11. *(a)* The following forces act at a point :

(i) 25 N inclined at 35° towards north of east

(ii) 20 N towards north

(iii) 30 N towards north-west

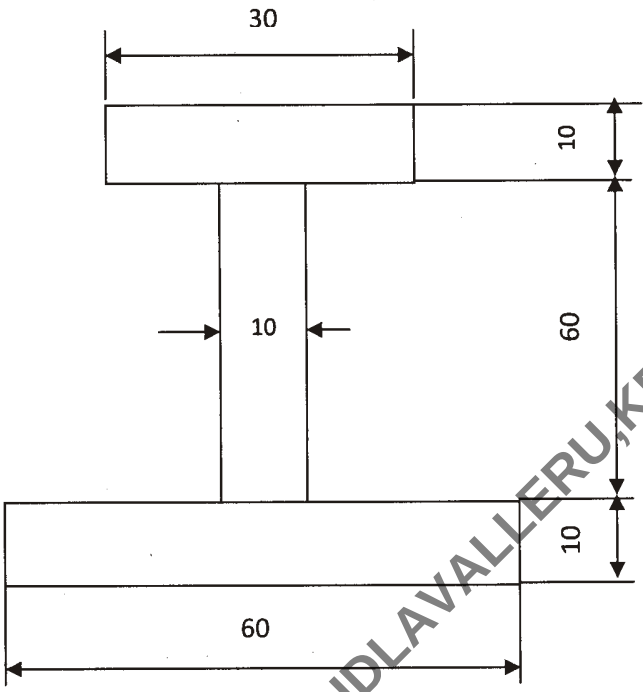
(iv) 20 N inclined at 20° towards south of west

Determine the magnitude and direction of resultant force.

(b) A machine weighing 1500 N is supported by two chains attached to some point on the machine. One of the chains is inclined at 30° to the horizontal and other chain inclined at 45° to the horizontal. Calculate the tensions in the two chains.

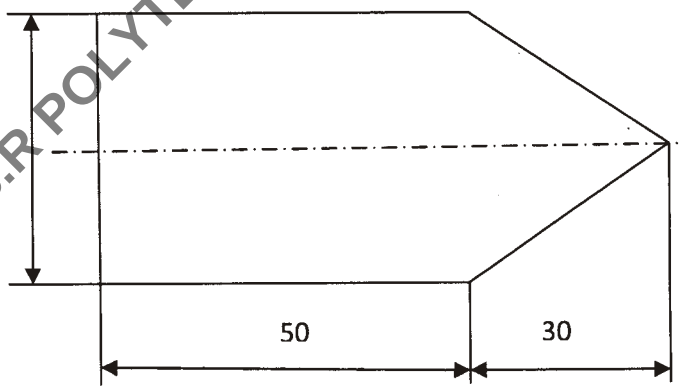
12. A body of weight 85 N is placed on a rough inclined plane whose angle of inclination with the horizontal is 35°. If the coefficient of friction between the plane and the body is 0·2, determine the minimum force required *(a)* to prevent the body sliding down and *(b)* to pull it up the plane. The effort is to be applied along the plane.

13. Find the moment of inertia of the following I-section about its centroidal axes. All dimensions are in mm :



14. *(a)* How is system of forces classified? Explain them briefly.

(b) Find the centroid of the composite section shown below. All dimensions are in mm :



15. *(a)* A lift carries a load of 1000 N and is moving with a uniform acceleration of 1·45 m/s^2. Determine the tension in the cables supporting the lift when—

(i) lift is moving upwards;

(ii) lift is moving downwards.

Take g 9 81 m / s^2

(b) A bullet of mass 0·1 kg is fired into a target with a velocity of 350 m/s. The mass of the target is 10 kg and it is free to move. Find the loss of kinetic energy.

16. (a) Find the amplitude and time period of a particle moving with a simple harmonic motion, which has velocity of 9 m/s and 4 m/s at the distance of 2 m and 3 m respectively from the centre.

(b) A body is projected vertically upwards with a velocity of 12 m/s. Determine the maximum height attained by the body and the velocity at 5 m of height.

17. In a differential wheel and axle, the difference between axle diameters is 50 mm and the diameter of the effort wheel is 750 mm. If a load of 2500 N is lifted by an effort of 175 N and a load of 3250 N is lifted by an effort of 210 N, determine—

(a) law of the machine;

(b) load lifted by an effort of 225 N;

(c) mechanical advantage;

(d) velocity ratio;

(e) efficiency.

18. (a) Explain the working of a Weston differential pulley block with a neat diagram.

(b) Illustrate the working of the crank and slotted lever mechanism with a neat diagram.

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