



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. $1\frac{1}{2}+1\frac{1}{2}$
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. $1\frac{1}{2}+1\frac{1}{2}$

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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

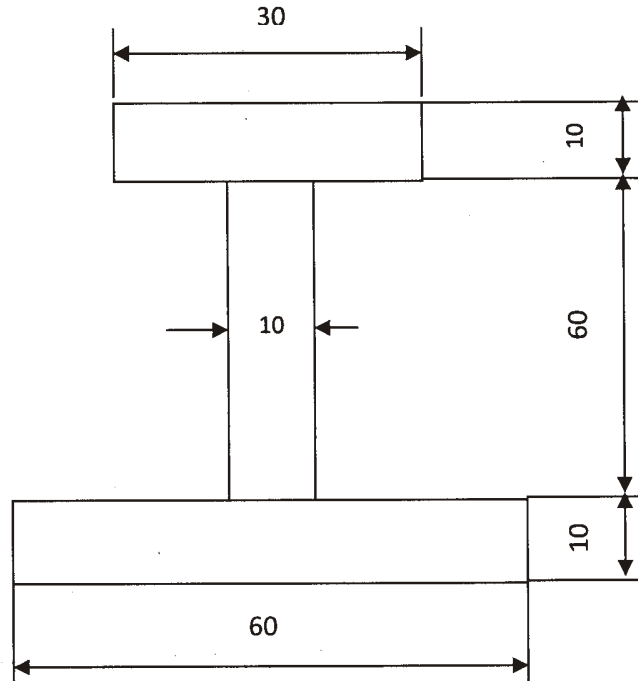
(iv) 20 N inclined at 20° towards south of west

Determine the magnitude and direction of resultant force.

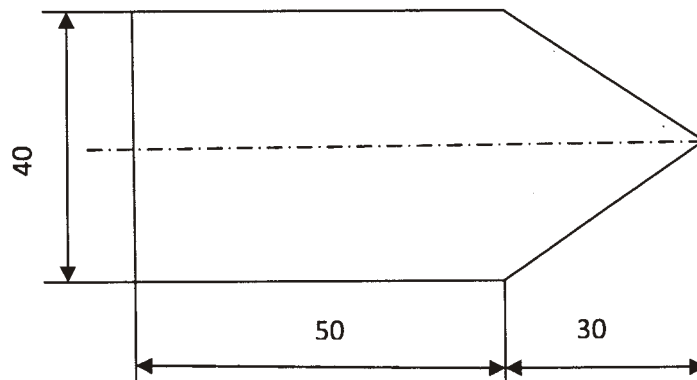
(b) A machine weighing 1500 N is supported by two chains attached to some point on the machine. One of the chains is inclined at 30° to the horizontal and other chain inclined at 45° to the horizontal. Calculate the tensions in the two chains.

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 $g = 9.81 \text{ m/s}^2$

- (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.
