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C16–M–105

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BOARD DIPLOMA EXAMINATION, (C–16)

JUNE—2019

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.

(3) Answers should be brief and straight to the point and shall not exceed *five* simple sentences.

1. State the Lami's theorem.

2. Determine the magnitude and direction of the resultant of two forces 12 N and 9 N acting at a point, if the angle between the two forces is 60°.

3. Define *(a)* angle of friction and *(b)* coefficient of friction.

4. Determine the horizontal effort required to move the body weighing 90 N along a horizontal plane. The plane is such that, if it is gradually raised up to 15°, the body will slide down.

5. State the perpendicular axis theorem of moment of inertia.

6. A bullet of mass 30 g is fired horizontally with a velocity of 250 m/s from a gun of mass 25 kg. Find the velocity with which the gun will recoil.

7. Define *(a)* periodic time, *(b)* amplitude and *(c)* oscillation.

8. Define *(a)* velocity ratio and *(b)* mechanical advantage.

9. The law of a certain simple machine is $P = 0{\cdot}04\,W + 2$ and its velocity ratio is 50. Calculate *(a)* mechanical advantage and *(b)* efficiency. Consider a load of 200 N.

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

PART—B

10×5=50

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

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

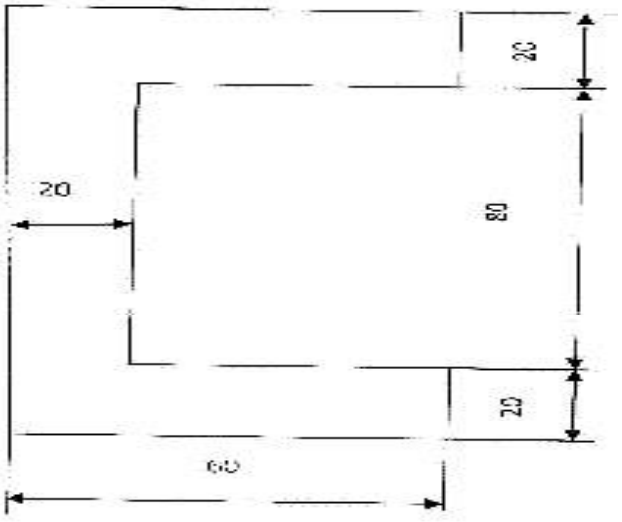
(3) Answers should be comprehensive and the criteria for valuation are the content but not the length of the answer.

11. *(a)* If the maximum and minimum resultant of two forces acting on a particle are 60 kN and 20 kN respectively. Determine the magnitude of the two forces.

(b) A weight of 80 N is suspended by two strings attached to it. One of the strings is in horizontal direction and the other is at an angle of 30° to the horizontal. Determine the tension in the two strings.

12. A body of weight 100 N is to be pulled up an inclined plane whose angle of inclination with the horizontal is 20°. If the coefficient of friction between the plane and the body is 0·28. Determine the effor required—*(a)* when the effort is parallel to the plane and *(b)* when the effort is parallel to the base.

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



14. *(a)* What do you understand by equilibrium? State the conditions for equilibrium.

(b) A bar of triangular lamina of sides 100 mm × 80 mm × 60 mm is placed in such a way that its longest side is on the ground. Calculate the moment of inertia of the triangular section about its base.

15. *(a)* A car of mass 1000 kg moves on a level road under the action of 981 N of propelling force. Determine the time taken by the car to increase its velocity from 24 kmph to 48 kmph and distance travelled during this time.

(b) A body of mass 0·1 kg starts falling freely under gravity from a height of 3 m. Calculate the potential and kinetic energies of the body when it is at a height of 1 m from the ground. Assume $g = 9{\cdot}81\ m/s^2$.

16. *(a)* A wheel rotating about a fixed axis at 30 r.p.m. is uniformly accelerated for 50 seconds during which it makes 40 revolutions. Determine—*(a)* angular velocity at the end of this interval and *(b)* time required for the speed to reach 80 rp.m.

(b) A bullet of mass 80 gm moving with a velocity of 250 m/s is fired into a block of wood into a depth of 20 cm. Find out the resistance offered by the wood.

17. A double purchase crab has following dimensions :

Effective diameter of the load drum = 160 mm

Length of the handle = 360 mm

Number of teeth on pinions = 20 and 30

Number of teeth and spur wheels = 75 and 90

It was observed that an effort on 90 N was required to lift a load of 1800 N and an effort of 135 N was required to lift a load of 3150 N. Determine—

(a) law of machine;

(b) velocity ratio;

(c) effort required to lift a load of 6000 N;

(d) efficiency in above case;

(e) maximum efficiency.

18. *(a)* Explain the working of a single purchase crab winch with a neat diagram.

(b) Explain any one of the inversions of a quadratic chain with a neat diagram.

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