C16–M–**105**

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BOARD DIPLOMA EXAMINATION, (C–16)
MARCH/APRIL—2017
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 following :　　　　　　　1½+1½=3

(a) Parallelogram law of forces

(b) Principles of moments

2. Two forces 80 N and 70 N act simultaneously at a point. Find the resultant force if the angle between them is 140°.

3. Define the following terms :　　　　　1½+1½=3

(a) Angle of friction

(b) Angle of repose

4. A body weighing 560 N hauled along a rough horizontal plane by a pull of 180 N acting at an angle of 30° with horizontal. Find the coefficient of friction.

5. State the following theorems :   1½+1½=3

    (a) Perpendicular axis

    (b) Parallel axis

6. Define the following terms :   1×3=3

    (a) Displacement

    (b) Velocity

    (c) Acceleration

7. A body moving with a velocity of 12 m/s and attains a velocity of 85 m/s in 10 seconds. Find the acceleration and distance travelled.

8. Define the following terms with respect to simple machine :

         1×3=3

    (a) Mechanical advantage

    (b) Velocity ratio

    (c) Efficiency of a machine

9. The law of the machine is P 0 04W 2. Its velocity ratio is 50. What is the mechanical advantage and what is the efficiency when W 200 N?

10. Define the following terms :   1½+1½=3

    (a) Successfully constrained motion

    (b) Incompletely constrained motion

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

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

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

11. A roller of diameter 500 mm and weight 1500 N is to be taken up a step of 50 mm high. Find the magnitude and direction of minimum pull *P* required on the handle to pull the roller up the step.

12. A body resting on a rough horizontal plane required a pull of 18 kN inclined at 30 degrees to the plane just to move it. It was also found that a push of 22 kN inclined at 30 degrees to the plane just moved the body. Determine the weight of the body and the coefficient of friction.

13. An I-section is made up of top flange 100 mm × 20 mm, web 120 mm × 30 mm and bottom flange 160 mm × 30 mm. Determine moment of inertia about centroidal axis I_{xx} and I_{yy}.

14. *(a)* the resultant of two concurrent forces is 12 N. If the forces are equal and makes 120° with each other, find their magnitude and the angle that resultant makes. 5

    (b) A bar of triangular section 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 section about the centroidal axis parallel to the base. 5

15. A stone is projected upwards with a velocity of 120 m/s. With what initial velocity should a second stone be projected upwards 2 seconds later so that it may overtake the first stone at its maximum height?

16. A bullet of mass 200 grams is fired horizontally with a velocity of 30 m/s from a gun of mass 100 kg. With what velocity, will the gun recoil? If the resistance to sliding of the gun is 20 N before it comes to rest, find the time taken to do so and the distance over witch it moves.

17. A double purchase crab has the following dimensions :

Effective diameter of load drum is 160 mm, length of the handle is 360 mm, numbers of teeth on pinions are 20 and 30, and numbers of teeth on spur wheels are 75 and 90.

When tested it was found that an effort of 90 N was required to lift a load of 1800 N and effort of 135 N was required to lift a load of 3150 N.

Determine *(a)* law of the machine, *(b)* probable effort to lift a load of 6000 N, *(c)* efficiency in the above case and *(d)* maximum efficiency.

18. *(a)* Derive an expression for velocity ratio of wheel and axis with the help of sketch. 5

(b) Explain the slider crank mechanism with a neat sketch. 5

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