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C16–M–105

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BOARD DIPLOMA EXAMINATION, (C–16)

OCTOBER—2020

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. Define the following terms : 1½+1½=3

(a) Equilibrium

(b) Equilibrant

2. Two forces 12 N each act at right angles to each other. Find the magnitude and direction of a single force that produces the same effect. 3

3. State the laws of solid friction.

4. Find the effort required to move a load of 686 N on rough horizontal plane. The coefficient of friction between the contact surfaces is 0·25. The effort is applied at an angle of 20° with the horizontal. 3

5. Find the centroid of I-section with top flange of 60 mm × 20 mm, web of 80 mm × 20 mm and bottom flange of 100 mm × 20 mm. 3

6. Obtain an expression for the distance covered by a particle in *n*th second. 3

7. Define work, power and energy. 1+1+1=3

8. Briefly explain the difference between a revisable machine and self-locking machine. 3

9. The velocity ratio of a simple machine is 10. The effort applied is 150 N. Determine the efficiency, if load lifted is 1200 N. 3

10. Define lower pair, higher pair and give one example of each. 1+1+1=3

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.

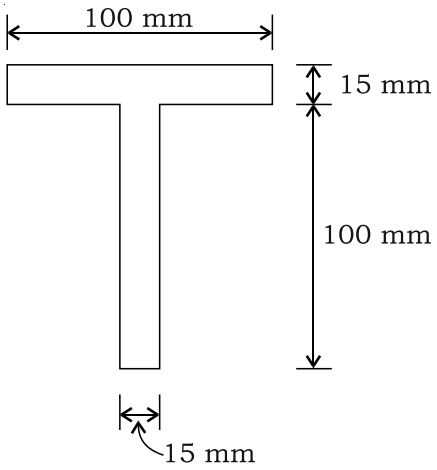
11. A smooth circular cylinder of radius 1·5 m is laying in a triangular grove, one side of which makes 20° angle and other side 40° with the horizontal. Find the reactions at the surface of contact, if there is no friction and the cylinder weighs 1 kN. 10

12. A body resting on a rough horizontal plane required a pull of 90 N inclined at 25° to the plane just to move it. It was also found that a push of 110 N inclined at 25° to the plane just moved the body. Determine weight of the body and the coefficient of friction. 10

13. *(a)* Two unlike parallel forces of 100 N and 40 N are acting at a distance of 250 mm. Find the magnitude and position of the resultant. 5

(b) Derive an expression for moment of inertia of a rectangular section of height *h* and width *b* about its centroidal axis. 5

14. Find the moment of inertia of the T-section shown in the figure about axis passing through its centroid parallel to *AB*. 10



15. A particle moving in a straight line with uniform acceleration travels 5 m in the third second of its motion and 9 m in the sixth second. Find its initial velocity, acceleration and the distance travelled in the tenth second. 10

16. A motor car of total mass 900 kg is travelling at constant speed of 45 kmph up an incline of 1 in 30 against frictional resistance of 0·1 N/kg. Calculate the tractive effort required to maintain this constant speed. If the engine is suddenly switched off, what will be the time taken for the car to come to rest? 10

17. Following are the specifications of a single purchase crab :

Diameter of load drum $d = 20$ cm
Length of the lever $l = 120$ cm
Number of teeth on pinion = 10
Number of teeth on spur wheel = 100

Find the velocity ratio of the machine. On this machine efforts of 100 N and 160 N are required to lift the loads of 3000 N and 9000 N respectively. Find the law of the machine and efficiencies at the above loads. 10

18. *(a)* Derive the expression for velocity ratio of third system of pulleys with neat sketch. 5

(b) Explain crank and slotted lever mechanism with a neat sketch. 5

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