



C09-M-303

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BOARD DIPLOMA EXAMINATION, (C-09)  
OCT/NOV—2013  
DME—THIRD SEMESTER EXAMINATION  
ENGINEERING MECHANICS

Time : 3 hours ]

[ Total Marks : 80

## PART—A

- Instructions :** (1) Answer **all** questions.  
(2) Each question carries **three** marks.  
(3) Answer should be brief and straight to the point and shall not exceed *five* simple sentences.

1. State the parallelogram law of forces.
2. A bullet of mass 0.05 kg is fired horizontally with velocity of 800 m/s from a gun of mass 1000 kg. Find the velocity of recoil of gun.
3. Define the following terms :  
(a) Angular velocity  
(b) Angular acceleration
4. State the laws of static friction.
5. A body of weighing 500 N is pushed by a force of 120 N on a rough horizontal plane. If the line of action of push is  $20^\circ$  with horizontal, find the coefficient of friction.

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6. Define the following terms :  
(a) Ideal machine  
(b) Self-locking machine
7. In a system of pulleys of the first type, there are three movable pulleys and a weight of 320 N can just be supported by an effort of 50 N. Find the efficiency of the machine.
8. Define (a) moment of inertia and (b) parallel axis theorem.
9. Find the moment of inertia of a rectangular lamina of 40 mm wide and 80 mm deep with respect of centroidal axes.
10. Define higher pair and lower pair. Give two examples for each.

## PART—B

- 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. Find the magnitude and direction of the single force that brings the following system of concurrent forces into equilibrium :  
(a) A force of 20 N acting due East  
(b) A force of 25 N acting  $40^\circ$  North of East  
(c) A force of 10 N acting  $50^\circ$  West of North  
(d) A force of 30 N acting vertically downwards

12. A wheel rotating about a fixed axis at 20 r.p.m. is uniformly accelerated for 70 seconds during which time it makes 50 revolutions. Find—

- (a) angular velocity at the end of this interval;
- (b) time required for the speed to reach 100 rev/min.

13. (a) Obtain an expression for the distance covered by a particle in the  $n$ th second.

(b) The law of the machine is  $P = 0.04W + 2$ . Its velocity ratio is 50. What is the mechanical advantage and the efficiency when  $W = 200$  N?

14. (a) Define (i) angle of friction and (ii) angle of repose. 2+2

(b) List out three practical examples for each of the following: 3+3

- (i) Sliding friction
- (ii) Rolling friction

15. A body of weight 85 N is placed on a rough inclined plane whose angle of inclination with the horizontal is  $35^\circ$ . If the coefficient of friction between the plane and the body is 0.2, find the least force required (a) to prevent the body sliding down and (b) to pull it up the plane. The effort is applied along the plane.

16. In a differential wheel axle, the diameter of the effort wheel is 400 mm. The radii of the axle are 150 mm and 100 mm respectively. The diameter of the ropes is 10 mm. Find the load which can be lifted by an effort of 196 N assuming the efficiency of the machine to be 75%.

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17. Find the MI of I-section about centroidal axes shown in Fig. 1. All dimensions are in mm.

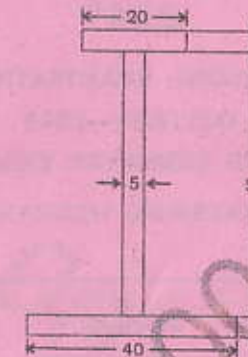


Fig. 1

18. (a) Find the centroid of the T-section shown in Fig. 2. All dimensions are in mm.

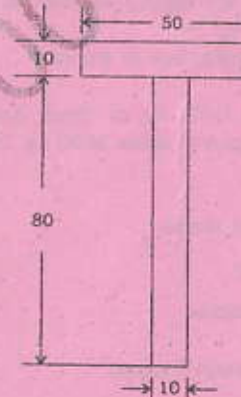


Fig. 2

(b) Explain the pantograph mechanism with a neat sketch.

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