



C09-M-303

**3247**

**BOARD DIPLOMA EXAMINATION, (C-09)**  
**OCT/NOV—2016**  
**DME—THIRD SEMESTER EXAMINATION**  
**ENGINEERING MECHANICS**

Time : 3 hours ]

[ Total Marks : 80

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**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 parallelogram law of forces and give mathematical expression for resultant. 2+1
2. A body starting from rest, moves with an acceleration of  $3\text{ m/sec}^2$ . Find the velocity at the end of 30 seconds and the distance described in that time. 1+2
3. List out any three applications of SHM. 1×3
4. State any three laws of static friction. 1×3
5. A body of weight 600 N is resting on a rough horizontal plane. The coefficient of friction between the body and surface is 0.25. Determine the horizontal force required to pull the body, and also calculate the angle of friction at the limiting condition. 2+1

- \* 6. Define the following terms with respect to simple machines : 3×1  
 (a) Velocity ratio  
 (b) Mechanical advantage  
 (c) Efficiency
7. Draw a line diagram of first system of pulleys. 3
8. Define the following terms : 2+1  
 (a) Center of gravity  
 (b) Centroid
9. Find the polar moment of inertia of a circle of radius 30 mm. Also calculate the radius of gyration about polar axis. 1+2
10. Write any two differences between machine and mechanism and give one example for each. 2+1

**PART—B**

10×5=50

**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. The following forces act at a point : 5+5  
 20 N inclined at 30° North of West  
 15 N towards South  
 25 N towards North-East  
 30 N inclined at 40° towards South of East

Find the magnitude and direction of the resultant force.

12. A pile hammer of mass 1350 kg drops from a height of 60 cm on to a pile of mass 675 kg. The pile penetrates 5 cm per blow. Assuming that the penetration to the pile is resisted by constant force, find the resistance to penetration of the ground. 10

- \* 13. (a) If the distance between the rails of the track is 110 cm, how much the outer rail be elevated for a curve of 260 m radius in order that the resultant force may be normal at a speed of 50 kmph? 5
- (b) In a Weston's differential pulley, block diameters of concentric pulleys are 300 mm and 200 mm. It has been found that an effort of 1.98 kN just lifts a load of 9.9kN. Calculate the mechanical advantage, velocity ratio and efficiency of the machine. 1+3+1
14. A body of weight 900 N is to be pulled up on an inclined plane of angle  $18^\circ$ . The coefficient of friction between body and plane is 0.3. Find the effort required (a) when it is parallel to the plane, (b) when it is parallel to the base and (c) when it is inclined to the plane at  $10^\circ$ . 3+3+4
15. A screw jack having 48 mm mean diameter and 5 mm pitch is used to lift a load of 30 kN. Find the effort required to raise the load at the end of the lever 0.6 m long. Take the coefficient of friction between the screw and the nut as 0.12. 10
16. In a lifting machine, an effort of 100 N lifts a load of 2500 N and an effort of 130 N lifts a load of 3980 N.
- (a) Establish the law of machine.
- (b) Calculate the effort required to lift a load of 6000 N.
- (c) Find the load that can be lifted using an effort of 200 N.
- (d) What is the maximum efficiency of the machine, assuming  $VR = 75$ ? 4+2+2+2
17. An I section is made up of top flange 100 mm 20 mm and web 120 mm 30 mm and bottom flange 160 mm 30 mm. Determine MI about centroidal axis parallel to base. 10
- \* 18. (a) A bar of triangular section of sides 100 mm 80 mm 60 mm placed in such a way that its longest side is on the ground. Calculate the second moment of area of the section about the base. 5
- (b) Explain watt mechanism with a neat sketch. 5

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