



C-16-M-105

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**BOARD DIPLOMA EXAMINATION, (C-16)**

MARCH / APRIL - 2019

**DME - FIRST YEAR EXAMINATION**

**ENGINEERING MECHANICS**

Time : 3 Hours]

[Total Marks : 80

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**PART - A**

**2×15=30**

- Instructions :**
- (1) Answer any 15 questions.
  - (2) Each question carries 2 marks.
  - (3) Answer should be brief and straight to the point and shall not exceed five simple sentences.

- 1 State lami's theorem and write the relevant formula.
- 2 Define equilibrium.
- 3 A single force of 10N is resolved into two concurrent forces of 6N each. Find the angle between them.
- 4 State parallelogram law of forces and write mathematical formula.
- 5 Define static friction and dynamic friction.
- 6 What horizontal force is required to pull a body of weight 200N along the horizontal surface. Take coefficient of friction as 0.2.
- 7 Give the classification of friction.
- 8 Define Angle of friction and Angle of repose.
- 9 Write the formula for Moment of Inertia of the following plane figures.
  - (a) Semi-Circle
  - (b) Hollow Rectangle

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- 10 State Parallel axis theorem.
- 11 Define time of flight.
- 12 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.
- 13 State Law of Conservation of Momentum.
- 14 Write the expression of
- Equation of trajectory
  - Max. height reached by projectile.
- 15 Define reversible machine and irreversible machine.
- 16 What is a simple machine? List out 2 simple machines.
- 17 In a system of pulleys of the first type there are three movable pulleys and a weight of 350N can just be supported by an effort of 50N. find the efficiency of the machine.
- 18 Write the expression for velocity ratio in case of
- Simple pulley
  - Differential pulley.
- 19 Illustrate the first order lever with a practical example.
- 20 Write the law of machine with effort Vs load diagram.

**PART - B****10×5=50**

- Instructions :**
- Answer any **FIVE** questions.
  - Each question carries **TEN** marks.
  - Answer should be comprehensive and criterion for valuation is the content but not the length of the answer.

- 21 The following forces act at a point
- 25N inclined at  $35^\circ$  towards North of East.
  - 20N towards North.
  - 30N towards North-West.
  - 20N inclined at  $20^\circ$  towards South of west. Find the magnitude and direction of the resultant force.

- 22 (a) A lamp weighing 5 N is suspended from the ceiling by means of a wire. It is pulled to one side by a horizontal chord, until the wire makes an angle of  $60^\circ$  with the ceiling. Find the Tension in the wire and chord.
- (b) A bar of T-section has flange 50 mm wide, 10 mm thick and the web is 80 mm deep, 10 mm thickness. Find its centroid .
- 23 A body of weight 85N is placed on 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 (i) to prevent the body sliding down and (ii) to pull it up the Plane. The effort is applied along the plane.
- 24 Find the moment of inertia about centroidal axes for the given I-section. The dimensions are as follows :
- Top Flange: 90 mm  $\times$  20 mm
- Web: 20 mm  $\times$  100 mm and
- Bottom Flange: 150 mm  $\times$  40 mm
- 25 (a) A wheel rotating about a fixed axis at 30 rpm is uniformly accelerated for 50 seconds during which it makes 40 revolutions. Find (i) angular velocity at the end of this interval and (ii) Time required for the speed to reach 80 rpm.
- (b) A sphere of mass 30 Kg moving at 3 m/s overtakes and collides with another sphere of mass 20 Kg moving at 1 m/s in the same direction. Find the common velocity after impact.

- 26** A particle is moving with its acceleration directed to and proportional to its distance from a fixed point. When the distance of the particle from equilibrium position has values of 1.3 m and 1.8 m, the corresponding velocities are 5 m/s and 2 m/s. Determine :
- (a) Amplitude
  - (b) Maximum velocity
  - (c) Maximum acceleration
  - (d) Time period.
- 27** A double purchase crab has following dimensions:  
Effective dia. Of load drum =150 mm;  
Length of handle = 350 mm  
No. of teeth on pinions = 25 and 35;  
No. of teeth of spur wheels = 70 and 90  
When tested it was found that an effort of 80 N was required to lift a load of 1700 N and effort of 120 N was required to lift a load of 3000 N.  
Determine :
- (i) Law of machine.
  - (ii) Probable effort to lift a load of 5000 N.
  - (iii) Efficiency in the above case.
  - (iv) Maximum efficiency.
- 28** (a) Draw a neat sketch of a differential wheel and axle derive an expression for its velocity ratio.  
(b) There are 4 pulleys arranged in third system. Find the effort required to lift a load of 5000 N. Assume efficiency of the machine as 85%.