

B.E./B.TECH. Degree Examination, December 2020

Second Semester

**ME16251 - ENGINEERING MECHANICS**

(Regulation 2016)

Time: Three hours

Maximum : 80 Marks

Answer **ALL** questions**PART A - (8 X 2 = 16 marks)**

1. The total momentum of a system of masses (i. e. moving bodies) in any one direction remains constant, unless acted upon by an external force in that direction. This statement is called  
(A) Newton's first law of motion (B) Newton's second law of motion  
(C) Principle of conservation of energy (D) Principle of conservation of momentum
2. The moment of inertia of a thin spherical shell of mass  $m$  and radius  $r$ , about its diameter is  
(A)  $mr^2/3$  (B)  $2mr^2/3$  (C)  $2mr^2/5$  (D)  $3mr^2/5$
3. When two elastic bodies collide with each other?  
(A) The two bodies will momentarily come to rest after collision  
(B) The two bodies tend to compress and deform at the surface of contact  
(C) The two bodies begin to regain their original shape  
(D) All of the above
4. The algebraic sum of moments of the forces forming couple about any point in their plane is  
(A) Equal to the moment of the couple  
(B) Constant  
(C) Both of above are correct  
(D) Both of above are wrong
5. What is the difference between resultant force and equilibrant force?
6. State the necessary and sufficient conditions for equilibrium of rigid bodies in two dimension
7. For What condition moment of a force will be zero?
8. What is the significance of D'Alembert's Principle?

**PART B - (4 X16 = 64 marks)**

9. (a) A tower guy wire shown below is anchored by means of a bolt at A as shown Fig-1. **(16)**  
The tension in the wire is 2500kN.  
Determine a) the components  $F_x, F_y$  &  $F_z$  of the force acting on the bolt  
b) the angles  $\theta_x, \theta_y$  and  $\theta_z$  defining the direction of the force.

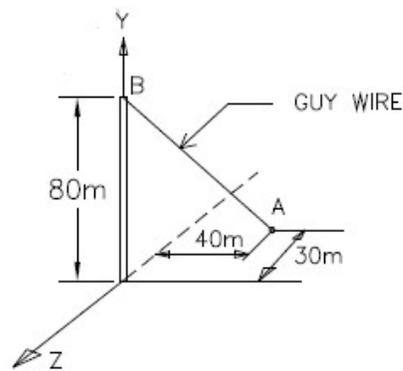


Fig-1

(OR)

- (b) A precast concrete post weighing 50 Kg and of length 6m shown in fig.2 is raised (16) for placing it in position by pulling the rope attached to it. Determine the tension in the rope and the reaction at A.

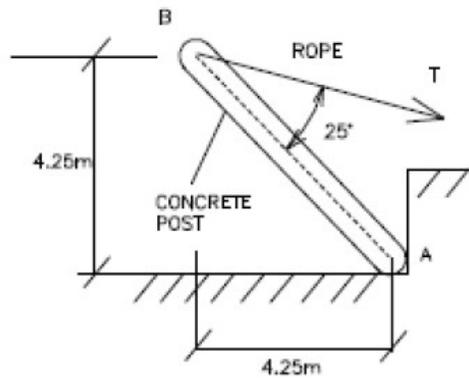


Fig-2.

10. (a) Blocks A and B of weight 200N and 100N respectively, rest on a  $30^\circ$  inclined plane (16) and are attached to the post which is held perpendicular to the plane by force P, parallel to the plane, as shown in fig.3 Assume that all surfaces are smooth and that the cords are parallel to the plane. Determine the value of P. Also find the Normal reaction of Blocks A and B.

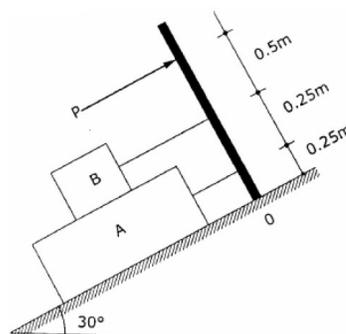


Fig-3

(OR)

- (b) Find reactions at points A & B for the given figure -4 (16)

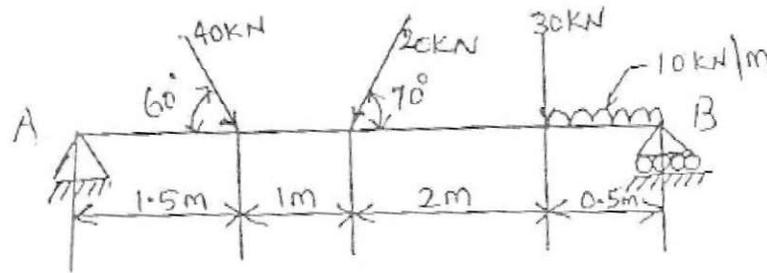


Fig-4.

11. (a) Find the moment of inertia of the section shown in the figure-5 about its horizontal centroidal axis. (16)

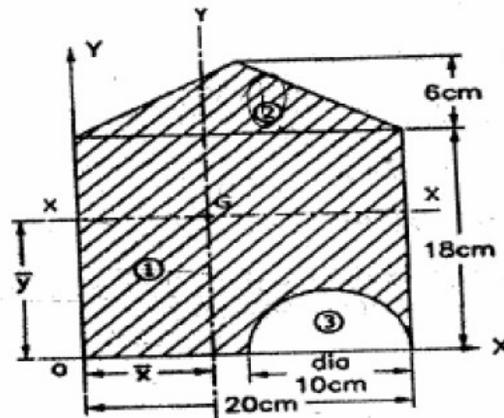


Fig-5

(OR)

- (b) Calculate the mass moment of inertial of the plate shown in figure-6 with respect to the axis AB. Thickness of the plate is 5 mm and density of the material is 6500 Kg/m<sup>3</sup> (16)

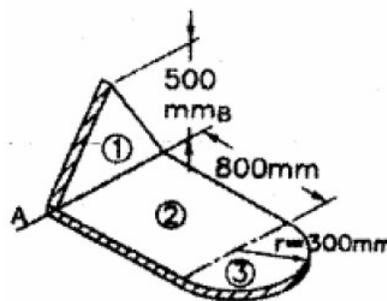


Fig-6

12. (a) Two weights 80 N and 20 N are connected by a thread and move along a rough horizontal plane under the action of a force 40 N, applied to the first weight of 80 N as shown in figure-7. The coefficient of friction between the sliding surfaces of the weights and the plane is 0.3. Determine the acceleration of the weights and the tension in the thread using work-energy equation. **(16)**

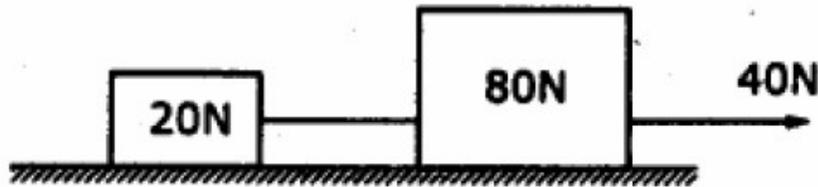


Fig-7

(OR)

- (b) In a screw jack, the pitch of the square threaded screw is 5.5 mm and mean diameter is 70 mm. The force exerted in turning the screw is applied at the end of lever 210 mm long measured from the axis of the screw. If the coefficient of friction of the screw jack is 0.07. Calculate the force required at the end of the lever to (i) raise a weight of 30 KN (ii) lower the same weight. **(16)**