

B.Tech I Year II Semester (R15) Supplementary Examinations December 2016

**ENGINEERING MECHANICS**

(Civil Engineering)

Time: 3 hours

Max. Marks: 70

**PART – A**  
(Compulsory Question)

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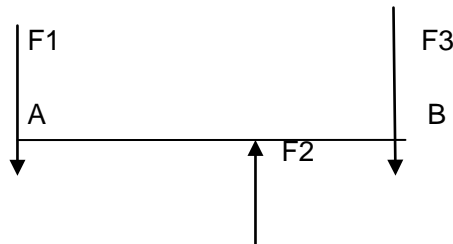
- 1 Answer the following: (10 X 02 = 20 Marks)
- State the law of parallelogram of forces and law of triangles.
  - What are the conditions of equilibrium?
  - Explain any four laws of solid friction.
  - Define limiting force of friction and kinetic friction.
  - Explain about radius of gyration.
  - State and prove the perpendicular axis theorem.
  - A force of unknown magnitude acts on a body of mass 150 kg and produces an acceleration of  $3 \text{ m/s}^2$  in the direction of force. Find the force.
  - Explain about motion on inclined smooth surfaces.
  - Explain about different types of frames.
  - What is method of sections?

**PART – B**

(Answer all five units, 5 X 10 = 50 Marks)

**UNIT – I**

- 2 (a) State and prove the Varignon's theorem.  
 (b) Three parallel forces  $F_1$ ,  $F_2$  and  $F_3$  are acting on a body. If the force  $F_1 = 250 \text{ N}$  and  $F_3 = 1000 \text{ N}$  and the distance between  $F_1$  and  $F_2 = 1.0 \text{ m}$ , then determine the magnitude of force  $F_2$  and the distance of  $F_2$  from force  $F_3$ .



OR

- 3 (a) Explain about different types of loads.  
 (b) A simply supported beam AB of length 9 m carries a uniformly distributed load of  $10 \text{ kN/m}$  for a distance of 6 m from the left end. Calculate the reactions of A and B.

**UNIT – II**

- 4 A uniform rod AB of length 50.8 cm weighing 100 N is resting on a rough horizontal surface whose coefficient of friction is 0.1. It is subjected to a force P applied horizontally at the end A in the direction perpendicular to its length. Determine the point O about which it would commence to turn.

OR

- 5 Find the least force required to drag a body of weight W, placed on a rough inclined plane having inclination  $\alpha$  to the horizontal. The force is applied to the body in such a way that it makes an angle of  $\theta$  to the inclined plane and the body is:
- On the point of motion up the plane.
  - On the point of motion down the plane.

**UNIT – III**

6 Derive the centre of gravity of circular, rectangular and triangle section from integration method.

**OR**

7 Find out the moment of inertia of the following sections:

- (a) Hollow circular section.
- (b) Uniform thin rod.
- (c) Curve.

**UNIT – IV**

8 Three marks A, B and C at a distance of 100 m each are made along a straight road. A car starting from rest and with uniform acceleration passes the mark A and takes 10 seconds to reach B and further 8 seconds to reach the mark C.

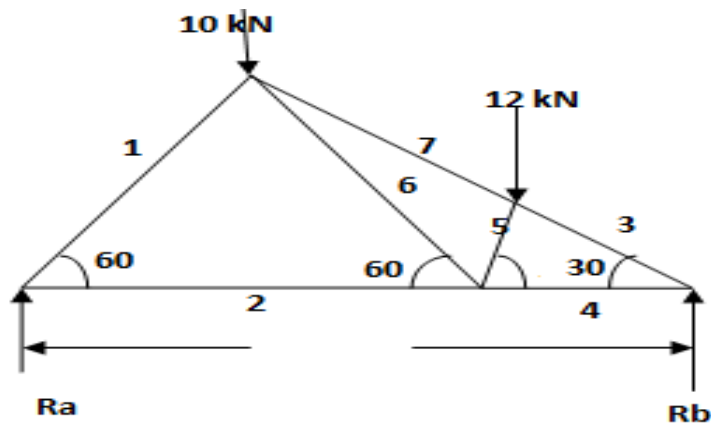
- Calculate:
- (i) The magnitude of the acceleration of the car.
  - (ii) The velocity of the car at A.
  - (iii) The velocity of the car at B.
  - (iv) The distance of the mark A from the starting point.

**OR**

- 9 (a) Derive the expression of rotary motion by using D' Alembert's principle.
- (b) Find an expression for the radius of gyration of circular lamina and a solid sphere.

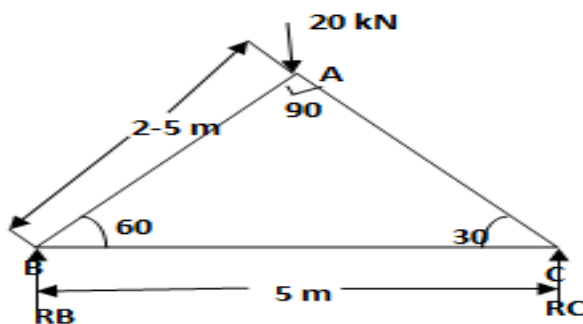
**UNIT – V**

10 A truss of span 5 m is loaded as shown in figure below. Find the reactions and forces in the members of the truss.



**OR**

11 Find the forces in the members AB and AC of the truss show in figure below. Use method of sections.



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