Code: 15A03302 **R15**

B.Tech II Year I Semester (R15) Regular & Supplementary Examinations November/December 2017

ENGINEERING MECHANICS

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

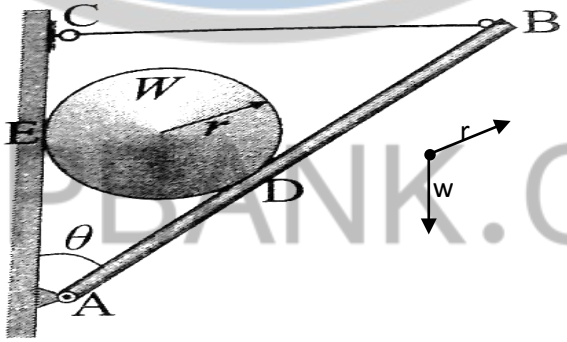
(a) What are concurrent forces, coplanar forces and collinear forces?
(b) Explain the conditions of equilibrium.
(c) State the laws of solid friction.
(d) What is angle of repose?
(e) Explain parallel axes theorem and perpendicular axes theorem.
(f) Define moment of inertia of mass.
(g) Explain Newton's laws of motion for linear motion and rotational motion.
(h) Explain D'Alembert's principle.
(i) State clearly the difference between a deficient frame and a redundant frame
(j) Give the expression for the frequency and time period of simple pendulum.

PART – B

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

UNIT – I

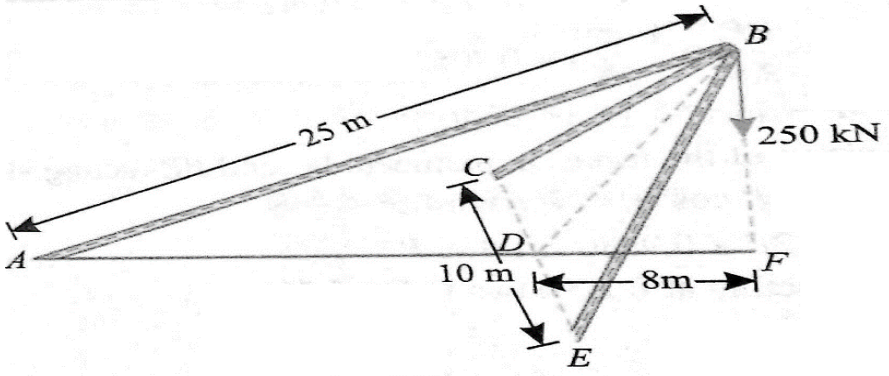
2 A smooth circular cylinder of weight W and radius r is supported in a horizontal position against a smooth vertical wall by a hinged bar AB as shown in figure below. The AB is supported by a horizontal cable BC. Find the value of the angle θ that AB should make with the wall to attain a minimum tension T in cable BC.



OR

3 (a) State Varignon's theorem.

(b) Figure below shows a shear leg crane lifting a load of 250 kN. The legs BC and BE are 20 m long and 10 m apart at the base. The back stay AB is 25 m long. If all the members are pin-jointed at A, C and E at the same level. Find the forces in all the three members of the crane.



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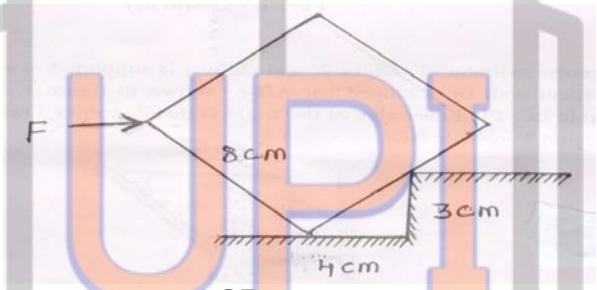
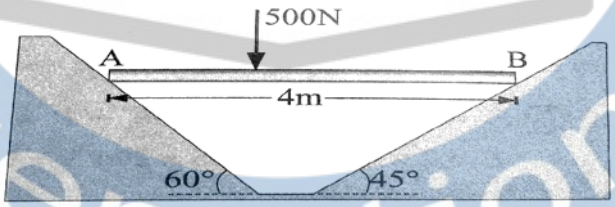
UNIT – II

4 A uniform solid cube of side 8 cm and weight 100 N is resting with an edge on the ground and its base on the edge of a 3 cm step as shown in figure below. An increasing horizontal force F is applied at the edge. In what ways is the cube likely to lose equilibrium? At what minimum value of F would it happen?. Assume the coefficient of friction between the cube and the ground and between the cube and the step as 0.3.



OR

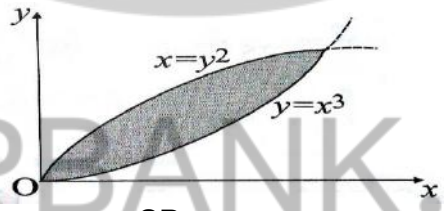
5 A horizontal bar AB of length 4 m and weight 400 N is lying on inclined planes as shown in figure below. Find how close to the ends A and B a load of 500 N can be placed safely, if coefficient of friction between the bar and supports is 0.2.



UNIT – III

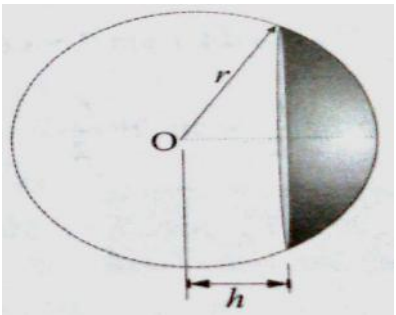
6 (a) Determine the mass moment of inertia of a solid sphere.

(b) Determine the coordinates of centroid of the shaded area between the two curves shown in the figure below.

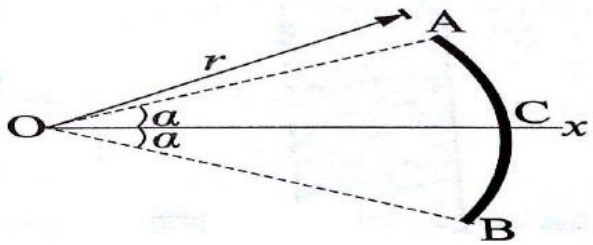


OR

7 (a) Find the centre of gravity of a segment of a sphere of radius r as shown in figure below. Find the position of centre of gravity of the hemisphere from the centre.



(b) Find the moment of inertia of an arc of mass m and radius r about x-axis as shown in the figure below.



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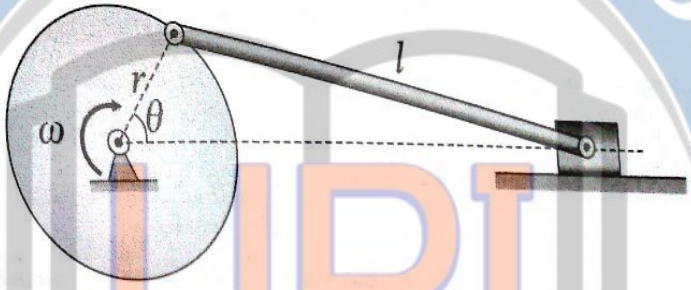
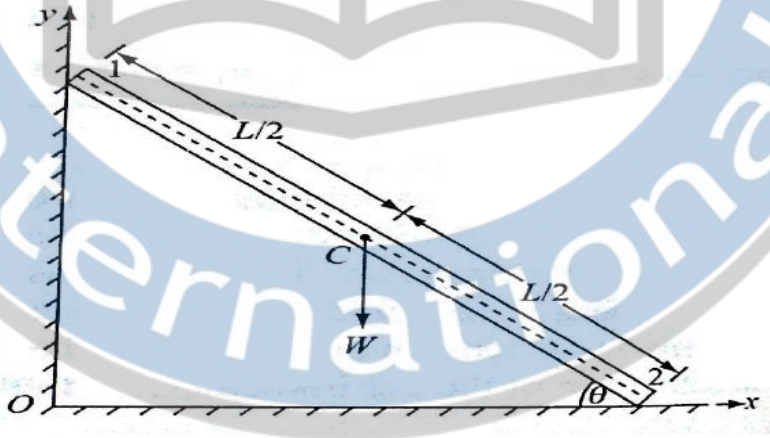
UNIT – IV

8 For the slider-crank mechanism shown in the figure below, determine: (i) The velocity of the slider. (ii) The angular velocity of the connecting rod.



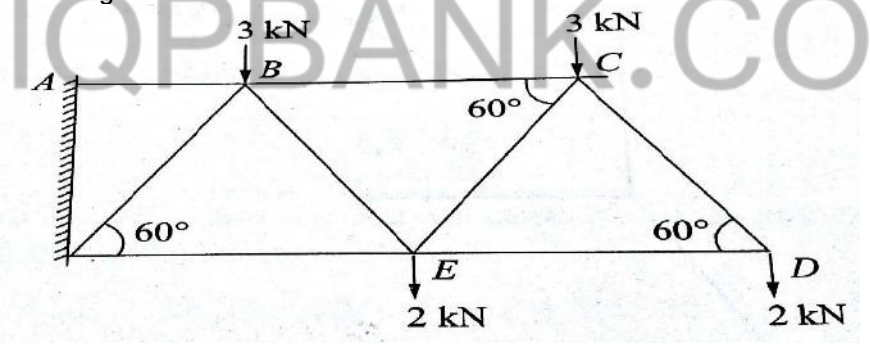
OR

9 A uniform bar of length L and weight W rests on smooth surfaces as shown in the figure below. Obtain an expression for the angular velocity of the bar and determine the angle θ at which the bar no longer touches the vertical wall.



UNIT – V

10 A warren type cantilever truss with imposed loads shown in figure below. Find the forces in all the members of the truss using method of tension coefficients.



OR

11 (a) Obtain the expression for the motion of a particle in simple harmonic motion

(b) Give the differential equation of motion for a compound pendulum when it performs an oscillatory motion about the fixed axis through a point of support. Also obtain the expression for the equivalent length and maximum frequency of oscillation of a compound pendulum.

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