Code: 13A01101

R13

B.Tech I Year (R13) Supplementary Examinations December/January 2014/2015

ENGINEERING MECHANICS

(Common to CE, ME and Ch.E)

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 is the difference between the collinear and concurrent forces?

(b) State parallelogram law of forces

(c) Explain the term Cone of friction.

(d) Stae the laws of static and dynamic friction.

(e) Define centre of gravity and centroid

(f) State the parallel axis theorem

(g) What do you mean by rectilinear motion and give examples

(h) Explain the principle of conversation of energy

(i) Define perfect frame and imperfect frame.

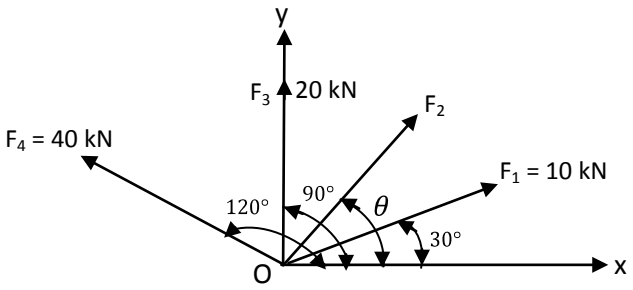
(j) What do you understand by free vibrations?

PART – B

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

UNIT - I

2 The resultant of four forces which are acting at a point O as shown in figure below is along Y-axis. The magnitude of forces F_1, F_3 and F_4 are 10 kN, 20 kN and 40 kN respectively. The angles made by 10 kN, 20 kN and 40 kN with X- axis are 30^0, 90^0 and 120^0 respectively. Find the magnitude and direction of force F_2 if resultant is 72 kN.



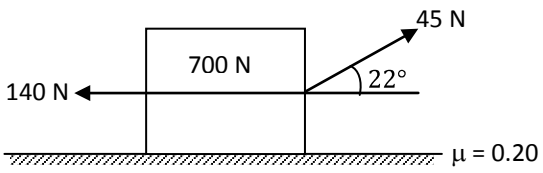
OR

3 (a) A simply supported beam of length 6 m carrying a uniformly distributed load of 5 kN/m over a length of 3 m from the right end. Calculate the reactions at both ends.

(b) A force of 100 N is acting at a point making an angle of 30^0 with the horizontal. Determine the components of this force along X and Y axis.

UNIT - II

4 Find the frictional force in the block shown in figure below and state whether the block is in equilibrium or in motion. Also determine the additional force 'P' that must be added to 140 N force, to just move the block to the left.



OR

5 A block over lying a 10^0 wedge on a horizontal floor and leaning against vertical wall weighing 1500 N is to be raised by applying a horizontal force to the wedge. Assuming co-efficient of friction between all the surfaces in contact to be 0.3. Determine the minimum horizontal force to be applied to raise the block.

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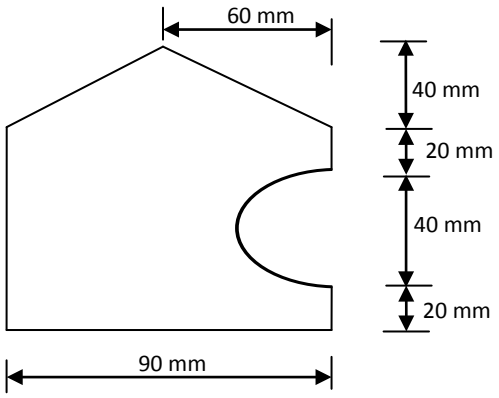
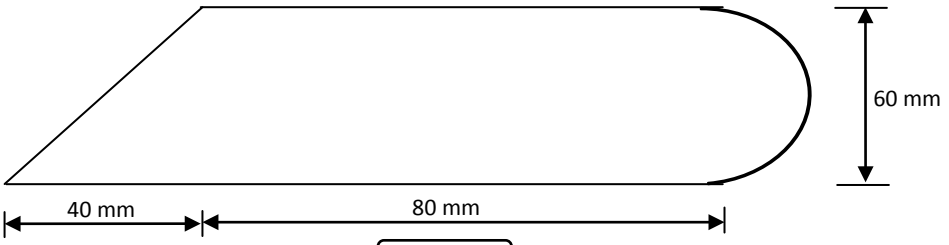
UNIT - III

6 Locate the centroid of plane area as shown in figure below.



OR

7 Calculate the moment of inertia of the section shown in figure below about xx and yy axis through the centroid.



UNIT - IV

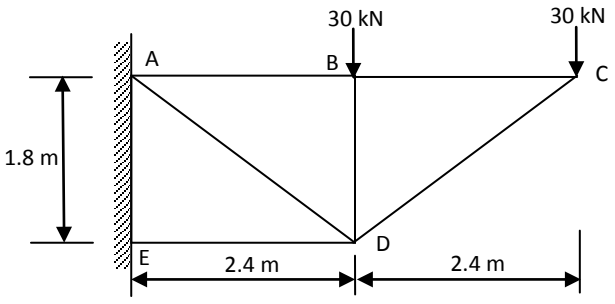
8 The motion of a particle along a straight line is defined by relation $x = t^3 - 4.5t^2 + 5$, where 'x' is in meters and 't' in seconds. Plot motion curves from t = 0 to t = 5 s with $\Delta t = 0.5$ s.

OR

9 A spring is used to stop 10 kg package which is moving down on an inclined plane and makes an angle of 25^0 with horizontal. The spring constant is K = 30 kN/m and is held by cables so that it is initially compressed by 80 mm. If the velocity of the package is 8 m/s when it is at 15.5 m from the spring, determine the maximum additional deformation of the spring in bringing the package to the rest position. Assume μ = 0.30.

UNIT - V

10 Find the forces in the members of the truss shown in figure below.



OR

11 A body oscillates with a simple harmonic motion along x- axis. Its displacement varies with time according to $x = 8 \cos(\pi t + \pi/4)$, where t is in seconds and angle in radians.

(a) Determine amplitude, frequency and period of vibration.
(b) Calculate the velocity and acceleration of the body at any time 't'.
(c) Using results of (b), determine the position, velocity and acceleration of the body at t = 1 second.

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