Code No: R201203 **R20** SET - 1

I B. Tech II Semester Regular Examinations, September- 2021

ENGINEERING MECHANICS

(Only for CE))

Time: 3 hours Max. Marks: 70

Answer any five Questions one Question from Each Unit
All Questions Carry Equal Marks

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UNIT-I

1 a) A system of forces consists of (9M)

(i) Force $P_1 = 3i + 5j – 6k$ acting through point (2, 1,-3)

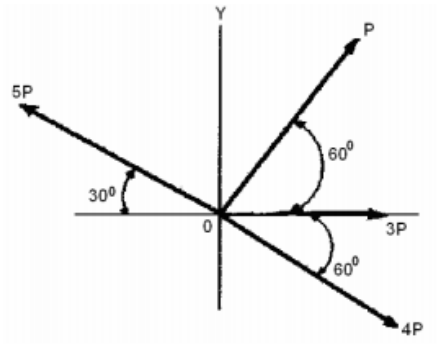
(ii) Force $P_2 = 5i – 4j + 3k$ acting through point (1, 4, 2) and a moment $M = 20i – 35j + 60k$. The forces are in Newton (N) units, distances in 'm' units and the moment in 'N-m' units. Calculate

i) The component of the resultant forces and its magnitude
ii) The total moment of the system about the origin 'O'.
iii) The moment of the system about the line through 'O' drawn in the 1st octant which makes angles of 65^o and 75^o with X and Y axes respectively.

b) Write the moment of force and its application? (5M)

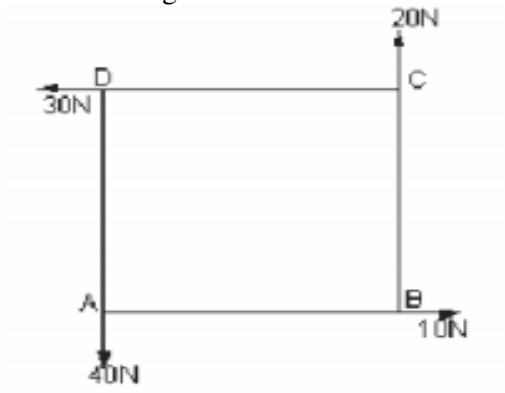
Or

2 a) Find the magnitude and direction of the resultant R of four concurrent forces acting as shown in figure (7M)



Figure

b) Four forces of magnitudes 10 N, 20 N and 30 N and 40 N are acting respectively along the four sides of a square ABCD with dimensions 500 mm × 500 mm as shown in Figure Determine the magnitude and direction of the resultant force. (7M)



Figure
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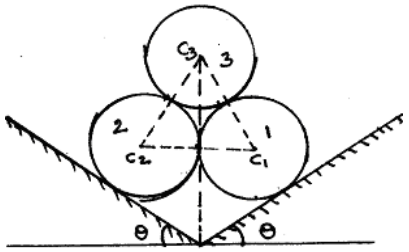
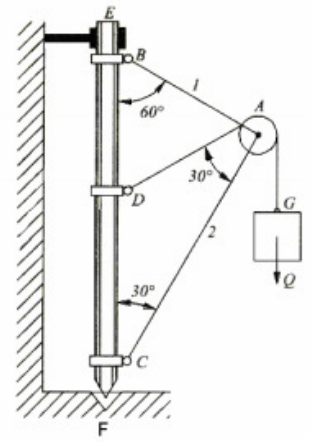
UNIT-II

3 a) Three identical cylinders, each weighing W, are stacked as shown in figure on smooth inclined surfaces, each inclined at an angle 'θ' with the horizontal. Determine the smallest angle 'θ' to prevent stack from collapsing. (7M)



Figure

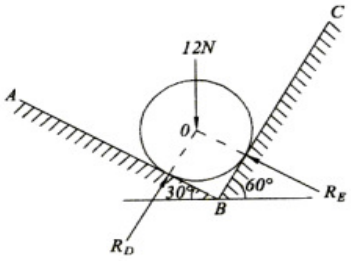
b) A pulley A is supported by two bars AB and AC which are hinged at points B and C to a vertical mast EF as shown in figure. Over the pulley hangs a flexible cable DG which is fastened to the mast at D and carries at the other end G a load Q = 20 kN. Neglecting friction in the pulley, determine the forces produced in the bars AB and AC. The angles between the various members are as shown in the figure (7M)



Figure

Or

4 a) A ball of weight Q = 12 N rests in a right - angled trough, as shown in figure Determine the forces exerted on the sides of the trough at D and E if all surfaces are perfectly smooth. (7M)



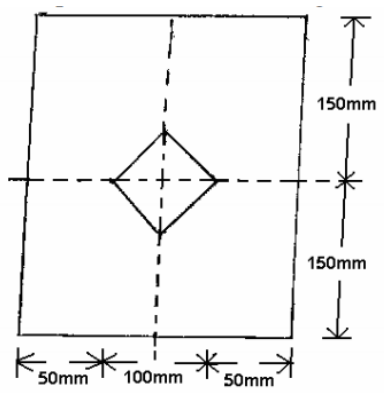
Figure

b) Explain Lamis theorem and converse of the triangle law of forces. (7M)

UNIT-III

5 a) Discuss static friction and angle of friction. (5M)

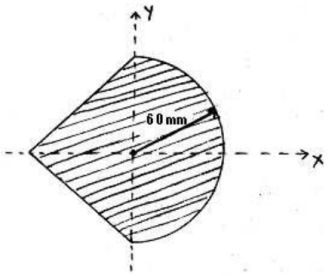
b) Locate the centroid of the plane area shown in figure. (9M)



Figure

Or

6 a) Locate the centroid of a shaded area as shown in figure. (9M)



Figure

b) State and define Pappus theorem in detail? (5M)

UNIT-IV

7 a) Compute moment of inertia of hemisphere about its diametral base of radius 'R'. (7M)

b) Calculate the mass moment of inertia of a circular cone of base radius 300mm and height 600mm about a line which passes through the mass centre of the cone and which is parallel to the base of the cone. The mass density of the cone is 2500 kg/m^3. (7M)

Or

8 A rectangular parallelopiped has the following dimensions. (14M)

Length along x-axis = 'l'
Height along y-axis = 'a'
Breadth along z-axis = 'b'
Density of the material is 'w'

Determine the mass moment of inertia of the parallelopiped about the centroidal axes.

UNIT-V

9 a) A particle under a constant deceleration is moving in a straight line and covers a distance of 20m in first two seconds and 40m in the next 5 seconds. Calculate the distance it covers in the subsequent 3 seconds and the total distance covered, before it comes to rest. (7M)

b) The acceleration of a particle in rectilinear motion is defined by the relation $a = 25 - 4s^2$ where 'a' is expressed in m/sec^2 and's' is position coordinate in metres. The particle starts with no initial velocity at the position s = 0. Determine (i) the velocity when s = 3 metres (ii) the position where the velocity is again zero (iii) the position where the velocity is maximum. (7M)

Or

10 A 2000 Kg Automobile is driven down a 5^0 incline at a speed of 90 km/h. When the brakes are applied causing a constant total braking force of 7.5 KN. Determine the distance travelled by Automobile as it comes to stop. Use work-energy method. (14M)