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**Question Paper Code: R2104**

B.E./B.Tech. DEGREE EXAMINATION, APRIL 2024

Second Semester

Civil Engineering

R21UCE204- ENGINEERING MECHANICS

(Regulations R2021)

Duration: Three hours

Maximum: 100 Marks

Answer All Questions

PART A - (5x 1 = 5 Marks)

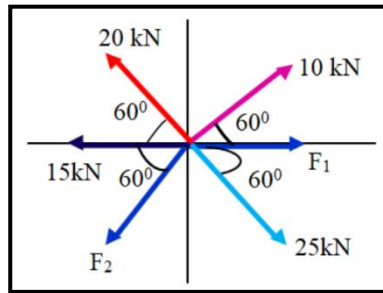
1. What is the relationship between each force, if three concurrent forces acting on a body according to Lami's theorem? CO1-U
  - (a) Directly proportional to the sine of the angle between the other two forces
  - (b) Inversely proportional to the cosine of the angle between the other two forces
  - (c) Directly proportional to the cosine of the angle between the other two forces
  - (d) Inversely proportional to the sine of the angle between the other two forces
2. The internal force in structures among the following is? CO1-U
  - (a) Gravity force
  - (b) Compression force
  - (c) Impact force
  - (d) Bending force
3. What is the formula of radius of gyration? CO1-U
  - (a)  $k^2 = I/A$
  - (b)  $k^2 = I^2/A$
  - (c)  $k^2 = I^2/A^2$
  - (d)  $k^2 = (I/A)^{1/2}$
4. The co-efficient of friction depends upon CO1-U
  - (a) Nature of surfaces
  - (b) Area of contact
  - (c) Shape of the surfaces
  - (d) All of the above
5. The Newton's Second Law of Motion gives a relation between force, mass and \_\_\_\_\_ CO1-U
  - (a) Velocity
  - (b) Time
  - (c) Acceleration
  - (d) Distance

PART – B (5 x 3= 15 Marks)

6. State the equilibrium of a coplanar system of forces. CO1-U
7. Sketch the different types of supports with support reactions. CO1-U
8. How would you find out the centroid of composite sections? CO1-U
9. What is the force F required to just initiate the block shown in figure to slide if Coefficient of friction between the surfaces in contact is 0.4? CO4 -Ana
10. The motion of a particle is defined by the relation  $S=t^3-9t^2+24t-2$  where s is the distance in cm and t is in sec. Determine the position, velocity and acceleration when  $t=5\text{sec}$ ? CO2 – App

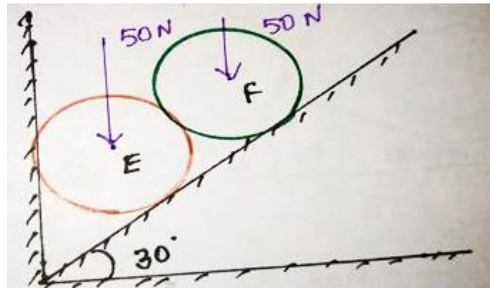
PART – C (5 x 16= 80 Marks)

11. (a) Determine the unknown forces  $F_1$  &  $F_2$  for the force system as shown in fig. CO5-Ana (16)



Or

- (b) Two identical rollers, each of weight 50 N, are supported by an inclined plane on vertical wall as shown in fig. Find the reactions at the points of A, B and C. Assume all the surfaces to be smooth. CO5- Ana (16)

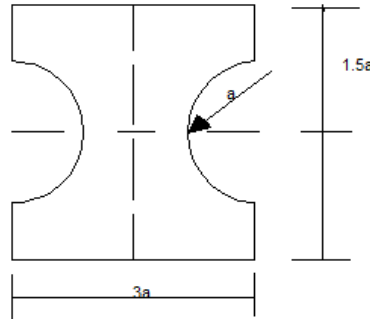


12. (a) A force  $(10i+20j-5k)\text{N}$  acts at a Point  $P(4,3,2)\text{m}$ . Determine the moment of this force about the point  $G(2,3,4)\text{m}$  in vertical form. Also find the magnitude of the moment and its angles with respect to x,y,z. CO4- Ana (16)

Or

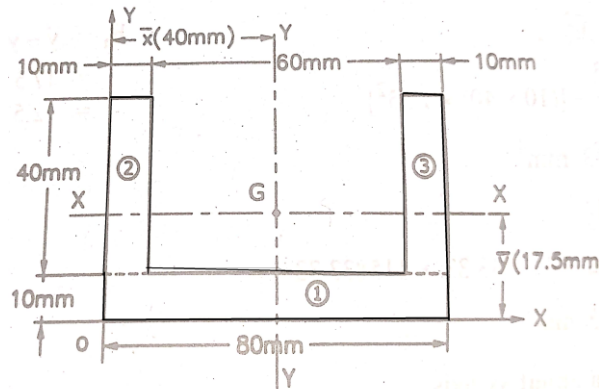
- (b) Find the magnitude and location of the single equivalent force for a beam AB of length 8 m having a point C at 3m from A subjected to the following forces, CO4- Ana (16)  
 An upward force 10N at A  
 A downward force 10N at C  
 An upward force of 40N at B

13. (a) Determine the moment of inertia of the shaded region shown in figure with respect to x axis and y axis when  $a=20\text{mm}$ . CO3- App (16)

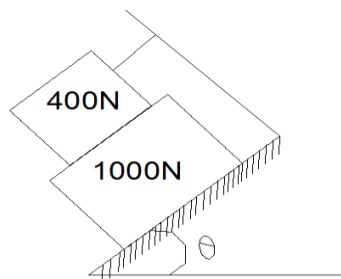


Or

- (b) Find the moment of inertia of the section shown below in figure. CO3- App (16)

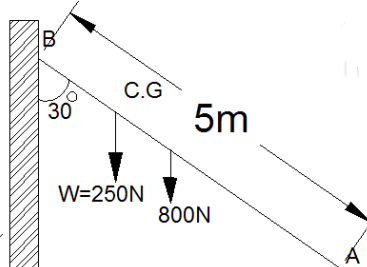


14. (a) What should be the value of the angle  $\theta$  so that motion of the 1000N block impends down the plane? The coefficient of friction  $\mu$  for all surfaces is  $\frac{1}{4}$ . CO4- Ana (16)

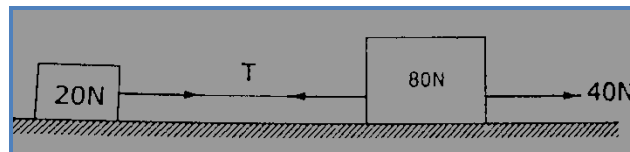


Or

- (b) A uniform ladder of weight 250N and length 5m is placed against a vertical wall in a position where its inclination to the vertical is  $30^\circ$ . A man weighing 800N climbs the ladder. At what positions will be induce slipping? Take coefficient of friction  $\mu=0.2$  at both the contact surfaces of the ladder. CO4- Ana (16)



15. (a) Two weights 20 N and 80 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 fig., CO6-Ana (16)  
 The co-efficient 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 Newton's Second Law.



Or

- (b) A vehicle is moving with a velocity of 15 m/sec. the car is brought to rest by applying brakes in 10 seconds. Find i) retardation ii) distance travelled by the car after applying brakes. CO6-Ana (16)