C   Reg. No. :

Question Paper Code: R2104

B.E./B.Tech. DEGREE EXAMINATION, NOV 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   CO1-U
    acting on a body according to Lami's theorem?

    (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) $k2 = I/A$ (b) $k2 = I2/A$ (c) $k2 = I2/A2$ (d) $k2 = (I/A)1/2$

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   CO1-U
    and _____

    (a)Velocity   (b) Time   (c)Acceleration   (d) Distance

PART – B (5 x 3= 15 Marks)

6. Write down the expression for the force vector AB.
   Coordinates of A (5,4,8)
   Coordinates of B (2,9,7)
   Position Vector
   Unit Vector
   Tension in AB

   CO2 – App

7. A beam AB of span 10m is loaded with udl of 15 kN/m. Determine the equivalent point load.

   CO2 – App

8. Find the polar moment of inertia of a hollow circular section of outer diameter 80mm and inner diameter 40 mm about an axis through its centroid.

   CO1-U

9. A cubical block rests on an inclined plane having coefficient of friction as 0.33. Determine the angle of inclination when the block just slides down the inclined plane.

   CO4 -Ana

10. A car accelerates uniformly from a speed of 30 Km/Hr to a speed of 75 Km/Hr in 5 secs. Determine the acceleration of the car and the distance traveled by the car during 5 secs.
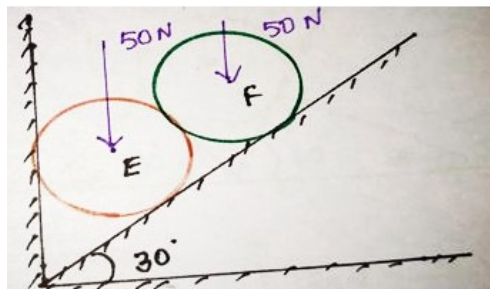
    CO2 – App

PART – C (5 x 16= 80 Marks)

11. (a) Determine the unknown forces F1 & F2 for the force system as shown in fig.
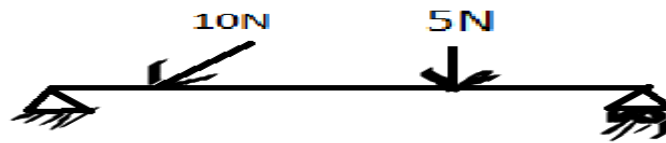
    CO5-Ana (16)
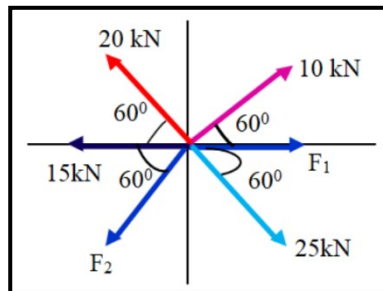
Or

   (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)

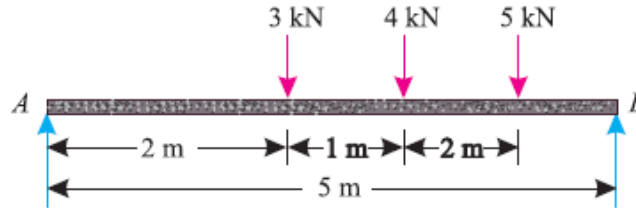**R2104**

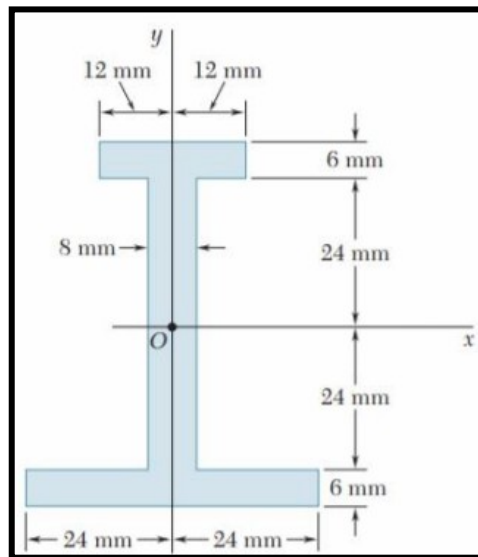12. (a) Find the reaction about A and B   CO4- Ana (16)

10N   5N

Or

(b) Simply supported beam AB of span 5 m is loaded as shown in   CO4- Ana (16)
Fig. Find the reactions at A and B

3 kN   4 kN   5 kN

A   B

$\leftarrow$ 2 m $\longrightarrow$ $\leftarrow$1 m$\rightarrow$$\leftarrow$2 m$\rightarrow$

$\leftarrow$ 5 m $\rightarrow$

13. (a) Find the Moment of Inertia of the Unsymmetrical I Section as   CO3- App (16)
shown in fig.,

12 mm   12 mm

6 mm

8 mm$\rightarrow$ $\leftarrow$ 24 mm

O   x

24 mm

6 mm

$\leftarrow$ 24 mm $\rightarrow$$\leftarrow$ 24 mm $\rightarrow$

Or

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

Y

$\bar{x}$(40mm) $\rightarrow$ Y

10mm $\rightarrow$ 60mm $\longrightarrow$ $\leftarrow$ 10mm

40mm   ②   G   ③   X

X $\bar{y}$(17.5mm

10mm   ①   X

O $\leftarrow$ 80mm $\rightarrow$

Y

3

R2104
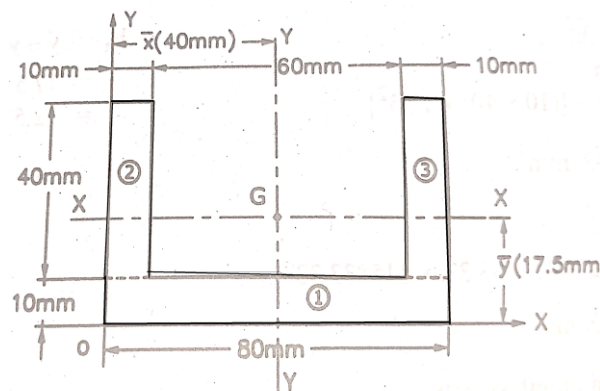
14. (a) A block of weight W1=1290N rests on a horizontal surface and supports another block of weight W2=1290N on the top of it as shown in fig 2. Block of weight W2 is attached to a vertical wall by an inclined string AB. Find the force 'p'applied to the lower block that will be necessary to cause the slipping to impend.   CO4- Ana (16)
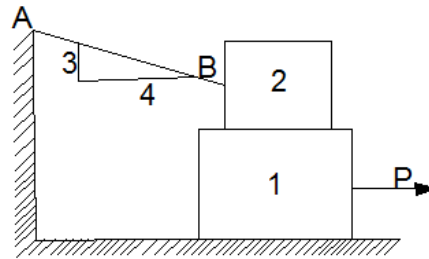
Or

(b) A ladder of weight 350N and length 7m is placed against a vertical wall in a position where its inclination to the vertical is 45°. A man weighing 750N climbs the ladder. At what positions will be induce slipping? Take coefficient of friction μ=0.2 at both the contact surfaces of the ladder.   CO4- Ana (16)

15. (a) A car is moving with a velocity of 20 m/sec. the car is brought to rest by applying brakes in 6 seconds. Find i) retardation ii) distance travelled by the car after applying brakes.   CO6-Ana (16)

Or

(b) A spring is stretched by 50 mm by the application of a force. Find the work done, if the force required to stretch 1 mm of the spring is 10 N.   CO6-Ana (16)

R2104