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Reg. No. :

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**Question Paper Code: R3705**

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

Third Semester

Mechanical Engineering

R21UME305 –ENGINEERING MECHANICS

(Regulations R2021)

Duration: Three hours

Maximum: 100 Marks

Answer All Questions

PART A - (10 x 1 = 10 Marks)

1. The unit of weight \_\_\_\_\_ . CO1- U  
(a) kilogram                      (b) Newton                      (c) Watt                      (d) Gram
2. According to the Newton's First Law, The Resultant R is CO1- U  
(a)  $R \neq 0$                       (b)  $R = 1$                       (c) R is infinitive                      (d) 0
3. Unit of Moment? CO1- U  
(a) N                      (b) N M                      (c) m m                      (d)  $m^2$
4. Following is not a scalar quantity ? CO1- U  
(a) Density                      (b) mass                      (c) Volume                      (d) Acceleration
5. Moment of inertia is the CO2  
(a) Second moment of force                      (b) second moment of area  
(c) Second moment of mass                      (d) all the above
6. The point at which the resultant of all \_\_\_\_\_ act is called Centre of gravity. CO1- U  
(a) Perpendicular forces                      (b) Parallel forces  
(c) Inclined forces                      (d) all of the above
7. Varignon's theorem is used to find \_\_\_\_\_ CO1- U  
(a) direction of resultant force                      (b) location of resultant force  
(c) magnitude of resultant force                      (d) nature of resultant force

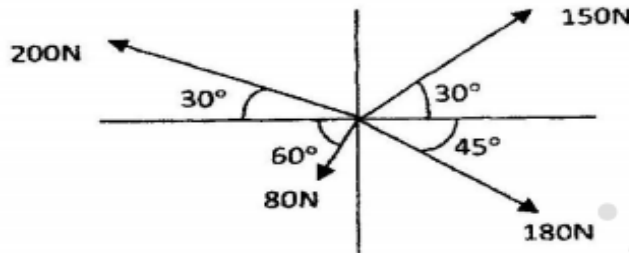
8. Two non-collinear parallel equal forces acting in opposite direction CO1- U  
 (a) Balance each other (b) constitute a moment  
 (c) Constitute a couple (d) constitute a moment of couple
9. The coefficient of friction depends on CO1- U  
 (a) Area of contact (b) shape of surfaces (c) Strength of surfaces (d) nature of surface
10. The ratio of limiting friction and normal reaction is known as CO1- U  
 (a) Coefficient of friction (b) angle of friction  
 (c) Angle of repose (d) sliding friction

PART – B (5 x 2= 10 Marks)

11. Demonstrate fundamental and derived units? Give examples CO1- U
12. Comment varignon’s theorem with formula CO1- U
13. Distinguish centroid and center of gravity. CO1- U
14. Illustrate D’Alembert’s principle CO1- U
15. Illustrate friction. CO1- U

PART – C (5 x 16= 80 Marks)

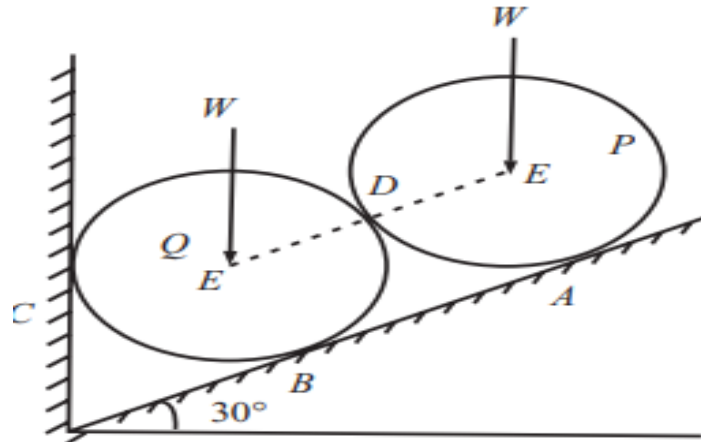
16. (a) Predict the Resultant of the concurrent force system shown in the following Figure. CO2-App (16)



Or

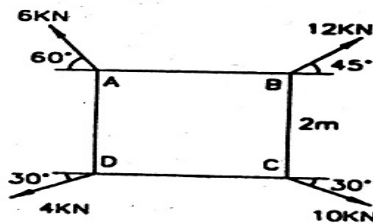
- (b) The resultant of the two forces, when they act at an angle of  $60^\circ$  is 14 N. If the same forces are acting at right angles, their resultant is  $\sqrt{137}$ N. Compute the magnitude of the two forces. CO2-App (16)

17. (a) Two identical rollers, each of weight  $W = 50\text{N}$  are supported by an inclined plane and a vertical wall as shown in figure below. Solve the reactions at the point of supports. Assume all the surfaces to be smooth. COI- U (16)

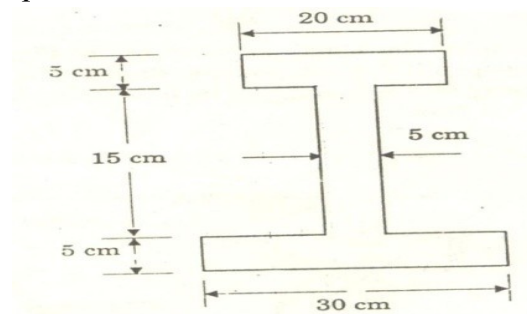


Or

- (b) Four forces of magnitude and direction acting on a square ABCD of side 2 m are shown in the figure. Solve the resultant in magnitude and direction and also locate its point of application with respect to the sides AB and AD COI- U (16)



18. (a) Solve the Principal Moment of Inertia and Locate the Principal Axes of an unequal I- section about centroidal axes COI- U (16)

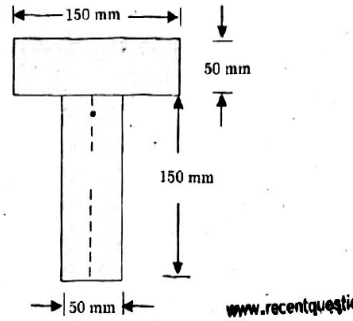


Or

- (b) Solve the moment of inertia of shaded area as shown in figure COI- U (16)

about  $I_{xx}$  axis and  $I_{yy}$  axis.

Find the area moment of inertia of the T section, shown in Fig.



19. (a) A Burglar's car had a start with acceleration of  $2 \text{ m/s}^2$ . A police vigilant party came after 5 second and continued to chase the Burglar's car with a uniform velocity of  $20 \text{ m/s}$ . Find the time taken in which the police van will overtake the Burglar's car? CO3-App (16)

Or

- (b) A car is moving with a velocity of  $15 \text{ m/sec}$ . The car is brought to rest by applying brakes in 5 seconds. Determine i) The retardation  
ii) Distance travelled by the car after applying brakes. CO3-App (16)

20. (a) A Uniform ladder of weight  $1000 \text{ N}$  and length  $4 \text{ m}$  rests on a horizontal ground and leans against a smooth vertical wall. The ladder makes an angle of  $60^\circ$  with horizontal, when a man of weight  $750 \text{ N}$  stands on the ladder at a distance of  $3 \text{ m}$  from the top of the ladder, the ladder is at the point of sliding. Determine the Coefficient of friction between ladder and the floor. CO3-App (16)

Or

- (b) Block (2) rests on block (1) and is attached by a horizontal rope AB to the wall as shown in fig. What force P is necessary to cause motion of block (1) to impend? The co-efficient of friction between the blocks is  $\frac{1}{4}$  and between the floor and block (1) is  $\frac{1}{3}$ . Mass of blocks (1) and (2) are  $14 \text{ kg}$  and  $9 \text{ kg}$  respectively. CO3-App (16)

