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Question Paper Code: R3705

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2025

Third Semester

Mechanical Engineering

R21UME305 – BASICS OF ENGINEERING MECHANICS

(Regulations R2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The forces, whose line of action lie on the same line, are known as CO 2 - App
(a) coplanar forces (b) concurrent forces
(c) collinear forces (d) none of the above
2. Forces in space are represented using CO1- U
(a) 1D system (b) 2D vectors (c) 3D vectors (d) Scalars
3. A free body diagram is used to represent the CO1- U
(a) external boundaries (b) internal stresses
(c) all forces acting on a body (d) Sketch geometry
4. A couple consists of two 30 N forces separated by 0.4 m. What is the CO1- U
moment of the couple?
(a) 12 Nm (b) 30 Nm (c) 24 Nm (d) 6 Nm
5. Perpendicular axis theorem is applicable to CO1- U
(a) 1D line (b) Solids (c) Spheres only (d) Plane areas
6. Polar moment of inertia is useful in analysis of CO1- U
(a) m^4 (b) m^3 (c) m^2 (d) m^1
7. If two cars move towards each other with velocities 30 km/h and 40 km/h, CO 4 - App
the relative velocity is
(a) 10 km/h (b) 70 km/h (c) 35 km/h (d) 40 km/h
8. The change in momentum of a particle is equal to CO1- U

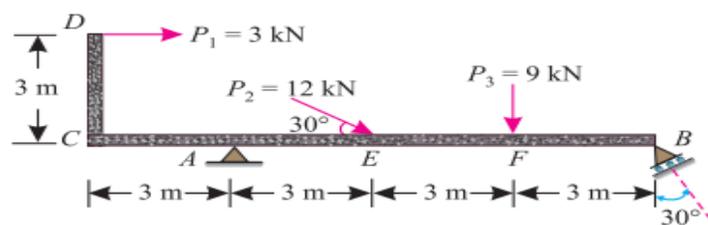
- (a) Impulse applied (b) Work done (c) Kinetic energy (d) Mass
9. A body weighing 100 N is just on the point of motion with $\mu = 0.4$. The force required to move it is CO 3 - App
- (a) 20 N (b) 40 N (c) 60 N (d) 25 N
10. If the helix angle is less than the friction angle, the screw jack is CO 3 - App
- (a) Self-locking (b) Overhauling (c) Frictionless (d) None of the above

PART – B (5 x 2= 10 Marks)

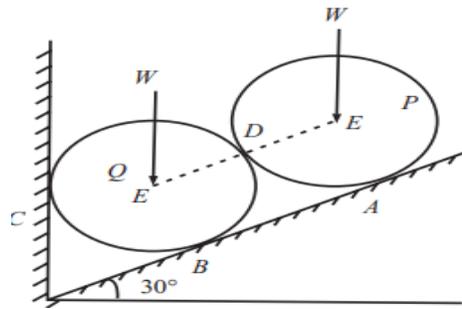
11. State the principle of transmissibility CO1- U
12. Convert the UDL load into Point Load CO1- U
13. State Varignon's theorem. CO1- U
14. Define mass moment of Inertia CO 1 - U
15. List the value of coefficient of restitution. CO 1 - U

PART – C (5 x 16= 80Marks)

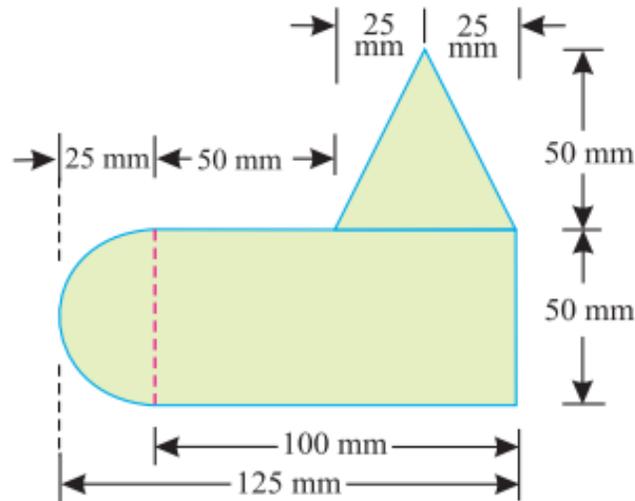
16. (a) (i) The forces 20 N, 30 N, 40 N, 50 N and 60 N are acting at one of the angular points of a regular hexagon, towards the other five angular points, taken in order as shown in figure. Find the magnitude and direction of the resultant force. CO2-App (8)
- (ii) The following forces act at a point: CO2- App (8)
- 20 N inclined at 30° towards North of East,
 - 25 N towards North,
 - 30 N towards North West, and
 - 35 N inclined at 40° towards South of West.
- Calculate the magnitude and direction of the resultant force.
- (b) Find the resultant and direction of a system of concurrent space force having the following magnitude and passing through the origin O, A 50N (3, 2,2), B 50N (-12,4,-3), C 80N (3,2,-6). CO2-App (16)
17. (a) Determine the reaction force at support CO2 - App (16)



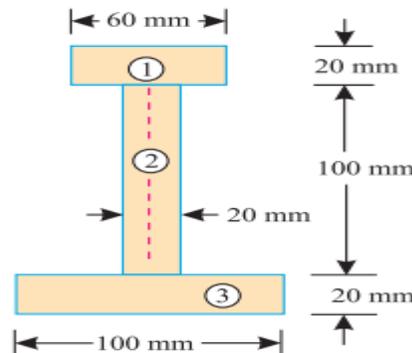
- (b) Two identical rollers, each of weight $W = 50\text{N}$ are supported by an inclined plane and a vertical wall as shown in figure below. Solve the reactions at the point of supports. Assume all the surfaces to be smooth. CO2-App (16)



18. (a) Calculate the centroid of the given section CO3-App (16)



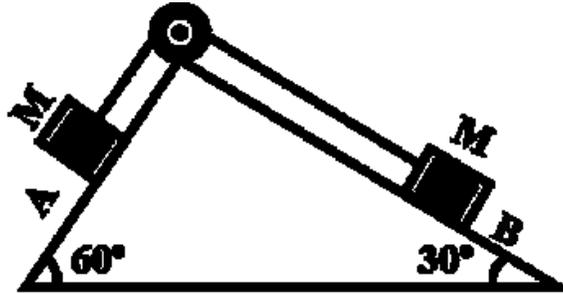
- (b) Calculate the Moment of Inertia of the section CO3-App (16)



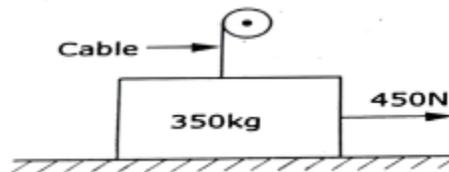
19. (a) A burglar car had a start with an acceleration of 2m/s^2 . A police vigilant party came after 5 seconds and continued to chase the CO4-App (16)

burglar car with a uniform velocity of 20m/s. calculate the time taken in which the police van will overtake a burglar car.

- (b) Solve the acceleration of the weight and tension in the spring of the below figure. Assume all surfaces to be smooth. CO4-App (16)



20. (a) A man can pull horizontally with a force of 450N. A mass of 350 kg is resting on a horizontal surface on which the coefficient of friction is 0.20. The vertical cable of a crane is attached to the top of the block as shown in figure. What will be the tension in the cable if the man is just able to start the block to the right? CO3 App (16)



- (b) Determine the least value of the force P to cause the motion to impend rightwards. Assume coefficient of friction under the blocks to be 0.20 and pulley to be frictionless. CO 3 - App (16)

