

**B.Tech DEGREE EXAMINATION, NOVEMBER 2023**

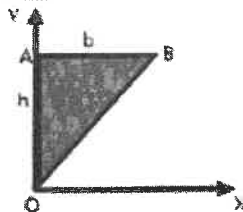
Third Semester

**18ASC101T - APPLIED ENGINEERING MECHANICS***(For the candidates admitted during the academic year (2020-2021 & 2021-2022))***Note:**

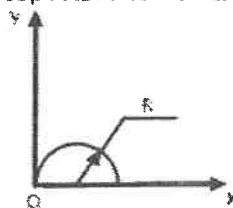
- i. **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40<sup>th</sup> minute.
- ii. **Part - B** and **Part - C** should be answered in answer booklet.

**Time: 3 Hours****Max. Marks: 100****PART - A (20 × 1 = 20 Marks)****Marks BL CO**Answer **all** Questions

- Forces acting in a system on a plane are called \_\_\_\_\_.  
(A) Concurrent Force System (B) Co-linear Force System  
(C) Co-Planar Force System (D) Parallel Force System
- Which of the following is the vector quantity?  
(A) Mass (B) Energy  
(C) Momentum (D) Angle
- How many degrees of freedom is constrained in Hinged support?  
(A) 1 (B) 2  
(C) 3 (D) 4
- Two forces act towards a point: one is vertically upwards 300N and the other force Horizontally towards Left 200N. What is the resultant direction with reference to the first quadrant zero-degree reference?  
(A) 56.31 (B) 123.69  
(C) 236.31 (D) 303.69
- For the given fig. find the centroid position relative to 'O' where b = 3 units and h = 3 units.



- For the above semi-circular arc of radius R = 4 units, the centroid position with respect to 'O' is \_\_\_\_\_.  
(A) (1.5, 1.5) (B) (1, 1)  
(C) (2, 2) (D) (1, 2)
- For the above semi-circular arc of radius R = 4 units, the centroid position with respect to 'O' is \_\_\_\_\_.  
(A) (4, 2.546) (B) (4, 3.39)  
(C) (2.546, 4) (D) (3.39, 4)



- Second theorem of Pappus - Guldinus Theorem states that \_\_\_\_\_.  
(A)  $X = \int x \cdot dA$  (B)  $Y = \int y \cdot dA$   
(C)  $A = 2\pi yL$  (D)  $V = 2\pi yA$

8. If the area of the centroid is symmetrical on an axis then the centroid will be lying \_\_\_\_\_.  
 (A) Some where along the symmetry line (B) Anywhere on the area  
 (C) In the mid point of the symmetry line (D) Away from the symmetry line
9. A car starting from rest is accelerated at the rate of  $0.5 \text{ m/s}^2$ . Find the distance covered by the car in 15 seconds.  
 (A) 45.25 m (B) 56.25 m  
 (C) 64.25 m (D) 80 m
10. A car had a start with an acceleration of  $2 \text{ m/s}^2$ . A bike came after 5 seconds and continued to chase the car with a uniform velocity of  $20 \text{ m/s}$ . Find the time taken, in which the bike will overtake the car.  
 (A) 20 s (B) 15 s  
 (C) 10 s (D) 5 s
11. Which of the following statement is wrong?  
 (A) A bus going down the valley may have variable acceleration (B) A body falling freely under the force of gravity is an example of motion under variable acceleration  
 (C) A lift going down in a gold mine cannot have constant acceleration in the entire journey (D) In a cricket match, the ball does not move with constant acceleration.
12. Which is the most suitable method for solving kinematics problem involving force, velocity and displacement?  
 (A) D'Alembert's Principle (B) Work & Energy  
 (C) Impulse and momentum (D) Newton's 2<sup>nd</sup> law
13. A flywheel starts from rest and revolves with an acceleration of  $0.5 \text{ rad/s}^2$ . What will be its angular velocity and angular displacement after 10 seconds.  
 (A) 5 rad/s (B) 8 rad/s  
 (C) 10 rad/s (D) 12 rad/s
14. In order to fulfill the condition of rolling without slipping, the applied force should be \_\_\_\_\_ the friction force available.  
 (A) Greater than (B) Equal to  
 (C) Lesser than (D) Independent
15. Large force acting on a particle for a very short duration which produces definite change in the momentum is called as \_\_\_\_\_.  
 (A) Pressure (B) Uniform force  
 (C) Impulse force (D) Friction force
16. The time derivative of angular momentum gives \_\_\_\_\_.  
 (A) Angular Velocity (B) Angular Acceleration  
 (C) Torque (D) Work
17. Which orbit is followed by geosynchronous satellite?  
 (A) circle (B) elliptic  
 (C) parabola (D) hyperbola

18. Kepler's third law provides a convenient relation between the periodic times of two satellites describing elliptic orbits about the same body. Denoting the semi major axes of the two orbits by  $a_1$  and  $a_2$ , respectively, and the corresponding periodic times by  $t_1$  and  $t_2$ , we have \_\_\_\_\_.  
 (A)  $\frac{t_1}{t_2} = \frac{a_1^3}{a_2^3}$  (B)  $\frac{t_1^2}{t_2^2} = \frac{a_1^3}{a_2^3}$   
 (C)  $\frac{t_1^3}{t_2^3} = \frac{a_1^3}{a_2^3}$  (D)  $\frac{t_1^2}{t_2^2} = \frac{a_1}{a_2}$
19. Angular momentum of a particle moving under a central force is \_\_\_\_\_.  
 (A) Zero (B) Decreasing  
 (C) Constant (D) Increasing
20. The acceleration due to gravity 'g' is given by \_\_\_\_\_.  
 (A)  $\frac{G.M.m}{R^2}$  (B)  $\frac{G.M.m}{R}$   
 (C)  $\frac{G.M}{R^2}$  (D)  $\frac{G.M}{R}$

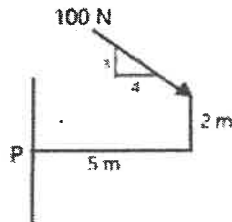
**PART - B (5 × 4 = 20 Marks)**

Answer any 5 Questions

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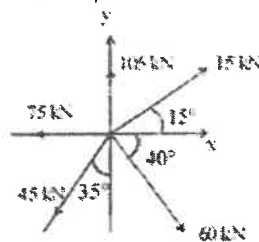
21. Determine the moment about the point P.

4 3 1



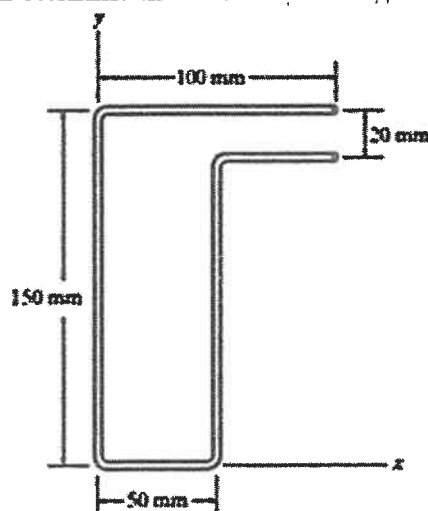
22. Determine the magnitude and direction of the resultant from the given concurrent force system.

4 3 1

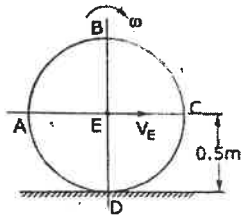


23. Determine the centroid of the given wire in its respective positions.

4 3 2



- |   |   |   |   |
|---|---|---|---|
| 24. A car is moving with a velocity of 20 m/s. The car is brought to rest by applying brakes in 6 seconds. Find the retardation and distance travelled by car after applying the brakes.        | 4 | 3 | 3 |
| 25. A cylinder of radius 0.5m rolls without slipping along a horizontal plane as shown in Fig. at a centre is 3 m/s. Determine the velocity of points A, B, C and D on the rim of the cylinder. | 4 | 3 | 4 |

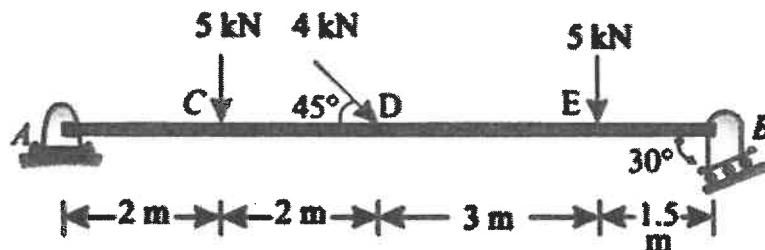


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|---|---|---|---|
| 26. The angle of rotation of a body is given by the equation, $\theta = 3t^3 + 4t^2 - 6t + 9$ , where $\theta$ is expressed in radians and $t$ in seconds, find the Angular velocity. | 4 | 3 | 4 |
| 27. A bomb is released from an aircraft, flying at a speed of 1500 Km/hour on a straight line, 2000 m above the ground. Determine the time required for the bomb to reach the ground. | 4 | 3 | 5 |

**PART - C ( $5 \times 12 = 60$  Marks)**

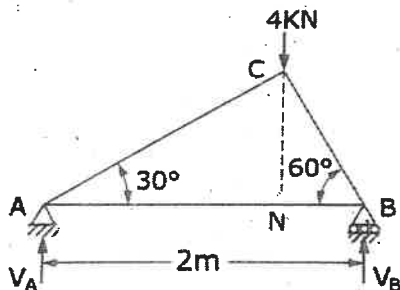
Answer all Questions

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|---|----|---|---|
| 28. (a) A beam AB 8.5 m long is hinged at A and supported on rollers over a smooth surface inclined at $30^\circ$ to the horizontal at B. The beam is loaded as shown in Fig. | 12 | 3 | 1 |
|---|----|---|---|



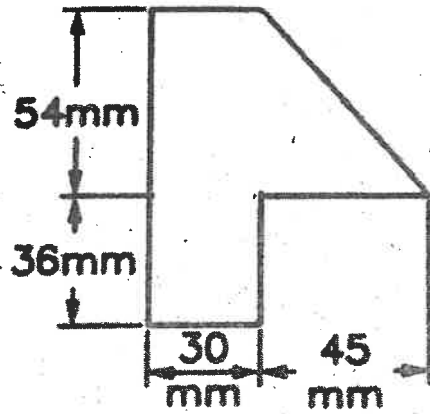
(OR)

- (b) Determine the magnitude and nature of forces in all members of the truss shown in Fig.



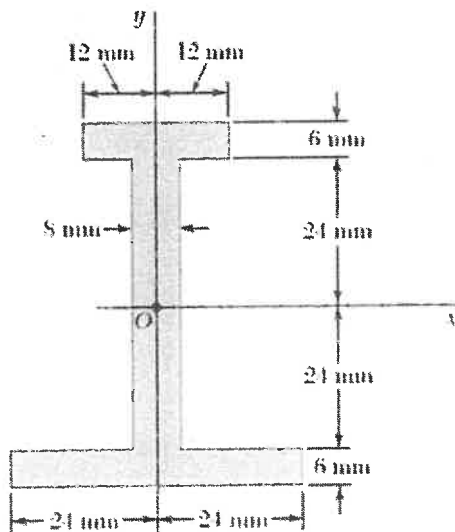
29. (a) Locate the Centroid for the area shown below

12 3 2



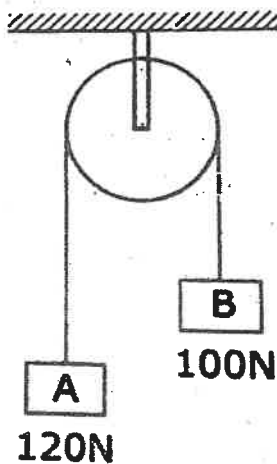
(OR)

(b) Determine the moment of inertia of the shaded area with respect to the x-axis and y-axis



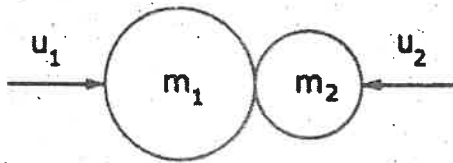
30. (a) Two blocks A and B of weight 120N and 100 N are hung to the ends of the rope, which is passing over an ideal pulley as shown in figure. The velocity of the system is increased from 1m/s to 2 m/s. How much the distance, these blocks will move? Also calculate the tension in the string?

12 3 3



(OR)

- (b) Two bodies one of mass 30kg, moves with a velocity of 9 m/s strikes on an another body of mass 15kg, moves in opposite direction with velocity 9 m/s centrally. Find the velocity of each body after impact, if the coefficient of restitution is 0.8.

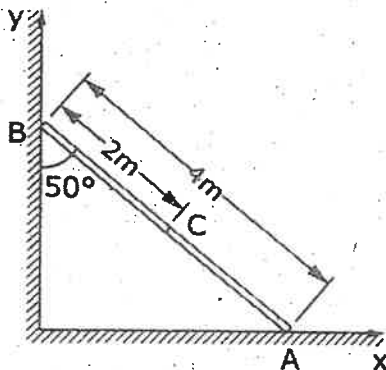


31. (a) A flywheel starts rotating from rest and is given an acceleration of  $2 \text{ rad/s}^2$   
 (i) find the angular velocity and speed in rpm after 60 sec  
 (ii) If the flywheel is brought to rest with a uniform angular retardation of  $125 \text{ rad/s}^2$ , determine the time taken by the flywheel in seconds to come to rest

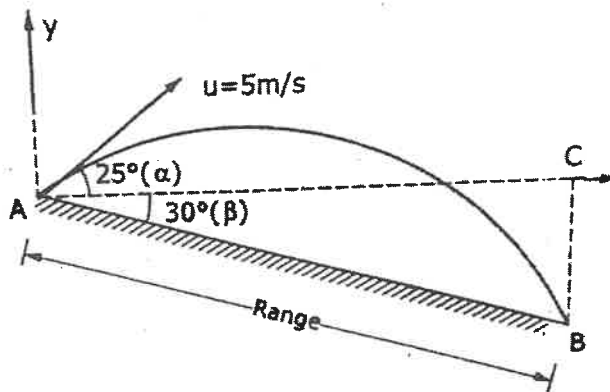
12 3 4

(OR)

- (b) A bar AB of length 4 m has its ends A and B constrained to move horizontally and vertically as shown in figure. The end B moves with a velocity of 10 m/s downwards and makes an angle of  $50^\circ$  with vertical. Determine the velocity of point A and mid-point C.

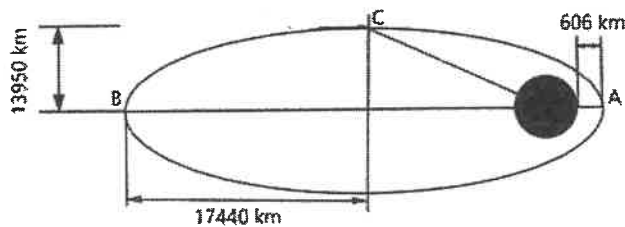


32. (a) A ball is projected from A with velocity  $5\text{ m/s}$  at an angle of  $25^\circ$  as shown in fig. Determine the horizontal and vertical distances of B, which the ball hits the plane, which is  $30^\circ$  below the horizontal.



(OR)

- (b) A satellite describes an elliptic orbit of a minimum altitude of  $606\text{ km}$  above the surface of the earth. The semi-major and semi-minor axes are  $17,440\text{ km}$  and  $13,950\text{ km}$ , respectively. Knowing that the speed of the satellite at point C is  $4.78\text{ km/s}$ , determine (a) the speed at point A, the perigee, (b) the speed at point B, the apogee.



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