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SAINTGITS COLLEGE OF ENGINEERING
KOTTAYAM, KERALA

(AN AUTONOMOUS COLLEGE AFFILIATED TO
APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIRST SEMESTER B.TECH DEGREE EXAMINATION (S), MAY 2022

Course Code: 20EST100

Course Name: ENGINEERING MECHANICS

Max. Marks: 100   Duration: 3 Hours

PART A
### *(Answer all questions. Each question carries 3 marks)*

1. Explain free body diagram with sketches.
2. State and prove Varignon's theorem.
3. Define (a) Angle of friction (b) Angle of repose (c) Cone of friction
4. Discuss the different types of beams based on its support conditions?
5. State and explain parallel axis theorem.
6. State Pappus and Guldinus Theorems.
7. Explain D'Alembert's principle.
8. Displacement of a particle is given by $S=t^3-3t^2+2t+5$. Compute the velocity of the particle at t=1s.
9. Describe the concept of instantaneous center.
10. Define the terms (i) Free vibration and (ii) Forced Vibration

PART B
(Answer one full question from each module, each question carries 14 marks)
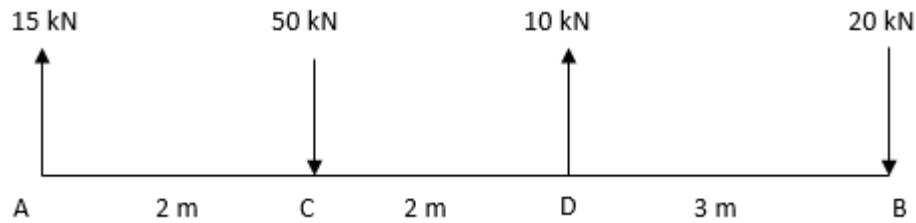### MODULE I

11. a) Show that the resultant of forces is zero for the system of forces shown in figure   (8)
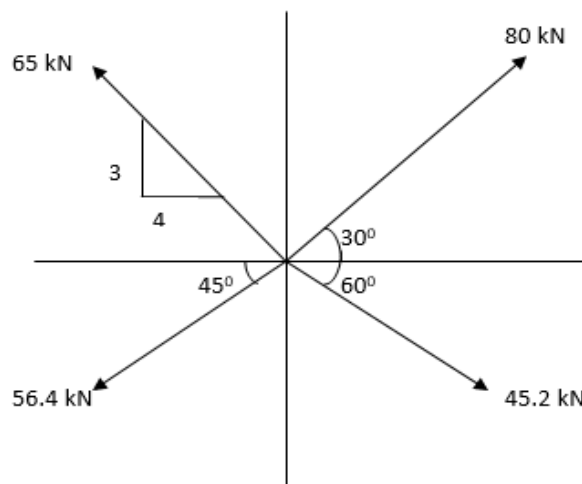
b) A rigid bar is subjected to a system of parallel forces as shown in figure. Modify the system to a single force and couple system at 'B'. (6)


OR

12. Two spheres each of weight 1000N and of radius 25cm rest in a horizontal channel of width 90cm as shown in fig. Identify the reactions at the point of contacts. (14)
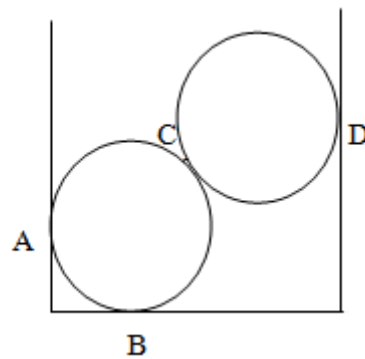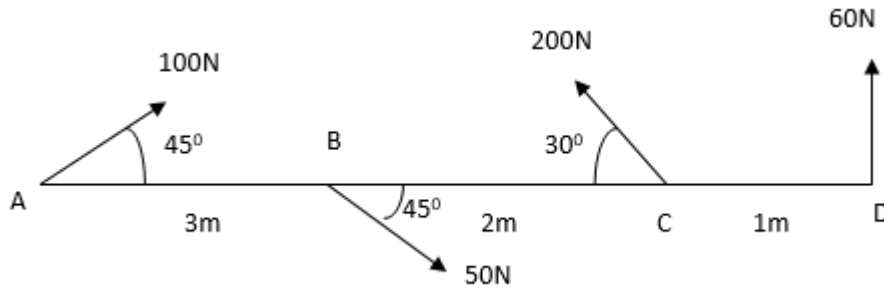

MODULE II

13. a) A ladder of length 5m and weight 300N is placed against a vertical wall with which it makes an angle of 45 degrees. The coefficient of friction between the floor and the ladder is 0.5 and that between the wall and the ladder is 0.4. In addition to its own weight, the ladder has to support a man of weight 500N at 1m from the top along the ladder. Calculate the minimum inclination of the ladder with the horizontal so that there is no slipping. (8)

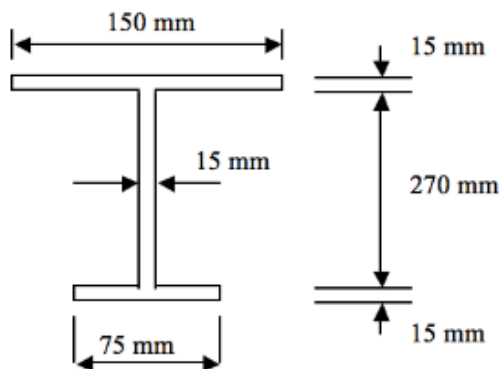b) Compute the reaction at supports of beam AB, where AC=3 m and BC= 2m. (6)
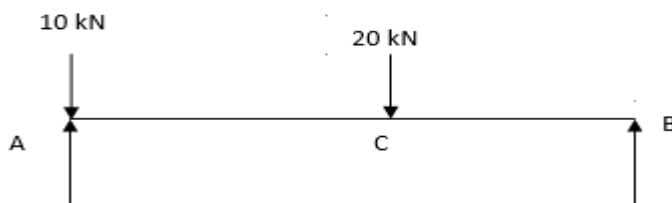
OR

14. Estimate the magnitude, position and direction of the resultant of coplanar force shown (14) in the figure w.r.t the point A.

MODULE III

15. a) Evaluate moment of inertia of the figure shown below (10)

b) Calculate the mass moment of inertia of a solid cylinder along XX and ZZ axis, (4) assuming density of steel as $6000kg/m^3$, length as 8cm and radius as 2cm.

OR

16. a) Forces 32kN, 24kN, 24kN and 120kN are concurrent at origin and are (14) respectively directed through the points whose coordinates are :
A (2,1,6), B (4,-2,5), C (-3,-2,1) and D (5,1,-2). Analyze the resultant of the system.

MODULE IV

17. a) The equation of motion of a particle is given by $S=18t+3t^2-2t^3$, where s is the total (8) distance covered from the starting point in meters at the end of t seconds. Identify the:
(a) Velocity and acceleration at start
(b) Time, when particles reach its maximum velocity and
(c) Maximum velocity of the particle

b) A pilot flying his bomber at a height of 1500m with uniform horizontal velocity of (6) 40m/s wants to strike a target on the ground. Estimate the distance from the target, he should release the bomb?

OR

18. a) A lift has an upward acceleration of 2.4m/s^2. (8)

     i. Compute the force a man weighting 750N exerts on the floor of the lift?

     ii. Compute the force he would exert, if the lift had an acceleration of 1.2m/s^2 downwards?

     iii. Compute the upward acceleration that would cause his weight to exert a force of 900N in the floor.

    b) Explain the terms projectile, trajectory and range of projectile? (6)

MODULE V

19. a) A wheel rotating about a fixed axis at 20 r.p.m is uniformly accelerated for 70seconds, during which time it makes 50 revolutions. Solve (i) angular velocity at the end of this interval and (ii) time required for the speed to reach 100 revolution per minutes. (8)

    b) The angle of rotation of a body is given by the equation $\Theta=2t^3-5t^2+8t+6$ where Θ is expressed in radians and t in seconds. Estimate the (6)
(i) Angular Velocity and (ii) Angular Acceleration at t=1second.

OR

20. a) A body moving with SHM has velocities 10m/s and 4m/s at 2m and 4m distance respectively from the mean position. Compute amplitude and time period of the body. (6)

    b) Define the terms (i) Amplitude (ii) Oscillation (iii) Period (iv) Frequency (8)

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