

Hall Ticket Number:

Code No. : 11042 (A)

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS), HYDERABAD

Accredited by NAAC with A++ Grade

B.E. (CBCS) I-Semester Main and Backlog Examinations, July-2021.

Basic Engineering Mechanics

(Civil, EEE, ECE & Mech. Engg.)

Max. Marks: 60

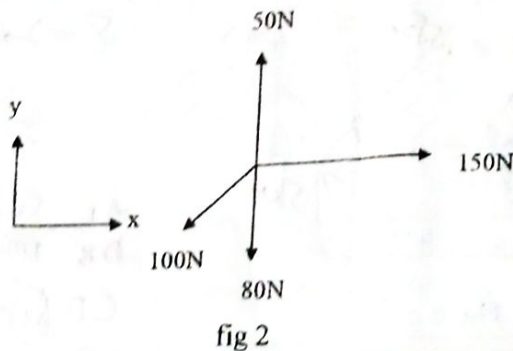
Time: 2 hours

Note: Answer any NINE questions from Part-A and any THREE from Part-B

Part-A (9 × 2 = 18 Marks)

Q. No.	Stem of the question	M	L	CO	PO
1.	Define the concurrent co-planner force system?	2	1	1	1
2.	Two forces 13 N and 16 N are acting at a point. The angle between the forces is 90°. Find the magnitude and direction of the resultant. $R = 20.61$	2	2	1	2
3.	A force $F = (10i + 8j - 5k)$ N acts at point A (2, 5, 6) m. What is the moment of the force about the point B (3, 1, 4) m. $-36i + 15j - 48k$	2	2	2	2
4.	Define the term free body diagram and state its importance.	2	1	2	1
5.	State the assumptions in the analysis of a perfect truss	2	1	2	1
6.	How can you check the stability of a truss?	2	1	3	1
7.	Define angle of friction and angle of repose.	2	3	3	2
8.	A rope is wrapped a cylinder as shown in fig. Determine the force required to just support a weight of 1 kN. $\mu = 0.3$ between the rope and the cylinder. $T_2 = T_1 e^{\mu \theta} = T_1 e^{0.3\pi} = 2.57 N$	2	1	4	1
9.	What is meant by Moment of Inertia?	2	3	4	2
10.	Determine the moment of inertia of an area of rectangle of base 2 cm and height 4 cm about the centroidal x and y axes. $\frac{bd^3}{12}$ $\frac{db^3}{12}$	2	1	2	1
11.	State the difference between equilibrium and resultant.	2	3	2	2
12.	The line action of a 100 N force F passes through the points A (2, 5, 8) and B (7, 2, 6). Find the component of the force along x, y and z axis. $81.11, -48.46, -32.44$	7	3	1	2
13. a)	Find the resultant and its direction for the concurrent co-planner force system shown in fig 2. Angle made by 100N with the horizontal is 60° $R = 153.64$ $\theta = 49.38$				

Part-B (3 × 14 = 42 Marks)



Contd... 2

- b) Determine the magnitude and direction of the smallest force P required to start the wheel over the block as shown in Fig.3. The self-weight of the wheel is 10 kN and radius is 0.6 m .

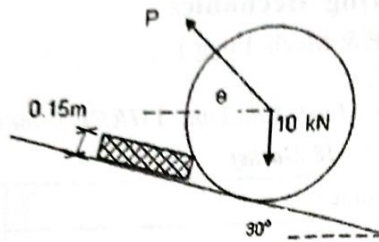


Fig. 3

$P = 9.4 \text{ kN}$
 $\alpha = 71.4^\circ$

14. a) Determine the reactions at A and D of the beam as shown in Fig.4. Neglect the self-weight of the beam.

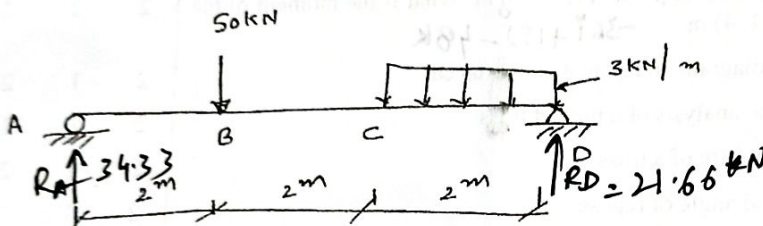


Fig. 4

- b) Find the axial forces in the members of the tripod loaded in the Fig. 5, $W = 25 \text{ kN}$

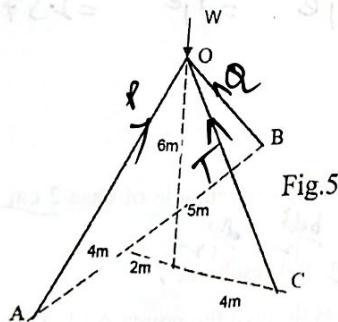


Fig.5

$P_m = 9.26$
 $Q_m = 7.408$
 $T_m = 8.33$
 $P = 69.2 \text{ kN}$
 $Q = 59.71$; $T = 60.09$

15. a) Find the axial forces in all the member of the truss loaded and supported as shown in Fig. 6.

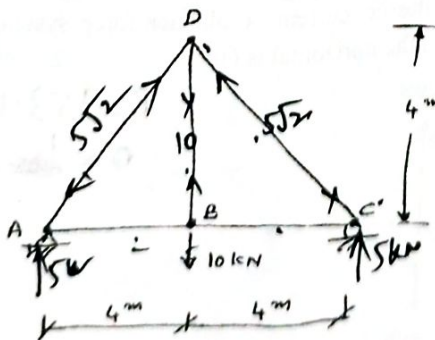


Fig. 6

$W = 25 - 3$
 $S = 2 \times 4 - 3$
 $= 5 \text{ pairs}$
 $AD = 5\sqrt{2} (C)$
 $DB = 10 (T)$
 $CD = 5\sqrt{2} (C)$

- b) Find the axial forces in all the members of the truss loaded and supported as shown in Fig. 7.

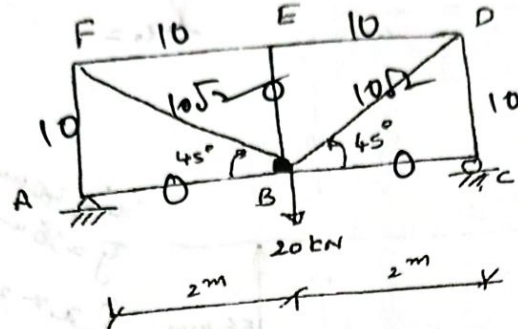


Fig. 7

16. a) A ladder 5 m long rests on a horizontal ground and leans against a smooth vertical wall at an angle of 70° with the horizontal. The weight of the ladder is 300 N. The ladder is on the verge of sliding when a man weighing 750 N stands on a rung 1.5 m along the ladder. Calculate the coefficient of friction between the ladder and the floor.

$$\mu = 0.13$$

- b) What should be the value of θ in Fig. 8 which will make the motion of 900 N block down the plane to impend? The coefficient of friction for all contact surfaces is 0.3.

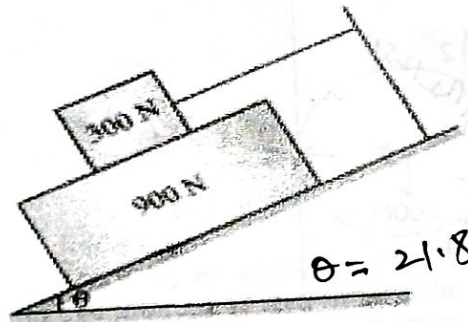


Fig. 8

17. a) A semicircular area is removed from the trapezoid shown in Fig. 9. Determine the X and Y coordinate of the centroid for the shaded area.

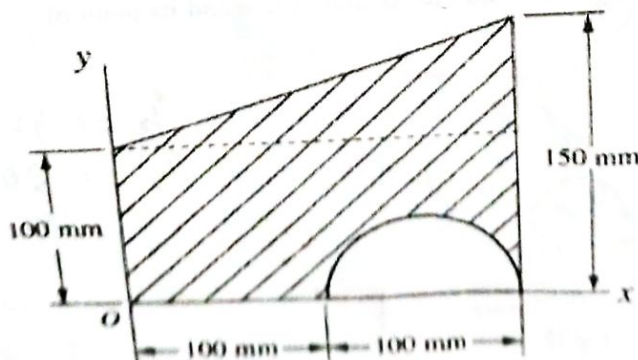


Fig. 9

$$\bar{x} = 98.59$$

$$\bar{y} = 71.81$$

- b) For the shaded area as shown in Fig.10, determine the Moment of Inertia of an area of plane figure about its centroidal axes. All units are in millimeters.

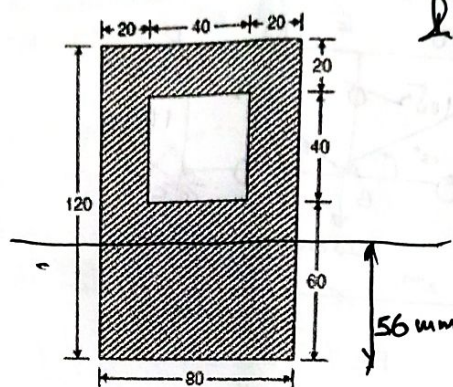


Fig.10

$$I_{xx} =$$

$$\begin{aligned} \bar{x} &= 40 \text{ mm} \\ \bar{y} &= 56 \text{ mm} \\ I_{xx} &= 108 \times 10^4 \text{ mm}^4 \\ I_{yy} &= 108 \times 10^4 \text{ mm}^4 \end{aligned}$$

18. a) Three cylinders are placed in a rectangular ditch as shown in Fig.11. Neglecting the friction, determine the reactions at 1 to 6. The radii of the three cylinders A, B and C are 100 mm, 150 mm and 125 mm respectively.

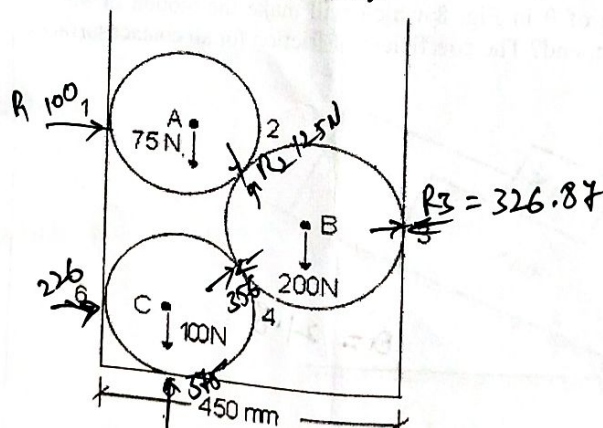


Fig.11

- b) A triangular plate is subjected to the force system shown in Fig. 12. Let $P_1 = 7 \text{ kN}$, $P_2 = 10 \text{ kN}$, $P_3 = 15 \text{ kN}$ and $M = 7 \text{ kNm}$. Find the resultant force and its point of action on X and Y axis.

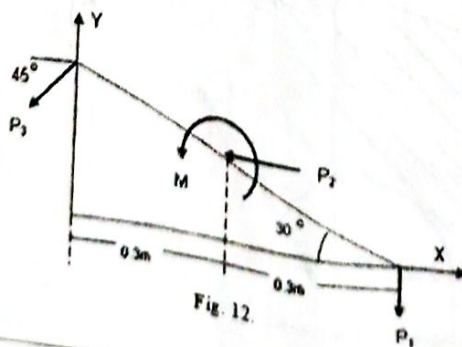


Fig. 12.

$$\begin{aligned} \bar{x} &= 0.12 \text{ m} \\ \bar{y} &= 0.36 \text{ m} \end{aligned}$$

19. Answer any two of the following:

- a) Determine the forces in the members CD, CG and GF of the truss loaded and supported as shown in Fig.13.

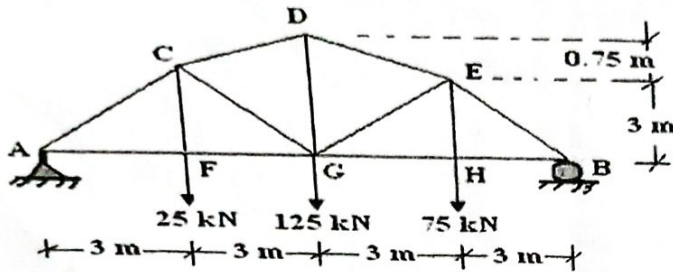


Fig.13

- b) Consider the system as shown in Fig. 14. If $\theta = 70^\circ$ and $\mu = 0.25$ at all surfaces of contact. What is the force (W) required to slide the wedge (A) in the downward direction.

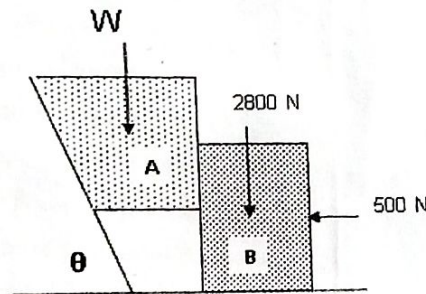


Fig.14

$W = 1205 \text{ kN}$

- c) A semi-circular cut is made in rectangular wooden beam as shown in Fig.15. Determine the moment of inertia of the section about the centroidal axes.

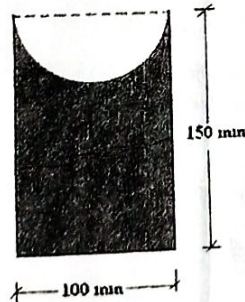


Fig.15

$y = 0.55 \text{ mm}$
 $I_x = 1.24 \times 10^7 \text{ mm}^4$
 $I_y = 1.49 \times 10^7 \text{ mm}^4$

M: Marks; L: Bloom's Taxonomy Level; CO: Course Outcome; PO: Programme Outcome

S. No.	Criteria for questions	Percentage
1	Fundamental knowledge (Level-1 & 2)	14
2	Knowledge on application and analysis (Level-3 & 4)	86
3	*Critical thinking and ability to design (Level-5 & 6) (*wherever applicable)	-
