Hall Ticket Number:

Code No. : 11016BEM S

VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

B.E. (CBCS) I-Semester (New) Supplementary Examinations, May/June-2018

Basic Engineering Mechanics

(Civil, EEE & Mech. Engg.)

Time: **3** hours Max. Marks: **60**

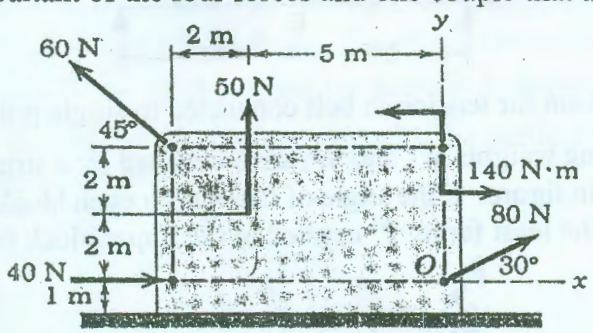
*Note: Answer **ALL** questions in **Part-A** and any **FIVE** from **Part-B***

Part-A (10 × 2=20 Marks)

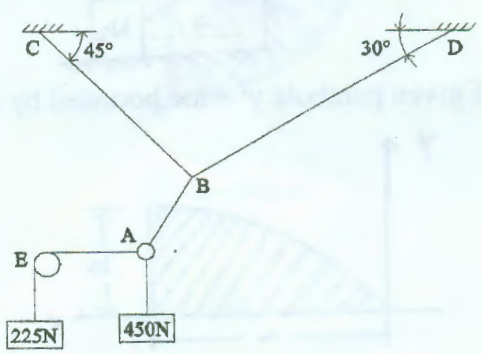
1. Explain various types of forces.
2. Determine magnitude and direction of the resultant of two forces 100N and 150N at an angle of 45°
3. Explain the free body diagram with suitable examples.
4. Write the equilibrium equations for a concurrent force system in space.
5 Distinguish between perfect frame and redundant frame.
6. What are the steps involved in the analysis of a truss?
7. Enumerate the applications of belt friction.
8. Explain the terms i) limiting friction ii) Friction Angle.
9. State and prove parallel axis theorem.
10. Differentiate between centroid and centre of gravity.

Part-B (5 × 8 = 40 Marks)
(All sub-questions carry* equal *marks)

11. a) Determine the resultant of the four forces and one couple that act on the plate shown.



b) Find the tensions in the three cables connected to B. The entire system of cables is coplanar. The roller at E is free to turn without resistance.



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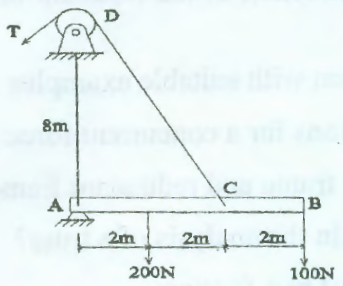
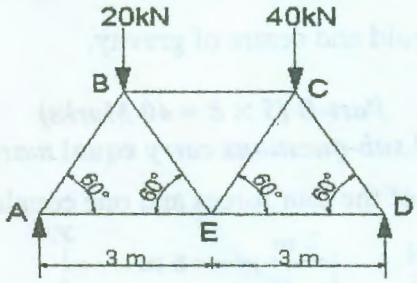
12. a) A system of forces consists of:
Force $P_1 = 3i + 5j - 6k$ acting through point (2,1,-3)
Force $P_2 = 5i - 4j + 3k$ acting through point (1,4,2) and a moment $M = 20i - 35j + 60k$.
The forces are in Newton (N) units, distance in 'm' units and the moment in 'N-m' units.
Calculate
i) The component of the resultant forces and its magnitude
ii) The total moment of the system about the origin 'O'

b) A boom AB is supported in a horizontal position by a hinge A and a cable which runs from 'C' over a small pulley at 'D'. Compute the tension in the cable and the horizontal and vertical components of the reaction at A. Neglect the weight of the boom and size of the pulley at D.



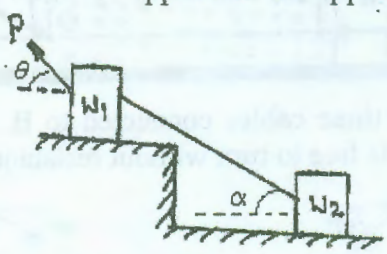
13 a) Explain the terms: Perfect frame, imperfect frame and deficient frame.

b) Determine the support reactions and members forces in a structure shown below:

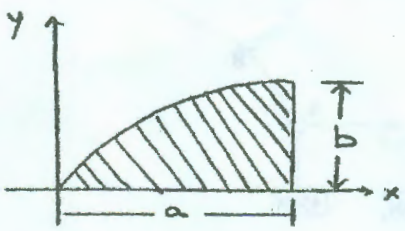


14. a) Write the expression for tension in belt connected to single pully.

b) Two blocks having weights W_1 and W_2 are connected by a string and rest on horizontal planes as shown in figure. If the angle of friction for each block is ϕ, find the magnitude and direction of the least force 'P' applied to the upper block that will induce sliding.



15. a) Locate the centroid of given parabola $y^2 = kx$ bounded by x- axis the line $x = a$.



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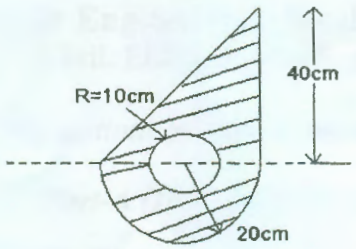
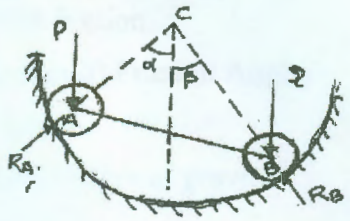
b) Find the moment of inertia of the shaded area about the horizontal centroidal axis as shown in fig



16. a) Define Force and explain its characteristics & types with suitable diagrams.

b) A Ringed bar AB with rollers of weights P = 50 N and Q = 100N at its ends is supported inside a circular ring in a vertical plane as shown in figure. The radius of the ring and length AB are such that the radii AC and BC form a right angle at 'C' that is, $\alpha + \beta = 90^{\circ}$. Neglecting friction and weight of the bar AB, find the configuration of equilibrium as defined by the angle $\frac{(\alpha-\beta)}{2}$ that makes with horizontal. Find also the reactions R_A and R_B and the compressive force 'S' in the bar AB.



17. Answer any **two** of the following:

a) What are the steps involved in the analysis of redundant frames.

b) Two equal bodies P and Q of weight 'W' each are placed on a rough inclined plane. The bodies are connected by a light string. If $\mu_p = 1/2$ and $\mu_q = 1/3$, show that the bodies will be both on the point of motion when the plane is inclined at $\tan^{-1}$ (5/12)

c) Determine the angle that the line AB makes with the vertical when the shaded stem is suspended at A as shown in fig.