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Reg.No. \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

FIRST/SECOND SEMESTER B.TECH DEGREE SPECIAL EXAMINATION, AUGUST 2016

**BE 100 - ENGINEERING MECHANICS**

Time : 3 Hours

Maximum Marks : 100

**Part – A***Answer all the questions. Each question carries 5 Marks (8 X 5 = 40 Marks)*

- (a). State the principle of Transmissibility of forces.  
(b). Explain the concept of free body diagrams.
- Find the support reactions in the beam shown in figure 1

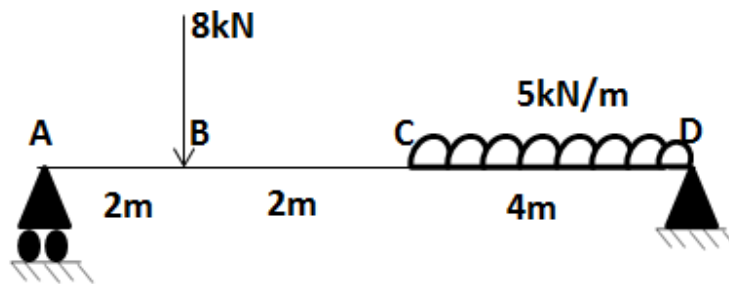


Fig.1

- What is Polar Moment of Inertia? How does it differ from Product of Inertia?
- Define virtual work and state principle of virtual work.
- Explain Instantaneous centre of zero velocity. How can you locate it?
- Calculate the velocity at a point  $\frac{2}{3}$ rd radius from the top point of a rail car wheel of radius 250 mm, if the car moves without slipping on straight rails at 15 m/s.
- Differentiate between free vibration and forced vibration of bodies
- Explain the concept of single degree of freedom systems.

## Part – B

Answer two questions from each set

SET 1 Answer any 2 questions. Each question carries 10 Marks (2 X 10 = 20 Marks)

9. Forces of 15N, 20N, 25N, 35N and 45N act at an angular point of a regular hexagon towards the other angular points as shown in figure 2. Calculate the magnitude and direction of the resultant force.

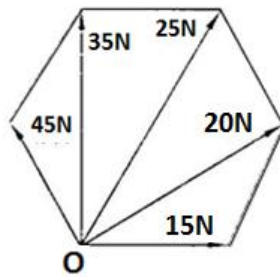


Fig.2

10. A rigid bar AB is acted upon by forces as shown in figure 3. Reduce the force system to (i) a single force (ii) force moment system at A (iii) force moment system at D

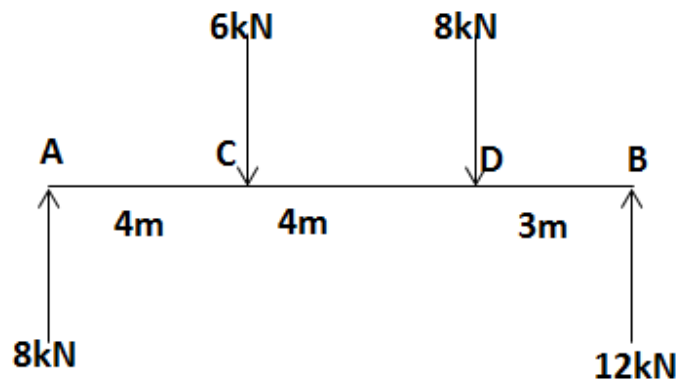


Fig.3

11. Determine the reactions at supports A and B of the beam as shown in the figure 4.

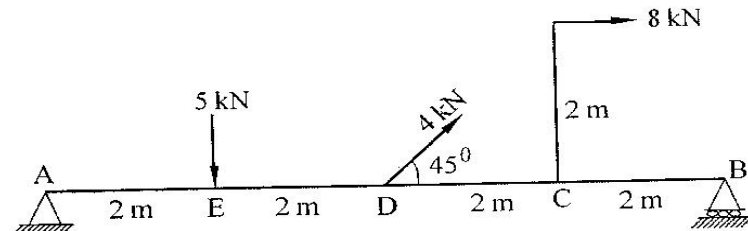


Fig.4

**SET 2 Answer any 2 questions. Each question carries 10 Marks (2 X 10 = 20 Marks)**

12. Z - section is shown in the below figure 5. Determine the centroid of the given section after selecting proper references axis.

- X coordinate
- Y coordinate

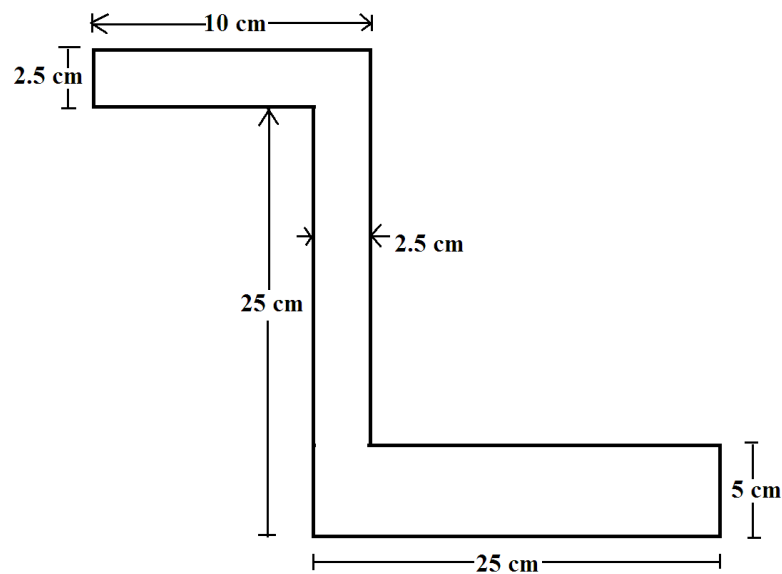


Fig.5

- A uniform ladder of length 25m and weight  $W$  is leaning against a wall. It makes  $45^\circ$  with the horizontal. A man whose weight is 0.6 times that of the ladder goes up the ladder. Determine the maximum distance he can climb before the ladder slips. Assume coefficient of friction between the ladder and the wall to be 0.25 and that between the floor and the wall to be 0.3.
- A simply supported beam of length 4m has a concentrated load of 5kN at 1m from the left support. It also has a uniformly distributed load of 2kN/m over its right half. Find the support reactions using the principle of virtual work.

**SET 3 Answer any 2 questions. Each question carries 10 Marks (2 X 10 = 20 Marks)**

- A reciprocating engine mechanism is shown in the figure 6. The crank OA has a constant angular velocity of 300 rpm. The crank OA is of length 12 cm and the connecting rod AB

is of length 60 cm. Find 1) the angular velocity of the connecting rod. 2) The velocity of the piston when the crank makes an angle of  $30^\circ$  with the horizontal.

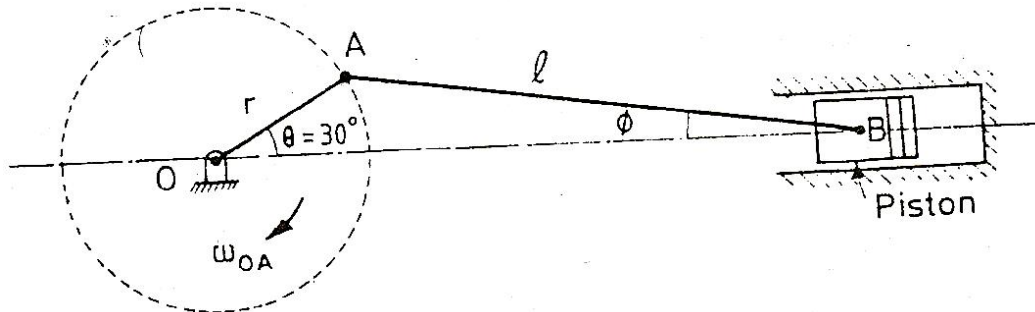


Fig.6

16. An elevator of mass 500 kg is ascending with an acceleration of  $3\text{m/s}^2$ . During this ascent its operator whose mass is 70 kg is standing on the scales placed on the floor. What is the scale reading? What will be the total tension in the cables of the elevator during his motion?
17. A body is moving with simple harmonic motion and has velocities of  $8\text{m/s}$  and  $3\text{m/s}$  at a distance of  $1.5\text{m}$  and  $2.5\text{m}$  respectively from the centre. Find the amplitude and time period of the body.