

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIRST SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2017

Course Code: BE100

Course Name: ENGINEERING MECHANICS

Max. Marks: 100

Duration: 3 Hours

PART A

Answer all questions, each carries 5 marks.

- | | | Marks |
|---|--|-------|
| 1 | State and explain Lami's theorem. | (5) |
| 2 | A force of 1000N acts on a bracket as shown in Fig 1. Determine the moment of the force about Q. | (5) |

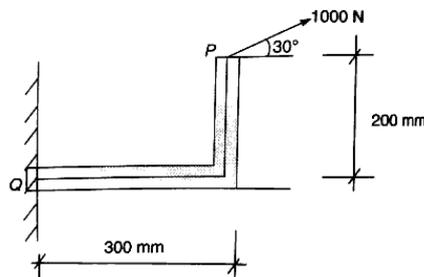


Fig. 1

- | | | |
|---|---|-----|
| 3 | State and prove parallel axis theorem. | (5) |
| 4 | Using the principle of virtual work, determine the reactions of a beam AB of span 8m. The beam carries a point load of 4kN at a distance of 3m from A. | (5) |
| 5 | A wheel is rotating about its axis with a constant angular acceleration of 3 rad/s^2 . If the initial and final angular velocities are 5.25 rad/s and 10.5 rad/s , determine the total angle turned through, during this interval. | (5) |
| 6 | a) A vertical lift of total mass 500kg acquires an upward velocity of 2m/s over a distance of 3m of motion with constant acceleration, starting from rest. Apply D'Alembert principle to calculate the tension in the cable supporting the lift. | (3) |
| | b) If the lift, while stopping, moves with a constant deceleration and comes to rest in 2s, calculate the force transmitted by a man of mass 75kg on the floor of the lift during that interval. | (2) |
| 7 | Explain longitudinal, transverse and torsional vibrations with sketches. | (5) |
| 8 | A helical spring of negligible mass is found to extend 0.15mm under a mass of 0.5kg. Then a mass of 40kg is attached at its lower end. The spring mass system is displaced vertically through 100mm and released. Find the stiffness of the spring, period of oscillation and its natural frequency for the SHM produced. | (5) |

PART B

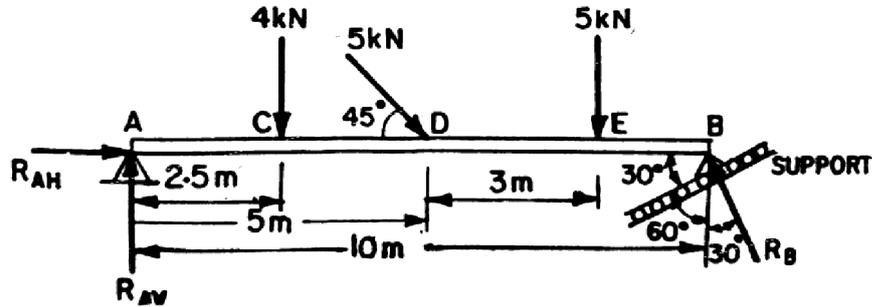
Answer any 2 questions from each SET

SET 1

Each question carries 10 marks.

- | | | |
|---|---|-----|
| 9 | a) Two forces F and 2F act on a particle. If the first force is increased by 12kN and the second force is doubled, the direction of their resultant remains unchanged. Find the value of F. | (5) |
| | b) Five forces 4, $\sqrt{3}$, 5, $\sqrt{3}$ and 3kN respectively act at one of the angular points of a regular hexagon towards other five angular points. Find the magnitude and | (5) |

- direction of the resultant forces.
- 10 A beam AB 10m long is hinged at A and supported on rollers over a smooth surface inclined at 30° to the horizontal at B. The beam is loaded as shown in Fig 2. Determine the reactions at A and B. (10)



- 11 a) Three cylinders are supported between two vertical walls. Determine the reactions at the points of contact. The weight of each cylinder is 1000N. (5)

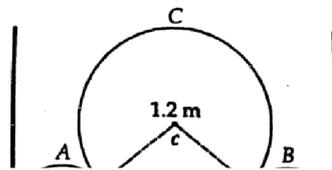


Fig. 3

- b) A rigid bar is subjected to a system of parallel forces as shown in Fig 4. Reduce this system to a single force and moment system at A. (5)

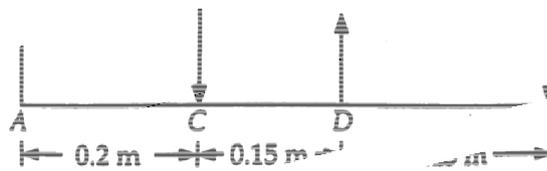


Fig. 4

SET II

Each question carries 10 marks

- 12 Locate the centroid of the shaded area shown in Fig. 5 (10)

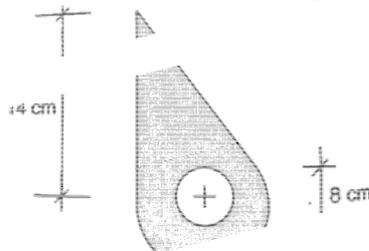
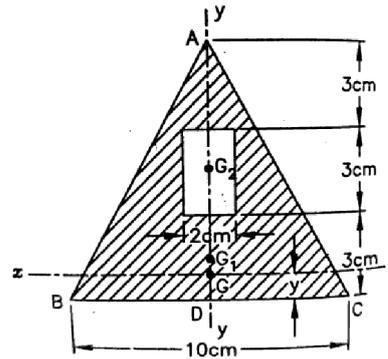


Fig. 5

- 13 A rectangular hole is made in a triangular section as shown in Fig 6. Determine the M.I. of the section about x-x axis passing through the CG of the section and (10)

parallel to BC. Also find the M.I, with respect to BC.



- 14 A uniform ladder of weight W and leans against a smooth vertical wall. The wall is horizontal and is at an angle of 65° to the horizontal. When a force F is applied at the top of the ladder at a distance of 4 m from the top of the ladder, the ladder is in equilibrium. Determine the co-efficient of friction between the ladder and the ground. (10)

End

- 15 a) A cylindrical roller, 50 cm in diameter, is in contact with two horizontal conveyors. The conveyors are moving at uniform speeds of 5 m/s and 5 m/s as shown in Fig. 7. Assuming that there is no slip at the points of contact, determine, (5)
- the position of the instantaneous centre of the roller,
 - the linear velocity of the centre C, and
 - the angular velocity of the roller.

Fig. 7

- b) Determine the three parameters asked in the previous question, if the velocities of the belts are in opposite direction. (5)
- 16 A mass of 60 kg is supported by two springs of stiffnesses 6 kN/m and 8 kN/m . The springs are arranged in series. The mass is given an initial displacement of 40 mm and is released. Determine the period of vibration, the maximum velocity and maximum acceleration. (10)
- 17 a) A reciprocating pump plunger is driven by a crank of radius 30 cm which is rotating at 120 rpm . Assuming SHM for the plunger, find out the velocity and acceleration of the plunger when it is at 15 cm from either end of the stroke. (5)
- b) Find out the maximum force required to push the plunger in the previous question, if the mass of the plunger is 10 kg . (5)
