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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Second Semester, B.E. - Semester End Examination; May/June - 2019

Engineering Mechanics

(Common to All Branches)

Time: 3 hrs *Max. Marks: 100*

Course Outcomes

The Students will be able to:

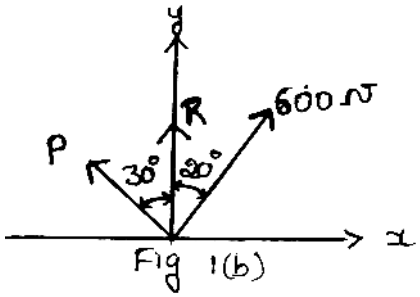
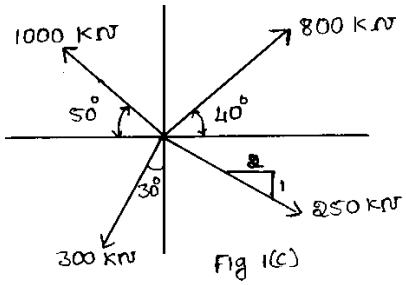
*CO1: **Apply** the knowledge of basic science and mathematics to classify the force systems and compute its resultant.*

*CO2: **Analyze** the system of forces in equilibrium with or without frictional forces.*

*CO3: **Locate** the Centroid and composite moment of inertia of irregular and built up sections.*

*CO4: A**nalyze** the problems with respect to linear motion, curvilinear motion and energy.*

***Note:** Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

Q. No.	Questions	Marks	COs	BL	POs
	UNIT - I				
1 a.	Define; i) Moment of force ii) Couple iii) Free body diagram	6	CO1	L1	PO1
b.	Determine the magnitude for force '*P*' in Fig. 1(b), so that the resultant is vertical and also find the magnitude of the resultant.  Fig 1(b)	6	CO2	L3	PO2
c.	Determine the magnitude and direction of resultant of the concurrent force system shown in Fig. 1(c).  Fig 1(c)	8	CO2	L3	PO2
2 a.	Explain the principle of transmissibility and principle of superposition of forces.	6	CO1	L1	PO1
b.	State and prove Varignon's theorem.	6	CO1	L2	PO2
c.	Find the resultant, magnitude, direction and distance from point 'X' of the force system shown in Fig. 2(c).	8	CO2	L3	PO2

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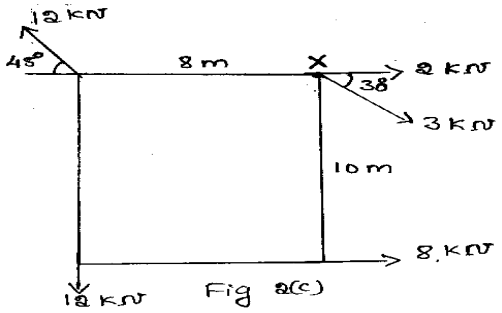

Fig 3(c)

UNIT - II

3 a.	What are statistically determinate beams?	2	CO1	L1	PO1
b.	What are the different types of loads and supports on beams?	8	CO1	L1	PO1
c.	Determine the reaction at the support for the beam shown in Fig. 3(c).	10	CO2	L3	PO2

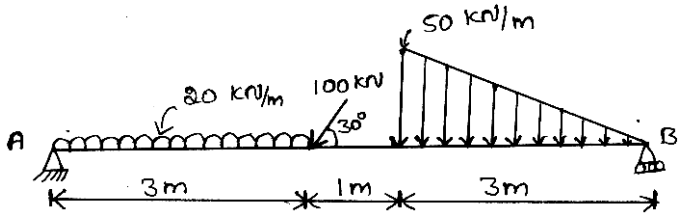

Fig. 3(c)

4 a.	Explain different types of friction.	6	CO2	L1	PO1
b.	Explain angle of friction and angle of repose with neat sketches.	6	CO2	L1	PO1
c.	Two blocks 'A' and 'B' weighting 3 kN and 1.5 kN respectively are connected by a string over a frictionless pulley as shown in Fig. 4(c). Find the minimum value of force '*T*' to generate an impending motion to the right. The coefficient of friction for the surface of contact for block 'A' and 'B' are 0.2 and 0.3 respectively.	8	CO2	L3	PO2

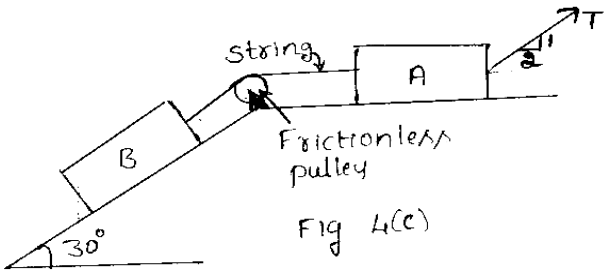

Fig 4(c)

UNIT - III

5 a.	Determine the Centroid for semi circle by the method of first principles.	10	CO3	L2	PO2
b.	Locate the Centroid of the shaded area shown in Fig. 5(b).	10	CO3	L3	PO2

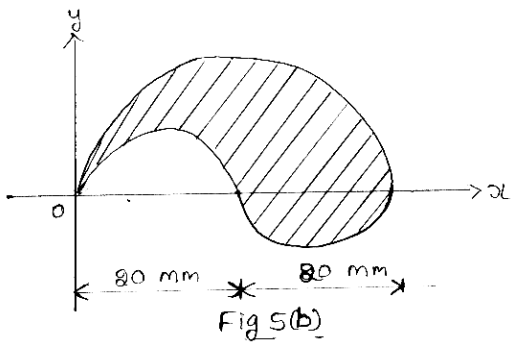

Fig 5(b)

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6 a.	Determine the Centroid for isosceles triangles by method of first principles.	10	CO3	L2	PO2
b.	Locate the CG of area $(\bar{x}, \bar{y})$ shown in figure with respect to Cartesian coordinate shown in Fig. 6(b).	10	CO3	L3	PO2

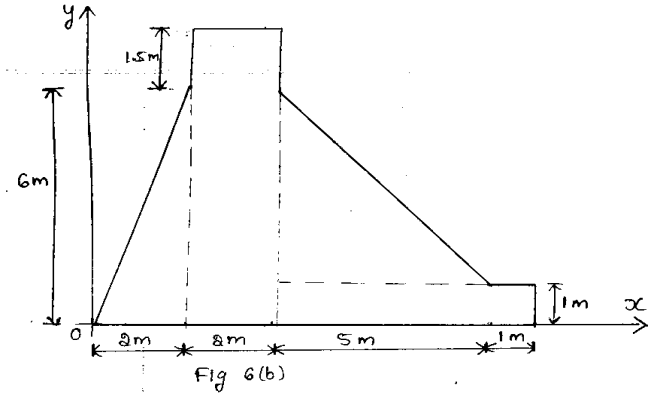

Fig 6(b)

UNIT - IV

7 a.	State and prove Parallel axis theorem.	8	CO3	L2	PO2
b.	Find the area of inertia of the section shown in Fig. 7(b) both horizontal and vertical in centroidal axis.	12	CO3	L3	PO2

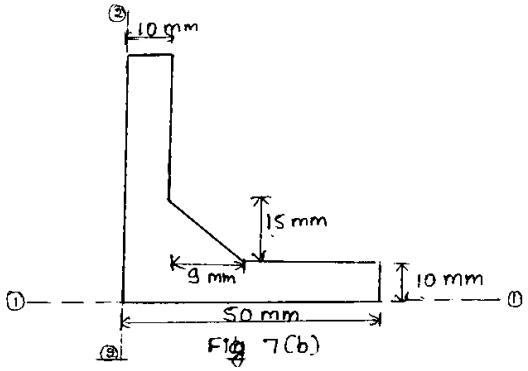

Fig 7(b)

8 a.	Derive the moment of inertia of rectangle about the centroidal axis by method of integration.	10	CO3	L2	PO2
b.	Determine the second moment of area about horizontal axis for shaded area shown in Fig. 8(b). Find the radius of gyration about the same axis. Consider R_1 = 50 mm and R_2 = 20 mm	10	CO3	L3	PO2

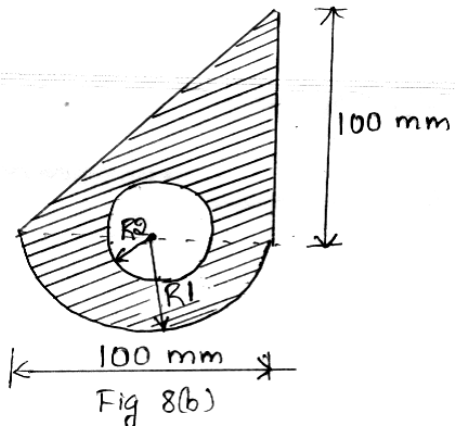

Fig 8(b)

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UNIT - V

9 a.	Define superelevation and write the benefits of providing superelevation.	5	CO4	L1	PO1
b.	Define centrifugal and centripetal force with diagram.	5	CO4	L1	PO1
c.	A police officer observes a car approaching at the unlawful speed of 60 kmph. He gets on his motor cycle and starts chasing the car just as it passes in front of him. After accelerating for 10 s at a constant rate, the officer reaches his top speed of 75 kmph. How long does it take the officer to overtake the car from the time he started.	10	CO4	L3	PO2
10 a.	What is a projectile? Define the following terms briefly; i) Angle of projection ii) Horizontal range iii) Vertical height iv) Time of flight	10	CO4	L1	PO1
b.	Define work, power and energy.	6	CO4	L1	PO1
c.	A circular automobile test track has a radius of 200 m. The design of the track is such that when a car travels at a speed of 72 kmph. The force between the automobile and track is normal to the surface of track. Find the angle of bank of super elevation.	4	CO4	L3	PO2

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