***U.S.N*** | | | | | | | | | | |

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

***(An Autonomous Institution affiliated to VTU, Belgaum)***

**Second Semester, B.E. – Make-up Examination; July - 2016**

**Engineering Mechanics**

**(Common to all Branches)**

*Time: 3 hrs* *Max. Marks: 100*

***Note**: i) Answer **FIVE** full questions, selecting **ONE** full question from each unit.*
*ii) Missing data may suitably be assumed.*

## UNIT - I

1 a. Distinguish between :
i) Force and Couple ii) Resultant and Equilibrant 6
iii) Composition and resolution of forces.

b. With the aid of a neat sketch explain principle of transmissibility. 4

c. A small ring is situated at the centre of a hexagon and supported by six strings tied tight in the same plane and radiating from the centre of the ring and each connected to a different angular point of the hexagon. The tension in the four consecutive strings are 10 kN, 25 kN, 45 kN and 30 kN respectively. Find the tension in the remaining strings such that the ring is in equilibrium. 10

2 a. With neat sketches discuss different types of loads and explain how they can be reduced to concentrated loads. 6

b. Determine the reactions at the ends of the beams AB and CD as shown in Fig. Q2.b Neglect the self weight of the beams. 14

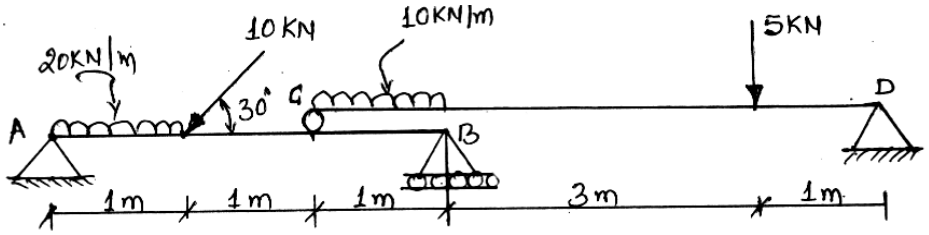



Fig Q 2.b

## UNIT - II

3 a. Differentiate between centroid and a centre of gravity. 4

b. Locate the centroid of quadrant of circular lamina from the first principles. 6

c. Determine the position of the centroid for the shaded area with respect to the axis as shown in the Fig. 3(c). 10

Contd…2

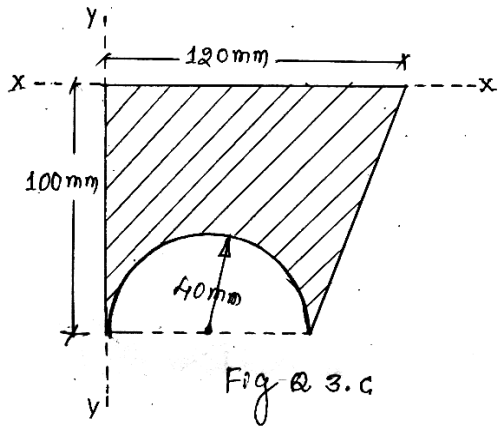


Fig Q 3.c

4 a. Determine the centre of gravity of a semicircle by method of integration. 6

b. Determine the position of the centroid for the shaded area with respect to the axis as shown in Fig.4.b. 14

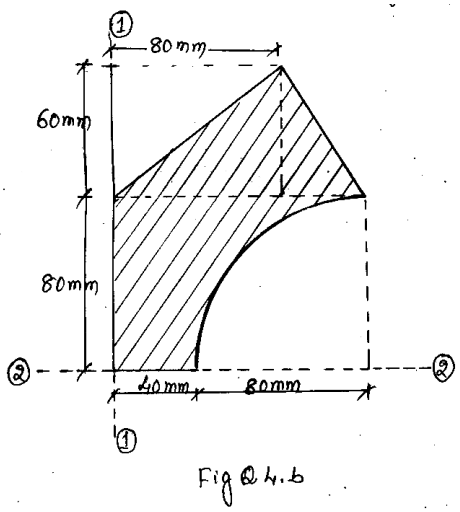


Fig Q 4.b

**UNIT - III**

5 a. State and prove parallel axis theorem. 6

b. Determine the $I_{XX}$ and $I_{YY}$ for section shown in Fig. Q5.b 14

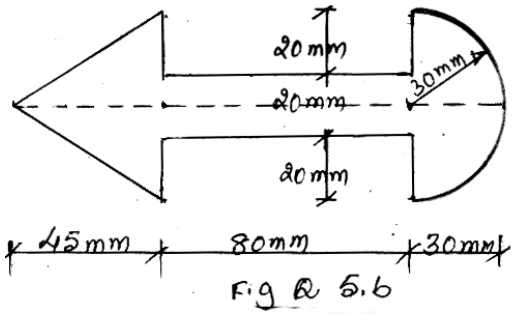


Fig Q 5.b

6 a. Derive an expression for moment of Inertia of a triangle about the base using the method of integration. 6

b. In a tabular form, with neat sketch give the formula used for $I_{XX}$ and $I_{YY}$ for various geometrical shapes to determine the moment of inertia. 4

Contd…3

c. Determine the second moment of area about horizontal centroidal axis as shown in Fig.Q6(c). Also find radius of gyration. 10

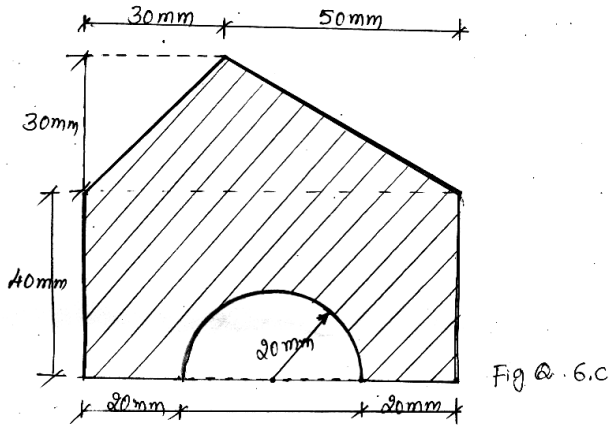


Fig Q. 6.c

**UNIT - IV**

7 a. Explain with neat sketches : 6

i) Angle of friction ii) Angle of repose iii) Cone of friction.

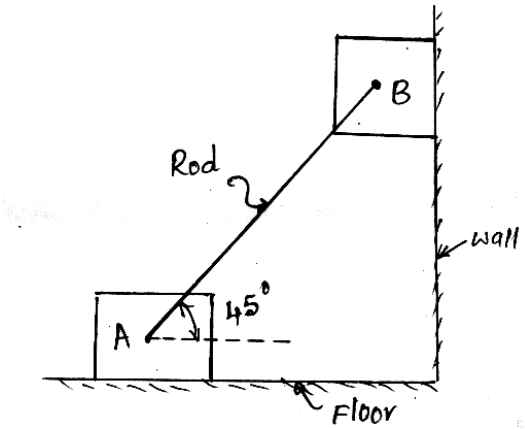
b. State the laws of dry friction. 4

c. A body resting on a rough horizontal plane required a pull of 180 N inclined at 30º to the plane just to move it. It was found that push of 220 inclined at 30º to the plane just to move the body. Determine the weight of the body. 10

8 a. Define : 6

i) Static friction ii) Sliding friction iii) Coefficient of friction.

b. Two blocks A and B are held in position by a rod AB as shown in Fig. Q8.b. The weight of block B is 1000 N. Find the weight of the block A such that the block will not slide away from the wall. Take angle of friction for all contact surface as 15º. 14




**UNIT - V**

9 a. Define the terms : 6

i) Speed ii) Velocity

iii) Acceleration iv) Retardation.

Contd…3

b. A car moving with a velocity of 20 m/s. The car is brought to rest by applying breakes in 6 seconds. Determine the, 6

i) The retardation rate ii) The distance travelled by the car after applying breakes.

c. A projectile is fired with an initial velocity of 40 m/s at an angle of 25º with the horizontal. Determine; 8

i) The horizontal range ii) Maximum height attained by the particle iii) The time of flight.

10a. Define work, power and energy. 6

b. A pile hammer weighing 2500 N fall on a pile. If the hammer drops freely from a height of 5 metres find the impulsive force of the blow if the hammer comes to rest in $\frac{1}{100}$ seconds. 6

Take; g = 9.81 m/s$^2$.

c. A ball is thrown vertically into the air at 36 m/s. After 3 seconds another ball is thrown vertically up with what initial velocity must the second ball have to pass the first at 30 m from the ground? 8

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