

## B. Tech Odd Semester Examination, February, 2023

### Agricultural Engineering (3rd Semester)

Course No.: ASH-304  
**(Engineering Mechanics)**

*Full Marks: 50*  
*Pass Marks: 30*

*Time: 2 hours*

- Note:**
1. Attempt any five questions.
  2. Begin each answer in a new page.
  3. Answer parts of a question at a place.
  4. Assume reasonable data wherever required.
  5. The figures in the right margin indicate full marks for the question.
  6. All the mathematical symbols and abbreviations have their usual meanings.

1. (a)(i) Determine the centroid of the triangle of base 'b' and height 'h'.
- (ii) Explain perpendicular axis theorem.
- (iii) Define D'Alembert's principles in curvilinear motion.
- (iv) State the law of equilibrium of two forces  
1.5x4=6
- (b) Determine the resultant of the nonconcurrent, non-parallel system of forces shown in the Figure No.1. 4

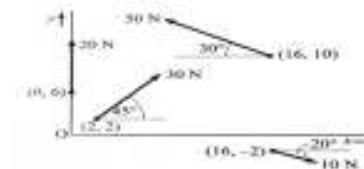


Fig. No-1

6. (a) A weight  $W$  attached to the end of a flexible rope of diameter  $d = 0.75 \text{ cm}$  is raised vertically by winding the rope on a reel as shown. If the reel is turned uniformly at the rate of 2 r.p.s. What is the tension in rope. The inertia of rope may be neglected. 7



Fig.No.- 8

- (b) Define polar moment of inertia and radius of gyration. 3
7. (a) A circular ring has a mean radius  $r = 500 \text{ mm}$  and is made of steel for which  $\omega = 77.12 \text{ KN / m}^3$  and for which ultimate strength in tension is  $413.85 \text{ MPa}$ . Find the uniform speed of rotation about its geometrical axis perpendicular to the plane of the ring at which it will burst? 6

- (b) Define the following term as-  
(a) Moment of force (b) Angle of repose  
(c) Rectilinear motion (d) Curvilinear Motion  
(e) Composite Area (f) Composite curve 6

8. (a) The driver of an automobile, travelling along a straight level highway, suddenly applies the brakes so that the car slides for 2 s, covering a distance 9.66 m, before coming to a stop. Assuming that during this time the car moved with constant deceleration; find the coefficient of friction between the tyres and pavement. 5

- (b) Determine the coordinates  $x_c$  and  $y_c$  of the centroid  $C$  of the area bounded by the parabola  $Y^2 = kx$ , the straight line  $x=a$  and  $x$ -axis. 5

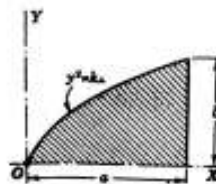


Fig.No.- 8

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Turn Over

2. (a) Determine the moment of inertia of L section as shown in Figure No. 2 about its centroidal axes parallel to the less also find the polar moment of inertia. 5

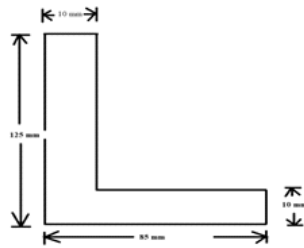


Fig. No-2

- (b) Locate the centroid of the plane shaded area shown below.

Fig. No-3

3. (a) A weight  $Q$  is suspended from a small ring,  $C$ , supported by two cords,  $AC$  and  $BC$ . The cord  $AC$  is fastened at  $A$  while the cord  $BC$  passes over a smooth frictionless pulley at  $B$  and carries a weight  $P$  as shown in Fig.4. If  $P = Q$  and  $a = 50^\circ$ , find the angle  $B$ . 5

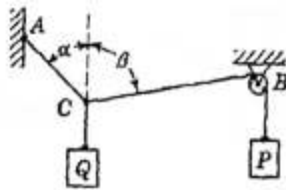


Fig.No - 4

- (b) Consider a semi-circle of radius  $R$ , and calculate its distance from the diametral axis. 5

4. (a) Determine the forces in all the members of the truss shown in Fig.5 and indicate the magnitude and nature of forces on the diagram of the truss. All inclined members are at  $60^\circ$  to horizontal and length of each member is 2 m. 7

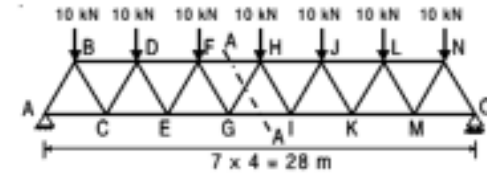


Fig.No-5

- (b) A smooth circular cylinder of weight ' $W$ ' and radius ' $R$ ' rests in a V shape groove whose sides are inclined at angles  $\alpha$  and  $\beta$  to the horizontal as shown. Find the reactions  $R_A$  and  $R_B$  at the points of contact. 3

Alpha ( $\alpha$ ) =  $20^\circ$   
Beta ( $\beta$ ) =  $60^\circ$

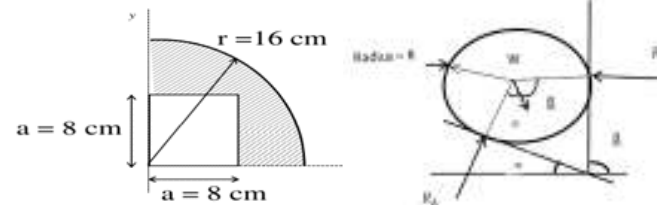


Fig.No-6

5. Block A weighing 1000N rests over block B which weights 2000N as shown in fig (a). Block A is tied to wall with a horizontal string. If the coefficient of friction between A and B is  $1/4$  and between B and floor is  $1/3$ , what should be the value of  $P$  to move the block B. If (1)  $P$  is horizontal (2)  $P$  is at an angle of  $30^\circ$  with the horizontal. 8

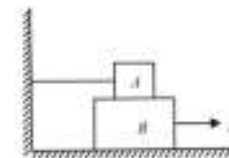


Fig.No-7