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**Reg. No. :**

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**Question Paper Code: 53A03**

**B.E. / B.Tech. DEGREE EXAMINATION, MAY 2018**

**Third Semester**

**Agricultural Engineering**

**15UAG303 - FUNDAMENTALS OF ENGINEERING MECHANICS**

**(Regulation 2015)**

**Duration: Three hours**

**Maximum: 100 Marks**

**PART A - (10 x 1 = 10 Marks)**

1. Forces are called concurrent when their lines of action meet in CO1- R  
(a) one point                      (b) two points                      (c) plane                      (d) Perpendicular planes
2. If a number of forces act simultaneously on a particle, it is possible to replace them by a CO1- R  
(a) Single force through C.G                      (b) Single force  
(c) Couple                      (d) Couple and a force
3. A framed structure is perfect if it contains members equal to CO2- R  
(a)  $2n-3$                       (b)  $n-1$                       (c)  $2n-1$                       (d)  $n-2$
4. The units of moment of inertia of an area are CO2- R  
(a)  $\text{kg m}^2$                       (b)  $\text{m}^4$                       (c)  $\text{kg/m}^2$                       (d)  $\text{m}^3$
5. Pick up the incorrect statement from the following : CO3- R  
(a) The C.G. of a circle is at its center  
(b) The C.G. of a triangle is at the intersection of its medians  
(c) The C.G. of a rectangle is at the inter-section of its diagonals  
(d) The C.G. of a semicircle is at a distance of  $r/2$  from the Centre

6. The unit of mass moment of inertia is CO3- R
- (a)  $\text{kg}\cdot\text{m}^2$                       (b)  $\text{kg}/\text{m}^2$                       (c)  $\text{kg}\cdot\text{m}$                       (d)  $\text{kg}/\text{m}$
7. The bending moment at the free end of the a cantilever beam carrying any type of load is CO4- R
- (a) Zero                      (b) minimum                      (c) Maximum                      (d) equal to the load
8. The coefficient of friction depends on CO4- R
- (a) area of contact    (b) area of contact    (c) strength of surfaces    (d) nature of surface
9. Coulomb friction is the friction between CO5- R
- (a) bodies having relative motion                      (b) two dry surfaces
- (c) two lubricated surfaces                      (d) solids and liquids
10. The slope on the road surface generally provided on the curves is known as CO5- R
- (a) Angle of friction                      (b) Angle of repose
- (c) Angle of banking                      (d) Angle of slope

PART – B (5 x 2= 10Marks)

11. State triangular law of forces and Lami's theorem. CO1- R
12. What is the difference between a moment and a couple? CO2- R
13. State perpendicular axis theorem CO3- R
14. Define D'Alembert's principle CO4- R
15. What is a wedge? CO5- R

PART – C (5 x 16= 80Marks)

16. (a) Two forces of magnitude 20 N and 40 N are acting on a particle such that the angle between the two forces is  $135^\circ$ . If both these forces are acting away from the particle. Calculate their resultant and find its direction. CO1- App (16)

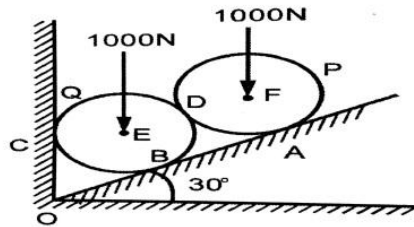
Or

- (b) The line of action of forces concurrent at the origin O passes through P, Q and R having co-ordinates (2,0,-2), (3,-3,4), (-2,3,5) respectively, if the magnitude of the forces are 20N, 40N, 60N. Find the Magnitude and direction of the resultant force? CO1- App (16)

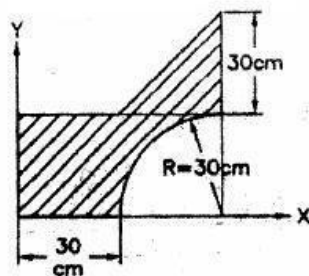
17. (a) Three like parallel forces 20 kN, 40 kN and 60 kN are acting at points A, B and C respectively on a straight line ABC. The distances are  $AB = 3$  cm and  $BC = 4$  cm. Find the resultant and also the distance of the resultant from point A on line ABC. CO2- App (16)

Or

- (b) Two identical rollers, each of weight  $W = 1000$  N, are supported by an inclined plane and a vertical wall as shown in Fig. Find the reactions at the point of supports A, B and C. Assume all the surfaces to be smooth. CO2-Ana (16)



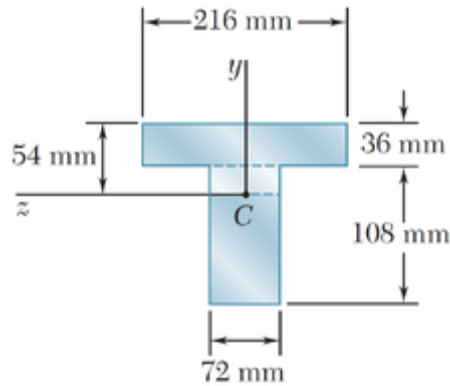
18. (a) Determine the co-ordinates of centroid of the shaded area shown in figure. CO3-Ana (16)



- (i) To find  $\bar{X}$  and (ii)  $\bar{Y}$

Or

- (b) Determine the moment of the section about the horizontal and vertical axes, passing through the centre of gravity of the T-section as shown in figure. CO3- Ana (16)

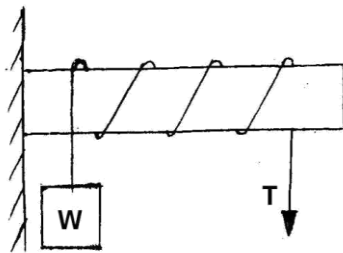


19. (a) A body is projected at an angle such that its horizontal range is 3 times the maximum height. Find the angle of projection

Or

- (b) Two bodies weighing 300N and 450N are hung to the ends of a rope passing over an ideal pulley. (i) With what acceleration the heavier body comes down? (ii) What is the tension in the string?

20. (a) A rope is wrapped three and a half times around a cylinder as shown in fig. Determine the force  $T_1$  exerted on the free end of the rope that is required to support a 1kN weight. The coefficient of friction between the rope and the cylinder is 0.25



Or

- (b) Two bodies of weights 40 N and 15 N are connected to the two ends of a light inextensible string, which passes over a smooth pulley. The weight 40 N is placed on a smooth inclined plane, while the weight 15 N is hanging free in air. If the angle of the plane is  $15^\circ$ , determine: acceleration of the system and tension in the string. Take  $g = 9.80 \text{ m/s}^2$ .