Reg. No. | | | | | | | | | | | |

D.K.M. COLLEGE FOR WOMEN (AUTONOMOUS), VELLORE-1

SEMESTER EXAMINATIONS

NOVEMBER – 2017 15CMA5C

STATICS

Time : 3 Hrs **Max. Marks : 75**

SECTION-A (10 x 2 = 20)

Answer ALL questions.

1. *State Hooke's Law.*
2. *Define moment of a force.*
3. *What is meant by couple?*
4. *Three forces acting along the sides of a triangle in the same order are equivalent to a couple. Show that they are proportional to the sides of the triangle.*
5. *Define angle of friction.*
6. *Write the definition of co – efficient of friction.*
7. *Define the directrix of a catenary.*
8. *Write the intrinsic equation of the shape of the string.*
9. *Define centre of mass.*
10. *Find the mass centre of thin wire in the form of a circular arc.*

SECTION-B (5 x 5 = 25)

Answer any FIVE of the following questions.

11. *Find the magnitude and direction of the resultant of two forces.*
12. *State and prove varigon's theorem.*
13. *ABC is an equilateral triangle of side a; D, E, F divide the sides BC, CA, AB respectively in the ratio 2:1. Three forces each of magnitudes P, act at D, E, F perpendicularly to the sides and outward from the triangle. Prove that they are equivalent to a couple of moment* $\frac{1}{2}Pa$.
14. *Find the inclination* θ *to the vertical of a uniform ladder AB of length 2a and weight* ω *which is in limiting equilibrium having contact with a rough horizontal floor and a rough vertical wall, the co – efficient of friction being* μ.
15. *A rod AB rests with in a fixed hemi spherical bowl whose radius is equal to the length of the rod. If* μ *is the co – efficient of friction, show that in limiting equilibrium, the inclination* θ *of the rod to the horizontal is given by* $tan\theta = \frac{4\mu}{3-\mu^2}$.
16. *If the tangents at the points A and B of a hanging string are at right angles, show that the tension at the middle point M of the arc AB is equal to the half of the weight of the string AB.*
17. *OA and OB are two uniform rods of lengths 2a, 2b. If angle* $AOB = \alpha$, *show that the distance of the mass centre of the rods from O is* $\frac{(a^4+2a^2b^2cos\alpha+b^4)^{1/2}}{a+b}$.

18. *Show that the vertical angle α of a cone which is such that the centre of gravity of its whole surface area including the base coincides with the centre of gravity of its volume is* $2\ sin^{-1}\ 1/3$.

SECTION-C (3 x 10 = 30)

Answer ALL questions.

19. *(a) S is the circumcentre of a triangle ABC. If forces of magnitudes P, Q, R acting along SA, SB, SC are in equilibrium, show that P, Q, R are in the ratio*

(i) $\frac{P}{sin 2A} = \frac{Q}{sin 2B} = \frac{R}{sin 2C}$.

(ii) $\frac{P}{a^2(b^2+c^2-a^2)} = \frac{Q}{b^2(c^2+a^2-b^2)} = \frac{R}{c^2(a^2+b^2-c^2)}$

(iii) $\frac{P}{\Delta BSC} = \frac{Q}{\Delta CSA} = \frac{R}{\Delta ASB}$.

(Or)

(b) (i) Five equal forces act along the sides AB, BC, CD, DE, EF of a regular hexagon. Show that the sum of moments of these forces about any point Q on FA is a constant.

(ii) Forces of magnitudes 3p, 4p, 5p act along the sides AB, BC, CA of an equilateral triangle taken in order. Find the magnitude and the direction of the resultant. *(5 + 5)*

20. *(a) A uniform ladder of length l rests on a rough horizontal ground with its upper end projecting slightly over a smooth horizontal rod at a height h above the ground. If the ladder is about to slip. Show that the co – efficient of friction is equal to* $h\sqrt{l^2 - h^2}/l^2 + h^2$.

(Or)

(b) Find the mass centre of *(5 + 5)*

(i) Lamina in the form of a sector of a circle and

(ii) Cardioidal Lamina.

21. *(a) (i) If a chain is suspended from two points A, B on the same level and the depth of the middle point below AB is* $\frac{1}{n}$*, where 2l is the length of the chain, show that the horizontal span AB is equal to* $l\frac{n^2-1}{n} log \frac{n+1}{n-1}$.

(ii) The sag of a telegraph wire tightly stretched between two poles distant a apart, is b. Show that, if the weight per unit length is ω, the terminal tension is approximately $\left(\frac{a^2}{8b} + \frac{7b}{6}\right)\omega$.

(Or)

(b) Find the resultant of two parallel forces acting on a rigid body.

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