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

DEPARTMENT OF MATHEMATICS

QUESTION BANK (ODD SEMESTER)

STATICS

III B.Sc. – MATHEMATICS

UNIT I **SECTION-A** **2 MARKS**

1. Define equilibrium.
2. Define repulsion.
3. Define resultant forces.
4. . State Lami's theorem.
5. State the condition for any number of forces acting at a point to be in equilibrium.

SECTION-B **5 MARKS**

1. State and prove parallelogram law theorem.
2. The resultant of two forces 3p and 2p is R. If first force is doubled then the resultant also doubled. Find the angle between the forces
3. State and prove Lami's theorem.

SECTION-C **10 MARKS**

1. Two forces of magnitudes F_1,F_2 acting at a point including an angle α between them. If they are interchanged then show that the resultant is turned through an angle
$$2\tan^{-1}\left(\frac{F_1 - F_2}{F_1 + F_2}\right) tan\alpha/2$$
2. The resultant of two forces P,Q acting at an angle θ is equal to$(2m+1)\sqrt{(P^2+Q^2)}$ when they act an angle (90-θ) the resultant is $(2m-1)\sqrt{(P^2+Q^2)}$. Prove that
$$\tan\theta = \frac{m-1}{m+1}$$
3. State and prove converse of the triangular law.

UNIT II SECTION-A 2 MARKS

1. State triangular law of forces.
2. State lami's theorem
3. Define like and unlike parallel forces.
4. Define couple and moment of a couple.

SECTION-B 5 MARKS

1. Forces $2, \sqrt{2}, 5, \sqrt{3}, 2kg$ respectively act at the angular point of a regular hexagon towards the five other angular points. Find the magnitude and direction of the resultant.
2. S and H a circumcentre and orthocentre of triangle ABC.Show that the resultant of the forces $\overrightarrow{HA}, \overrightarrow{HB}, \overrightarrow{HC}$ acting at H is $\overrightarrow{2HS}$

SECTION-C 10 MARKS

1. To find the resultant of two like parallel forces acting on a rigid body.
2. To find the resultant of two unlike parallel forces acting on a rigid body.
3. State and prove varignon's theorem.

UNIT III SECTION-A 2 MARKS

1. Define couple
2. Define moment.
3. Define scalar moment.

SECTION-B 5 MARKS

1. Force of magnitude P,Q,R acting on a rigid boby are along the sides BC,CA,AB OF triangle ABC.If the resultant passes through the circumcentre and centroid then find the ratio og P:Q:R.
2. System of coplanar couples acting on a rigid body can be reduced into a single couple whose moment is algebraic sum of moments of a individual couples.
3. Three forces acting on a rigid body be represented both in magnitude and in direction, along the line of action by three sides of a triangle taken in order then they are equivalent to a couple whose moments is twice the vector area of the triangle.
4. The system of coplanar forces acting on a rigid body can be reduced into either a single force or a couple.

SECTION-C 10 MARKS

1. Find equation of line of action of a single force which is equivalent to a system of coplanar forces acting on a rigid body.
2. Find necessary and sufficient condition for a system of coplanar forces acting on a rigid body to be in equivalent.

UNIT IV SECTION-A 2 MARKS

1. Define coefficient of friction.
2. What is limiting of friction.
3. Write the properties of friction.

SECTION-B 5 MARKS

1. A ladder which stands on a horizontal ground leaning against a vertical wall, has its centre of gravity at distance **a** and **b** from its lower and upper ends respectively. show that, if the ladder is in limiting equilibrium, and if μ and μ' are the coefficients of friction at the lower and upper contacts, its inclination θ to the vertical is given by tan θ $=\frac{(a+b)\mu}{a-b\mu\mu'}$
2. State laws of friction.
   OA and OB are two uniform rods of lengths 2a,2b.If <AOB =a, show that the distance of the mass centre of the rods from O, is $\frac{(a^2+2a^2b^2\ cos\alpha+b^2)^{1/2}}{a+b}$

SECTION-C 10 MARKS

1. Find the equilibirium position of a body placed on a rough inclined plane.
2. A uniform ladder is in equilibrium with one end resting on the ground and the other against a vertical wall, if the ground and wall be both rough, the coefficients of friction being μ *and* μ' respectively and if the ladder be on the point of slipping at both ends, show that θ, the inclination of the ladder to the horizon is given by $\tan\theta = \frac{1-\mu\mu'}{2\mu}$

UNIT V SECTION-A 2 MARKS

1. Prove that $y^2 = c^2 + s^2$.
2. Define suspension bridge.
3. Define centre of mass.
4. Find the centre of mass of three particles of different masses placed at the vertices of three uniform rods forming a triangle.

SECTION-B 5 MARKS

1. Find the centre of mass of a lamina in the form of a quadrant of an ellipse of axes 2a,2b.
2. The span of a suspension bridge is 100m and the sag at the middle of each cable is 10m.If 1the total load on each cable is 750bquintals,find he greatest tension in each cable and the tension in each cable and the tension at the lowest point.

3. A uniform string of length l is suspended from the point A,B in the horizontal line. If the tension at A is n times the tension at the lowest point C, then show that the span is
   i. $\frac{l}{\sqrt{n^2-1)}}\log(n+\sqrt{n^2-1})$.

SECTION-C 10 MARKS

1. Find the mass centre of a cardioidal lamina.
2. To calculate approximately the sag of a telephone wire in terms of its length and span when the wire is tightly pulled and tied and to find the tension if w is the weight of the wire per unit length.