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

G. VENKATASWAMY NAIDU COLLEGE (AUTONOMOUS), KOVILPATTI – 628 502.

UG DEGREE END SEMESTER EXAMINATIONS - APRIL 2025.

(For those admitted in June 2021 and later)

PROGRAMME AND BRANCH: B.Sc., MATHEMATICS

SEM	CATEGORY	COMPONENT	COURSE CODE	COURSE TITLE
V	PART - III	CORE	U21MA511	STATICS

Date & Session: 26.04.2025/AN **Time : 3 hours** **Maximum: 75 Marks**

Course Outcome	Bloom's K-level	Q. No.	SECTION – A (10 X 1 = 10 Marks) Answer ALL Questions.
CO1	K1	1.	Choose the resultant of two equal forces P, P at an angle α. a) $2\cos\frac{\alpha}{2}$ b) $2P\cos\frac{\alpha}{2}$ c) $2P\cos\alpha$ d) $2\cos\alpha$.
CO1	K2	2.	If 3 forces acting at a point are in equilibrium each force is proportional to the ---------- of the angle between the other two. a) Sine b) Cosine c) Tangent d) Co-tangent
CO2	K1	3.	P and Q are like parallel forces, Q is moved parallel to itself through a distance 'x', then select the resultant of P and Q moves through a distance. a) $\frac{Q}{P+Q}$ b) $\frac{Q}{P-Q}$ c) $\frac{Qx}{P+Q}$ d) $\frac{Qx}{P-Q}$.
CO2	K2	4.	If the force tends to turn the body in a clockwise direction, its moment is said to be ----------. a) Neutral b) Positive c) Negative d) Both positive and negative.
CO3	K1	5.	When a body is leaning against a ------ surface, the reaction on the body is ---------- to the surface. a) Smooth and perpendicular b) Rough and normal c) Rough and perpendicular d) Smooth and normal.
CO3	K2	6.	If three coplanar forces acting on a rigid body keep it in equilibrium, they must either be concurrent or be all ----------. a) perpendicular b) parallel c) coplanar d) same.
CO4	K1	7.	Trace the maximum value of friction. a) μ b) R c) $\frac{\mu}{R}$ d) μR.
CO4	K2	8.	The force which balance other forces acting on the body is called a ----------. a) normal b) frictional force c) passive d) static.
CO5	K1	9.	Write the intrinsic equation of a common catenary. a) $s = c\sin\Psi$ b) $s = c\cos\Psi$ c) $s = c\cot\Psi$ d) $s = c\tan\Psi$.
CO5	K2	10.	If two points A and B from where the string is suspended are in a horizontal line, then the distance AB is called the ---------. a) span b) sag c) directrix d) catenary.

Course Outcome	Bloom's K-level	Q. No.	**SECTION – B (5 X 5 = 25 Marks)** **Answer ALL Questions choosing either (a) or (b)**
CO1	K3	11a.	The resultant of two forces P, Q acting at a certain angle is X and that of P, R acting at the same angle is also X. The resultant of Q, R again acting at the same angle is Y. Determine the value of P as P = $(X^2 + QR)^{1/2} = \frac{QR(Q+R)}{Q^2+R^2-Y^2}$ **(OR)**
CO1	K3	11b.	Five forces acting at a point are represented in magnitude and direction by the lines joining the vertices of any pentagon to the midpoints of their opposite sides. Estimate that they are in equilibrium.
CO2	K3	12a.	Estimate the conditions of equilibrium of three coplanar parallel forces. **(OR)**
CO2	K3	12b.	Three like parallel forces, acting at the vertices of a triangle, have magnitudes proportional to the opposite sides. Determine that their resultant passes through the incentre of the triangle.
CO3	K4	13a.	If three forces acting on a rigid body are in equilibrium, conclude that they must be coplanar. **(OR)**
CO3	K4	13b.	Illustrate two trigonometrical theorems.
CO4	K4	14a.	Classify the four laws of friction. **(OR)**
CO4	K4	14b.	A particle of weight 30 kgs resting on a rough horizontal plane is just on the point of motion when acted on by horizontal forces of 6kg wt and 8 kg wt at right angles to each other. Evaluate the coefficient of friction between the particle and the plane and the direction in which the friction acts.
CO5	K5	15a.	A uniform chain of length 'l' is to be suspended from two points in the same horizontal line so that either terminal tension is 'n' times that at the lowest point. Prove that the span must be $\frac{1}{\sqrt{n^2-1}} log\,(n + \sqrt{n^2 - 1}$. **(OR)**
CO5	K5	15b.	A uniform chain of length '2l' hangs over two small smooth pegs in the same horizontal line and at a distance '2a' apart. Prove that, if 'h' is the sag in the middle, the length of either part of the chain that hangs vertically is $h + l - \sqrt{2hl}$.

Course Outcome	Bloom's K-level	Q. No.	**SECTION – C (5 X 8 = 40 Marks)** **Answer ALL Questions choosing either (a) or (b)**
CO1	K3	16a.	Weights W, w, W are attached to points B,C,D respectively of a light string AE where B,C,D divide the string into 4 equal lengths. If the string hangs in the form of 4 consecutive sides of a regular octagon with the ends A and E attached to points on the same level, manipulate W = $(\sqrt{2} + 1)w$. **(OR)**
CO1	K3	16b.	Two beads of weights w and w' can slide on a smooth circular wire in a vertical plane. They are connected by a light string which subtends an angle 2β at the centre of the circle when the beads are in equilibrium on the upper half of the wire. Identify the inclination of the string to the

			horizontal as $tan\,\alpha = \frac{w \sim w'}{w + w'}\, tan\,\beta$.
CO2	K4	17a.	Two like parallel forces P and Q act on a rigid body at A and B respectively. **(a)** If Q be changed to $\frac{P^2}{Q}$, Conclude that the line of action of the resultant is the same as it would be if the forces were simply interchanged. **(b)** If P and Q be interchanged in position, Examine that the point of application of the resultant will be displayed along AB through a distance 'd', where $d = \frac{P - Q}{P + Q}\, AB$
			(OR)
CO2	K4	17b.	Illustrate Varigon's theorem of Moments.
CO3	K4	18a.	A uniform rod of length 'a', hangs against a smooth vertical wall being supported by means of a string of length 'l' tied to one end of the rod, the other end of the string being attached to a point in the wall. Examine that the rod can rest inclined to the wall at an angle θ given by $cos^2\,\theta = \frac{l^2 - a^2}{3a^2}$. Analyze the limits of the ratio of a:l in order that equilibrium may be possible or not?
			(OR)
CO3	K4	18b.	A uniform rod of length '2l' rests with its lower end in contact with a smooth vertical wall. It is supported be a string of length 'a', one end of which is fastened to a point in the wall and the other end to a point in the rod at a distance 'b' from its lower end. If the inclination of string to the vertical be θ, Discover that $cos^2\,\theta = \frac{b^2(a^2 - b^2)}{a^2\, l\,(2b - l)}$.
CO4	K5	19a.	Predict the equilibrium of a body on a rough inclined plane under any force.
			(OR)
CO4	K5	19b.	A particle is placed on a rough plane whose inclination to the horizon is α and is acted upon by force P acting parallel to the plane and in a direction making an angle β with the line of greatest slope in the plane. If the coefficient of friction be μ and the equilibrium be limiting, deduct the direction in which the body will begin to move.
CO5	K5	20a.	Interpret the equation of the common catenary.
			(OR)
CO5	K5	20b.	Prove that the length of an endless chain which will hang over a circular pulley of radius 'a' so as to be in contact with two-thirds of the circumference of the pulley is $a\left[\frac{4\pi}{3} + \frac{3}{log\,(2 + \sqrt{3})}\right]$