(i) **Printed Pages :3** **Roll No. .....**

(ii) **Questions :8**

Sub. Code : 0 2 4 0

Exam. Code: 0 0 0 3

B.A/B.Sc. (General) 3rd Semester

1125

MATHEMATICS

Paper - III :Statics

Time Allowed : 3 Hours] **[Maximum Marks : 30**

Note :- Attempt **five** Questions selecting at least **two** questions from each Unit. Each question WIll carry 6 marks.

UNIT-I

I (a) Prove that direction of the resultant of two concurrent forces is inclined more towards the greater force. 3

(b) If greatest possible resultant of two forces R and S acting at a point is m times the least, show that the angle between them when their resultant is half their sum is

$$\cos^{-1}\left(-\frac{m^2+2}{2(m^2-1)}\right)$$

II (a) If a force be resolved into two components, one of which is at right angles to the force and equal to it in magnitude, find the direction and magnitude, of the other. 3

(b) A, B and C are three points on a circle. Forces inversely proportional to AB and BC act alongAB and BC respectively. Show that their resultant acts along the tangent to the circle at B. 3

III (a) Find the resultant of two unlike. parallel forces R and S (R > S) acting at two distinct points. 3

(b) A string is tied to two points at the same level, and a Smooth ring of W kg wt which can slide freely along the String is pulled by a horizontal force of P kg wt. If in the position of equilibrium the portions of string are inclined at 60 and 30 to the horizontal, find the value of P and tensron in the String

IV (a) State and prove Lami's Theorem. 3

(b) A weight W is supported on a smooth plane of inclination β to the horizontal by a force whose line of action makes an angle 2β with the horizontal. If the pressure on the Plane be arithmetic mean of the weight and the force,

showthat: $\beta = \frac{1}{2} \sin^{-1}(\frac{3}{4})$ 3

UNIT-II

V (a) A 100 kg vertical force is applied at the end B of a tree AB which is fixed in the ground making an angle 60° with the horizontal:

(i) Find the moment of force at B about A.

(ii) What is the magnitude of a horizontal force applied at B which creates the same moment about A? 3

(b) Three like parallel forces 2R + S, 4R - S and 8N act at the vertices of a triangle. Find R and S if their resultant passes through the centroid of the triangle. 3

VI (a) Show that two coplanar couples of equal and opposite moments are in equilibrium. 3

(b) A light wire, in the form of an arc of a circle subtending an angle β at its Center and having two weight P and Q as its extremities, rests with its convexity downloads upon a horizontal plane. If θ is the inclination to the vertical of the radius to the end at Which P is suspcnded, then show that

$$\tan\theta = \frac{Q\sin\beta}{P + Q\cos\beta}$$

VII(a) ABCD is a rectangle with AB and BC of 'a' and 'b' units respectively, Forces P, P act along AB and CD and forces Q, Q act along AD and CB where P > Q. Prove that the perpendicular distance between the resultant of the forces P, Q at A and the resultant of the forces P, Q at C is

$$\frac{Pb - Pa}{\sqrt{P^2 + Q^2}}$$

VIII(b) A uniform ladder of weight W is resting in limiting equilibrium with its.one end on a rough horizontal floor and the other end agalnst a smooth vertical wall. Show that the inclination of the ladder to the vertical is twice the angle of friction.

(a) A heavy rod AB whose centre of gravity divides it into two portions a and b is placed inside a smooth sphere. The rod subtends an angle 2α at the centre. Find inclination of the rod to the vertical and reactions at A and B. 3

(b) If the force which acting parallel to a rough plane of inclination θ to the horizon is just sufficient to draw a weight up be m times the force which will just be on the pomt of sliding down,

Show that $\tan\theta = \frac{m+1}{m-1}\mu$, where μ is the coefficient of friction.