B-2110

8463/NH

Time: -3 hrs **M. M. 40**

STATICS [redacted]-(MATHS) III

Note: - Candidate are required to Attempt five questions in all selecting two questions from each Section-A and B and Section-C is compulsory.

Section-A **12 marks**

Q1:- State and prove Lami's theorem.

Q2: ABCD is a square and O is a point dividing BC in the ratio 3:1. Find the resultant of forces 12, 5, 9 kg. wt. Acting along AB, AO and AD respectively.

Q3:- Forces equal to P, 2P and 4P act along the sides of an equilateral triangle taken in order. Find their resultant.

Q4:- ABCDEF is regular hexagon, forces P, 2P, 3P, 2P, 5P, 6P act along AB, BC, DC, ED, EF and AF respectively. Show that the six forces are equivalent to a couple and find its moment.

Section-B **12 marks**

Q5:- A Uniform rod AB of wt. W and length 2a can turn about a smooth pivot at its upper end A and lower end B is kept at a distance 2b from the vertical by a horizontal force applied at B. Find the reaction at the end A and the horizontal force.

Q6:- A ladder rests at an angle α to the horizon with its ends resting on a smooth plane and against a smooth vertical wall, the lower end being attached by a string to the junction of the wall and floor, find the tension in the string. Also find the tension in the string when a man whose weight is one half that of the ladder has ascended two-third of its length.

Q7:- A body of weight W can just be sustained on a rough inclined plane by a force P and just dragged up the plane by a force Q, P and Q both acting up the line of the greatest slope. Find the coefficient of friction.

Q8:- A rod of uniform thickness has its two halves composed of different materials. If the rod balances about a point distant one third of its whole length from one end, compare the densities of two parts.

Section-C **16 marks**

Q9: (a) State Newton's law of motion.

(b) State Parallelogram Law of forces.

(c) A man carries a weight of 20 kg at one end of the stick 1m long resting on his shoulder and holds the other end. Find the pressure on his shoulder, if the stick projected in form of his shoulder is 60 cm.

(d) Prove that the algebraic sum of the moments of the forces forming a couple about any point in their plane is constant.

(e) A uniform rod BC of 2 kgs can turn freely about B and is supported by a string AC=80 cm long attached to a point A in the same horizontal line as B, the distance AB is one meter. If the rod is 60 cm long, find the tension in the string.

(f) A weight of 30 kg can just rest on a rough inclined plane when its inclination to the horizon is 30°, when the inclination is increased to 60° find the least horizontal force which will support it.

(g) If C.G. of a sector of a circle subtending an angle 2α at the centre lies on the chord of the sector prove that $2tan\alpha = 3\alpha$.

(h) A triangle ABC is weighing 6 kgs. What weight must be placed at A so that C.G. of the whole may bisect the line joining A to the middle point of BC?