Roll No. | | | | | | | | | | | | | **Total No. of Pages: 02**

Total No. of Questions: 07

B.Sc. (CS) (Sem. – 4)

FUNDAMENTALS OF STATICS

Subject Code: BCS-402

M Code: 72318

Date of Examination: 15-12-2022

Time: 3 Hrs. **Max. Marks: 60**

INSTRUCTIONS TO CANDIDATES:

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains SIX questions carrying TEN marks each and students have to attempt any FOUR questions.**

SECTION-A

1. Explain briefly:

   a) State Lami's theorem.

   b) The resultant of the forces P, Q, R acting along the sides BC, CA, AB, respectively of a triangle ABC passes through its circumcentre. Show that

   $$P\cos A + Q\cos B + R\cos C = 0.$$

   c) State $m - n$ theorem.

   d) Define moment of a force about a point. Also, prove that the vector sum of the moments of all the coplanar forces (acting at a point of a rigid body) about any arbitrary point is equal to the moment of their resultant about the same point.

   e) State and prove triangle law of forces.

   f) A body of weight 40kg. rests on a rough horizontal plane whose coefficient of friction is 0.25, find the least force which acting horizontally would move the body

   g) Give the condition for equilibrium of a particle on a rough plane.

   h) Define null line and null plane.

   i) Find the null point of the plane $x + y + z = 0$ for the force system $(X, Y, Z; L, M, N)$.

   j) Show that $LX + MY + NZ$ and $X^2 + Y^2 + Z^2$ are invariant.

SECTION-B

2. ABC is a triangle. Forces P, Q, R acting along the lines OA, OB, OC are in equilibrium. Prove that if O is the circumcentre of the triangle ABC, then

   a) $P: Q: R = \sin 2A: \sin 2B: \sin 2C$ and

   b) $P: Q: R = a^2(b^2 + c^2 - a^2): b^2(c^2 + a^2 - b^2): c^2(a^2 + b^2 - c^2)$.

3. Three forces P, Q, R act along the sides BC, CA, AB of a triangle ABC, taken in order and their resultant passes through the centre of the inscribed and circumscribed circles, prove that $P: Q: R = (\cos B - \cos C): (\cos C - \cos A): (\cos A - \cos B)$.

4. Equal weights P and P are attached to two strings ACP and BCP passing over a smooth peg C. AB is a heavy beam of weight W, whose centre of gravity is a feet from A and b feet from B, show that AB is inclined to the horizon at an angle $\tan^{-1}\left[\frac{a-b}{a+b}\tan\left(\sin^{-1}\frac{W}{2P}\right)\right]$.

5. A weight of 60kgs. Is on the point of motion down rough inclined plane when supported by a force of 24kgs. wt. acting parallel to the plane and is on the point of motion up the plane when under influence of a force of 36kgs. wt. parallel to the plane, find the coefficient of friction.

6. A solid of uniform density is built up of a hemisphere of radius r and a circular cylinder of radius r and height h on the circular base of the hemisphere. Find the position of centre of gravity of the solid from the common base.

7. Find the condition that the straight line $\frac{x-a}{l} = \frac{y-b}{m} = \frac{z-c}{n}$ may be a null line for a given system of forces.

NOTE : Disclosure of Identity by writing Mobile No. or Marking of passing request on any paper of Answer Sheet will lead to UMC against the Student.