

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 : 07-07-22

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. Write briefly :

- a) In what ratio does the C.G. of the curved surface of a hollow cone divides its axis of symmetry?
- b) State polygon law of forces.
- c) State  $\lambda - \mu$  theorem.
- d) Define limiting and static friction.
- e) State two necessary and sufficient conditions that a system of coplanar forces acting on a rigid body be in equilibrium.
- f) State polygon law of forces. Is its converse true.
- g) What is the geometrical interpretation of moment of a force about a point? Justify.
- h) Define Wrench.
- i) What do you mean by null lines?
- j) Define friction.

## SECTION-B

2. a) Two forces of magnitude  $P + Q$  and  $P - Q$  make an angle  $2\alpha$  with one another, and their resultant makes an angle  $\theta$  with the bisector of the angle between them. Show that  $P \tan \theta = Q \tan \alpha$ .
- b) Define couple. Prove that the algebraic sum of moments of the forces forming a couple about any point in their plane is constant.
3. Prove that if three parallel forces acting on a rigid body be in equilibrium, then each is proportional to the distance between the other two. Use this result to solve the problem : A heavy uniform rod 200cm long rests horizontally on two pegs which are 50 cm apart, a weight of 20 kg suspended from one end or a weight of 8kg suspended from the other end will just tilt the rod up. Find the weight of the rod.
4. Define the basic three kinds of friction. A uniform ladder of length  $l$  rests on a rough horizontal ground with its upper end projecting slightly over a smooth horizontal rail at a height  $a$ . If the ladder is about to slip and  $\lambda$  is the angle of friction with the ground, prove that  $\tan \lambda = \frac{a\sqrt{l^2 - a^2}}{l^2 + a^2}$ .
5. a) A hemisphere and a solid cone have a common base. The center of gravity of the common structure coincides with the centre of the common base. If  $R$  is the radius of hemisphere and  $h$  is height of the cone, then find  $\frac{h}{R}$ .
- b) Find the null point of the plane  $x + y + z = 0$  for the force system  $(X, Y, Z; L, M, N)$ .
6. a) Forces of magnitude  $P, 2P, -P$  and  $2P$  act along the sides  $AB, BC, CD$  and  $DA$  respectively of a square  $ABCD$  and  $P\sqrt{2}$  acts along each of the diagonals  $BD$  and  $CA$ . Show that the forces reduce to a couple and find its moment.
- b) A given force  $F$  is resolved into two components inclined at  $45^\circ$  and  $\alpha$ . If the second component is  $\frac{\sqrt{2}}{\sqrt{3}}F$ , find  $\alpha$  and the first component.
7. a) Show that among the null lines of any system of forces four are generators of hyperboloid, two are belonging to one system of generators and two to the other system.
- b) Three equal forces acting on a rigid body at  $(a,0,0), (0,b,0)$  and  $(0,0,c)$  parallel to  $Y, Z$  and  $X$ -axis respectively. Find the resultant wrench.

**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.**