

This question paper contains 3 printed pages.]

Your Roll No.

1392

A

B.Sc. (Hons.)/I

ELECTRONIC SCIENCE—Paper 1.1 (I)

(Mechanics and Strength of Materials)

Time : 3 Hours

Maximum Marks : 38

*(Write your Roll No. on the top immediately
on receipt of this question paper.)*

Attempt five questions in all, including

Q. No. 1 which is compulsory.

Marks are indicated against each question.

1. (a) How can a two-body problem be reduced to an equivalent one-body problem?
- (b) A reference frame rotates with a uniform angular acceleration with respect to an inertial frame. Give the expression for the fictitious forces.
- (c) Show that the conservation of linear momentum is invariant under a Galilean transformation.
- (d) Why is a hollow shaft more rigid than a solid shaft of the same mass, length and material?
- (e) Draw the shear force and bending moment diagram in case of a weightless cantilever loaded at its free end.

$2 \times 5 = 10$

[P.T.O.]

2. (a) Derive an expression for the gravitational potential and field at a point inside and outside a uniform solid sphere. 3 + 1
- (b) State and prove Kepler's third law of planetary motion. 3
- 3 (a) Describe the Michelson Morley experiment. How is the negative result of this experiment explained? 4
- (b) A photon and a relativistic electron have a common Compton wavelength. Compare their momenta, relativistic masses and kinetic energies. 3
4. (a) Derive an expression for the relativistic mass as a function of the velocity of a particle of mass m_0 . 5
- (b) What is the twin paradox in special theory of relativity? 2
5. (a) Define the Young's modulus of a material and relate it to Poisson's ratio and bulk modulus of the material. 3
- (b) A cantilever of length l is clamped rigidly in a wall at the left end and carries a load W at its right end. The cantilever has a small weight w . Calculate deflection under the load. 4
6. (a) Define the terms shear force and bending moment. 2
- (b) A simply supported beam of length 10 m carries a uniformly distributed load of 10 N/m over half its length starting from A at 4 m from the left support to B where a concentrated load of 100 N is also situated. Draw shear force and bending moment diagrams. 5

7. (a) Derive an expression for the torque required to twist a hollow cylinder. 4
- (b) Prove the relation :

$$M = \frac{YI}{R} \quad 3$$

for the bending moment produced in a beam bent in the arc of a circle of radius R , where Y is the Young's modulus of the material and I is the geometrical inertia of the cross-section. 3