53 (CE 302) STMT

2013

(December)

STRENGTH OF MATERIALS

Paper : CE 302

Full Marks : 100

Pass Marks : 30

Time : Three hours

*The figures in the margin indicate full marks
for the questions.*

*Answer **any five** questions out of **seven**.*

1. *(a)* Derive the equation for theory of simple bending showing relation between various characteristics of beam.   15

   (b) A timber beam of rectangular section supports a load of $20kN$ uniformly distributes over a span of $3.6m$. If depth of the beam section is twice the width and maximum stress is not to exceed $7Mpa$, find the dimensions of the beam section.   5

2. (a) Derive equation for strength of a solid shaft and also derive for the power transmitted by a shaft. 7+3

(b) A solid shaft is subjected to a torque of $1.6kNm$. Find the necessary diameter of the shaft, if the allowable shear stress is $60Mpa$. The allowable twist is $1°$ for every 20 diameters length of the shaft. Take $C = 80Gpa$. 10

3. (a) Derive for the total stress of a symmetrical column with eccentric loading about one axis. 10

(b) In a tension specimen $13mm$ in diameter the line of pull is parallel to the axis of the specimen but is displaced from it. Determine the distance of the line of pull from the axis, when the maximum stress is 15 per cent greater than the mean stress on a section normal to the axis. 10

4. (a) What are the general ways of failure of a column and struts ? Also list out the assumptions made in Euler's column theory. 10

(b) Compare the ratio of the strength of a solid steel column to that of a hollow of the same cross-sectional area. The internal diameter of the hollow column is $3/4$ of the external diameter. Both the columns have the same length and are pinned at both ends.   10

5. An element in a strained body is subjected to a compressive stress of $200Mpa$ and a clockwise shear stress of $50Mpa$ on the same plane. Calculate the values of normal and shear stresses on a plane inclined at $35°$ with the compressive stress. Also calculate the value of maximum shear stress in the element.   20

6. (a) List out the relations between loading, shear force and Bending Moment at a point or between *any two* sections of a beam.   8

    (b) In an experiment a bar of $30mm$ diameter is subjected to a pull of $60kN$. The measured extension on gauge length of $200mm$ is $0.09mm$ and the change in diameter is $0.0039mm$. Calculate the Poisson's ratio and the values of the three modulii.   12

7. Write short notes on : 4×5

    (a) Point of contraflexure

    (b) Theory of simple bending

    (c) Principal stress

    (d) Section modulus.