GANPAT UNIVERSITY

B.Tech. 3rd Semester (Mechanical),
Regular Examination : Nov- Dec : 2012

2ME302 STRENGTH OF MATERIALS

Instructions: -

(1) Answer to the two sections must be written in separate answer books.
(2) Assume suitable data if required.
(3) Figures to the right indicate full marks.

Invigilator's Sign.: _____

Exam. No. of the candidate: _____

Max. Marks: 70

Max. Time: 3 Hours

Section - I

1 (A) Derive classic flexural formula based on theory of pure bending. (05)

OR

1 (A) A circular beam is cantilever supported at the end and carries a point load at the free end. Prove that the ratio of span to diameter $= \frac{\text{Maximum Bending Stress}}{6 \times \text{Maximum Shear Stress}}$ (05)

2 (A) Draw shape of shear distribution diagrams for the beams having following cross sections under a shear force 'S'(I) Hollow Rectangular and Hollow Circular Shape, (II) I-Shape and Channel 'H' shape, (III) Triangle and Composite Section, (IV) T Shape and Inverted T Shape and (V) channel 'U' shape and circular shape. (05)

(B) A short column of external diameter D and internal diameter d carries an eccentric load P. Find the maximum eccentricity of the load that cannot produce tension in the cross section. (05)

(C) Explain clearly, the graphical method of finding out stresses in a rectangular element subjected to normal stresses σ_1 and σ_2 and shear stress (s). Using the same method, find out principal planes and principal stresses. (05)

3 Attempt any Three: 15)

(A) A point in a strained material is subjected to a tensile stress of 120 MPa and a clockwise shear stress of 40MPa what are the values of normal and shear stresses on a plane inclined at an angle of 25° with the normal to the tensile stress. Check the answer by Mohr's circle method.

(B) A beam of inverted T-section of overall depth 100 mm and thickness of web and flange is to carry bending moment. Determine the width of flange so that maximum permissible compressive stress 105 MPa and maximum permissible tensile stress 35 MPa reached simultaneously. What is the moment carrying capacity of this beam? Flange is in tension.

(C) A simply supported wooden beam of span 1.3 m having a cross section 150 mm wide by 250 mm deep carries a point load W at the centre. The permissible stresses are $7N/mm^2$ in bending and $1\ N/mm^2$ in shearing. Calculate the safe load W.

(D) A hollow circular column having and internal diameters of 300 mm and 250 mm respectively carries a vertical load of 100 kN at the outer edge of the column. Calculate the maximum and minimum intensities of stress in the section.

Section – II

4 (A) Prove that maximum shear stress at any point in a thin cylinder, subjected to internal fluid pressure is given by, $\tau_{max} = p\ d\ /\ 8\ t$ (06)

Also find an expression for change in diameter and change in length for thin cylinder subjected to internal pressure.

(B) A cylindrical vessel whose ends are closed by means of rigid flange plates is made of steel plate 3 mm thick. The internal length and diameter of vessel are 50 cm and 25 cm respectively, Determine the longitudinal and circumferential stresses in the cylindrical shell due to an internal fluid pressure of $3\ MN/m^2$. Also calculate increase in length, diameter and volume of the vessel. Take: $E = 200\ GN/\ m^2$ and $1/m = 0.3$. (06)

OR

4 (A) Where moment area method is conveniently used? Find the slope and deflection of a simply supported beam carrying a [1] point load at the centre and [2] u.d.l. over the entire length using moment area method. (06)

(B) A Simply supported rectangular R.C. beam of length 3m and cross-section 100 mm X 250 mm is subjected to a central point load of 15 KN. Find the maximum slope and deflection of the beam by Macaulay's method. Find the point load that can be placed centrally on the beam to cause a central deflection of 20 mm. Take E = 2 X 10^4 N/mm^2 (06)

5 (A) What do you mean by strength of riveted joint? Find an expression for the tearing strength, shearing strength and bearing strength of riveted joint. (05)

(B) A boiler 2.25 m diameter and of plate 16 mm thick subjected to a pressure of 5.6 bar. The rivets used for boiler are 20 mm diameter. The respective allowable crushing, tension and bearing strengths are 120 MPa, 60 MPa and 45 MPa. The longitudinal joint is double riveted double cover plate butt joint. Find the efficiency of joint and pitch of rivets on the basis of strength of joints. (Hint: strength of one rivet in shear=1.875 τ d^2 $\pi/4$) (06)

OR

5 (A) Derive the Euler's crippling load for column subjected to eccentric loading. (05)

(B) A hollow cylindrical cast iron column is 4 m long with both ends fixed. Determine the minimum diameter of the column, if it has to carry a safe load of 250 KN with a factor of safety of 5. Take the internal diameter as 0.8 times the external diameter. Take: α = 1/ 1600 in Rankine's formula and σ_c = 550 MN/m^2. (06)

6 Attempt any Two: (12)

(A) Derive the relation for a circular shaft when subjected to torsion as given below

$$T/J=F_s/R=N\theta/L$$

(B) A solid cylindrical shaft is to transmit 300kW power at 100 r.p.m. (1) If the shear stress is not to exceed $80N/mm^2$, find its diameter. (2) What percent saving in weight would be obtained if this shaft is replaced by a hollow one whose internal diameter equals to 0.6 of the external diameter, the length, the material and maximum shear stress being the same?

(C) Compare the torsional resistance of solid circular shaft and hollow circular shaft made from the same material and having same cross sectional area. The solid circular shaft is having 60mm diameter and hollow circular shaft is having internal diameter 0.75 times the external diameter.

"END OF PAPER"