SEAT No. :

[Total No. of Pages : 4

[4760] - 117

M.E. (Mechanical) (Design Engineering)
ADVANCED STRESS ANALYSIS
(2008 Pattern) (Semester - I)

Time :3 Hours]

[Max. Marks :100

Instructions to the candidates:

1) *Answer any three questions from each section.*

2) *Answers to the two sections should be written in separate answer books.*

3) *Neat diagrams must be drawn wherever necessary.*

4) *Figures to the right indicate full marks.*

5) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*

6) *Assume suitable data, if necessary.*

SECTION - I

Q1) a) Derive the compatibility equation in Cartesian co-ordinate system. **[8]**

b) Investigate what problem of plane stress is represented by the function. $\phi = m\left[\dfrac{x}{-^2} + \dfrac{y}{-^2} - 1\right]$

$$\phi = \frac{3F}{4h}\left(xy - \frac{2Ry^3}{3h^2}\right) + \frac{P}{2}y^2$$

Where, h is half depth of the beam, and F as the concentrated load. **[8]**

Q2) Show that

Solves the torsional problem for the solid elliptical shaft. Determine 'm' in terms of G , where G is modulus of torsional rigidity of shaft and   is angle of twist. Find the maximum shearing stress and the wrapping function. **[16]**

P.T.O.

Q3) State the assumptions made in solutions of problems in contact stresses. Derive from fundamentals the expression for the contact stresses between two rollers (with parallel axis) under compressive load. How this relation is used to find contact stresses between two spur gears. **[16]**

Q4) Circular disc of uniform thickness with 800 mm diameter has a central hole of 70 mm diameter. Determine the radial & circumferential stress distribution in the disc when it is rotating at 3000 r.p.m. about its own axis if Material density (ρ) = 8000 kg/m^3 and Poisson's ratio = 0.3. Plot the stress distribution and comment on it. Derive the expression used. **[16]**

Q5) Write short notes on any three: **[18]**

    a)   Theorem of virtual work.

    b)   Torsion of non circular shaft.

    c)   Stress in beams subjected to unsymmetrical bending.

    d)   Concept of plain stress & strain with suitable example.

SECTION - II

Q6) a)   Explain following terms used in photo elastic analysis: **[10]**

        i)   Isoclinics.

        ii)   Stress and strain fringe valve.

        iii)   Dark field Polari scope.

        iv)   Birefringement material.

    b)   How strain gauges are arranged to obtain various strain rosettes. **[6]**

Q7) a) Locate the position of shear centre for following cross section as shown in Fig. 1 of the beam. All dimensions are in mm. Derive the expression if any, you use. **[12]**
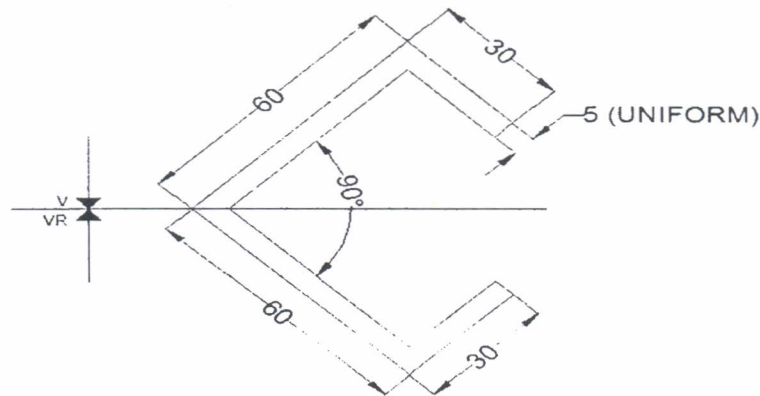

Fig.1

b) Explain the term shear centre and its importance. **[4]**

Q8) a) Prove that the differential equation for radial equilibrium in cylindrical coordinates of an element in a uniform thin disc rotating at ω rad/sec and subjected to principal direct stresses   is given by **[8]**

$$\sigma t - \sigma r - r\frac{\partial \sigma r}{\partial r} = \rho \omega^2 r^2$$

σr and σt

b) How you will increase the strength of a thick cylinder? **[4]**

c) Explain the term disk of uniform strength. **[4]**

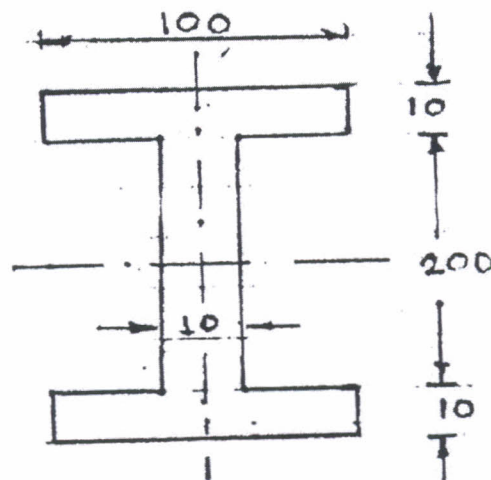**Q9)** a) Determine the shape factor for I section shown in fig.2

Fig.2

[10]

b) Explain the fracture mechanics approach for estimation of residual life of component. What is critical stress intensity factor? How it is useful in design of cracked components? [6]

Q10) Write short notes on any three [18]

a) Contact Stresses for gears

b) Brittle coating method & Coating Materials

c) Crack initiation and Crack opening phenomenon

d) Spring back effect in plastic bending.

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