Total No. of Questions : 7]

SEAT No :

P 3907

[Total No. of Pages :2

[5155]-157

M.E. (Mechanical) (Design Engineering)
ADVANCED STRESS ANALYSIS
(2013 Credit Pattern) (Semester-I)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***Attempt any five questions out of 7.***
2) ***All the questions should be solved in one answer book and attach extra supplements if required.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Use of calculator is allowed.***
5) ***Assume Suitable data if necessary, but state the assumptions clearly.***

Q1) A square plate of side a has a tensile stress in it described by **[10]**
$\sigma_x = Dy$ $\sigma_y = Ax$ and possibly some shear stress in addition.
Find a) Stress function.
b) Most general shear stress which can be associated with these tensile stress.

Q2) A circular plate (E = 200GPa, υ = 0.29, Yield stress = 276 MPa) has a radius of 250 mm and thickness h = 25 mm. The plate is simply supported at the edges and is subjected to a uniform pressure p of 1.38 MPa. **[10]**
Determine the maximum bending stress in the plate and maximum deflection. Derive the equation for maximum deflection you use.

Q3) An important part of a structure which currently is being made of an aluminium alloy having a modulus of elasticity of 60 MPa is to be replaced by a composite material containing E-glass fibre in nylon matrix. **[10]**
Determine minimum volume fraction of glass fibre, if it is desired that while weight reduction is important, the specific modulus of the component should not be lower than that of the current material. The direction of loading in the composite will be in the fibre direction. The density of aluminium alloy used is 2800 kg/m^3.

Material	Density (Kg/m^3)	Modulus of Elasticity (GPa)
E-glass	2550	72
Nylon	1140	2.8

P.T.O.

Q4) Derive an equilibrium equation in polar coordinate system. **[10]**

Q5) A three element rectangular rosette strain gauge is mounted on a steel specimen. For a particular state of loading of the structure the strain gauge readings are-

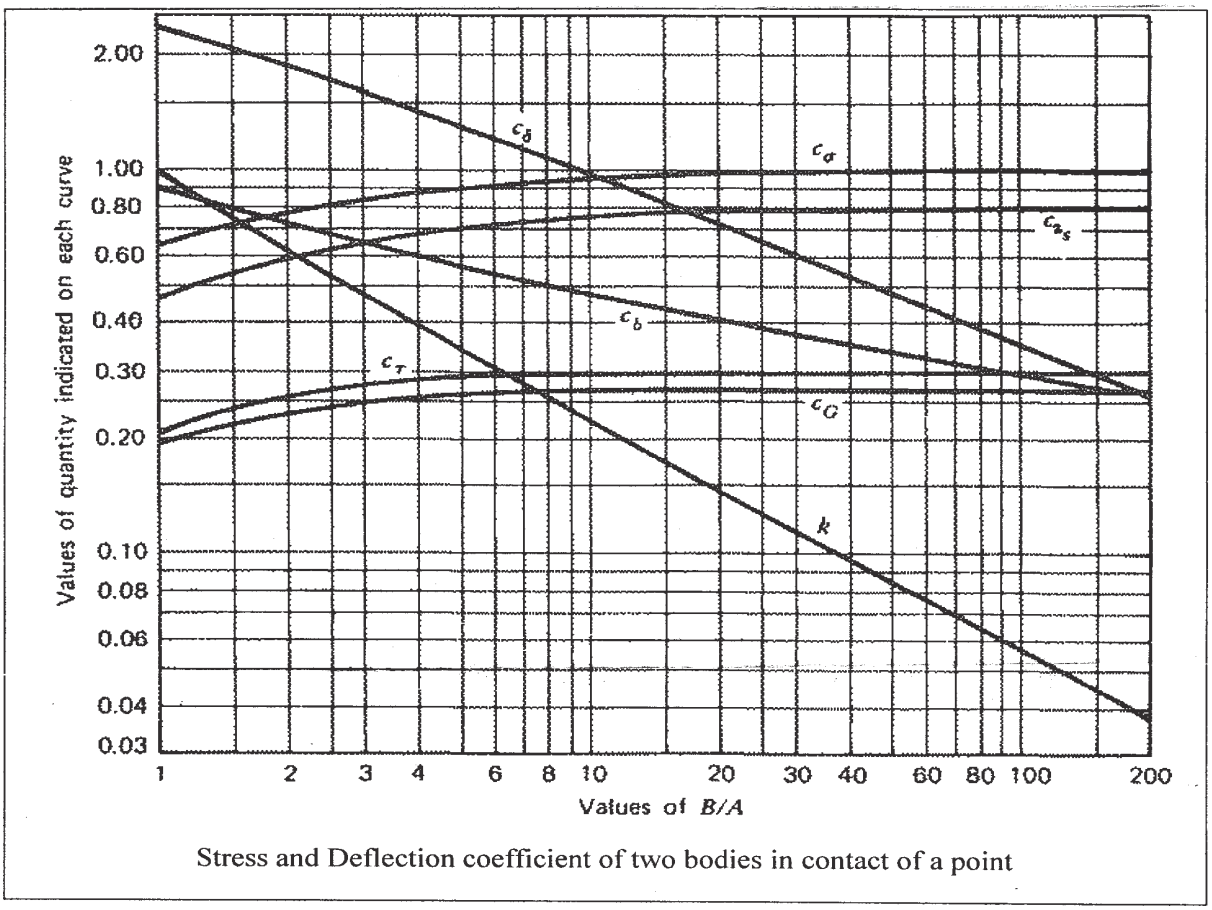
$\varepsilon_A = 200\ \mu$m/m, $\varepsilon_B = 900\ \mu$m/m, $\varepsilon_C = 1000\ \mu$m/m,

Determine the values and orientation of the principal stresses and the values of the maximum shear stress at the point, Let E = 200GPa and $\upsilon = 0.285$. **[10]**

Q6) A steel railway car wheel may be considered a cylinder with a radius of 440mm. The wheel rolls on a steel rail whose top surface may be considered another cylinder with a radius of 330 mm. For the steel wheel and steel rail, Young's modulus E = 200GPa and Poisson's ratio $\upsilon = 0.285$ and yield stress Y = 880 MPa. If the wheel load is 110 kN, determine the maximum Principal stress, maximum shear stress and maximum octahedral shear stress and the factor of safety against initiation of yielding based on the maximum shear stress criterion. **[10]**

Q7) a) Explain different criterions for stress analysis using plasticity approach. **[5]**

b) Explain different types of engineering plastics with suitable examples. **[5]**



Stress and Deflection coefficient of two bodies in contact of a point