M. C. E. EXAMINATION, 2024

1st semester

THEORY OF ELASTICITY AND ELASTIC STABILITY

Time 3 hours   Full marks 100

Answer each part in separate answer scripts

Part- I (Full marks = 60)

Answer either Question 1 or 2. Questions 3 and 4 are mandatory.

1. Deduce the generalized tensorial transformation law for vectors. Hence show how does a dyad (say stress or strain) transform? Also, prove that the determinant of a transformation matrix a_{jq} is unity.   6+6+6 = 18

2. It is given that at a certain point in a solid metal cube, the stress-components relative to axes x_i are σ_{11}= 80 MPa, σ_{22}= 60 MPa, σ_{33}= 20 MPa, σ_{12}= 20 MPa, σ_{23}= 10 MPa, and σ_{31}= 40 MPa.
   (a) Determine the stress vector on a plane normal to the vector $\vec{R} = 3\hat{\imath} + 3\hat{\jmath} + 3\hat{k}$.
   (b) Determine the principal stresses and principal direction of the major principal stress.   6+12=18

3. Find the expressions for (a) traction $T_i^{(n)}$ and (b) normal stresses σ_n with respect to stress components σ_{ij}.   8+8 =16

4. Provide a graphical interpretation of the strain terms ε_{11}, ε_{22} and ε_{12}. Derive the stress-strain raw of an orthotropic material from that of an anisotropic material.   6+12+8 =26

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M.E. CIVIL ENGINEERING FIRST YEAR FIRST SEM. EXAM. -2024

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PART-II (MARKS-40)

Use a separate Answer-Script for each part

No. of questions	Answer all questions	Marks 6+18+16=40
1.	What do you mean by stable, unstable and neutral equilibrium. Discus with neat sketch.	6
2.	Determine the elastic buckling load of a column having one fixed support and other end free. Also determine the buckling load of a column having both end fixed support.	18
3.	Deduce the fourth order equation of plate bending with neat sketch.	16