M. C. E. EXAMINATION, 2017
1st semester
THEORY OF ELASTICITY AND ELASTIC STABILITY
Time 3 hours
Full marks 100
Use separate answer scripts for each part

Part- I

Answer any Three questions. Each question carries 20 marks.

1. The stress-components relative to axes x_i are $\sigma_{11} = 90$ MPa, $\sigma_{22} = 60$ MPa, $\sigma_{33} = 20$ MPa, $\sigma_{12} = 20$ MPa, $\sigma_{23} = 10$ MPa, and $\sigma_{31} = 40$ MPa.
    (a) Determine the normal and shear components of stresses on a plane perpendicular to vector (1,3,1). Avoid using formula.
    (b) Determine the principal stresses.

                                                                    8+6+6=20

2. Deduce the tensor formula for transforming strain. What is a Jacobian matrix with relation to the expression of strain? What is the significance of the determinant of the Jacobian matrix?

                                                                    10+8+2=20

3. Deduce the following relationships where the variables hold their usual meaning
    (a) $T_i^{(n)} = \sigma_{ij} n_j$
    (b) $\sigma'_{ij} = a_{ip} a_{jq} \sigma_{pq}$

                                                                    10+10 = 20

4. Write notes on constitutive relationships of each kind of linear elastic materials.

                                                                    20

M. Civil Engineering, 1st Semester , 2017

SUBJECT – Theory of Elasticity and Elastic Stability

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(40 marks for this part)

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PART II

Answer ALL Questions

1. Use the energy approach to calculate the buckling load of a **fixed-fixed column** 6m long and with EI = 2000t-m^2. Obtain the buckling load also by **finite difference** dividing the total column height into four equal portions. Compare the results. 20

2. Calculate the buckling load of the truss shown below. AE = 8 × 10^{8}N. 20