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T 2 Examination – October 2019

M. Tech. 1st Semester (Structural Engineering) & B. Tech. 7th Semester (Civil Engineering)

Course Code: *13M1WCE131* Max. Marks: 25
Course Name: *Finite Element Methods*
Course Credit: *03* Max. Time: *90 Minutes*

Note: All questions are compulsory. Carrying of mobile phone during examination will be treated as case of unfair means. Assume any missing data.

Q.1 Derive the expression for displacement vector transformation (local to global ordinate system) in two dimensional coordinate system for a bar element. 3

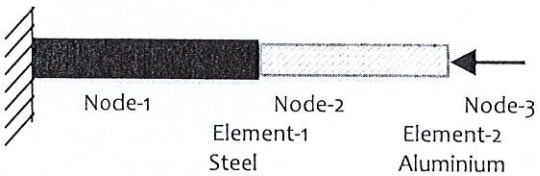
Q.2 Derive the expression for displacement vector transformation (local to global ordinate system) in three dimensional coordinate system two for a bar element. 3

Q.3 Derive the expression for global stiffness matrix in two and three dimensional coordinate system for a bar element. (2.5X 2)

Q.4 Compute the stress expression for a bar element in plane and space coordinate system. (2X2)

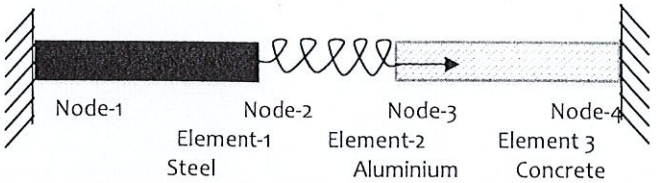
Q.5 Derive the bar element equation from potential energy approach. 4

Q.6 Determine the nodal displacement, forced in each element for the bar assemblage shown in figure.1 (a) and (b), using direct stiffness approach. (3X2)



Length L_{steel} = 3000mm $L_{Aluminium}$= 2500 mm
Cross-section area A_{steel}= 200 mm², $A_{Aluminium}$=150 mm²
Elastic modulus E_{Steel} = 3 times $E_{Aluminium}$
$E_{Aluminium}$= 70 GPA
Applied load at Node-3 is 30kN.
End support at node 1 is fixed.

Figure:1 (a)



Length
L_{steel} = 3000mm $L_{Aluminium}$= 2000 mm $L_{concrete}$ = 3000mm
Cross-section area A_{steel}= $A_{Aluminium}$ =$A_{concrete}$ =200 mm²
Elastic modulus E_{Steel} = 3 times $E_{Aluminium}$=10 times $E_{concrete}$
$E_{Aluminium}$= 60 GPA
k_{spring} =400 kN/m
Applied load at Node-3 is 50kN.
End support conditions; Node 1 and 4 are fixed.

Figure:1 (b)