Registration No: | | | | | | | | | | |

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M.TECH
CEPC103

1st Semester Regular/Back Examination – 2014
MATRIX METHODS OF ANALYSIS OF STRUCTURE
BRANCH(S): STRUCTURAL & FOUNDATION ENGINEERING,STRUCTURAL ENGINEERING

Time: 3 Hours

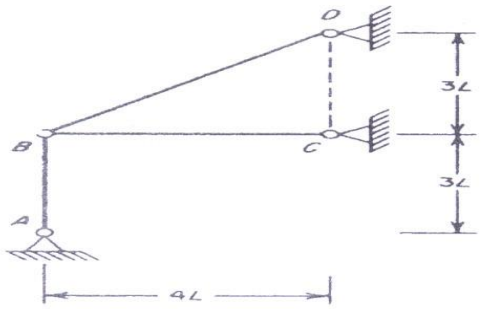
Max Marks: 70

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1 Answer the following questions: (2x10)

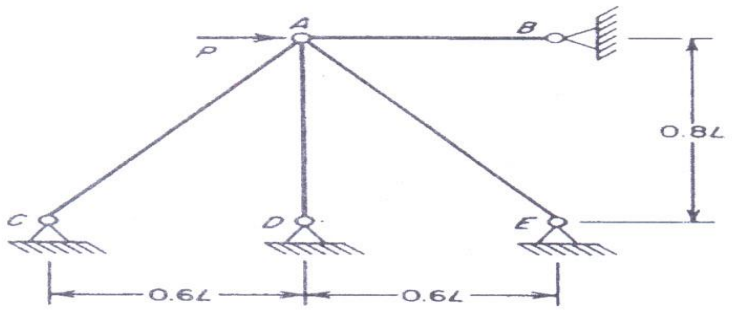
a) Enumerate different approaches for a structural problem by matrix analysis.
b) State the basic steps of the stiffness matrix method.
c) Element stiffness and element flexibility matrices are inverse of each other. Comment.
d) Which method is particularly suitable for structures having less no of kinematic indeterminacies and why?
e) Prove the reciprocal theorem in terms of flexibility coefficients.
f) In how many ways the force vs. deformation relationship can be established in linear structural analysis?
g) Using structure approach, can a fixed beam of single span be analyzed? Comment.
h) To get a correct solution to a structural problem, what are the conditions to be satisfied throughout the structure?
i) Calculate the static and kinematic indeterminacies of the figure in Q.4.a.
j) Matrix method of structural analysis is not suitable for hand calculations. Comment.

Q2 a) Realizing the translations of joint B as the degrees of freedoms of the truss shown in figure below, solve the problem by stiffness approach to calculate the translations. At joint B, there is a load of 'P' horizontally towards right and a load of '2P' vertically downwards. AE constant for all members. (5)



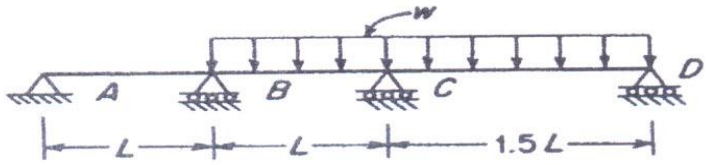
b) Calculate the bar forces of the above truss problem by using stiffness approach. (5)

Q3 Analyse the plane truss shown below by flexibility matrix method choosing members AC and AE as the redundants. E is same for all members. Assume that the cross sectional area of member AB is 0.6A, that for AD is 0.8A, and those for AC and AE are equal to A. (10)



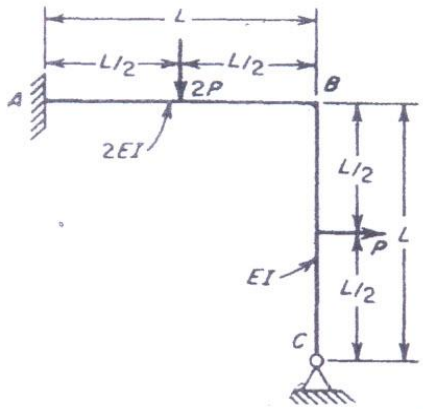
Q4 a) Choosing the bending moments at supports B and C as the redundants, derive the (5)

flexibility matrix of the continuous beam shown in figure below. EI constant for all spans.



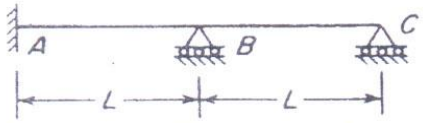
b) Calculate the redundants of the above problem by flexibility matrix method. (5)

Q5 a) Omitting the axial strains in the members, and treating the joint rotations of B and C as the kinematic redundants, obtain the stiffness matrix of the plane frame shown below. (5)



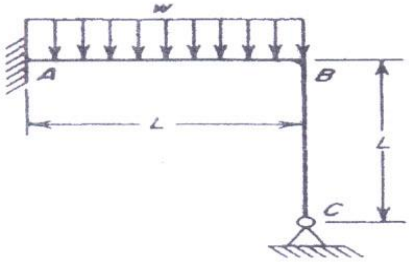
b) For the frame above, determine the joint rotations of B and C, and calculate the reactions at A and C by stiffness approach. (5)

Q6 a) Derive the stiffness matrix of the two span beam shown in figure below if the support B displaces downward by a small distance 's'. Select the kinematic redundants to be the rotations at B and C. EI constant for both spans. Neglect axial deformations. (5)



b) Solve the above problem by stiffness matrix method to calculate the kinematic redundants and support reactions. (5)

Q7 a) Treating the reactions at the pinned end C of the frame shown below and omitting the axial deformations, derive the flexibility matrix. (5)



b) Solve the frame by flexibility method to determine the redundants. (5)

Q8 Write Short Notes (Any Two) (5x2)

a) Equivalent joint loads
b) Importance of reciprocal theorem in matrix analysis
c) Virtual Work
d) Principle of superposition.