Register Number.....

M. E. DEGREE EXAMINATIONS: DECEMBER 2008

First Semester

STRUCTURAL ENGINEERING

P07SE102 – Matrix Methods of Structural Analysis

Time: Three Hours **Maximum Marks: 100**

Answer ALL Questions:-

PART A (20 x 1 = 20 Marks)

1 The Static Indeterminacy of the beam shown in figure 1 for vertical loading condition is

A. 0 B. 3

C. 1 D. 2

2 The number of degrees of freedom of the truss shown in figure 2 is

A. 12 B. 8

C. 11 D. 10

3 Which one of the following method is a flexibility method

A. Slope deflection method B. Moment distribution method

C. Kanis' Method D. Consistent deformation method

4 Stiffness has the unit of

A. Force B. Force / Unit Length

C. Length D. Length / Unit Force

5 Strain energy for bending member is

A. M^2 dx / 2EI B. M dx / $2I^2E$

C. M dx^2 / 2EI D. M dx / 2EI

6 Betti's law is applicable for

A. Elastic systems B. Inelastic systems

C. Supports yielding systems D. Varying temperature systems

7 If two statically equivalent force systems are connected by a transformation matrix then their displacement are connected by the reverse order by the transformation matrix is known as

A. Non linear transformation B. Contra Gradient law

C. Both D. None of the above

8 The orthogonal transformation is useful to achieve relation between

A. Flexibility and stiffness B. Local & global end forces

C. FEM and flexibility D. FEM and stiffness

9 The static condensation technique is also known as

A. Reduced stiffness matrix
B. Finite element technique
C. Flexibility matrix
D. Boundary element technique

10 The forces acting in the joints is called

A. Member forces
B. Nodal forces
C. Torque
D. Moment

11 The number of restrained structure in a three span continuous beam in stiffness method is

A. Two
B. Zero
C. Three
D. One

12 The force displacement relation in simple form is

A. $F = k\,u$
B. $F = k$
C. $F = (1/k)\,u^2$
D. $F = (1/k)\,u$

13 In flexibility method the first step is to make the structure

A. Statically determinate
B. Statically indeterminate
C. Kinematically determinate
D. Unstable

14 The force transformation matrix can be easily generated for

A. Statically indeterminate structure
B. Statically determinate structure
C. Statically indeterminate beam
D. Statically indeterminate truss

15 Which one of the following is different

A. Flexibility method
B. Compatibility method
C. Force method
D. Displacement method

16 The number of primary structure for a single span fixed beam is

A. Zero
B. Less than 1
C. More than 1
D. Less than or equal to 1

17 The number of equilibrium equations to be generated for writing computer programs for a dimensional rigid body is

A. 2
B. 4
C. 3
D. 6

18 In computer programs the moment at any point on the truss element is

A. Clockwise
B. Zero
C. Counter clockwise
D. Maximum

19

20

21 (

(b

22 (a

(b)

23 (a)

(b)

24 (a)

(b)

25 (a)

(b)

19 The common method adopted in software packages is

A. Stiffness method
B. Method of joints
C. Flexibility method
D. Theorem of three moments

20 Which one of the following is not a basic structure

A. Tanks
B. Cables
C. Beams
D. Trusses

PART B (5 x 16 = 80 Marks)

21 (a) Using the basic stiffness method compute the displacement and forces in each spring as shown in figure 3. $k_1 = 100$ kN/m, $k_2 = 30$ kN/m, $k_3 = 40$ kN/m and P = 50 kN

(OR)

(b) Using the principle of superposition, Draw SFD & BMD of the beam shown in figure 4. EI constant

22 (a) Using principle of contra gradient draw BMD of the beam shown in figure 5. Neglect the axial deformation. EI constant

(OR)

(b) (i) Prove the relation $[k] = [\beta]^T [k] [\beta]$ with usual meaning for the notations (10)

(ii) With the aid of sketches explain clearly Betti's law (6)

23 (a) Determine the forces in the members of the truss shown in figure 6 by displacement method. $A_1 = 2000$ mm^2, $A_2 = 1500$ mm^2, $A_3 = 1800$ mm^2 and $E = 2 \times 10^5$ N/mm^2

(OR)

(b) Analyse the continuous beam shown in figure 7 by sub structuring technique using stiffness method. Consider the beam consist of two substructures. EI constant

24 (a) Form the force transformation matrix of the beam shown in figure 5 and using that draw BMD. EI constant

(OR)

(b) Using flexibility method, determine the forces in the members of the truss shown in figure 8. AE constant

for a

25 (a) With the aid of flow charts, explain clearly the procedure to develop computer program for the analysis of single bay, single storey portal frame

(OR)

(b) With the aid of flow charts, explain clearly the procedure to develop computer program for the analysis of trusses contains maximum of 5 members

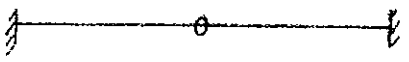

Figure ①

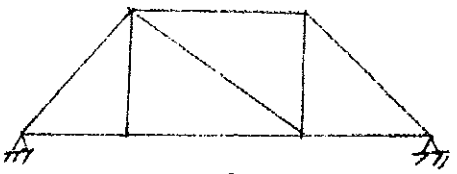

Figure ②

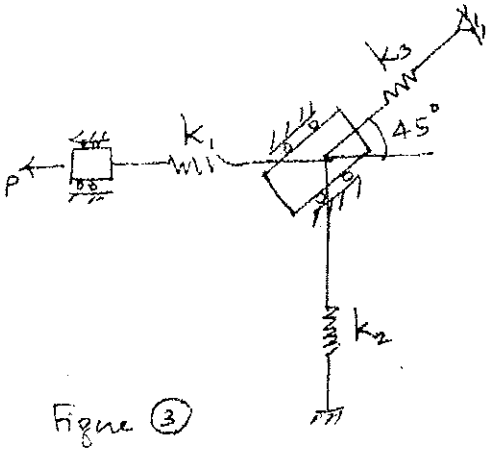

Figure ③

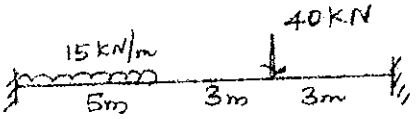

Figure ④

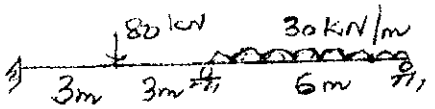

Figure ⑤

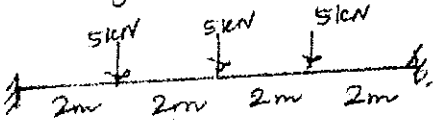

Figure ⑦

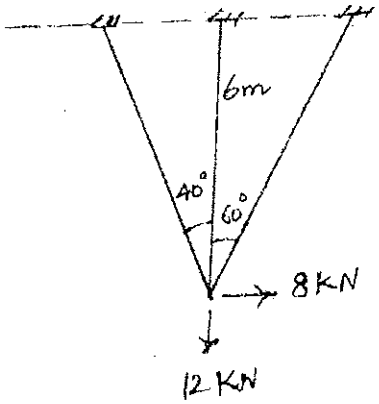

Figure ⑥

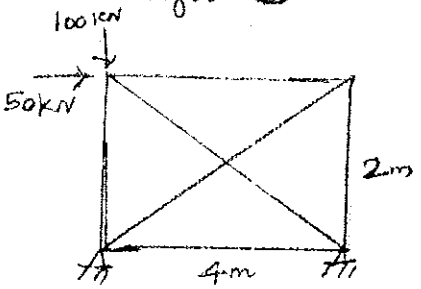

Figure ⑧

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