K. E. Society's

Rajarambapu Institute of Technology, Rajaramnagar

(An Autonomous Institute affiliated to SUK)

End Semester Examination. May 2016

F.Y. M.Tech. (Civil-Structure), Semester-II

| Enroll. No | Q.P.No EM632 |
|---|---|

Course: **Finite Element Analysis** Code: **CST 5021**

Day/date- Sat, 07/05/2016

Max. Marks-100

Time: 2:30 – 5:30 pm

*Instructions*: *i) All questions are compulsory*
*ii) Figures to the right indicate full marks*
*iii) Assume suitable data, if required and mention it clearly*
*iv) Use of nonprogrammable calculator is allowed*

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Q.1a) Explain steps included in finite element formulation and solution to an engineering problem. CO1 5

**OR**

a) What is Half Band Width? Explain importance of node numbering in FEM CO1 5

b) For three bar assemblage shown in fig.1,determine i) the assembled stiffness matrix ii) the displacement at node 2 and 3 iii) the reaction at node 1 and 4 ( Load P = 3000N is acting at node 2 ) CO1 12

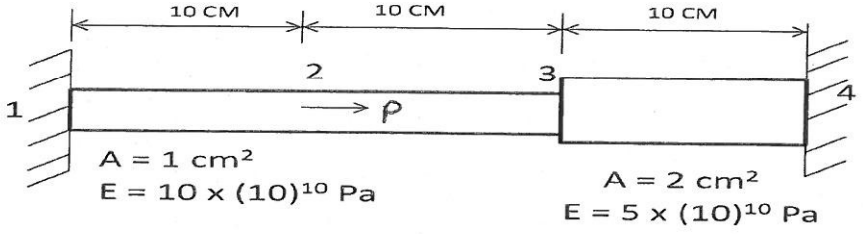


Fig.1

Q.2 Determine the forces in members of truss loaded as shown in fig.2. by using finite element method. Take A=10cm$^2$ and E=200 GPa, for all members. CO2 16

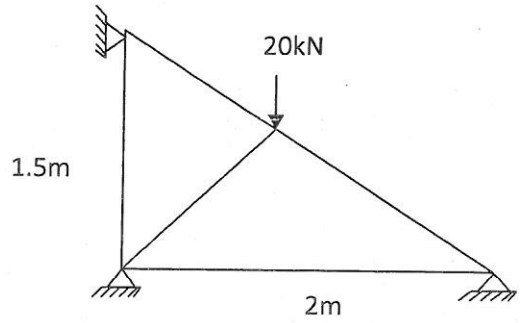


Fig.2

| | | | |
|---|---|---|---|
| Q.3a) | Write the various types of 3D elements. Explain when and why 3D elements used in finite element method?. | CO3 | 8 |
| **OR** | | | |
| a) | Describe the convergence requirements for a finite element displacement model. | CO3 | 8 |
| b) | Estimate shape functions for 4 noded rectangular element by establishing equations for lines. | CO4 | 8 |
| Q.4a) | Evaluate the integral $I = \int f(x)\,dx$, where $f(x) = 3x^2+2x+10$. Take - limit 3 to 7. Use two point Gaussian quadrature. | CO4 | 6 |
| **OR** | | | |
| a) | What do you mean Isoparametric element? Explain its importance. | CO4 | 6 |
| b) | Compute the relationship between natural and Cartesian coordinate system with suitable example, hence evaluate [K] for one dimensional element with u as the DOF/node, by using natural coordinate system. | CO4 | 11 |
| Q.5 | State applications of axisymmetric problem? Develop element stiffness matrix for triangular ring axisymmetric element. | CO4 | 16 |
| **OR** | | | |
| Q.5 | Define ACM element and Discuss detailed procedure to obtain stiffness matrix [K] for ACM element | CO5 | 16 |
| Q.6a) | Explain in brief the different types of shell elements. | CO5 | 6 |
| **OR** | | | |
| a) | Explain Hamilton's principle for linear elastic body, with suitable example. | CO6 | 6 |
| b) | Determine the consistent mass matrix for one dimensional bar discretized into two elements of length L, modulus of elasticity E, mass density $\rho$ and cross-sectional area A, throughout the length. | CO6 | 12 |

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# Rajarambapu Institute of Technology, Rajaramnagar

| Enroll No |
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End Semester/Reexam Examination May/June 2016

F. Y. M. Tech. Civil- Structures Sem. II

| Q. P. Code |
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| EM644 |

Design of Earthquake Resistant Structures CST 5041

Day & Date : Mon, 9/5/2016

Time : 2:30 - 5:30 pm Max Marks – 100

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Instructions: 1) All questions are compulsory.

2) Use of non programmable calculator is permitted.

3) I. S. 1893, SP 16 are permitted.

4) Figures to right indicate full marks.

Q. 1 Solve any two

a) Write details of different types of seismic waves with the help of neat sketches. Which of the waves are detrimental to structures and how? (C1) 06

b) Illustrate the recent earthquake in India/world and compare on different parameters with Bhuj/Latur earthquake. (C1) 06

c) What do you mean by intensity of an earthquake?(C3) Explain modified Mercalli's scale of intensity. (C2) 06

**Q. 2 Solve any two**

a) Write short note on "Tripartite response spectrum and its applications" (C4) 06

b) Explain how concept of response spectrum can be used to arrive at the design spectrum. Explain the procedure of construction of spectrum at a site. (C4) 06

c) Compare and comment on various response spectrums of recent earthquakes. 06 (C4)

Q. 3 For a residential three storied RCC building frame, the seismic weights on the floors are $W_1$= 294.3kN, $W_2$= 1863.9 kN $W_3$ = 1079.1kN. The storey stiffness's are $K_1$ = 100000kN/m, $K_2$= 100000kN/m and $K_3$ = 40000 kN/m. The storey heights are ground floor 4.0m, first and second floor 3.2m. The building is founded on hard soil and situated in zone IV. The free vibration results are: frequencies $p_1$= 10.035, $p_2$= 40.347 and $p_3$= 64.148 and mode shapes $\{\Phi_1\}$ = {1.00 0.97 0.76}, $\{\Phi_2\}$ = {1.00 0.511 -1.311}, $\{\Phi_3\}$ = {1.00 -0.235 0.075}. Determine the seismic forces by dynamic analysis. (C5) 20

4. A) Write advantages and disadvantages of stiff and flexible structures. (C6) 08

B) Discuss how to increase/decrease the following for a building in an earthquake prone area (any three): natural frequency of vibration, energy dissipation capacity, amplitude of vibration and ductility. (C6) 08

Q. 5. A RCC beam of rectangular section has to carry a distributed load of 25 kN/m in addition to its own weight and a dead load of 20kN/m. The maximum bending moment and shear force due to the earthquake are 70 kN-m and 30 kN respectively. Centre to centre distance between supports is 5.0m Design the beam using M25 grade and Fe 415 steel. (As per IS 13920). (C7) 20

Q. 6. A) Explain with example seismic design procedure for elevated Intze tank supported on 6 columns RC staging. Assume suitable data. (C7) 15

B) How to improve ductility of load bearing structures? (C6) 05

OR B) Write brief information about advantages, disadvantages and application of base isolators. (C6)

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EM658

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Rajarambapu Institute of Technology, Rajaramnagar

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**End Semester Examination, 2016**

**F. Y. M. Tech Civil Structure, Semester II**

**Course: Advanced Design of Steel Structures, Course Code: CST 5081**

(Program Elective II)

Date & Day: Wed, 11/5/2016. Maximum Marks: 100

Time: 2:30-5:30 pm

***Instructions:*** *1. All questions are compulsory.*
*2. Use of non-programmable calculator is allowed.*
*3. Use of IS:800-2007, IS:801-1975,IS: 875(Part 3)1987, IS:811-1987, IS: 11384-1985,IS Hand book/ Steel table is allowed*

| | | | | |
|---|---|---|---|---|
| 1 | a | A through type bridge truss of span 30 m is equally divided into 6 panels of 5 m each. The height of the truss is 5 m. The dead load and live load on each Pratt truss are 15kN/m and 60kN/m respectively. Draw the influence line diagram and calculate the design forces for the diagonal member meeting at the center. | **CO1** | **08** |
| | b | A simply supported beam of span 2.5m is subjected to a udl of 2kN/m. Design a light gauge cold formed steel lipped Z section for the beam. | **CO3** | **10** |
| | | **OR** | | |
| | b | Design a square cold formed light gauge steel section for a column to carry a load of 40kN. The effective length of the column is 3m. | **CO3** | **10** |
| 2 | | Design a simply supported composite beam to support the slab of a building $10m \times 40\ m$ with beams spaced at 4m center to center. The thickness of the concrete slab is $127mm$. Consider floor finish load of $1kN/m^2$ and live load of $5kN/m^2$.Use M20 grade concrete and steel with $f_y$= $250N/mm^2$. Assume that the propped method of construction is used. Design shear connectors. Check the beam for deflection. | **CO3** | **16** |
| 3 | | A continuous beam ABCD has the spans, AB= 8m, BC= 10m and CD= 6m. Span AB is subjected to a load of 15kN/m, span BC to 24kN/m and span CD to 20kN/m. | | |
| | a | Design a uniform section for the beam | **CO3** | **08** |
| | b | Design the beam with cover plates where necessary | **CO3** | **10** |
| 4 | a | A propped cantilever ABC, propped at B, AB= $\ell$ and overhang BC= $a$, is subjected to a udl of intensity $w$ per unit run throughout. Find the critical value of $a$ so that collapse occurs simultaneously in the overhang portion and in the interior span. Calculate the ultimate value of $w$. | **CO2** | **08** |
| | | **OR** | | |
| | a | A propped cantilever ABCD, fixed at A and propped at C is subjected to concentrated loads P at B and P/6 at D. AB= BC= CD= $\ell$. Calculate ultimate load $P_u$. | **CO2** | **08** |

| | | | | |
|---|---|---|---|---|
| | b | A rectangular portal frame ABCDE is hinged at A and E. Beam BCD is subjected to vertically downward concentrated load P at C. A horizontal concentrated load P/2 is acting at B. Columns AB= ED= $\ell/2$, length of beam ABC is $\ell$ with BC= CD= $\ell/2$. Calculate ultimate load $P_u$. Draw BMD | **CO2** | **08** |
| 5 | | A building consists of uniform portal frames ABCDEFG with fixed bases having span of beam BCDEF 16m and height of columns AB & GF 10m. The frames are spaced 5m apart. The left column AB is subjected to wind load of 5kN/m and beam BCDEF is subjected to load from roof 50kN at B, 100kN at C, 100kN at D, 100kN at E and 50kN at F. BC= CD= DE= EF= 4m. Design a portal frame for the building. Assume the frame is to be laterally supported. | **CO3** | **16** |
| 6 | a | A shed has to be designed for a bay of width 36 m and length 60 m. The height of the columns upto eaves level is 8 m. Provide slope 1:10 for the roofing. Calculate DL, LL and WL and carry out DL+LL, DL+WL and DL+LL+WL combination. The shed is located in Pune. | **CO1** | **08** |
| | b | Considering DL+LL combination and beam mechanism, calculate plastic moment for the frame in 6a above. | **CO2** | **08** |
| | | **OR** | | |
| | b | A portal frame ABCD is fixed at A and D. Column AB is inclined at an angle of 45°, beam BC is horizontal and column DC is vertical. Span of beam BC= $\ell$ and height of column DC= $\ell$. A horizontal concentrated load P is acting at C rightwards. Calculate ultimate load $P_u$. Sketch BMD. | **CO2** | **08** |