USN | | | | | | | | | | |

14MDE12

First Semester M.Tech. Degree Examination, June /July 2016
Finite Element Methods

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

1 a. Describe basic steps in FEM analysis. **(10 Marks)**

b. Determine the expression for displacement of a cantilever bar subjected to UDL load q_0 as shown in Fig. Q1(b) by Rayleigh – Ritz method. **(10 Marks)**

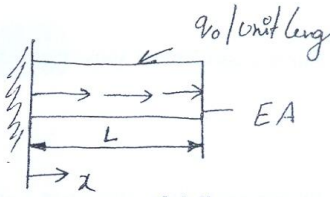

Fig. Q1(b) fixed free bar

2 a. Write a short notes on principle of minimum potential energy. **(04 Marks)**

b. Derive the stiffness matrix for a single element bar. **(06 Marks)**

c. Determine the nodal displacement at loading point, reaction, strain and stress far 1D bar subjected to axial load as shown in Fig. Q2(c). Consider P = 100 kN, E = 210 GPa, A = 0.01 m^2 and L = 1 m. **(10 Marks)**

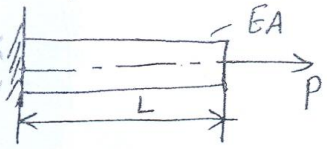

Fig. Q2(c)

3 a. For the truss element shown in Fig. Q3(a), determine the nodal displacement and stress in each member. Take E = 210 GPa, A = 0.01 m^2. **(10 Marks)**

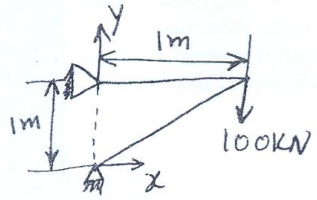

Fig. Q3(a)

b. A bar is loaded as shown in Fig. Q3(b), E = 2×10^5 N/mm^2 using penalty method of boundary conditions find :

i) Nodal displacement
ii) Stress in each element
iii) Reaction at the supports. **(10 Marks)**

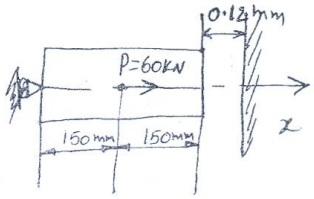

Fig. Q3(b)

4 a. Derive the shape functions for four noded quadrilateral elements. **(08 Marks)**

b. Evaluate the Jacobian matrix for a CST element. **(12 Marks)**

5 a. Write the assumptions made by Kirchoff's for thick and thin plates. **(05 Marks)**

b. For a triangular plate bending element (Thin plate) derive the stiffness matrix. **(15 Marks)**

6 a. For beam element write down the lumped mass matrix. **(10 Marks)**

b. For a truss element show that the consistent mass matrix is $: m^e = \frac{\rho AL}{6}\begin{bmatrix} 2 & 0 & 1 & 0 \\ 0 & 2 & 0 & 1 \\ 1 & 0 & 2 & 0 \\ 0 & 1 & 0 & 2 \end{bmatrix}$. **(10 Marks)**

7 Find eigen values and eigen vectors for stepped bar when it is subjected to axial vibrations with fixed free end conditions as show in Fig. Q7. **(20 Marks)**

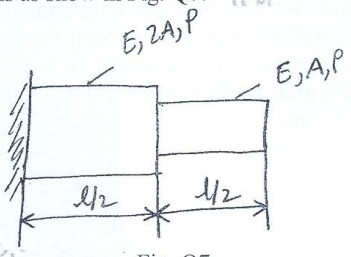

Fig. Q7

8 Write a short notes on any Four of the following :

a. C_0, C_1 and C_n continuity
b. Plane stress and plane strain
c. Serendipity elements
d. Hexahedral element
e. Convergence requirement. **(20 Marks)**

* * * * *

USN | | | | | | | | | | |

14MDE154

First Semester M.Tech. Degree Examination, June/July 2016
Design for Manufacture

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

1 a. Explain with a block diagram major phases in design process. **(10 Marks)**
b. Explain the effect of material properties on design using a block diagram. **(10 Marks)**

2 a. List and explain the important DFM guidelines. **(12 Marks)**
b. Explain process capability and process capability matrices. **(08 Marks)**

3 a. Explain sure fit law and truncated normal law with suitable examples. **(08 Marks)**
b. For 25 H_8d_8 compute the clearance, if the piece part errors are :
i) Uniformly distributed
ii) Normally distributed
iii) 1 σ truncated normal distribution
iv) 1.5 σ truncated normal distribution. **(12 Marks)**

4 a. Explain with hole and shaft curves :
i) Interchangeability ii) Selective assembly. **(08 Marks)**
b. Define laminated shims and list its benefits. **(04 Marks)**
c. The desired fit between the housing of bearing is 0.01 ± 0.006. Decide the number of groups so that production of housing is economical. Assume that the bearing are finished to high quality (IT3) if the housing bore is finished by fine turning (IT6). Assume $t_s = g_s$, show the size zone of hole and shaft component side by side. **(08 Marks)**

5 a. With suitable examples explain the different Datum features. **(08 Marks)**
b. Fig. Q5(b) below shows pin redimensioned for manufacture tolerance reduction has resulted. Also omitted limits (25.09/24.91) will not be exceded. **(12 Marks)**

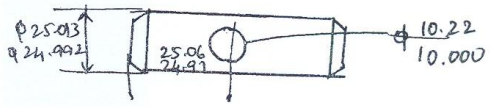

Fig. Q5(b)

6 a. Prepare a suitable operation sequence assuming the quantity production. **(10 Marks)**
b. Determine the manufacturing dimension for the given sketch. **(10 Marks)**

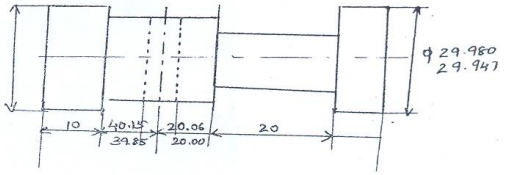

Fig. Q6(b)

7 Explain :
a. Tolerance and true position tolerancing virtual size concept. **(08 Marks)**
b. Design consideration for pattern, mould and parting line. **(08 Marks)**
c. Comparison between co-ordinate and convention method. **(04 Marks)**

8 Explain with neat sketch different types of limits. **(20 Marks)**

* * * * *

USN | | | | | | | | | | |

14CAE14

First Semester M.Tech. Degree Examination, June /July 2016
Experimental Mechanics

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

1 a. Describe the experimental panning. **(08 Marks)**

b. The following readings are taken from a certain length. Compute the mean readings, standard deviation, variance and average of the absolutes value of the deviation using biased basis.

Reading	1	2	3	4	5	6	7	8	9	10
X, cm	5.30	5.73	6.77	5.26	4.33	5.45	6.09	5.64	5.81	5.75

(12 Marks)

2 a. Define the following : i) Fixed error ii) Variance iii) Standard deviation iv) Random error. **(10 Marks)**

b. Derive an expression $\left|\frac{V_0}{Vi}\right| = \frac{k}{\sqrt{1+(WRC)^2}}$ using lowpass, single-section active filter. **(10 Marks)**

3 a. Derive an expression for the gauge factor of an electrical strain gauge. **(10 Marks)**

b. Explain different types of strain gauge rosettes. **(10 Marks)**

4 A three element rectangular rosette is mounted on a steel component with E = 204 GPa and $\gamma = 0.3$. The manufacturers gauge factor is 2.8 and cross sensitivity is 0.06 for this type gauge. The reading corresponding to the three gauge is indicated on a strain meter with gauge factor control set at 2.8 are m set $\hat{\epsilon}_A = 700\mu m/m$ $\hat{\epsilon}_B = -50\mu m/m$ and $\hat{\epsilon}_C = -700\mu m/m$.

Determine : i) Actual strains ii) principal strain iii) the magnitude of corrected principal stresses and their directions. **(20 Marks)**

5 a. Derive an expression for stresses to optical behavior of the model. **(10 Marks)**

b. Name the calibration methods of photoelastic model material and explain circular desc under diameteral compression. **(10 Marks)**

6 a. Describe stress freezing method with an example. **(10 Marks)**

b. Explain with the neat sketch scattered light polariscope. **(10 Marks)**

7 a. A fringe order of 2.5 was observed at a point in a stressed, plane stress model with light having a wave length of 589 nm. Assuming the 'C' remains constant, what fringe order would be observed at the point of consideration when light with wavelength of 548 nm is used? **(06 Marks)**

b. Explain birefringent coating material properties. **(06 Marks)**

c. Explain the principles of brittle coating method. **(08 Marks)**

8 Explain the following :

a. Birefringent strip–coating method

b. Holographic set–up and magnification

c. Moire techniques for in plane problems

d. Transmitted image **(20 Marks)**

* * * * *