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MTP/MTE/MTR/MLM/MEA/CAE11

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First Semester M.Tech Degree Examination, Dec.2015/Jan.2016
Applied Mathematics

Time: 3 hrs. Max. Marks:100

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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1 a. What is truncation error? Explain for the series $e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \ldots$. Compute $e^{0.5}$ by truncating the series to 1, 2, 3, 4 terms. Find truncation error in each step. **(10 Marks)**

b. Write a short note on precision and accuracy. Convert $(0.7)_{10}$ to binary form consisting of 4 and 6 bits. Compute round off error in each case. **(10 Marks)**

2 a. Find a real root of the equation $4e^{-x} \sin x - 1 = 0$. Correct to 3 decimal places by using Newton – Raphson method. Take $x_0 = 0.2$ as initial approximation. **(06 Marks)**

b. Perform 2 iterations of the Muller method. Find the smallest positive root of $x^3 - 5x + 1 = 0$. Take initial approximations as $x_0 = 0$, $x_1 = 0.5$, $x_2 = 1.0$. **(08 Marks)**

c. Use the Iterative method (fixed point iteration procedure) to find a real root of $\sin x = 10(x-1)$. Take $x_0 = 1.0$. **(06 Marks)**

3 a. Perform two iterations of Bairstow Method to extract a quadratic factor $x^2 + px + q$ from the polynomial $x^3 + x^2 - x + 2 = 0$. Use initial approximation as -0.9, 0.9. **(10 Marks)**

b. Find the roots of the equation $x^3 - 5x_1^2 - 17x + 21 = 0$ by using Graeffe's method. Carry out 3 iterations. **(10 Marks)**

4 a. For the following data, calculate $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at x = 24. **(10 Marks)**

x :	15	17	19	21	23	25
y :	3.873	4.123	4.359	4.583	4.796	5.8

b. Derive Newton – Cotes formula for numerical integration and hence deduce Simpson's $\frac{1}{3}$rd rule. Using this rule, evaluate $\int_0^1 \sqrt{1-x^2}\,dx$ by taking number of sub intervals as 8. **(10 Marks)**

5 a. Solve the system of equations $2x + y + z = 10$, $3x + 2y + 3z = 18$, $x + 4y + 9z = 16$ by the Gauss – Jordan method. **(10 Marks)**

b. Apply Cholesky method, to solve the system of equations :
$x + 2y + 3z = 5$, $2x + 8y + 22z = 6$, $3x + 22y + 82z = -10$. **(10 Marks)**

6 a. Using the Jacobi method, find all the eigen values and eigen vectors of the symmetric matrix

$$A = \begin{pmatrix} 1 & \sqrt{2} & 2 \\ \sqrt{2} & 3 & \sqrt{2} \\ 2 & \sqrt{2} & 1 \end{pmatrix}.$$ **(10 Marks)**

b. Find all the eigen values of the matrix using the Ruti – Shauser method.

$$A = \begin{pmatrix} 1 & 1 & 1 \\ 2 & 1 & 2 \\ 1 & 3 & 2 \end{pmatrix}$$ Carry out 3 iterations. **(10 Marks)**

7 a. Let T be a linear operator on R^3 defined by T (x, y, z) = (2y + z , x – 4y, 3x). Find the matrix of the transformation with respect to basis (1, 1, 1) , (1, 1, 0) , (1, 0, 0). **(10 Marks)**

b. Find a Least squares solution to AX = B with

$$A = \begin{pmatrix} 4 & 0 \\ 0 & 2 \\ 1 & 1 \end{pmatrix}$$ and $$B = \begin{pmatrix} 2 \\ 0 \\ 11 \end{pmatrix}$$. Also compute the least squares error. **(10 Marks)**

8 a. Let V be an inner product space. Let $\{u_1, u_2, u_3, \ldots, u_n\}$ be a set of non – zero, mutually orthogonal vectors of V. Then prove that

i) the set $\{u_1, u_2, \ldots u_n\}$ is linearly independent

ii) $$\left\| \sum_{i=1}^{i=n} \alpha_i u_i \right\|^2 = \sum_{i=1}^{i=n} |\alpha_i|^2 . \|u_i\|^2 .$$ **(10 Marks)**

b. Let {(1, -1, 1, 1) , (1, 0, 1, 0) , (0, 1, 0, 1) be a linearly independent set in R^4. Find an Orthonormal set $\{V_1, V_2, V_3\}$ such that

L {(1, -1, 1, 1) , (1, 0, 1, 0) , (0, 1, 0, 1)} = L (V_1, V_2, V_3). **(10 Marks)**

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14MDE12

First Semester M.Tech. Degree Examination, Dec.2015/Jan.2016
Finite Elements Methods

Time: 3 hrs. Max. Marks:100

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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1 a. Explain the concept of C_0 and C_1 continuity elements. **(04 Marks)**

b. Write a note on confirming and non-confirming elements. **(04 Marks)**

c. Determine the defection of a cantilever beam of length 'L' and loaded with a vertical load 'p' at the free end by Rayleigh-Ritz method using a trial function $y = a\left[1 - \cos\left(\frac{\pi x}{2L}\right)\right]$. **(12 Marks)**

2 a. Determine the expression for displacement of a beam subjected to uniform distributed load P_0 over the entire length by Galerkin methods using trial function $y = c_1 \sin\frac{\pi x}{L}$. **(10 Marks)**

b. A bar is loaded as shown in figure Q2(b), an axial load of P = 60kN is applied at the midpoint. Using penalty approach method of handling boundary conditions, determine,
- Nodal displacements
- Reactions at the support
- Stresses in each element.

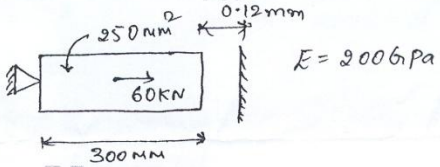

Fig Q2(b) **(10 Marks)**

3 a. A truss structure is subjected to a load of 1kN as shown in figure Q3 (a). Calculate the nodal displacements and forces if the elements stiffness (AE/L) for both elements is 10kN/mm.

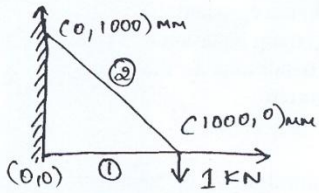

Fig Q3(a) **(10 Marks)**

b. Define Hermite shape functions, also derive the stiffness matrix for beam elements using strain energy concept. **(10 Marks)**

4 a. Derive the shape functions for Quad 8 element. **(10 Marks)**

b. Establish the Jacobian matrix for linear quadrilateral elements as shown in figure Q4(b) at point P(ξ, n) = (0.57735, - 0.57735) in local co-ordinate system. **(10 Marks)**

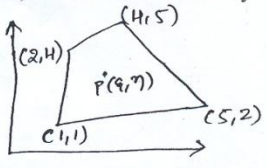

Fig. Q4(b)

5 a. Derive the element stiffness matrix of a truss element, also write the assumptions made in choosing the truss element. **(10 Marks)**

b. For the beam shown in figure Q5 (b), determine the displacements at node 2.
Take E = 210GPa b = 0.2m and h = 0.4m **(10 Marks)**

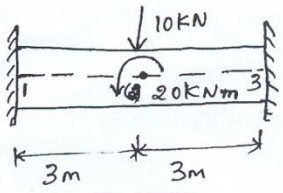

Fig. Q5(b)

6 A two step bar subjected to Loading condition as shown in figure Q6, is fixed at one end and the free end is at a distance of 3.5mm.
Determine,
i) The displacements at nodal points
ii) Stresses in elements
iii) The reactions at support
Given : $A_1 = 250mm^2$ $A_2 = 400mm^2$ and E = 200GPa
$P_1 = 300kN$ $P_2 = 600kN$. **(20 Marks)**

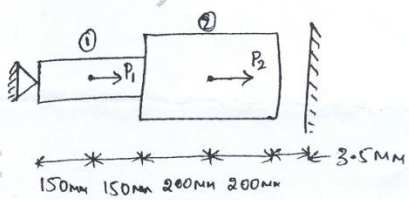

Fig Q6

7 a. Briefly explain the classical thin plate theory. **(10 Marks)**

b. Write the governing equation of a thin plate subjected to transverse distributed load and state the boundary conditions for the following :
- simply supported
- clamped. **(10 Marks)**

8 a. Derive the expression for element mass matrix of a solid body with distributed mass. **(04 Marks)**

b. Write the properties of eigen values and eigen vectors. **(04 Marks)**

c. Consider a two degree of freedom spring mass system with $x_1(t)$ and x_2 (t) as the independent generalized co-ordinates. Find the equation of motion using Lagrangean equations. **(12 Marks)**

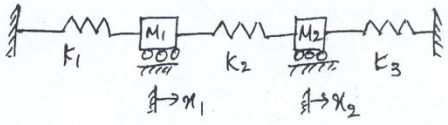

Fig Q8(c)

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14CAE14

First Semester M.Tech. Degree Examination, Dec.2015/Jan.2016
Experimental Mechanics

Time: 3 hrs. Max. Marks:100

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

1 a. Define and elaborate following terms :
   i) Calibration
   ii) Sensitivity of instrument
   iii) Hysteresis
   iv) Accuracy
   v) Precision. **(10 Marks)**

b. Ten people of various heights as given below were requested to read the letters on a car at 5 m distance. Number of letters correctly read is given in below table :

Height in feet	5′ 1″	5′ 3″	5′ 6″	5′ 7″	5′ 8″	5′ 9″	5′ 10″	5′ 11″	6′	6′ 1″
Number of letters read (y)	11	17	19	14	8	15	20	6	18	12

Find the correlation co-efficient and remark **(10 Marks)**

2 a. What do you mean by Data Analysis? What are the general considerations in Data Analysis? **(10 Marks)**

b. Below table shows aptitude test score, prior experience and performance evaluation :
   i) Develop the estimating equation between the data
   ii) If an employee scored 83 in aptitude test and have a prior experience of 8 years. What performance evaluation would be expected?

Number of employees	1	2	3	4	5	6
Aptitude test score (x_2)	74	87	69	93	81	97
Prior experience in years (x_1)	5	11	4	9	7	10
Performance evaluation (y)	28	33	21	40	38	46

(10 Marks)

3 a. What is strain rosette? Explain. **(04 Marks)**

b. Define gauge factor? Derive the expression for the same. **(06 Marks)**

c. A three element delta rosette strain gauge is cemented at a point on the surface of a machine element. The gauge factor of the strain gauge is 2.0 and the Poisson's ratio of material of strain gauge is 0.285. Given :

$\in_0 = +600\ \mu m/m$ $E = 200\ GPa$

$\in_{120} = 300\ \mu m/m$ $\gamma_0 = 0.3$

$\in_{240} = -400\ \mu m/m$ $k_t = 0.06$

Determine the actual strains and magnitude direction of principal strain and stresses? **(10 Marks)**

4 a. Derive the stress–optic law as applied to 2 – D photo–elasticity? **(10 Marks)**

b. Describe the determination process of isoclinics, isochromatics and fringe order with a plane polariscope arrangement. **(10 Marks)**

5 a. Explain Tardy's method of compensation technique? **(10 Marks)**

b. Explain shear difference method with proper sketches and equations applicable to 2–D photo–elasticity. **(10 Marks)**

6 a. Sketch and explain scattered light photography. **(10 Marks)**

b. What are the important properties of ideal photo–elastic material? Discuss a few important photo–elastic materials. **(10 Marks)**

7 a. What are the various methods used for stress separation in 3 – D photo –elasticity? Explain oblique incidence method? **(10 Marks)**

b. What are the assumptions made while analyzing brittle coating? Derive the expression for coating stresses? **(10 Marks)**

8 a. Derive the equations for plane waves and spherical waves. **(10 Marks)**

b. Describe the geometrical approach in Moire fringe analysis considering the case of pure extension without rotation. **(10 Marks)**

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14MDE154

First Semester M.Tech. Degree Examination, Dec.2015/Jan.2016
Design for Manufacture

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer any FIVE full questions.***
2. ***Hand Book allowed.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

1 a. Explain with a block diagram major phases of design process. **(08 Marks)**
b. List some of the important properties of materials to be considered in the design process. **(08 Marks)**
c. Explain process capability. **(04 Marks)**

2 a. Define tolerance, limits and fits. Explain their significance in assembly. **(10 Marks)**
b. Explain geometrical tolerances along with symbols. **(10 Marks)**

3 a. Explain the general principles of selective assembly, with sketches. **(08 Marks)**
b. A automobile stearing box is shown in Fig. Q3(b) where in drop is to have a vertical movement of $\begin{pmatrix}0.24\\0.12\end{pmatrix}$ mm. Show diagrammatically the two condition of assembly along with the relevant conditions on the basis of achieving larger machining tolerance. **(12 Marks)**

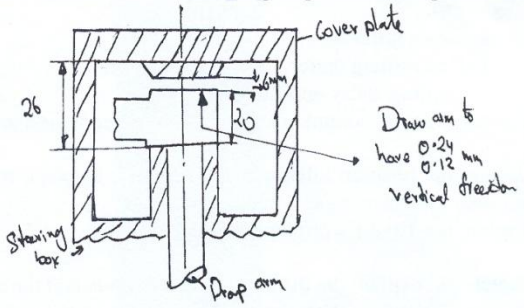


Fig. Q3(b)

4 a. Explain the functional and manufacturing datum systems in manufacturing components. Discuss the procedure of charging functional datum into manufacturing datum. **(10 Marks)**
b. The anchor stud shown in Fig. Q4(b) is to be manufactured in batches of 100. Indentify the functional datum, datum face and corresponding functional dimensions. Show three possible datum faces for machining the 15mm wide slot and draw appropriate dimensional layout for each. State the most desirable datum face. **(10 Marks)**

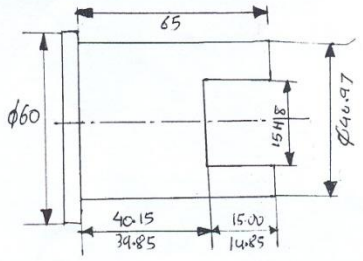
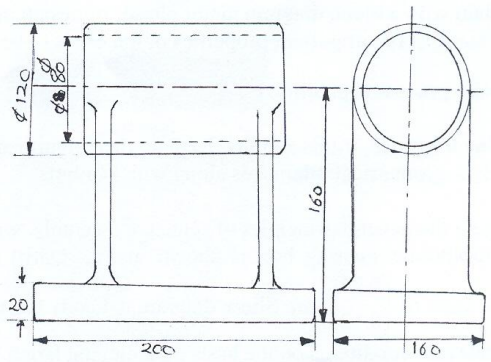


Fig. Q4(b)

5 a. Explain the various procedures for selecting the parting line for a hollow bush casting. **(08 Marks)**

b. A cast iron support bracket has to be cast as shown in Fig. Q5(b). Identify the possible parting lines and appropriate sand cores. Suggest suitable design modification to remove the need for sand cores. Retain approximately same weight of the casting. **(12 Marks)**

Fig. Q5(b)



6 a. Write a short notes on :

i) End milling cutter **(05 Marks)**

ii) Drilling Entry and Run-out **(05 Marks)**

b. Explain with an example simplification by separation and amalgamation. **(10 Marks)**

7 a. Define true position tolerance. Differentiate between true position tolerance system and co-ordinate tolerance system with an example. **(10 Marks)**

b. Explain the Taylor's principle of gage design. **(10 Marks)**

8 a. Sketch and explain the different types of limits and the snap gauges. **(10 Marks)**

b. Design GO and NOGO gauges for a shaft and hole of size ϕ90mm for 48eq type clearance fit. Show the size zones of the hole and shaft and those of the gauge neatly in a sketch.

$\phi 9048 = 90^{+0.052}_{+0}$

$\phi 90eq = 90^{-0.069}_{-0.152}$ **(10 Marks)**

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