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## MTP/MTE/MTR/MLM/MEA/CAE11

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

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions.

a. What is truncation error? Explain for the series

 $e^{x} = 1 + x + \frac{x^{2}}{2!} + \frac{x^{3}}{3!} + \frac{x^{4}}{4!} + \dots$  Compute  $e^{0.5}$  by truncating the series to 1, 2, 3, 4 terms.

Find truncation error in each step.

- 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.
- 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) 2
  - b. Perform 2 iterations of the Muller method, Find the smallest positive root of  $x^3 5x + 1 = 0$ . Take initial approximations as  $x_0 = 0, x_1 = 0.5, x_2 = 1.0$ .
  - 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)
- 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) 3
  - b. Find the roots of the equation  $x^3 5x_1^2 17x + 21 = 0$  by using Graeffe's method. Carry out 3 iterations.
- a. For the following data, calculate  $\frac{dy}{dx}$  and  $\frac{d^2y}{dx^2}$  at x = 24.

(10 Marks)

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	x:	15	17	19	21	23	25
i	<u>y:</u>	3.873	4.123	4.359	4.583	4.796	5.8
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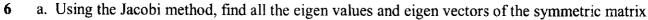
b. Derive Newton – Cotes formula for numerical integration and hence deduce Simpson's  $\frac{1}{3}$  rd

rule. Using this rule, evaluate  $\int \sqrt{1-x^2} dx$  by taking number of sub intervals as 8. (10 Marks)

- 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)

## Jec. 2015 Jan. 2016

## 14MAR/MAU/IAE/MDE/MMD/MST/MTH/ MTP/MTE/MTR/MLM/MEA/CAE11



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

a. Let T be a linear operator on R<sup>3</sup> 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

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

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

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

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

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

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

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