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First Semester M.Tech. Degree Examination, June/July 2017
Applied Mathematics

Time: 3 hrs. Max. Marks:100

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

1 a. Define Relative error, Absolute error, Inherent error, round off error and Truncation error. **(10 Marks)**

b. Find the percentage error made in calculating the area of the rectangle if 1% error is made while measuring length and breadth. **(05 Marks)**

c. If the errors in x y z are 0.01 at x = y = 1 = z in calculating $A = \frac{4x^2y^2}{z^3}$. Find the relative error in A. **(05 Marks)**

2 a. Find a root of the equation $x^3 - 5x + 1 = 0$ between 0 an 1 using the Bisection method upto five stages. **(06 Marks)**

b. Using the Regula – Falsi method, find the root correct to four decimal places of the equation $xe^x = \cos x$ that lies between 0.4 and 0.6. **(07 Marks)**

c. Using the Newton Raphson method, find the root of the equation $f(x) = e^x - 3x = 0$ that lies between 0 and 1. **(07 Marks)**

3 a. Perform three iterations of the Muller method to find the smallest positive root of the equation $x^3 - 5x + 1 = 0$, which lies in the interval (0, 1). **(10 Marks)**

b. Find all the roots of the polynomial $x^3 - 4x^2 + 5x - 2 = 0$ using the Graeffe's Root Squaring method. **(10 Marks)**

4 a. Solve the equation $x + 2y - z = 2$, $3x + 6y + z = 1$, $3x + 3y + 2z = 3$ by using Cramer's rule. **(05 Marks)**

b. Solve the system of equations by Gauss Elimination method $x + y + z = 9$, $x - 2y + 3z = 8$ $2x + y - z = 3$. **(05 Marks)**

c. Determine the inverse of the matrix $\begin{pmatrix} 1 & 1 & 1 \\ 4 & 3 & -1 \\ 3 & 5 & 3 \end{pmatrix}$ using the partition method. **(10 Marks)**

5 a. Using the Jacobi method, find all the eigen values and the corresponding eigenvectors of the matrix. **(12 Marks)**

$$\begin{pmatrix} 1 & \sqrt{2} & 2 \\ \sqrt{2} & 3 & \sqrt{2} \\ 2 & \sqrt{2} & 1 \end{pmatrix}$$

b. Find the dominant eigen value and the corresponding eigen vector of the matrix by Power method $\begin{pmatrix} 4 & 1 & -1 \\ 2 & 3 & -1 \\ -2 & 1 & 5 \end{pmatrix}$ perform seven iterations with the initial vector $(1\ 0\ 0)^T$. **(08 Marks)**

6 a. Use the Householders method to reduce the given matrix into the tridiagonal form

$$\begin{pmatrix} 4 & -1 & -2 & 2 \\ -1 & 4 & -1 & -2 \\ -2 & -1 & 4 & -1 \\ 2 & -2 & -1 & 4 \end{pmatrix}.$$

(12 Marks)

b. Solve the system of equations $x + 2y + 3z = 5$, $2x + 8y + 22z = 6$, $3x + 22y + 82z = -10$. Using the Cholesky method. **(08 Marks)**

7 a. Let π be the plane in R^3 spanned by vectors $X_1 = (1, 2, 2)$, $X_2 = (-1, 0, 2)$, $X_3 = (0, 0, 1)$.
i) Find an orthonormal basis for π ii) Extend it to an orthonormal basis for R^3. **(10 Marks)**

b. Let $T : R^3 \rightarrow R^3$ be the linear transformation defined by

$$T\left(\begin{bmatrix} x_1 \\ x_2 \end{bmatrix}\right) = \begin{bmatrix} x_1 - 2x_2 \\ -x_2 \\ 3x_1 - 5x_2 \end{bmatrix}.$$

Find the matrix, A such that $T(x) = Ax$ for all $x \in R^2$. **(10 Marks)**

8 a. Find the approximate value of the integral $I = \int_0^1 \frac{dx}{1+x}$ using composite trapezoidal rule with 2, 3, 5, 9 nodes and Romberg integration. **(10 Marks)**

b. Given

x	1.0	1.2	1.4	1.6	1.8	2.0
y	2.72	3.32	4.06	4.96	6.05	7.39

Find y' and y'' at x = 1.2. **(10 Marks)**

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