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CBCS Scheme

USN

16MDE/MMD/MST/MTP/MTR/ MCM/MEA/CAE/MAR/MAU11

First Semester M.Tech. Degree Examination, Dec.2016/Jan.2017

Applied Mathematics

Time: 3 hrs. Max. Marks: 80

Note: ***Answer any FIVE full questions, choosing one full question from each module.***

Module-1

1 a. Explain in brief :
   i) Significant figures
   ii) Truncation errors
   iii) Rounding off
   iv) Percentage errors. **(08 Marks)**

b. Establish a simple mathematical model for a falling body (parachutist) as $\frac{dv}{dt} = g - \left(\frac{c}{m}\right) v$ and obtain its solution as $v(t) = \frac{mg}{c}\left[1 - e^{-\left(\frac{c}{m}\right)t}\right]$ with m-mass of the falling body, C-the drag coefficient g-gravitational force, v-velocity and t-time. **(08 Marks)**

OR

2 a. Round off the numbers 865250 and 37.46235 to four significant figures and compute
   i) absolute error
   ii) relative error and
   iii) percentage error. **(08 Marks)**

b. Find graphically an approximate value of the root of the equation $3 - x = e^{x-1}$. **(08 Marks)**

Module-2

3 a. Explain Regula-Falsi method to find the root of the equation f(x) = 0 with suitable formulation. Use it to find the root of the equation $x \log_{10} x = 1.2$ to four decimal places with three approximations. **(08 Marks)**

b. With suitable formulation explain Newton Raphson method to find the root of the equation f(x) = 0. Use it to find the root of 3x = Cos x + 1 with initial value as 0.6 (take two approximations). **(08 Marks)**

OR

4 a. Explain the necessary steps involved in Muller's method to find the root of the equation f(x) = 0. Use it to find the first approximation of $\cos x = xe^x$ which lies between [0, 1]. **(08 Marks)**

b. Use Graeffe's root squaring method by squaring thrice from the equation $x^3 - 2x^2 - 5x + 6 = 0$. **(08 Marks)**

Module-3

5 a. State equations for $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ in the case of numerical differentiation on forward and backward differences. Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at x = 1.5 given the following table **(08 Marks)**

x	1.0	1.5	2.0	2.5	3.0
y = f(x)	1.729	1.691	1.505	1.416	1.311

b. Starting from general quadrature formula (Newton – Cote's formula) establish Wedde's formula using numerical integration. Use it to find $\int_4^{5.2} \log_e^x \, dx$ with 7 ordinates. **(08 Marks)**

OR

6 a. Apply Cramer's rule to solve the equations

$3x + y + 2z = 3$
$2x - 3y - z = -3$
$x - 2y + z = 4$ **(08 Marks)**

b. Apply Gauss – Jordon method to solve the equations

$x + y + z = 9$
$2x - 3y + 4z = 13$
$3x + 4y + 5z = 40.$ **(08 Marks)**

Module-4

7 a. Use Cholesky's method to solve the equations **(08 Marks)**

$2x + 3y + z = 9$
$x + 2y + 3z = 6$
$3x + y + 2z = 8$

b. Solve the following equations by Jacobi's iteration method. (Use 4 iterations). **(08 Marks)**

$20x + y - 2z = 17$
$3x + 20y - z = -18$
$2x - 3y + 20z = 25$
Take initial values as $x_0 = y_0 = z_0 = 0$.

OR

8 a. Determine the largest Eigen value and the corresponding Eigen vector of the matrix with 5 (five) iterations given that,

$A = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$ Take the initial vector as $[1\ 0\ 0]^T$. **(08 Marks)**

b. Use House – holder's method to reduce the following matrix to the tri-diagonal form.

$A = \begin{bmatrix} 1 & 4 & 3 \\ 4 & 1 & 2 \\ 3 & 2 & 1 \end{bmatrix}$ **(08 Marks)**

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Module-5

9 a. Give the properties of linear transformation. The columns of $I_2 = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ are denoted by $e_1 = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$, $e_2 = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$, suppose T is a linear transformation from R^2 to R^3 such that $T(e_1) = \begin{bmatrix} 5 \\ -7 \\ 2 \end{bmatrix}$ and $T(e_2) = \begin{bmatrix} -3 \\ 8 \\ 0 \end{bmatrix}$, find the image of an arbitrary X in R^2. **(08 Marks)**

b. If $T : R^n \rightarrow R^m$ be a linear transformation, prove that
   i) T is one – to – one if and only if the equation T(X) = 0 has a trivial solution.
   ii) T maps R^n onto R^m if and only if the columns of A span R^m.
   iii) T is one – to – one if and only if the columns of A are linearly independent.
(08 Marks)

OR

10 a. Give a geometrical interpretation of orthogonal projection.
If $u_1 = \begin{bmatrix} 2 \\ 5 \\ -1 \end{bmatrix}$, $u_2 = \begin{bmatrix} -2 \\ 1 \\ 1 \end{bmatrix}$, $y = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$ and $\{u_1, u_2\}$ is an orthogonal basis for w = span $\{u_1, u_2\}$, write y as the sum of vector in w and a vector orthogonal to w. **(08 Marks)**

b. Discuss in brief :
   i) Gram – Schmidt process
   ii) Least square lines
   iii) The general linear model. **(08 Marks)**

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