CBCS Scheme

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16MDE/MMD/MST/MTP/MTR/MCM
/MEA/CAE/MAR11

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

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define absolute, relative and percentage errors. An approximate value of π is given by $x_1 = \frac{22}{7} = 3.1428571$ and its true value is $x = 3.1415926$. Find the absolute and relative errors. **(05 Marks)**

b. Given $f(x) = \sin x$, construct the Taylor's series approximation of order 0 to 7 at $x = \frac{\pi}{3}$. **(05 Marks)**

c. A parachutist of mass 68.1 kg jumps out of a stationary hot air balloon, use $\frac{dv}{dt} = g - \left(\frac{C}{m}\right)v$ to compute velocity V prior to opening the chute. The drag coefficient 12.6 kg/sec. Given that $g = 9.81$ m/s^2 v = 0 and t = 0. **(06 Marks)**

OR

2 a. If $f = \frac{4x^2y^3}{z^4}$ and the error in x, y, z are 0.001. Calculate the absolute error and relative maximum error in 'f' at x = y = z = 1. **(05 Marks)**

b. Find the relative error of the number x = 0.004997,
(i) Truncated to three decimal digits.
(ii) Rounded off to three decimal digits. **(05 Marks)**

c. Find the number of terms of the exponential series such that their sum gives values of e^x at x = 1 to 6 decimal places and to 8 decimal places. **(06 Marks)**

Module-2

3 a. By using the Regula Falsi method, find an approximate root of the equation $x^4 - x - 10 = 0$ between 1.8 and 2. Carry out three approximations. **(05 Marks)**

b. Find the root of the equation $x \log_{10} x = 1.2$ by Bisection method where the root lies between 2 and 3. Carry out four approximations. **(05 Marks)**

c. Apply Newton Raphson method to find an approximate root correct to three decimal places, of the equation $xe^x = 2$. **(06 Marks)**

OR

4 a. Find the root of the equation $f(x) = x^3 - 2x - 5 = 0$ in (2, 3) by Muller's method. **(08 Marks)**

b. Find the real root of the equation $x^3 - 6x^2 + 11x - 6 = 0$ by Graeffe's root squaring method. **(08 Marks)**

Module-3

5 a. Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by using,

(i) Trapezoidal rule. (ii) Simpson's $\frac{1}{3}$ rule with h = 1. **(08 Marks)**

b. Use Romberg's method to compute $\int_0^1 \frac{1}{1+x}dx$, correct to three decimal places. **(08 Marks)**

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.

OR

6 a. 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 $x = 1.2$ **(08 Marks)**

b. The following table gives the temperature θ (in degree Celsius) of a cooling body at different instant of time t (in seconds)

t	1	3	5	7	9
θ	85.3	74.5	67	60.5	54.3

Find approximately rate of cooling at t = 8 seconds. **(08 Marks)**

Module-4

7 a. Solve the system of equations by Gauss elimination method,

$$2x_1 - x_2 + 3x_3 = 1$$
$$-3x_1 + 4x_2 - 5x_3 = 0$$
$$x_1 + 3x_2 - 6x_3 = 0$$
(05 Marks)

b. Find the inverse of a matrix $\begin{bmatrix} 1 & 1 & 3 \\ 0 & 2 & -6 \\ 0 & -2 & 2 \end{bmatrix}$ by Gauss Jordan method. **(05 Marks)**

c. Solve, by Jacobi iterative method, the equations $20x + y - 2z = 17$, $3x + 20y - z = -18$, $2x - 3y + 20z = 25$. **(06 Marks)**

OR

8 a. By using Given's method find the eigen values of the tridiagonal matrix $\begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$. **(08 Marks)**

b. Using the Jacobi method find all the eigen values and the corresponding eigenvectors of the matrix, $\begin{bmatrix} 1 & \sqrt{2} & 2 \\ \sqrt{2} & 3 & \sqrt{2} \\ 2 & \sqrt{2} & 1 \end{bmatrix}$. **(08 Marks)**

Module-5

9 a. Show that $\{v_1, v_2, v_3\}$ is an orthogonal basis of R^3, where $V_1 = \left[\frac{3}{\sqrt{11}}, \frac{1}{\sqrt{11}}, \frac{1}{\sqrt{11}}\right]^1$, $V_2 = \left[\frac{-1}{\sqrt{6}}, \frac{2}{\sqrt{6}}, \frac{1}{\sqrt{6}}\right]^1$, $V_3 = \left[\frac{-1}{\sqrt{66}}, \frac{-4}{\sqrt{66}}, \frac{7}{\sqrt{66}}\right]$. **(05 Marks)**

b. Let $y = \begin{bmatrix} 7 \\ 6 \end{bmatrix}$ and $u = \begin{bmatrix} 4 \\ 2 \end{bmatrix}$. Find the orthogonal projection of y onto u. **(05 Marks)**

c. Show that $S = \{u_1, u_2, u_3\}$ is an orthogonal set. Express the vector $y = [6, 1, -8]^1$ as a linear combination of the vectors in S where $u_1 = \begin{bmatrix} 3 \\ 1 \\ 1 \end{bmatrix}$, $u_2 = \begin{bmatrix} -1 \\ 2 \\ 1 \end{bmatrix}$, $u_3 = \begin{bmatrix} -\frac{1}{2} \\ -2 \\ \frac{7}{2} \end{bmatrix}$. **(06 Marks)**

OR

10 a. Find a QR factorization of, $A = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 1 & 0 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$. **(08 Marks)**

b. Find a least square solution of AX = b for,

$$A = \begin{bmatrix} 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 1 \end{bmatrix}, \quad b = \begin{bmatrix} -3 \\ -1 \\ 0 \\ 2 \\ 5 \\ 1 \end{bmatrix}.$$

(08 Marks)

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