

2016

M.Sc.

3rd Semester Examination

**APPLIED MATHEMATICS WITH
OCEANOLOGY AND COMPUTER PROGRAMMING**

PAPER—MTM-306(U-II)

(PRACTICAL)

Full Marks : 25

Time : 2 Hours

The figures in the right-hand margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

**(Advanced Numerical and Statistical Techniques :
Using C/C++/MATLAB)**

Answer any one question.

Problem : 16 marks; Lab. Note Book and Viva : 4+5 marks

(Question will be selected by lottery.)

(Turn Over)

1. Write a program to evaluate determinant by Gauss elimination method, using partial pivoting.

Test your program for the following matrix :

$$\begin{bmatrix} 0 & 3 & 8 & 1 \\ 1 & 1 & 2 & -1 \\ 1 & 5 & 7 & 0 \\ -4 & 1 & 3 & 1+x \end{bmatrix}$$

where x is your roll number.

2. Write a program to find the inverse of a matrix by partial pivoting :

$$\begin{bmatrix} 1 & 1 & 9 & -2 \\ 4 & 4 & 1 & -1 \\ 5 & 5 & 6 & -3 \\ 4 & 1 & 3 & 1 \end{bmatrix}$$

3. Write a program to solve a system of linear equations by Gauss Seidal iteration method. Test your program for the following equations :

$$12x_1 + 3x_2 - x_3 = \text{your roll number}$$

$$x_1 + 8x_2 - 3x_3 = -9$$

$$-3x_1 + 4x_2 - 10x_3 = 18$$

4. Write a program to solve a system of linear equations by matrix inverse method. Test your program for the following equations :

$$2x_1 + 4x_2 - x_3 = 4$$

$$x_1 + 7x_2 - 3x_3 = \text{your age}$$

$$-x_1 + 2x_2 - 4x_3 = -3$$

5. Write a program to solve a system of linear equations by LU decomposition method. Test your program for the following equations :

$$x_1 + 3x_2 - x_3 = 3$$

$$2x_1 + 2x_2 - 3x_3 = 7$$

$$-6x_1 + 7x_2 - x_3 = 8$$

6. Write a program to solve a system of linear equations by Gauss elimination method. Test your program for the following equations :

$$2x_1 + 3x_2 - x_3 = 6$$

$$x_1 + 8x_2 - 3x_3 = 7$$

$$-3x_1 + 4x_2 - 4x_3 = -6$$

7. Write a program to solve a system of tri-diagonal equations :

$$2x_1 + 3x_2 = 5$$

$$x_1 + 8x_2 - 3x_3 = 6$$

$$x_2 - x_3 = 0$$

8. (a) Write a program to find the following integration by Gauss-Legendre quadrature (6-point) formula :

$$\int_0^2 \left(2 + xe^{-x} + R/2 \right) dx$$

where R is your class roll number.

- (b) Write a program to solve the equation

$$\frac{dy}{dx} = 2x^2 + y, \quad y(0) = 2, \quad 0.1 \leq x \leq 0.5$$

by taking $h = 0.1$.

9. Write a program to solve the equation by Runge-Kutta (2nd and 4th order) methods :

$$\frac{dy}{dx} = 2x^2 + y^2, \quad y(0) = 1,$$

find y in the interval $0 \leq x \leq 0.5$, taking $h = 0.1$.

10. Write a program to solve the equation by Runge-Kutta (2nd and 4th order) methods :

$$\frac{dy}{dx} = -x^2 + 3y^2, \quad y(0) = 1,$$

find y in the interval $0 \leq x \leq 0.5$, taking $h = 0.1$.

11. Write a program to solve the following pair of first order first degree ODEs by 4th order Runge-Kutta method :

$$\frac{dy}{dx} = y + 2z, \quad \frac{dz}{dx} = 3y + 2z \quad \text{with } y(0) = 6, \quad z(0) = 4 \quad \text{for } x = 0.1, 0.2.$$

12. Write a program to solve the following ODE by Milne predictor-corrector methods for $x = 0.4, 0.5, 0.6$:

$$\frac{dy}{dx} = x^3 + y^2, y(0) = 1.$$

13. Write a program to solve the ODE

$$\frac{dy}{dx} = 2x + y^2, y(0) = 1, 0.1 \leq x \leq 1.1$$

by taking $h = 0.1$ and draw the curve using MATLAB.

14. Write a program to find the largest Eigenvalue of a square matrix by power method. Using your program find the eigenvalues of the following matrix :

$$\begin{bmatrix} x & 5 & 2 & 3 \\ 4 & 0 & 2 & -3 \\ 5 & 5 & 7 & 0 \\ 4 & 1 & 3 & -2 \end{bmatrix}$$

where $x = [R/10]$, $[]$ represents box function, and R is your class roll number.

15. Write a program to find the correlation coefficient for a bivariate sample. Test your program for the following data :

X	1.23	2.34	3.45	4.67	4.90	5.12	5.78	6.01
Y	1.2345	1.5678	2.4567	3.4567	3.9087	2.9876	2.1098	1.209

16. Write a program to find the multiple correlation coefficient for the sample (x_i, y_i, z_i) , $i = 1, 2, \dots, n$. Test your program for the following data :

X	1	2	3	4	4.5	5	5.5	6
Y	2.2345	2.5678	3.4567	4.4567	4.9087	3.9876	3.1098	2.209
Z	3.45	4.56	6.90	7.12	8.45	6.90	5.23	2.34

17. Write a program to find the regression lines for a bivariate sample. Test your program for the following data :

X	0.23	1.24	2.45	3.67	3.90	4.12	4.78	5.01
Y	1.235	1.678	2.567	3.456	3.087	2.976	2.198	1.209

18. Write a program to fit a linear curve for a bivariate sample. Test your program for the following data :

X	1.25	2.25	3.25	4.25	4.50	5.00	5.25	5.50
Y	1.23	1.78	2.47	3.43	3.90	2.96	2.18	1.20

19. Write a program to fit a quadratic curve for a bivariate sample. Test your program for the following data :

X	-1.23	-2.34	1.45	2.67	3.90	4.12	4.78	5.01
Y	-1.345	1.678	1.467	3.567	3.987	2.986	2.108	1.209

20. Write a program to find two partial correlation coefficient for the sample (x_i, y_i, z_i) , $i = 1, 2, \dots, n$. Test your program for the following data :

X	1	2	3	4	5	6	7	8
Y	2.3	3.4	4.5	6.7	6.9	7.1	7.5	8.1
Z	3.45	4.56	6.90	7.12	8.45	6.90	5.23	2.34