

**2015**

**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.)*

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

$$\frac{dy}{dx} = 5x + 5y^2, y(0) = 1,$$

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

*(Turn Over)*

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

$$\frac{dy}{dx} = -2y + 3z, \quad \frac{dz}{dx} = y + 9z$$

with  $y(0) = 6$ ,  $z(0) = 4$  for  $x = 0.1, 0.2$ .

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

$$\int_0^2 (e^x + \log(2x+1)) dx.$$

4. Write a program to solve the equation :

$$\frac{dy}{dx} = 2x^2 + 5y, \quad y(0) = 2 \quad 0.1 \leq x \leq 0.5$$

by Euler's method taking  $h = 0.1$ .

5. Write a program to find the regression lines for a bivariate sample.
6. Write a program to fit a linear curve for a bivariate sample.
7. Write a program to fit a quadratic curve for a bivariate sample.
8. Write a program to find the inverse of a matrix by partial pivoting. Use this program to solve a system of linear equations.
9. Write a program to solve a system of linear equations by Gauss elimination method.
10. Write a program to evaluate a determinant by Gauss elimination method, using partial pivoting.

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

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

12. Write a program to find the correlation coefficient for a bivariate sample.
13. Write a program to solve a system of tri-diagonal equations.
14. Write a program to find the largest Eigenvalue of a square matrix by power method.
15. Write a program to find the multiple correlation coefficient for the sample  $(x_i, y_i, z_i), i = 1, 2, \dots, n$ .
16. Write a program to find two partial correlation coefficients for the sample  $(x_i, y_i, z_i), i = 1, 2, \dots, n$ .
17. Write a program to solve a system of linear equations by Gauss Seidal iteration method.
18. Write a program to solve a system of linear equations by LU decomposition method.
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