WA-5706

M.A./M.Sc. (Sem. II) Examination, June - 2024

MATHEMATICS

PAPER - MATH 2C1

Numerical Analysis

Time Allowed : **Three Hours**

Maximum Marks : **100**

Note : This question paper contains **two** sections as under :

https://pyuleb.com

Section-A **Max. Marks-20**

This section will have **10** *questions, having* **02** *questions from each unit with no internal choice. Answer in about* **20** *words. All questions will have equal marks.* ***(10×02=20)***

Section-B **Max. Marks-80**

This section will have **10** *questions, having* **02** *questions from each unit, one question to be attempted from each unit. Words limit approximately* **400-500** *words. Questions may have sub divisions. All questions will have equal marks.* ***(16×5=80)***

https://pyqclub.com

SECTION – A

1 (i) What is difference between Transcendental equation and Polynomial equation?

(ii) What is Graeffe's Root Square method?

(iii) Write short note on Gauss elimination method.

(iv) What is partial pivoting in the solution of linear simultaneous equations?

(v) Define the principle of least squares in curve fitting.

(vi) Find the eigen values of the matrix

$$\begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}.$$

(vii) Define truncation error of a single step method for the solution of the initial value problem $y' = f(x, y)$, $y(x_0) = y_0$.

(viii) What are the predictor corrector methods for solving the initial value problems $y' = f(x, y)$, $y(x_0) = y_0$.

(ix) Write the second order difference approximations for (i) $y'(x_i)$ (ii) $y''(x_i)$ based on central differences.

(x) Write the standard five point formula for the solution of Poisson equation $U_{xx} + U_{yy} = G(x, y)$ for uniform mesh spacing h.

SECTION - B

UNIT - I

2 Derive the Newton's method for finding the q^{th} root of a positive number N, $N^{1/q}$, where $N > 0$, $q > 0$. Hence compute $(17)^{1/3}$ correct to four decimal places, assuming the initial approximation as $x_0 = 2$.

OR

Use the Birge-Vieta method to find a real root correct to three decimals of the following equation. Find the deflated polynomial also.

$x^3 - 11x^2 + 32x - 22 = 0,\ p = 0.5$

UNIT - II

3 Find the inverse of coefficient matrix of the system by the Gauss-Jordan method with partial pivoting and hence solve the following system of linear equations :

$$\begin{bmatrix} 1 & 1 & 1 \\ 4 & 3 & -1 \\ 3 & 5 & 3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 1 \\ 6 \\ 4 \end{bmatrix}$$

OR

Find the solution of the system of equations :

$$45x_1 + 2x_2 + 3x_3 = 58$$
$$-3x_1 + 22x_2 + 2x_3 = 47$$
$$5x_1 + x_2 + 20x_3 = 67$$

correct to three decimal places using Gauss Seidel iteration method.

UNIT - III

4 Fit a straight line to the following data :

x	6	7	7	8	8	8	9	9	10
y	5	5	4	5	4	3	4	3	3

OR

[Contd...

Find the largest eigen value and the corresponding eigen vector of the matrix

$$\begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$$ using power method.

Take $[1\ 0\ 0\ ]^T$ as initial eigen vector.

UNIT - IV

5 For the initial value problem, obtain approximations to $y(0.2)$ and $y(0.4)$, using the modified Euler method with $h = 0.2$.

$$y' = -2xy^2,\ y(0) = 1$$

Compare the numerical solutions with the exact solution $y(x) = 1/(1+x^2)$.

OR

Given $y' = x^3 + y,\ y(0) = 2$, compute $y(0.2)$, $y(0.4)$ and $y(0.6)$ using the Runge-Kutta method of fourth order.

UNIT - V

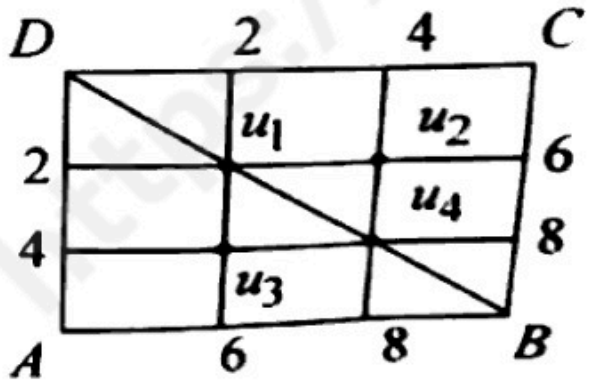
6 Solve the boundary value problem

$$(1+x^2)y''+4xy'+2y=2, y(0)=0, y(1)=1/2$$

by finite difference method. Use central difference approximations with $h = 1/3$.

OR

Solve $U_{xx}+U_{yy}=0$ numerically for the following mesh with uniform spacing and with boundary conditions as shown below in the figure :



https://www.uokonline.com