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SUBJECT CODE NO:- B-2065
FACULTY OF SCIENCE & TECHNOLOGY
B.Sc. S.Y. (Sem-IV)
Examination November/December- 2022
Mathematics MAT - 401
Numerical Methods

[Time: 1:30 Hours] **[Max. Marks: 50]**

Please check whether you have got the right question paper.

N.B i) Attempt all questions.
ii) Figure to the right indicate full marks.
iii) Use of non-programmable calculator and logarithmic table is allowed.

Q.1 A) Attempt any one: 08

a) Derive newton – Raphson formula for finding real roots of an equation f(x) = 0.

b) Derive Newton's general interpolation formula.

B) Attempt any one:

c) Obtain a root, correct to four decimal places, which lies between 2 and 3 of the equation $f(x) = x^3-2x -5 = 0$, by Using the method of false position. 07

d) Certain corresponding values of x and $\log_{10}^{x}$ are (300, 2.4771), (304, 2.4829), (305; 2.4843) and (307, 2.4871) Find $\log_{10} 301$.

Q.2 A) Attempt any one: 08

a) Define chebyshev polynomial and prove the recurrence relation
$T_{n+1}(x) = 2x\, T_n(x) – T_{n-1}(x)$.
Where $T_n(x)$ is a chebyshev polynomial of degree n.

b) Explain the Gaussian elimination method for solving system of linear equation.

B) Attempt any one: 07

c) Fit a straight line of the form $Y=a_0 + a_1x$ to the data.

x	1	2	3	4	6	8
y	2.4	3.1	3.5	4.2	5.0	6.0

d) Find the eigen values and eigen vectors of the matrix

$$A = \begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{bmatrix}$$

Q.3 A) Attempt any one: 05

a) Explain Picard's method of successive approximations to solve the differential equation $y' = f(x, y)$ With the initial condition $y(x_0) - y_0$

b) Prove that the Newton-Raphson method has quadratic convergence.

B) Attempt any one: 05

c) Using Euler's method, solve the differential equation $\frac{dy}{dx} + 2y = 0, \quad y(0) = 1$ take h=0.1 and obtain y(0.1), y(0.2) and y(0.3).

d) Using the method of separation of symbols, show that

$$\Delta^n u_{x-n} = u_x - n u_{x-1} + \frac{n(n-1)}{2} u_{x-2} + \cdots + (-1)^n u_{x-n}$$

Q.4 Choose the correct alternative. 10

i) Rate of convergence of Newton-Raphson method is _____
a) Linear b) Quadratic c) Cubic d) Biquadratic

ii) $\Delta^2 y_1 = ---$
a) $y_2-2y_1+y_0$ b) $y_3+2y_2+y_1$ c) $y_3-y_2+y_1$ d) $y_3-2y_2+y_1$

iii) The chebyshev polynomial of degree one is _____
a) x b) $2x^2-1$ c) $2x^2+1$ d) 1

iv) The eigenvalues of the matrix $\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$ are _____
a) 3,2 b) -3,-2 c) 1,-1 d) 0,4

v) Newton's forward difference interpolation formula is applicable only when the arguments are _____
a) Equally spaced b) Unequally spaced
c)Both equally and unequally spaced d) None of these