337312 (37)

BE (3^{rd} Semester)

Examination, Nov.-Dec., 2021

Branch : Mechanical

NUMERICAL ANALYSIS & COMPUTER PROG. (C & C++)

Time Allowed : Three Hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : Part (a) of each question is compulsory. Attempt any two parts from (b), (c) & (d).

Q. 1. (a) Define absolute, relative and percentage error. 2

(b) Solve using Newton-Raphson method : **7**

$3x = \cos x + 1$

(c) Solve by Gauss-Seidal iteration method : **7**

$x + y + 54z = 110$

$27x + 6y - z = 85$

$6x + 15y + 2z = 72$

(d) Find the positive root of $Xe^x = 2$ by the method of false position, correct upto four places of decimal. **7**

Q. 2. (a) Differentiate between curve fitting and an interpolation. **2**

(b) Find the best values of a and b in the law $y = ae^{bx}$ by the method of least squares : **7**

x	:	0	5	8	12	20
y	:	3	1.5	1	0.55	0.18

(c) Find the missing values : **7**

x	0	5	10	15	20	25
y	6	10	–	17	–	31

(d) Derive Newton's forward and backward interpolation formula. **7**

Q. 3. (a) Give the Taylor's series for y(x) around $x = x_o$. **2**

(b) Derive the expression for Simpson's $\frac{1}{3}$rd rule. **7**

$$\int_{x_0}^{x_0+h} f(x)\,dx = \frac{h}{3}\Big[\{f(x_0) + f(x_n)\} +$$

$$4\{f(x_1) + f(x_3)....\} + 2\{f(x_2) + f(x_4) + ...\}\Big]$$

(c) Solve :

$y' = y^2 + x, \ y(0) = 1$

using Taylor series method & compute y(0.1) and y(0.2). 7

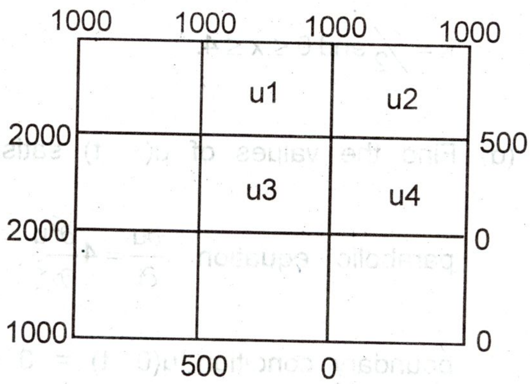
(d) Using Euler's modified method, find a solution to equation :

$$\frac{dy}{dx} = x + \left|\sqrt{y}\right| = f(x, y) .$$

with initial condition $y = 1$ at $x = 0$ for the range of $0 \le x \le 0.6$ in steps of 2. 7

Q. 4. (a) State the condition for a general second order linear partial differential equation to be of 'elliptic' type. **2**

(b) Evaluate the function u(x, y) satisfying $\nabla^2 u = 0$ at the lattice points, given the boundary values as follows : **7**



Use iterative method to obtain the solution.

(c) The transverse displacement u of a point at a distance x from one end at any time satisfies $\frac{d^2u}{dt^2} = 4\frac{d^2u}{dx^2}$ with boundary conditions $u = 0$ at $x = 0$, $t > 0$ and $u = 0$ at $x = 4$, $t > 0$ and initial condition. **7**

$u = x(4 - x), \frac{\partial u}{\partial t} = 0, h = k$

$k = \frac{1}{2}$ and $0 \le x \le 4$.

(d) Find the values of u(x, t) satisfying the parabolic equation $\frac{\partial u}{\partial t} = 4\frac{\partial^2 u}{\partial x^2}$ and the boundary condition $u(0, t) = 0 = u(8, t)$ and $u(x, 0) = 4x - \frac{1}{2}x^2$ at the points $x = i$,

$i = 0, 1, 2 \ldots\ldots 7$ and $t = \frac{1}{8}j$ j, $j = 0, 1, 2 \ldots\ldots 5$. **7**

Q. 5. (a) Explain very briefly different types of 'Data Type' in C language. **2**

(b) Discuss different relational & conditional operators available in C-language along with their precedance level. **7**

(c) Write a 'C' program to generate a series 1, 8, 27, 64 .... upto ten terms. **7**

(d) What is Array ? How does it differ from ordinary variable ? **7**