TDP (Honours) 6th Semester Exam., 2024

MATHEMATICS

(Honours)

SEVENTH PAPER

Full Marks : 80

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer each Group in separate answer-script

Scientific calculator is allowed

GROUP—A

(Numerical Analysis)

(*Marks* : 40)

UNIT—I

Answer *any* **two** questions

1. *(a)* State and prove Lagrange interpolation formula and express it in the form

$$\phi(x) = \sum_{i=0}^{n} \frac{\psi(x)}{(x - x_i)\,\psi'(x_i)} y_i \qquad 1+4=5$$

(b) Define central difference operator and averaging operator. 2

(c) Prove that

$$y'(x_0) = \frac{1}{h}\left[\Delta y_0 - \frac{1}{2}\Delta^2 y_0 + \frac{1}{3}\Delta^3 y_0 - \frac{1}{4}\Delta^4 y_0 + \ldots\right]$$

symbols have their usual meanings. 3

2. (a) Find the polynomial that fits the following data :

x	0·1	0·2	0·3	0·4	0·5
$f(x)$	1·40	1·56	1·76	2·00	2·28

Hence interpolate at $x = 0 \cdot 25$. 4

(b) Evaluate the integral $\int_0^1 \sin x^2\, dx$ by trapezoidal rule taking 10 sub-intervals. 3

(c) Write a short note on the choice and use of the interpolation formula. 3

3. (a) Find the approximate value of

$$I = \int_0^1 \frac{dx}{1+x}$$

using Simpson's 1/3 rule. 4

(b) Use the identity

$$\frac{\pi^2}{6} = \sum_{n=1}^{\infty} \frac{1}{n^2}$$

to compute π^2. 3

(c) Explain rounding off error and truncation error with examples. 3

UNIT—II

Answer *any* **two** questions

4. (a) Using Newton-Raphson method, solve the following equation correct up to 5th decimal place : 4

$$xe^x - 1 = 0$$

(b) Calculate the positive root of the equation $x^3 - 9x + 1 = 0$ correct up to three decimal places by the bisection method. 4

(c) Write one advantage and one disadvantage of regula-falsi method. 2

5. (a) Evaluate $y(1 \cdot 1)$ using Runge-Kutta method of order 4 for the initial value problem

$$\frac{dy}{dx} = x^2 + y^2, \quad y(1) = 0$$ 4

(b) Find the real root of $x^3 + x - 5 = 0$ by any numerical method. 4

(c) What is the working formula for numerical solution of equation using secant method? 2

6. *(a)* Solve by Euler's method, the following differential equation for $x = 1$ by taking $h = 0 \cdot 2$: 4

$$\frac{dy}{dx} = xy, \quad y = 1 \text{ when } x = 0$$

(b) Starting with initial vector $X^{(0)} = 0$, perform three iterations of Gauss-Seidel method to solve the following system of equations : 6

$$2x - y = -1$$
$$-x + 4y + 2z = 3$$
$$2y + 6z = 5$$

GROUP—B

(C Programming)

(*Marks* : 40)

UNIT—III

Answer *any* **two** questions

7. *(a)* What is an algorithm? Write an algorithm to determine whether a user-defined number *n* (say) is prime or not. 1+4=5

(b) What is literal? Define keywords and identifiers with examples. What is the difference between source code and object code? 1+2+2=5

8. *(a)* What will be the output of the following program? 4

```
include <stdio.h>
main() {
  int a=5, s=0;
  while (s>0)
  printf("%d", s);
  s++;
  printf("%d", ++a);
  printf("%d", ++s);
}
```

(b) What is flowchart? Draw a flowchart to find the factorial of a number. 2+4=6

9. *(a)* Explain arithmetic, assignment, binary, logical and relational operators in C with example. 5

(b) Write a C program to find the largest number among three numbers. 5

UNIT—IV

Answer *any* **two** questions

10. *(a)* What is looping in C programming? Explain 'for loop' and 'while loop' with suitable examples. 1+2+2=5

(b) Write a C program to find the smallest number in an array of 10 integers. 5

11. *(a)* What is the difference between user-defined function and library function? Write the utilities of printf(), scanf() and getch() in C program. 2+3=5

(b) Write a program to find the sum of the following series : 5

$S = 1 + 3 + 5 + 7 + \ldots$ up to nth term

12. *(a)* What is array? Explain 1-dimensional and 2-dimensional arrays with examples. 1+2+2=5

(b) Write the output of the following program : 5

```
#include <stdio.h>
main()  {
  int x, y;
  x=6;
  y=x++;
  if (x<5);
  printf("%d", y);
  printf("%d", x);
}
```

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