

(6 pages)

**OCTOBER 2013**

**P/ID 37459/PMAE**

---

Time : Three hours

Maximum : 60 marks

SECTION A — (10 × 1 = 10 marks)

Answer ALL questions.

Each question carries 1 marks.

1. What is polymorphism?
2. Mention the major application of scope resolution operator.
3. What are the conditions to be satisfied by the casting operator?
4. Define abstract class.
5. Define fixed point of a function.
6. Define pivotal element and pivotal row.
7. Write down the recursive pattern possessed by Newton polynomial.
8. Write down the centered formula of order  $O(h^4)$ .

9. What is the degree of precision of  
(a) Trapezoidal rule, and  
(b) Boole's rule?
10. State Lipschitz condition.

SECTION B — (5 × 3 = 15 marks)

Answer ALL questions.

Each question carries 3 marks.

11. (a) Enumerate the rules for naming variables in C++.

Or

- (b) Describe chain assignment.

12. (a) Write down the steps involved in the process of operator overloading.

Or

- (b) Narrate single inheritance with example.

13. (a) Suppose  $g \in C[a, b]$ ,  $g'(x)$  is defined on  $(a, b)$ , and there is a constant  $k$  such that  $|g'(x)| \leq k < 1$  for all  $x \in (a, b)$ . Then prove that  $g$  has a unique fixed point  $P$  in  $[a, b]$ .

Or

- (b) Using tom-digit arithmetic and Gaussain elimination method with trivial pivoting, solve the linear system.

$$24.14 x_1 - 1.210 x_2 = 22.93$$

$$1.133 x_1 + 5.281 x_2 = 6.414.$$

14. (a) Using the geometric series

$$\frac{1}{1+x^2} = 1 - x^2 + x^4 - x^6 + \dots$$

$$\text{Show that, } \pi = 2\sqrt{3} \left( 1 - \frac{3^{-1}}{3} + \frac{3^{-2}}{5} - \frac{3^{-3}}{7} + \dots \right).$$

Or

- (b) Given the following data, find  $y'(6)$  and the maximum value of  $y$  :

$$x : 0 \quad 2 \quad 3 \quad 4 \quad 7 \quad 9$$

$$y : 4 \quad 26 \quad 58 \quad 112 \quad 466 \quad 922$$

15. (a) By dividing the range into ten equal parts, evaluate  $\int_0^{\pi} \sin x dx$  by trapezoidal and Simpson's rule. Verify the answer with actual integration.

Or

- (b) Using modified Euler method, find  $y(0.2)$ ,  $y(0.1)$  given  $y' = x^2 + y^2$ ,  $y(0) = 1$ .

3 **P/ID 37459/PMAE**

SECTION C — (5 × 7 = 35 marks)

Answer ALL questions.

Each question carries 7 marks.

16. (a) Describe call by reference and return by reference with example.

Or

- (b) How to declare constructor? Write down the special characteristics of constructor function.

17. (a) Write down the rules for overloading operators.

Or

- (b) (i) Mention the meaning of the following flags :

`ios::showbase, ios :: showpos,`

`iso :: showpoint, iso :: uppercase`

- (ii) Explain class templates with multiple parameters with example.

4      **P/ID 37459/PMAE**  
[P.T.O.]

18. (a) State and prove fixed-point theorem.

Or

- (b) Using triangular factorisation method, solve,

$$2x_1 + 8x_2 + 6x_3 + 4x_4 = 52;$$

$$x_1 + 2x_2 + 4x_3 + x_4 = 21,$$

$$3x_1 + 10x_2 + 8x_3 + 8x_4 = 79$$

$$4x_1 + 12x_2 + 10x_3 + 6x_4 = 82.$$

19. (a) Assuming suitable conditions, derive Lagrange polynomial approximation of a function  $f(x)$ .

Or

- (b) Derive the relationship among the formulas

(i) second order forward difference formula

(ii) second order central difference formula  
and

(iii) second order backward difference formula, of order  $O(h^2)$  for approximating  $f'(x_0)$  and find the general algorithm to compute the numerical derivative.

20. (a) Using Romberg's method, evaluate  $\int_0^1 \frac{dx}{1+x}$ , correct to three decimal rules. Hence evaluate  $\log_e 2$ .

Or

- (b) Compute  $y(0.3)$ , given  $y' + y + xy^2 = 0$ ,  $y(0) = 1$ , by taking  $h = 0.1$  using Runge-Kutta method of fourth order, correct to 4 decimals.
-