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MATHEMATICS

( Major )

Paper : 6.2

( Numerical Analysis )

Full Marks : 60

Time : 3 hours

*The figures in the margin indicate full marks  
for the questions*

1. Answer the following questions : 1×7=7

- (a) What is meant by normalized floating point representation of real numbers?
- (b) Subtract 203.176 from 791.23 in normalized floating point representation.
- (c) Define relative error.
- (d) Define shift operator  $E$ .
- (e) Establish the relation  $E = 1 + \Delta$ .
- (f) Evaluate  $\Delta^2(3e^x)$ .
- (g) What is meant by extrapolation?

2. Answer the following questions : 2×4=8

- (a) What assumptions are to be kept in mind for interpolation?
- (b) Show that  $(1+\Delta)(1-\nabla)=1$ , where the symbols have their usual meanings.
- (c) Using normalized floating point representation, add  $.4546 E5$  and  $.5433 E7$ .
- (d) Find  $f(6)$ ; it is given  $f(0) = -3$ ,  $f(1) = 6$ ,  $f(2) = 8$ ,  $f(3) = 12$ , the third difference being constant.

3. Answer the following questions : 5×3=15

- (a) Derive Newton's forward interpolation formula.
- (b) Use the method of separation of symbols to prove the following identity :

$$u_x = u_{x-1} + \Delta u_{x-2} + \Delta^2 u_{x-3} + \dots \\ + \Delta^{n-1} u_{x-n} + \Delta^n u_{x-n}$$

Or

Given

$$\sin 45^\circ = 0.7071, \quad \sin 50^\circ = 0.7660$$

$$\sin 55^\circ = 0.8192, \quad \sin 60^\circ = 0.8660$$

Find  $\sin 52^\circ$  by using any method of interpolation. Mention why you have chosen the particular method.



- (c) Find the real root of the equation  $x^2 - 5x + 2 = 0$  correct to four places of decimal by using Newton-Raphson method.

4. Answer either (a) or (b) :

- (a) (i) Derive Simpson's one-third rule. 5  
 (ii) Calculate an approximate value of

$$\int_0^{\pi/2} \sin x \, dx$$

by Simpson's rule using 11 ordinates. 5

- (b) (i) Derive Euler-Maclaurin summation formula. 5  
 (ii) Find the sum of

$$\frac{1}{51^2} + \frac{1}{53^2} + \frac{1}{55^2} + \dots + \frac{1}{99^2} \quad 5$$

5. Answer either (a) or (b) :

- (a) Explain briefly the idea of numerical integration. Establish the general quadrature formula and deduce trapezoidal rule from it.  $2+5+3=10$

- (b) Derive Stirling's formula. Use Stirling's formula to find  $y_{28}$ , given

$$y_{20} = 49225, \quad y_{25} = 48316, \quad y_{30} = 47236,$$

$$y_{35} = 45926, \quad y_{40} = 44306$$

5+5=10

6. Answer either (a) or (b) :

- (a) (i) Give the geometrical interpretation of Newton-Raphson method. 2
- (ii) Prove that the bisection method always converges. 3
- (iii) Discuss the secant method with appropriate diagram. 5
- (b) (i) Find a real root of the equation  $x^3 - 2x - 5 = 0$  by the method of false position, correct to three decimal places. 5
- (ii) Find the first, second and third derivatives of the function tabulated below at the point  $x = 1.5$  : 5

$x$	1.5	2.0	2.5	3.0	3.5	4.0
$f(x)$	3.375	7.000	13.625	24.000	38.875	59.000

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