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D-5336

M.Sc. (III[rd] Semester) Examination, 2020

MATHEMATICS

(Numerical Analysis - I)

Time Allowed : Three Hours

Maximum Marks : 70

SECTION - A

Note : Attempt all ten questions. Each question carries one mark. **10×1=10**

Q. 1. Objective Type :

Fill in the blanks :

(i) The finite difference form of $\frac{\partial^2 u}{\partial x^2}$ = _____ and $\frac{\partial^2 u}{\partial y^2}$ = _____.

(ii) Gauss's forward interpolation formula used when u lies between _____ and _____.

(iii) The divided differences are _____ in all their arguments.

(iv) Stirling's formula is the _____ of the two Gauss's formula.

(v) The error E in the trapezoidal rule is of the order _____.

Choose the correct answer :

(vi) $\Delta^r x^{(n)} = 0$ if :

(a) $r < n$

(b) $r = n$

(c) $r > n$

(d) None of these

(vii) Newton's forward interpolation formula used mainly for interpolating the values of y :

(a) Near the beginning of a set of tabular value

(b) Near the ending of a set of tabular value

(c) Both (a) & (b)

(d) None of these

(viii)The divided difference operator Δ is :

(a) Constant

(b) Linear

(c) Quadratic

(d) None of these

(ix) Gauss backward interpolation formula useful when u lies between :

(a) 1 and 0

(b) –1 and 0

(c) –1 and 1

(d) None of these

(x) The sum of Newton's Cotes number is :

(a) 1

(b) –1

(c) 0

(d) None of these

SECTION - B

Note : Attempt any five questions. Each question carries 2 marks. **5×2=10**

Q. 2. Very short answer type (25-30 words) :

(1) Define operator E & write its properties.

(2) Find the error in Newton's interpolating polynomial.

(3) If $u = \frac{x - x_0}{n}$, then specify the range for u to obtain better result using Bessel's formula.

(4) Define divided differences and write two properties.

(5) State Stirling's interpolation formula upto the third order difference term.

(6) What are the errors in Trapezoidal and Simpson's rule of numrical integration.

(7) Can you use Lagrange's interpolation formula when h = 1.

SECTION - C

Note : Attempt any five questions. Each question carries 4 marks. **5×4=20**

Q. 3. Short answer type (250 words) :

(1) Prove that :

$$\left(\frac{\Delta^2}{E}\right)e^x \cdot \frac{Ee^x}{\Delta^2 e^x} = e^x$$

(2) Represent the function $f(x) = x^4 + 3x^3 - 5x^2 + 6x - 7$ in factorial polynomial and their successive forward differences, taking h = 1.

(3) Discuss various types of different interpolation methods.

(4) Find f(x) as a polynomial in x from the given data :

x	:	3	7	9	10
f(x)	:	168	120	72	63

(5) Find f(x) by Hermites interpolation from the table :

x	:	–1	0	1
f	:	1	1	3
f′	:	–5	1	7

(6) Using Bessel's formula find $3\sqrt{46.24}$ given :

x	:	41	45	49	53
$x^{1/3}$	:	3.4482	3.5569	3.6593	3.7563

(7) Find $y'(0)$ & $y''(0)$ from the following table :

x	:	0	1	2	3	4	5
y	:	4	8	15	7	6	2

SECTION - D

Note : Attempt any three questions. Each question carries 10 marks. **10×3=30**

Q. 4. Essay Type :

(1) From the following data, find y at x = 43 and x = 84 by using Gregory-Newton forward and backward interpolation formula :

x	:	40	50	60	70	80	90
y	:	184	204	226	250	276	304

(2) Apply Gauss's forward interpolation formula to find y(25) for the following data :

x	:	20	24	28	32
y	:	2854	3162	3544	3992

(3) Use Lagrange's interpolation formula to find the value of f(x) corresponding to x = 27 from the following data ;

x	:	14	17	31	35
f(x)	:	68.5	64.0	44.0	39.1

(4) Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by using Trapezoidal rule taking h = 1.