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E-5336

M.A. / M.Sc. (IIIrd Semester) Examination, 2021

MATHEMATICS

(Numerical Analysis - I)

Time Allowed : Three Hours

Maximum Marks : 70

Note : Attempt all sections as directed.

SECTION - A

(Objective Type / Multiple Choice Questions / True or False)

Note : Attempt any ten questions. **1×10=10**

Choose the correct answer :

Q. 1. (i) if $\Delta f(x) = f(x + n) - f(x)$, then a constant c, Δc equals :

(a) 1

(b) 0

(c) f(c) – f(0)

(d) f(x + c) – f(x)

(ii) What is the value of E f(x) :

(a) f(x + h)

(b) f(x + 2h)

(c) f(x – h)

(d) None of these

(iii) The value of $\nabla^2 y_3$ is :

(a) $y_3 + 2y_2 - y_1$

(b) $y_3 + 2y_2 + y_1$

(c) $y_3 - 2y_2 + y_1$

(d) None of these

(iv) The name of the operator δ :

(a) Mean operator

(b) Forward difference operator

(c) Shift operator

(d) Central difference operator

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(v) Newton forward interpolation formula is used for _____ intervals :

(a) Open

(b) Unequal

(c) Equal

(d) Closed

(vi) An interpolation formula in which both the function and its first derivative are to be assigned at each point of interpolation is :

(a) Newton's divided difference formula

(b) Lagrange's interpolation formula

(c) Hermite's interpolation formula

(d) None of these

(vii) The first divided difference with arguments 2, 4 of the function $f(x) = x^3 - 2x$ is :

(a) 24

(b) 26

(c) 22

(d) None of these

(viii) Which one of the following formula is used for unequal intervals ?

(a) Newton's forward formula

(b) Newton's backward formula

(c) Newton's divided difference formula

(d) None of these

(ix) Value of δ is equal to :

(a) $\Delta E^{-1/2}$

(b) $\nabla E^{1/2}$

(c) Both (a) and (b)

(d) None of these

(x) Value of $E^{1/2}$ is equal to :

(a) $\mu + \frac{1}{2}\delta$

(b) $\mu - \frac{1}{2}\delta$

(c) $\delta + \frac{1}{2}\mu$

(d) $\delta - \frac{1}{2}\mu$

(e) None of these

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(xi) The value of $\Delta\nabla$ is equal to :

(a) $\Delta\nabla$

(b) δ^2

(c) Both (a) and (b)

(d) None of these

(xii) The error in Simpson's 1/3 rule is of order of h^5. (True or False)

SECTION - B

(Very Short Answer Type Questions)

Note : Answer the following questions in 2-3 sentences. (Attempt any five questions). **2×5=10**

Q. 2. (i) Evaluate Δe^{ax}.

(ii) Define central difference operator δ & write its properties.

(iii) Define a difference quotient.

(iv) When Lagrange's interpolation formula is used ?

(v) State Laplace-Everett formula.

(vi) Write Newton's backward derivative formula.

(vii) State the formula for Weddle's rule.

SECTION - C

(Short Answer Type Questions)

Note : Attempt any five questions. **5×4=20**

Q. 3. (i) Find :

(a) $\Delta^{10}(1-ax)(1-bx^2)(1-cx^3)(1-dx^4)$

(b) $\Delta^3(1-x)(1-2x)(1-3x)$

(ii) Given $u_0 = 1$, $u_1 = 11$, $u_2 = 21$, $u_3 = 28$ and $u_4 = 29$, find $\Delta^4 u_0$.

(iii) Express $f(x) = x^4 - 5x^3 + 3x + 4$ in factorial notation.

(iv) Following are the population of a district :

Years (x)	1881	1891	1901	1911	1921	1931
Population (y)	363	391	421	?	467	501

Find the population of the year 1911.

(v) The values of sin x are given below for different values of x. Find the value of sin 32° :

x	30°	35°	40°	45°	50°
$y = \sin x$	0.5000	0.5736	0.6428	0.7071	0.7660

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(vi) Find $\frac{dy}{dx}$ at x = 0.6 of the function y = f(x), tabulated below :

x	0.4	0.5	0.6	0.7	0.8
y	1.5836494	1.7974426	2.0442376	2.3275054	2.6510818

(vii) Calculate $\int_0^{\pi/2} e^{\sin x}\, dx$, correct to four decimal places by Simpson's three-eight rule.

SECTION - D

(Long Answer Type Questions)

Note : Attempt any three questions. **3×10=30**

Q. 4. (i) Deduce the Newton's forward interpolation formula.

(ii) Given $\log_{10}654 = 2.8156$, $\log_{10}658 = 2.8182$, $\log_{10}659 = 2.8189$, $\log_{10}661 = 2.8202$, find $\log_{10}656$.

(iii) Describe geometric significance of Trapezoidal rule. Derive Trapezoidal rule from Newton-Cote's quadrature formula.

(iv) Use the Euler-Maclaurin expansion to prove :

$$\sum_{x=1}^{n} x^2 = \frac{n(n+1)(2n+1)}{6}$$

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