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3 SEM TDC STS M 2 (N/O)

2019

(November)

STATISTICS

(Major)

Course : 302

(Numerical Methods)

(New and Old Course)

Full Marks : 80
Pass Marks : 24/32

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Choose the correct alternative out of the given ones : 1×8=8

(a) If $f(x)$ be a polynomial of nth degree, then

(i) $\Delta^n f(x) = 0$

(ii) $\Delta^{n-1} f(x)$ = constant

(iii) $\Delta^{n+1} f(x) = 0$

(iv) $\Delta^{n+1} f(x)$ = constant

(b) Which one of the following is not correct?

(i) $E^m E^n f(x) = E^{m+n} f(x)$

(ii) $E \nabla = \nabla E = \Delta$

(iii) $E^{-n} f(x) = f(x - nh)$

(iv) $E^2 f(x) = [Ef(x)]^2$

(c) The central difference operator 'δ' is given by

(i) $E^{\frac{1}{2}} - E^{-\frac{1}{2}}$

(ii) $E^{\frac{1}{2}} + E^{-\frac{1}{2}}$

(iii) $E^{-\frac{1}{2}} - E^{\frac{1}{2}}$

(iv) $\frac{1}{2}(E^{\frac{1}{2}} + E^{-\frac{1}{2}})$

(d) Gauss forward formula is suitable for interpolation

(i) near the beginning of a series

(ii) near the middle of a series

(iii) of both beginning and end of a series

(iv) near the end of a series

(e) Which of the following interpolation formulas can be used for inverse interpolation?

(i) Newton's forward interpolation formula

(ii) Newton's backward interpolation formula

(iii) Lagrange's interpolation formula

(iv) Newton's divided difference formula

(f) Simpson's one-third rule is called

(i) straight line formula

(ii) hyperbolic formula

(iii) parabolic formula

(iv) None of the above

(g) A formula which is applicable to any number of sub-intervals whether even or odd is

(i) Weddle's formula

(ii) general quadrature rule

(iii) trapezoidal rule

(iv) All of the above

(h) Transcendental equation can be solved by using

(i) bisection method only

(ii) iterative method only

(iii) Newton-Raphson method only

(iv) All of the above

2. Answer any *two* of the following : 4×2=8

(a) Prove the operators relation

$$(1+\Delta)(1-\nabla) \equiv 1$$

(b) Evaluate

$$\Delta^3[(1-x)(1-2x)(1-3x)]$$

(c) Evaluate

$$\Delta\left(\frac{1}{1+x^2}\right)$$

3. (a) Use the method of finite differences to sum of the series

$$1^3+2^3+3^3+\cdots+n^3$$

5

Or

(b) Sum to n terms the series whose xth term is

$$x(x-1)(x-2)$$ 5

4. *(a)* Establish an interpolation formula for equal intervals. 4

(b) The following table is given :

x	0	1	2	3	4
$f(x)$	3	6	11	18	27

What is the form of the function $f(x)$? 4

5. Answer any *three* of the following : 8×3=24

(a) *(i)* Derive Gauss's forward formula for central differences. 4

(ii) Use Stirling's formula to find $f(35)$, given that $f(20) = 512$, $f(30) = 439$, $f(40) = 346$, $f(50) = 243$. 4

(b) What are divided differences? Prove that divided difference of a polynomial of nth degree is constant. 2+6=8

(c) Describe a method for inverse interpolation. If $y_1 = 4, y_3 = 12, y_4 = 19$ and $y_x = 7$, then find x. 4+4=8

(d) Write down Newton's interpolation formula with divided difference. Given $f(0) = 8$, $f(1) = 68$, $f(5) = 123$, find $f(2)$. 3+5=8

(e) (i) Deduce Lagrange's formula for interpolation. 4

(ii) Find the form of the function, given that

x	0	1	2	5
$f(x)$	2	3	12	147

4

6. Answer any *three* of the following : 9×3=27

(a) What is numerical differentiation? When do we use it? Find first and second derivatives of the function given below at the point $x = 1 \cdot 2$: 4+5=9

x	1	2	3	4	5
y	0	1	5	6	8

(b) State and prove Simpson's $\frac{1}{3}$rd rule for numerical integration. Use Simpson's $\frac{3}{8}$th rule to find

$$\int_0^6 \frac{dx}{(1+x)^2}$$ 4+5=9

(Continued)

(c) Define algebraic and transcendental equations. Give example of each. Find the root of $x^4 - x - 10 = 0$ which is nearer to $x = 2$, correct to three places of decimals by using Newton-Raphson method. 4+5=9

(d) Write short notes on the following : 3+3+3=9

(i) Regula falsi method

(ii) Bisection method

(iii) Newton-Raphson method

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