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3 (Sem–4/CBCS) MAT HC 2

2021

MATHEMATICS

(Honours)

Paper : MAT–HC–4026

(Numerical Methods)

Full Marks : 60

Time : Three hours

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

GROUP–A

(Marks 30)

(Traditional –type Questions)

1. Answer the following questions : $1 \times 5 = 5$

(a) What is the order of convergence of the Secant method ?

Contd.

(b) State Newton's divided difference interpolation formula for $(n+1)$ unequally spaced arguments.

(c) Find the value of $\Delta^2\left(\frac{1}{x-1}\right)$, taking $h=1$.

(d) Show that $E\nabla \equiv \nabla E \equiv \Delta$.

(e) What do you mean by numerical integration ?

2. Answer the following questions : $2 \times 5 = 10$

(a) Write the underlying idea of LU decomposition method.

(b) Write the condition under which the fixed point iteration method is convergent.

(c) Show that $\Delta \log f(x) = \log \left[1 + \frac{\Delta f(x)}{f(x)} \right]$.

(d) Evaluate $\Delta^2 \cos 2x$, taking the interval of difference as h .

(e) Write the numerical differentiation formulae for finding the first and second derivatives of a function $f(x)$ at a point x near the beginning of a given set of tabulated equidistant values.

3. Answer **any three** parts : $5 \times 3 = 15$

(a) Find a root of the equation $x^3 - 9x + 1 = 0$ in the interval $[2, 3]$ using bisection method with three iterations.

(b) Using Newton's method, find the square root of 12 correct to three decimal places.

(c) Find the form of the function $f(x)$ using Newton's interpolation formula from the following table :

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

(d) Use the method of separation of symbols to prove that

$$u_0 - u_1 + u_2 - \dots = \frac{1}{2}u_0 - \frac{1}{4}\Delta u_0 + \frac{1}{8}\Delta^2 u_0 - \dots$$

(e) Calculate the value of $\int_0^1 \frac{x}{1+x} dx$ taking six intervals by Trapezoidal rule.

GROUP B

(Marks 30)

(Innovative/Critical Questions)

4. Answer **any three** parts : $10 \times 3 = 30$

(a) Find the cube root of 15 correct to four significant figures by fixed point iteration method.
(First check the convergence of the method)

(b) Solve the following system using LU decomposition method :

$$2x + 3y + z = 9$$

$$x + 2y + 3z = 6$$

$$3x + y + 2z = 8$$

(c) Write down the Lagrange's polynomial passing through the points (x_0, f_0) , (x_1, f_1) and (x_2, f_2) . Hence express

$\frac{3x^2 + x + 1}{(x-1)(x-2)(x-3)}$ as a sum of partial fractions.

- (d) Find the first term of the series whose second and the subsequent terms are 8, 3, 0, -1, 0,....
- (e) The velocity of a particle at distance S from a point on its path is given by the following table :

S (meters)	0	10	20	30	40	50	60
V (m/sec)	47	58	64	65	61	52	38

Estimate the time taken to travel the first 60 metres.
