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IV Semester B.Sc. Hon's (Mathematics) Degree CBCSS – Regular/
Supplementary/Improvement Examination, April 2022
(2016 Admission Onwards)
BHM 405 : NUMERICAL ANALYSIS

Time : 3 Hours

Max. Marks : 60

SECTION – A

(Answer **any 4** questions out of 5 questions. **Each** question carries **1** mark.) **(4×1=4)**

1. Define a shift operator.

2. What is Simpson's $\frac{1}{3}$ rule of numerical integration ?

3. Write Newton's forward interpolation formula.

4. If $u_0 = 1$, $u_1 = 5$, $u_2 = 8$, $u_3 = 3$, $u_4 = 7$, $u_5 = 0$, then find $\Delta^5 u_0$.

5. What is the condition for convergence while solving $x = \phi(x)$ by iteration method ?

SECTION – B

(Answer **any 6** questions out of 9 questions. **Each** question carries **2** marks.)   **(6×2=12)**

6. Prove that $\mu^2 = 1 + \frac{1}{4}\delta^2$, where μ is the mean operator and δ is the central difference operator.

7. Prove that $\Delta^3 y_2 = \Delta^3 y_5$.

8. Determine the real root of $xe^x = 1$ by iteration method.

9. Show that $E = e^{hD}$, where E is the shift operator and D is the differential operator.

10. Form the divided difference table using the following data.

x	− 1	0	3	6	7
y	3	− 6	39	822	1611

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11. Show that the divided differences are symmetric.

12. Find the missing term in the table.

x	0	1	2	3	4
y	1	3	9	– –	81

13. Determine the maximum error in evaluating the integral $I = \int_0^{\frac{\pi}{2}} \sin x \, dx$.

14. Using Simpson's $\frac{1}{3}$ rule with h = 1, evaluate the integral $I = \int_3^7 x^2 \log x \, dx$.

SECTION – C

(Answer **any 8** questions out of 12 questions. **Each** question carries **4** marks.) **(8×4=32)**

15. Find a real root of $x^3 = 1 - x^2$ on the interval [0, 1] with an accuracy of 10^{-4} by iteration method.

16. Find a real root of $x \sin x + \cos x = 0$ by Newton Raphson method.

17. Find a real root of $x^3 - 2x - 5 = 0$ by bisection method.

18. Find Lagrange's interpolation formula using the following data.

x	0	1	3	4
y	− 12	0	12	24

19. If y(1) = 4, y(3) = 12, y(4) = 19 and y(x) = 7, find x.

20. From the following data, find $\frac{dy}{dx}$ at x = 3 and $\frac{d^2y}{dx^2}$ at x = 3.

x	0	1	2	3	4	5	6
y	6.9897	7.4036	7.7815	8.1291	8.4510	8.7506	9.0309

21. Show that $\Delta^n u_{x-n} = u_x - n u_{x-1} + \frac{n(n-1)}{2} u_{x-2} + \ldots + (-1)^n u_{x-n}$.

22. Calculate f(7.5) from the table :

x	1	2	3	4	5	6	7	8
f(x)	1	8	27	64	125	216	343	512

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23. Using Newton's divided difference formula find y when x = 2, where the tabulated points are given by (1 , −3), (3 , 9), (4, 30) and (6, 132).

24. Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Trapezoidal rule with h = 0.2, hence find the value of π.

25. Evaluate $\int_0^{\frac{\pi}{2}} e^{\sin x} dx$ correct to 4 decimals by Simpson's $\frac{3}{8}$ rule.

26. A rod is rotating in a plane. The angle θ (in radians) at different times t (in seconds) are given below.

t	0	0.2	0.4	0.6	0.8	1.0	1.2
θ	0	0.15	0.50	1.15	2.0	3.20	4.666

Find its angular velocity and angular acceleration when t = 0.6 seconds.

SECTION – D

(Answer **any 2** questions out of 4 questions. **Each** question carries **6** marks.) **(2×6=12)**

27. Find the smallest root of $xe^x = 1$ by Ramanujan's method.

28. Find the missing term :

x	0	5	10	15	20	30
y	1	3	– –	73	225	1153

29. Evaluate $\int_0^1 \frac{1}{1+x} dx$ correct to 3 decimal places :

   a) Using Trapezoidal rule taking h = 0.5

   b) Using Simpson's $\frac{1}{3}$ rule taking h = 0.25.

30. Find the value of $e^{1.17}$ using Gauss forward formula, from the following data :

x	1	1.05	1.1	1.15	1.2	1.25	1.3
y	2.7183	2.8577	3.0042	3.1582	3.3201	3.4903	3.6693

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