

29/5/24



DOON UNIVERSITY, DEHRADUN
End Semester Examination, IV Semester, 2024
 Academic Year 2023-24 (Even Semester)
School of Physical Sciences Department of Mathematics
Programme: BSc Mathematics
Course Code with Title: MAC 251: Numerical Methods.

Time Allowed 2 Hours

Maximum Marks: 50

1. All questions are compulsory.
2. Use of Scientific calculator is allowed.

SECTION: A [5x3=15M]

Q1. Find $\Delta^{10}(1 - ax)(1 - bx^2)(1 - cx^3)(1 - dx^4)$.

Q2. Prove $\Delta = \frac{1}{2}\delta^2 + \delta \sqrt{1 + \frac{\delta^2}{4}}$

Q3. Find the function whose first difference is e^x .

Q4. Find the missing term in the following table

x	0	1	2	3	4
$f(x)$	1	3	9	---	81

Q5. Given that $y = 2x^3 - 3x^2 + 3x - 10$ find $\Delta^3 y$

SECTION: B [3x5=15M]

Q6. Solve the equation $\frac{dy}{dx} = 1 - y$ with the initial condition $y(0) = 0$ using Euler's method at $x = 0.1, 0.2, 0.3$.

Q7. Find the value of $\sin 52$ from the given table

θ°	45°	50°	55°	60°
$\sin \theta$	0.7071	0.7660	0.8192	0.8660

Q8. Find the value of $f(x)$ at point $x = 4$. Given that

x	1.5	3	6
$f(x)$	-0.25	2	20

OR

Using Lagrange's interpolation formula find $y(10)$ from the following table

x	5	6	9	11
$f(x)$	12	13	14	16

SECTION: C [2x10=20M]

Q9. Reservoir discharging water through sluices at a depth h below the water surface has a surface area A for various values of h as given below:

h (in meters)	10	11	12	13	14
A (in sq.meters)	950	1070	1200	1350	1530

If t denotes time in minutes, the rate of fall of the surface is given by

$$\frac{dh}{dt} = -\frac{48}{A}\sqrt{h}$$

Estimate the time taken for the water level to fall from 14 to 10 m above the sluices.

OR

Find $f'(1.1)$ and $f''(1.1)$ from the following table

x	1	1.2	1.4	1.6	1.8	2
$f(x)$	0	0.1280	0.5540	1.2960	2.4320	4

Q10. Given $\frac{dy}{dx} = y - x$, $y(0) = 2$. Find $y(0.1)$ and $y(0.2)$ by Runge-Kutta method correct to four decimal places.