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**VA—80—2024**

**FACULTY OF SCIENCE AND TECHNOLOGY**

**B.Sc. (Third Year) (Fifth Semester) EXAMINATION**

**NOVEMBER/DECEMBER, 2024**

**(CBCS/New Pattern)**

**MATHEMATICS**

**Paper XIV**

**(Numerical Analysis)**

**(Friday, 13-12-2024)**

**Time : 10.00 a.m. to 12.00 noon**

*Time—Two Hours*

*Maximum Marks—40*

*N.B. :— (i) All questions are compulsory.*

*(ii) Figures to the right indicate full marks.*

*(iii) Use of non-scientific/non-programmable calculator is allowed.*

1. Derive the Newton-Gregory formula for backward interpolation and estimate the population for the year 1975 from the following data : 15

<b>Year <math>x</math></b>	<b>Population <math>y</math></b> <b>(in lakhs)</b>
1941	46
1951	67
1961	83
1971	95
1981	102

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Or

- (a) Prove that the  $n$ th divided differences of a polynomial of the  $n$ th degree are constant. 8
- (b) Given  $\log_{10} 654 = 2.8156$ ,  $\log_{10} 658 = 2.8182$ ,  $\log_{10} 659 = 2.8189$ ,  $\log_{10} 661 = 2.8202$ , find  $\log_{10} 656$ . 7
2. Derive the Gauss's central difference forward interpolation formula for equal intervals and hence find the value of  $y$  when  $x = 3.75$  from the following table : 15

$x$	$y_x$
2.5	24.145
3.0	22.043
3.5	20.225
4.0	18.644
4.5	17.262
5.0	16.047

Or

- (a) Explain Euler's modified method for the solution of equations of first order. 8
- (b) Apply Simpson's rule to estimate the value of the integral  $\int_1^2 \frac{dx}{x}$ , by dividing the interval (1, 2) into 4 equal parts. 7

3. Attempt any *two* of the following : 5 each

(i) Evaluate :  $\frac{\Delta^2 x^3}{Ex^2}$ , interval of differencing being  $n$ .

(ii) Find the third divided difference with arguments 2, 4, 9, 10 of the function  $f(x) = x^3 - 2x$ .

(iii) Prove that :

$$\sqrt{1 + \delta^2 \mu^2} = 1 + \frac{1}{2} \delta^2.$$

(iv) Calculate by Trapezoidal rule an approximate value of  $\int_{-3}^{+3} x^4 dx$ , by taking seven equidistant ordinates.