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SB—45—2022

FACULTY OF ARTS/SCIENCE

B.A./B.Sc. (Third Year) (Sixth Semester) EXAMINATION

MAY/JUNE, 2022

(CBCS/Old Pattern)

MATHEMATICS

Paper XV

(Numerical Analysis)

(Saturday, 11-6-2022)

Time : 10.00 a.m. to 12.30 p.m.

Time—2½ 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. State and prove the Newton-Gregory formula for backward interpolation. Use it to estimate the population for the year 1975.

The population of a country in the decennial census were as under :

Year	Population (in lakhs)
x	y
1941	46
1951	67
1961	83
1971	95
1981	102

Or

- (a) Prove that the divided differences are symmetrical in all their arguments, that is, the value of any divided difference is independent of the order of the argument.

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P.T.O.

- (b) From the table, find the number of students who obtained less than 45 marks : 7

Marks	No. of Students
30—40	31
40—50	42
50—60	51
60—70	35
70—80	31

2. Prove the Lagrange's interpolation formula for unequal intervals and apply it to find the value of $\log_{10} 656$. 15

Given that :

$$\log_{10} 654 = 2.8156,$$

$$\log_{10} 658 = 2.8182, \quad \log_{10} 659 = 2.8189,$$

$$\log_{10} 661 = 2.8202.$$

Or

- (a) Prove the Bessel's interpolation formula. 8
- (b) By means of Newton's divided difference formula find $f(8)$ and $f(15)$ from the following table : 7

x	$f(x)$
4	48
5	100
7	294
10	900
11	1210
13	2028

3. Attempt any *two* of the following : 10

- (a) Prove the trapezoidal rule as an approximate quadrature formula.
(b) Discuss Euler's modified method to solve the differential equation of

$$\text{first order } \frac{dy}{dx} = f(x, y).$$

- (c) Find using 7 ordinates the value of the integral :

$$\int_2^3 \frac{dx}{x}$$

by using Simpson's one-third rule.

- (d) Given :

$$\frac{dy}{dx} = y^2 + 1$$

with the boundary condition $y = 1$ at $x = 0$ in the range $0 \leq x \leq 1$
obtain y as a series in powers of x .