This question paper contains **3** printed pages]

BF—44—2016

FACULTY OF ARTS/SCIENCE

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

OCTOBER/NOVEMBER, 2016

(Revised Course)

MATHEMATICS

Paper XVI (MT-304)

(Numerical Analysis)

(Friday, 14-10-2016) **Time : 10.00 a.m. to 12.00 noon**

Time—2 *Hours* *Maximum Marks*—40

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

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

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

1. Attempt any *five* of the following : 2 each

(*a*) Prove that :

$$\Delta[f(x) + g(x) + \ldots\ldots] = \Delta f(x) + \Delta g(x) + \ldots\ldots\ldots$$

(*b*) Define factorial function.

(*c*) Prove that :

$$\mu = \cosh \frac{U}{2}.$$

(*d*) Construct the divided difference table with arguments 2, 4, 9 for the function $f(x) = x^3 - 2x$.

(*e*) State Simpson's $\frac{1}{3}$rd rule as approximate quadrature formula.

(*f*) Define numerical differentiation.

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

(*a*) Prove that Newton-Gregory formula for forward interpolation using polynomial in x of degree n :

$$P_n(x) = A_0 + A_1(x - a) + A_2(x - a)$$
$$(x - a - h) + A_3(x - a)(x - a - h)(x - a - 2h)$$
$$+ \ldots\ldots\ldots + A_n(x - a)(x - a - h) \ldots\ldots\ldots$$
$$\ldots\ldots\ldots (x - a - \overline{n-1}\,h)$$

(*b*) Prove that :

(*i*) $\Delta^p \Delta^q f(x) = \Delta^{p+q} f(x)$

(*ii*) $E\Delta = \Delta E.$

(*c*) Given :

$\log_{10} 100 = 2$, $\log_{10} 101 = 2.0043$,

$\log_{10} 103 = 2.0128$, $\log_{10} 104 = 2.0170$.

Find :

$\log_{10} 102$.

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

(*a*) Prove that the Stirling's interpolation formula for equal intervals.

(*b*) Use Bessel's formula to find Y_{25}, given $Y_{20} = 2854$, $Y_{24} = 3162$, $Y_{28} = 3544$, $Y_{32} = 3992$.

(*c*) Find a polynomial satisfied by (–4, 1245), (–1, 33), (0, 5), (2, 9) and (5, 1335).

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

(*a*) Prove the Simpson's $\frac{3}{8}$ rule as approximate quadrature formula.

(*b*) Evaluate integral $\int_0^6 f(x)\,dx$ using Simpson's $\frac{1}{3}$rd rule. Given :

x	***f(x)***
0	6.9897
1	7.4036
2	7.7815
3	8.1291
4	8.4510
5	8.7506
6	9.0309

(*c*) Using Euler's modified method, obtain solution of the equation :

$$\frac{dy}{dx} = x + \left|\sqrt{y}\right| = f(x, y)$$

with boundary condition $y = 1$ at $x = 0$ for the range $0 \le x \le 0.6$ in the steps of 0.2. (upto first, second, third approximations to y_1).