* A - 3 0 1 6 *

A-3016

B. Sc. (Sem. III) Examination

March / April – 2015

Mathematics : MTH - 303

(Numerical Analysis - I)

Time : **3** Hours] [Total Marks : **70**

Instructions :

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ **B. Sc. (Sem. 3)**

Name of the Subject :

☛ **Mathematics : MTH - 303**

☛ Subject Code No. : **3 0 1 6** ☛ Section No. (1, 2,.....) : **Nil**

Seat No. :

Student's Signature

(2) All questions are compulsory.

(3) Follow usual notations.

(4) Use of non-programmable calculator is allowed.

(5) Figures to the right indicate marks of the question.

1 Answer any **five** as directed : **10**

(1) Round-off the following numbers to the four significant digits : 0.0022218, 19.235101, 38.46235 and 81.255.

(2) Find the relative error of the number 8.6 if both of its digits are correct.

(3) Define relative error.

(4) Prove that $\nabla E \equiv \delta E^{\frac{1}{2}}$.

(5) Prove that $\nabla E \equiv E\Delta$.

(6) Find the value of E^2x^2, when the value of x vary by a constant increment 3.

(7) Construct the forward difference table for the data : (0, 1), (1, 3), (2, 9) (3, 27) and (4, 81).

(8) Define : Interpolation.

2 (a) Derive the formula for finding the absolute error in the quotient $\frac{a}{b}$ of two numbers a and b. **5**

OR

(a) Derive the general error formula.

(b) Attempt any two. **10**

(1) Three approximate values of the number $\frac{1}{3}$ are given as 0.30, 0.33 and 0.34. Which of these three is the best approximation ?

(2) Find the error in the product of any two numbers a and b.

(3) Let $\frac{5xy^2}{z^3}$; then find the relative error if $\Delta x = \Delta y = \Delta z = 0.001$ and $x = y = z = 1$.

(4) Sum the numbers : 0.1532, 15.45, 0.000354, 305.1, 143.3, 8.12, 0.0212, 0.643 and 0.1734. Where in each of which all the given digits are correct.

3 (a) Explain 'Newton-Raphson Method' to obtain the real root of an quation $f(x) = 0$. **5**

OR

(a) Explain 'Method of false-position' to obtain the real root of an equation $f(x) = 0$.

(b) Obtain the real root of any two of the following; correct to three decimal places : **10**

(1) $x^3 - 4x - 9 = 0$, using 'Method of false-position'.

(2) $x^3 + x^2 + x + 7 = 0$, using 'Bisection Method'.

(3) $x^3 - 4x - 9 = 0$, using 'Iteration Method'.

(4) $x^3 - 3x - 5 = 0$, using 'Newton-Raphson Method'.

4 (a) Prove that (i) $1+\frac{\delta^2}{4}\equiv\mu^2$; (ii) $\delta\equiv E^{\frac{1}{2}}\Delta$. **5**

OR

(a) Prove tha $E\equiv e^{hD,}$ where D is the differential operator.

(b) Attempt any two : **10**

(1) Prove that (i) $\Delta\equiv E\nabla$ and (ii) $E^{-1}\equiv 1-\nabla$.

(2) Prove that $\delta^2\equiv\Delta-\nabla\equiv\Delta\nabla$.

(3) Show that $\Delta\equiv\frac{1}{2}\delta^2+\delta\sqrt{1+\frac{\delta^2}{4}}$.

(4) Evaluate (i) $\left(\frac{\Delta^2}{E}\right)x^3$ and (ii) $\Delta^2\cos x$.

5 (a) Derive interpolation formula : **5**

$$y_n(x)=y_0+p\Delta y_0+\frac{p(p-1)}{2!}\Delta^2 y_0+\frac{p(p-1)(p-2)}{3!}\Delta^3 y_0+.....$$

$$+\frac{p(p-1)...(p-n+1)}{n!}\Delta^n y_0$$

OR

(a) Derive Newton's backward difference interpolation formula.

(b) Attempt two :

(1) Obtain the value of $f(x)$ at $x=0.21$ from the following table :

x	0.20	0.22	0.24	0.26	0.28	0.30
$f(x)$	1.6596	1.6698	1.6804	1.6912	1.7024	1.7139

(2) Obtain the value of y when x = 0.26 from the following table :

x	0.10	0.15	0.20	0.25	0.30
y	0.1003	0.1511	0.2027	0.2553	0.3093

(3) Obtain the value of $sinx$ when $x = 0.22$ from the following table :

x	0.15	0.17	0.19	0.21	0.23
$y = \sin x$	0.14944	0.16918	0.18886	0.20846	0.22748

(4) Using Gauss's formula, obtain $f(1.50)$:

x	1.0	1.2	1.9	2.0	2.1	2.2
$f(x)$	0.0	–0.112	–0.016	0.336	0.992	2.0