Five Year Integrated M.Sc. Examination, 2019

Semester-II

Course: MT-1-2-2

(Scientific Computing)

Time: Three Hours **Full Marks: 40**

Questions are of value as indicated in the margin.

[All the notations and symbols are used in their usual forms]

Answer ***any four*** questions.

1. Define finite difference (Δ) and E operators. Obtain a relation between them. Show that the nth order finite difference of a polynomial of degree n is a constant. (1+1)+3+5

2. If $f(x) = x^3 - 4x^3 + 5x - 14,$ compute the entry $y = f(x)$ for $x = 1, 3, 5, 7, 9, 11$ and prepare the difference table. Explain why third order finite differences $\left(\Delta^3 f(x)\right)$ are constant throughout. Verify that this constant is 48. 5+2+3

3. a) Find (i) Δc^x, (ii) $\Delta\left(ka^{bx}\right)$, (iii) $\Delta \sin 2x.$ 2+2+2

   b) Prove that $f(a+nh) = f(a) + \binom{n}{1}\Delta f(a) + \binom{n}{2}\Delta^2 f(a) + \ldots + \binom{n}{n}\Delta^n f(a).$ 4

4. Discuss in brief the purpose of developing interpolation formulae. Derive Newton's Forward and Lagrange's interpolation formulae. 2+4+4

5. Discuss in brief the notion of numerical integration. Hence derive Simson's one-third rule for integration. 5+5

6. a) Derive Newton-Raphson Method of finding the roots of an equation. 5
   b) Find an approximate root of the following equation using Newton-Raphson Method taking iteration 6 steps $x - \cos x = 0.$ 5

———