

2020-2021

MATHEMATICS B.Sc. PROGRAM COURSE

SEM - V — SEC

COURSE NAME: NUMERICAL METHODS

COURSE CODE: BMTMSERT 504

F.M - 50

1. Answer the following questions —

15 × 2 = 30

(i) Round off the following numbers upto three significant digits -  
 a)  $0.005723$ , b)  $1.005723$

(ii) If we take  $\pi = 3.14$  instead of  $3.14159$  then the absolute error is —

(iii) What will be the absolute error (upto two significant digits) in  $x_A = 0.333$  when  $x_T = 1/3$ .

(iv) What will be the percentage error in  $x_A = 0.333$  when  $x_T = 1/3$ .

(v) What is the maximum relative error in  $v = \frac{8xy^2}{x^3}$  and errors in  $x, y, z$  be  $0.001$  (find relative error when  $x=y=z=1$ )?

(vi) If  $\Delta$  and  $\nabla$  are the forward and backward difference operators respectively and  $E$  be the shifting operator, then write down the relations between

a)  $E$  &  $\Delta$ , b)  $E$  &  $\nabla$ , c)  $E, \nabla, \Delta$

(vii)  $\left(\frac{\Delta^2}{E}\right) \sin x = ?$

(viii)  $\Delta^n (a^x) = ?$

(ix) Let  $p$  be the unique polynomial of suitable degree such that  $p(1) = 2$ ,  $p'(1) = 3$ ,  $p(2) = 6$ ,  $p'(2) = 7$ ,  $p''(2) = 8$ , then  $p(0) = ?$

- (x) Write down the general form of- Regula-Falsi Method. What is the order of convergence of this method?
- (xi) Write down the Lagrangian Interpolating polynomial in terms of  $y_i = w(x_i)$ ,  $i=0, 1, 2, \dots, n$ .
- (xii) Find value of  $(\Delta^v - 2\Delta + 1)y$  when  $y = a2^x + bx2^x$  and  $h=1$ .
- (xiii) Write down the similarity and difference between relative and absolute error.
- (xiv) What are the order of convergence of fixed point iteration & Newton Raphson Method?
- (xv) If the initial guess  $x_0 = 2$ , what will be the new estimate  $x_1$  after first iteration of the equation  $x^3 - x - 1 = 0$ .

2// Answer the following —————  $5 \times 4 = 20$

(i) Let  $\{0, 1/2, 1\}$  be three distinct points on  $[0, 1]$ . Let  $p$  be the unique interpolating polynomial suitable degree on  $[0, 1]$  s.t  $p(0) = 0$ ,  $p(1/2) = 0$  and  $p(1) = 1$ , then what will be the value of  $p(1/4)$ ?

(ii) Find the missing term of the given table

$x$	0	1	2	3	4
$y$	1	2	4	?	16

(iii) What is the degree of the polynomial of least degree which takes the following data?

$x$	0	1	2	3	4	5
$f(x)$	0	3	8	15	24	35

(iv) Find the second degree polynomial passes through  $(0, 3), (1, 6), (2, 11), (3, 18), (4, 27)$ .

(v) Find the maximum step size  $h$  such that the errors in linear interpolation for the function  $y = \sin x$  in  $[0, 1]$  is less than  $5 \times 10^{-5}$ .