DMM-3098

B. Sc. (Sem. IV) Examination

April / May - 2016

Mathematics - MTH-403

(Numerical Analysis - II)

(New Course)

Time : 2 Hours] [Total Marks : **50**

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. 4)**

Name of the Subject :

☛ **MATHEMATICS - MTH-403 (NEW)**

☛ Subject Code No. : **3 0 9 8** ☛ Section No. (1, 2,.....) : **Nil**

Seat No. :

Student's Signature

(2) All questions are compulsory.

(3) Follow usual notations.

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

(5) Use of Scientific non-programmable calculator is allowed.

1 Answer any **FIVE** as directed. **[10]**

(1) Use divided difference interpolation formula to obtain the function $f(x)$ for the given data $(0, -2)$ and $(3, 2)$.

(2) If $(x) = \frac{1}{x}$, then obtain $[a, b]$ and $[a, b, c]$.

(3) If $b - a = c - b = h, h > 0$, then obtain the value of $[a, b, c]$.

(4) Prove that $[x_0, x_1, x_2] = [x_2, x_1, x_0]$, where $x_n = x_0 + nh, h > 0$.

(5) Construct the divided difference table for the following data:

x:	-2	0	4	7
y:	3	6	12	24

(6) Write the formula to obtain $\left[\frac{dy}{dx}\right]_{x=x_n}$ and $\left[\frac{d^2y}{dx^2}\right]_{x=x_0}$.

(7) List the subintervals of $[5, 11]$ for applying Simpson's $\frac{1}{3}$ Rule, taking $h = 0.5$

(8) Write the definition of IVP.

2 Attempt any **TWO.** **[10]**

(1) Derive Lagrange's interpolation formula for unequally spaced values of argument.

(2) Use Newton's Divided Difference Interpolation formula to obtain the cubic polynomial from the following table of values :

x:	0	2	3	4	5	9
$f(x)$:	4	26	58	112	194	922

(3) Use Lagrange's Interpolation formula to obtain the value of $f(6)$:

x:	5	7	11	13	21
$f(x)$:	150	392	1452	2366	9702

(4) Express the rational function $\frac{x^2 + x - 3}{x^3 - 2x^2 - x + 2.}$ as a sum of partial fraction.

3 Attempt any **TWO.** **[10]**

(1) Derive the formula to find the 2nd order differentiation at $x = x_n$.

(2) The following table of values x and y is given, find the value of the second derivative when $x = 8$:

x:	0	2	4	6	8	10
y:	5.2	10.5	16.8	24.2	32.7	40.8

(3) The function $y = f(x)$ is defined as follows :

x:	0	0.1	0.2	0.3	0.4	0.5	0.6
$f(x)$:	3.01	3.16	3.29	3.36	3.40	3.38	3.32

Obtain $\frac{d^2y}{dx^2}$ when $= 0.2$.

(4) From the following table of values, obtain $\frac{dy}{dx}$ when $x = 1.6$:

x:	1.2	1.3	1.4	1.5	1.6
y:	0.9320	0.9636	0.9855	0.9975	0.9996

4 Attempt any **TWO.** **[10]**

(1) State and prove Simpson's $\frac{1}{3}$ rule.

(2) Use Simpson's $\frac{3}{8}$ rule to evaluate the integral $\int_0^1 \sqrt{1-x^2}dx$ by taking $h = \frac{1}{6}$.

(3) Apply Trapezoidal rule to obtain the value of the integral $I = \int_0^1 \frac{1}{1+x} dx$ by taking $h = 0.125$.

(4) Evaluate the integral $\int_0^2 \frac{1}{x^2+x+1} dx$ by Simpson's $\frac{1}{3}$ rule with $h = 0.5$.

5 Attempt any **TWO.** **[10]**

(1) Explain Taylor's series method to solve the initial value problem $\frac{dy}{dx} = f(x,y)$, where $y(x_0) = y_0$.

(2) If $\frac{dy}{dx} = \frac{1}{x^2+y}$, $y(4) = 4$, compute the value of $y(4.1), y(4.2)$ by Taylor's series method.

(3) Given the differential equation $\frac{dy}{dx} = \frac{x^2}{y^2+1}$ with the initial condition $y = 0$ when $x = 0$, use Picard's method to obtain y for $x = 0.25, 0.5, 1.0$.

(4) Using Euler's method solve the following problems:
$\frac{dy}{dx} + 2y = 0,\ y(0) = 1$. Obtain $y(0.1), y(0.2)$ and $y(0.3)$.