BACHELOR OF SCIENCE EXAMINATION, 2018

(2nd Year, 2nd Semester)

MATHEMATICS (Subsidiary)

Paper - 11S

[Numerical Methods]

Full Marks : 35 Time : One Hour Thirty Minutes

The figures in the margin indicate full marks.

(Symbols and Notations have their usual meanings)

Answer any *five* questions.

1. (a) Explain Absolute error and Relative error in connection with numerical computation.

(b) Find the absolute error and relative error if we write $x = 0.333$ instead of $x = \frac{1}{3}$.

(c) Find the number of significant figures in

(i) $x_A = 1.8921$, given its relative error as 0.1×10^{-2}

(ii) $x_A = 0.3941$, given its absolute error as 0.25×10^{-2}

where x_A is the approximate value of a number.

2+3+2

2. Let $f(x)$ be real valued, continuous function and have continuous derivatives of order $(n+1)$ for all x in an interval (a,b) containing the interpolating points $x_0, x_1, x_2, ..., x_n$. Prove that at any point x in (a,b), the error in approximating $f(x)$ by the interpolating polynomial $\phi(x)$ is given by $E(x) = f(x) - \phi(x) = \dfrac{\psi(x) f^{(n+1)}(\xi)}{(n+1)!}$, $\xi \in (a,b)$

where $\psi(x) = (x - x_0)(x - x_1).....(x - x_n)$ is given. 7

3. Evaluate $\log_{10} 2.91$ using the following table correct upto four decimal places.

x	2.0	2.2	2.4	2.6	2.8	3.0
$\log_{10} x$	0.30103	0.34242	0.38021	0.41497	0.44716	0.47721

7

[*Turn over*]

4. Evaluate $\int_0^1 \sqrt{1-x^3}\, dx$ by

   (i) Simpson's one-third rule and

   (ii) Trapezoidal rule,

   taking six intervals, correct upto four decimal places. 4+3

5. Compute the root of the equation $2x - \log_{10} x - 7 = 0$, by Regula Falsi method, lying between 3 and 4, correct upto three decimal places. 7

6. Prove that Gauss-Jacobi iteration converges iff the system of equation

$$a_{11}x_1 + a_{12}x_2 + \ldots + a_{1n}x_n = b_1$$
$$a_{21}x_1 + a_{22}x_2 + \ldots + a_{2n}x_n = b_2$$
$$\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$
$$a_{n1}x_1 + a_{n_2}x_2 + \ldots + a_{nn}\, x_n = b_n$$

   is strictly diagonally dominant. 7

7. Solve the following differential equation by Euler's method for $x = 1$, taking $h = 0.2$:

$$\frac{dy}{dx} = xy,\ y(0) = 1.$$ 7