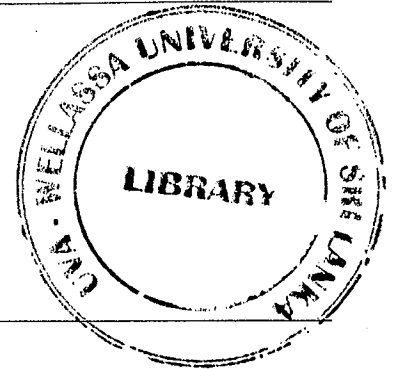


Uva Wellassa University of Sri Lanka
 Faculty of Science and Technology
 Department of Science and Technology
 300 level 2nd Semester Examination – Sept. / Oct. 2015
 SCT 302-2 Advanced Mathematics II



Instructions to candidates

Duration: 02 hours
Number of questions: 4 Essay Questions
Mark allocation: 100
 Use standard symbols without definition.
 Scientific calculators are allowed.
Answer all questions



1.
 a. Derive the **Euler method** for solving the initial value problem approximately.

$$\frac{dy}{dt} = f(t, y) \quad , \quad t_0 \leq t$$

$$y(t_0) = y_0$$

(10 mark)

- b. By considering the following initial value problem;

$$\frac{dy}{dt} = x + y, \quad y(0) = 1 \quad ; \quad x \in [0,1]$$

find the values of $y(0.1)$ and $y(0.2)$ using **Runge-Kutta method** of 2nd order.

(15 mark)

2. Given a set of pairs of data $(x_i, y_i), i = 1, 2, \dots, n$, there exist a unique polynomial $P_{n-1}(x)$ of degree at most $(n - 1)$ satisfying the conditions $P_{n-1}(x_i) = y_i, i = 1, 2, \dots, n$. The polynomial is called the interpolation polynomial of the data.

- a. Name two forms of the interpolation polynomial and write their formulas. (5 mark)
- b. Find the interpolation polynomial for the set of data given below, in both forms you have described above.

x	-1	0	1
y	1	-1	2

(20 mark)

- 3.
- Derive the Trapezoidal rule using the distinct nodes $(a, f(a))$ and $(b, f(b))$ as its interpolation points. (5 mark)
 - Find the approximate value of the integral $\int_b^a f(x) dx$ where $a = 0, b = 1$ and $f(x) = x^2 e^{-x}$ using Trapezoidal rule and Simpsons rule. (10 mark)
 - Use forward difference method and backward difference method to approximate $f'(0.4)$, where $f(x) = \sin x$ with $h = 0.1$ and $h = 0.2$. (10 mark)
4. Consider the following model;

$$\begin{aligned} \text{MAX: } & 3X_1 + 2X_2 \\ \text{Subject to: } & 2X_1 + X_2 \leq 18 \\ & 2X_1 + 3X_2 \leq 42 \\ & 3X_1 + X_2 \leq 24 \end{aligned}$$

$X_1, X_2 \geq 0$
 find the optimal solution for the above model using graphical method in Linear programming (25 mark)