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

Uva Wellassa University

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

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1.

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

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

$$y(t_0) = y_0$$

(10 mark)

b. By considering the following initial value problem;

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

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), $i = 1,2, \ldots, n$, there exist a unique polynomial $P_{n-1}(x)$ of degree at most $(n-1)$ satisfying the conditions $P_{n-1}(x_i) = y_i$, $i = 1,2, \ldots, n$. 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)

24

3.

a. Derive the Trapezoidal rule using the distinct nodes $(a, f(a))$ and $(b, f(b))$ as its interpolation points. (5 mark)

b. 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)

c. 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;

$$MAX: 3X_1 + 2X_2$$

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

$$X_1, X_2 \geq 0$$

find the optimal solution for the above model using graphical method in Linaer programming (25 mark)