Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(ONLINE)
SEMESTER II
SESSION 2019/2020

COURSE NAME	:	MATHEMATICS ENGINEERING IV
COURSE CODE	:	BEE 31602
PROGRAMME CODE	:	BEJ/BEV
EXAMINATION DATE	:	JULY 2020
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **THREE (3)** QUESTIONS ONLY. **OPEN BOOK EXAMINATION**

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

Q 1 (a) Investigate the first derivatives of the function at point using three points central difference with for

(6 marks)

(b) The current i of a circuit at time t is given in the table below:

t, sec	4	5	6	7	8
$i(t)$	0.244	0.405	0.597	0.824	1.093

Given the voltage drop, $V_L(t) = L\dfrac{di}{dt}$ and the inductance, L is 5H. Calculate $V_L(6)$ using the **FOUR (4)** suitable methods in 4 decimal places.

(14 marks)

Q 2 (a) A basketball player makes a successful shot from the free-throw line. Suppose that the path of the ball from the moment of release to the moment it enters the hoop is described by

$$y = 2.15 + 2.09x - 0.41x^2, \quad 0 \le x \le 3.6$$

where x is the horizontal distance (in meters) from the point of release, and y is the vertical distance (in meters) above the floor.

(i) Estimate the distance of the ball travels from the moment of release to the moment it enters the hoop, by using the trapezoidal rule and appropriate Simpson's rule with $h = 0.4$.

[Hint: Arc length of the curve, $L = \int_a^b \sqrt{1 + \left(\dfrac{dy}{dx}\right)^2}\, dx$]

(9 marks)

(ii) Calculate the exact solution of the traveled distance by using a scientific calculator.

(1 mark)

(iii) Find the absolute error for each method (from **Q2(a)(i)**).

(1 mark)

(iv) Determine which method approximates better.

(1 mark)

(b) A curve, y = f (x) between x = a and x = b is rotated about the x-axis. The volume of the solid of revolution, thus generated, is given by the following integral

$$\int_a^b \pi y^2 \, dx .$$

Estimate the volume of the solid of revolution when the curve $y = e_x$ between x = 0 and x = 0.5 is rotated about the x-axis by using appropriate Simpson's rule. Consider $\pi = 3.142$ with four sub-intervals.

(8 marks)

Q 3 (a) An RC electrical circuit consists of a constant resistance R (in ohms), a constant capacitance C (in Farad) and an electromotive force $E(t)$ (in volts) can be modeled as equation below:

Given volts, $R = 4$ ohms, $C = 0.1$ F and $i = 0$ when $t = 0$,

(i) Analyze the current at second using the Euler's Method with the step size $h = 0.02$ in 4 decimal places.

(8 marks)

(ii) Find the absolute error in 4 decimal places if the exact solution of **Q3(a)(i)** is:

(2 marks)

(b) Given , for , with the boundary conditions of and , estimate the values of $y(t)$ with step size $h = 0.25$ in 4 decimal places.

(10 marks)

Q 4 (a) The temperature distribution of the one-dimensional silver rod is governed by the heat equation as follows.

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$$

Given the boundary conditions , , for and the initial condition for mm, analyze the temperature distribution of the rod with mm and s in 4 decimal places.

(10 marks)

(b) Analyze the wave equation , where mm and s with the boundary conditions , the initial condition and $\frac{\partial u}{\partial t}(x,0) = 0$, by using a suitable finite-difference method with mm and s in 4 decimal places.

(10 marks)

- END OF QUESTIONS -