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Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(TAKE HOME)
SEMESTER II
SESSION 2020/2021

COURSE NAME	:	ORDINARY DIFFERENTIAL EQUATION
COURSE CODE	:	BEE 11203
PROGRAMME CODE	:	BEJ/BEV
EXAMINATION DATE	:	JULY 2021
DURATION	:	3 HOURS 30 MINUTES
INSTRUCTION	:	ANSWER **ALL** QUESTIONS **(OPEN BOOK EXAMINATION)**

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

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Q1 **(a)** Given an expression $y = Ax^2 + Bx$, obtain an ordinary equation from the expression by eliminating the constant.

(6 marks)

(b) Show that $y = \frac{x^3}{2} + \frac{C}{x}$ is the solution for the differential equation $\frac{dy}{dx} = 2x^2 - \frac{y}{x}$.

(4 marks)

(c) Find the solution for $y' + x^2 y = 0$ using

(i) method of separation of variable, and

(4 marks)

(ii) power series without using recurrence relations.

(11 marks)

Q2 **(a)** Determine the solution of $y'' - y' = e^{2x} - x + \sin x$ using method of undetermined coefficient.

(8 marks)

(b) Show that by using variation of parameter method will produce the same answer as **Q2 (a)**.

(17 marks)

Q3 Given a non-homogeneous system of the first order linear differential equation as shown below.

$$y'_1 = -10y_1 + 10y_2 + 5$$
$$y'_2 = -\frac{20}{3}y_1 + \frac{98}{15}y_2 + \frac{10}{3}$$

(a) Evaluate the general equation of the homogeneous system.

(11 marks)

(b) Determine the particular integral for the non-homogenous system.

(6 marks)

(c) Formulate the general solution for the non-homogenous system.

(2 marks)

(d) Calculate the particular solution for $y_1(x)$ and $y_2(x)$ with $y(0) = \binom{1}{-1}$.

(6 marks)

Q4 **(a)** Given a differential equation $y'' - 8y' + 3y = f(t)$ where $f(t)$ is a periodic function as shown in **Figure Q4 (a).**

(i) Find the piecewise function of $f(t)$.

(2 marks)

(ii) Find the Laplace Transform $Y(s)$, of the differential equation with initial values, when $t = 0, y = 1$ and $y' = -2$

(8 marks)

(b) A series RL circuit is shown in **Figure Q4 (b)** where $R = 10\Omega$ and $L = 2H$. The source to the circuit is given as $V(t) = 2e^{-t}(t-1)H(t-1)$.

(i) By applying Kirchoff Law, show that the circuit can be represented by the following equations

$$\frac{di(t)}{dt} + 5i(t) = e^{-t}(t-1)\,H(t-1)$$

(2 marks)

(ii) Determine the current $i(t)$ for the circuit using Laplace Transform with initial condition $i(0) = 0$.

(13 marks)

-END OF QUESTIONS –

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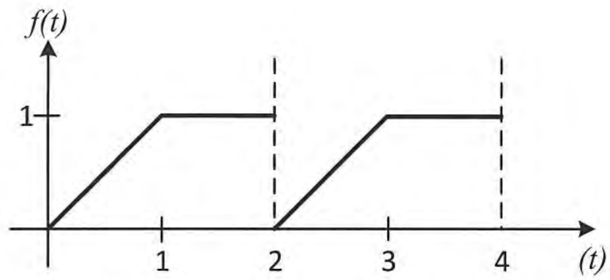

Figure Q4 (a): Periodic function of $f(t)$

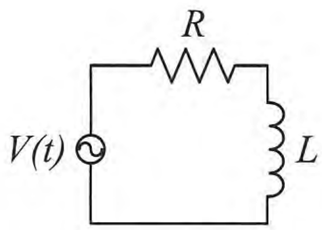

Figure Q4 (b): Series *RL* circuit