CONFIDENTIAL

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2021/2022

COURSE NAME	:	ORDINARY DIFFERENTIAL EQUATIONS / ENGINEERING MATHEMATICS II
COURSE CODE	:	BEE11203 / BEE11403
PROGRAMME CODE	:	BEJ / BEV
EXAMINATION DATE	:	JULY 2022
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER **ALL** QUESTIONS. 2. THIS FINAL EXAMINATION IS AN **ONLINE** ASSESSMENT AND CONDUCTED VIA **OPEN BOOK.**

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

Q1 (a) Given $\frac{dy}{dx}=\frac{x^2+y^2}{3xy}$,

(i) Justify if the given differential equation is homogeneous?

(2 marks)

(ii) State your reason for **Q1(a)(i)**.

(1 mark)

(iii) Find the general solution of the given differential equation in **Q1(a).**

(9 marks)

(b) Given a first order differential equation $\frac{dy}{dx}=e^{-x^2}(2x+1)\sin x-2xy$

(i) Justify if the given differential equation is linear?

(1 mark)

(ii) Identify $p(x)$ and $q(x)$

(1 mark)

(iii) Find the particular solution if the initial condition is given as $y(0)=5$

(11 marks)

Q2 Given a second order linear differential equation as follows,

$$4y''-27y'-7y=\cosh(7x)-2e^{-\frac{x}{4}}$$

(a) Identify the case for the complementary function of the given differential equation.

(3 marks)

(b) Convert $f(x)$ in terms of exponential functions.

(1 mark)

(c) Solve for the particular integral function y_p ,by using Undetermined Coefficient method.

(15 marks)

(d) Obtain the general solution.

(1 mark)

(e) Calculate the particular solution if the initial conditions are given as $y(0)=\frac{1513}{756}$ and $y'(0)=0$

(5 marks)

Q3 Given the following system of first-order differential equations.

$$\begin{pmatrix} \dfrac{dy_1}{dt} \\ \dfrac{dy_2}{dt} \end{pmatrix} = \begin{pmatrix} 8 & -2 \\ 2 & 4 \end{pmatrix} \begin{pmatrix} y_1 \\ y_2 \end{pmatrix} + \begin{pmatrix} 1 \\ 3 \end{pmatrix} e^{6t}$$

(a) Express the general solution Y_c of the homogeneous system.

(7 marks)

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

(12 marks)

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

(2 marks)

(d) Determine the particular solution for the non-homogenous system if $t = 0, y_1 = 1, y_2 = 1$.

(4 marks)

Q4 **Figure Q4** below shows an RLC circuit with $L = 4H$, $R = 100\Omega$ and $C = 0.01F$ which is initially at rest, $V(0) = 0$. A power source of $E(t) = \sin 2t$ is applied to the circuit for the first 10 seconds.

(a) Show that the RLC circuit can be modelled by

$$LC\frac{d^2V_o}{dt^2} + RC\frac{dV_o}{dt} + V_o = E(t)$$

(5 marks)

(b) By using Laplace transform, find the output voltage $V_o(t)$.

(20 marks)

- END OF QUESTIONS –

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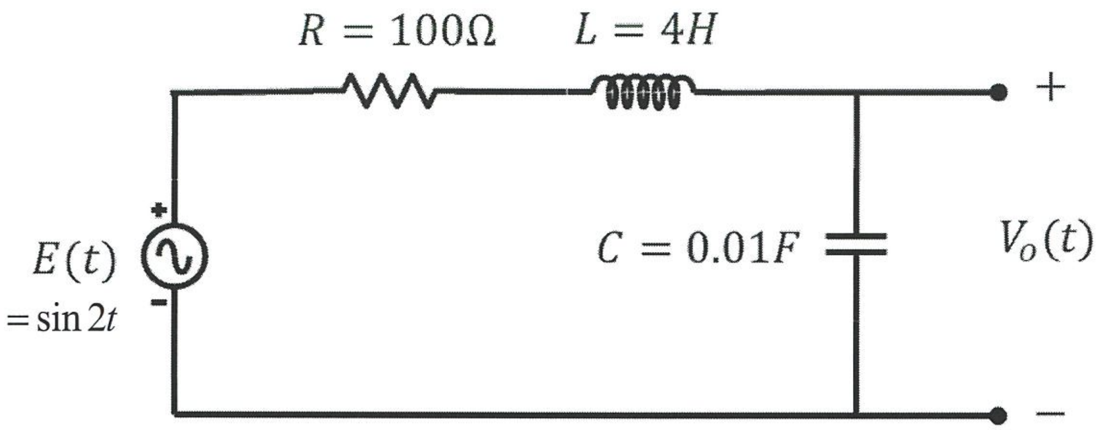

Figure Q4: ***RLC*** **circuit**