FINAL
ALTERNATIVE ASSESSMENT

(COVER PAGE)

Session	:	**April 2022**
Programme	:	Diploma in Mechanical Engineering Programme (DMEN) Diploma in Electrical and Electronic Engineering Programme (DEEI)
Course	:	MAT1135 & MAT1122: Engineering Mathematics 2
Date of Examination	:	06 August 2022(Saturday)
Time	:	08.00am-10.30am Reading Time : Nil
Duration	:	2 Hours 30 Minutes

Note: 30 minutes is added into the duration of the examination to factor in any connectivity matters and for you to scan and upload your scripts

Special Instructions :

This paper consists of **FOUR (4)** questions. Answer **ALL** questions. Working must be shown.

Material permitted :
Non-Programmable Scientific Calculator

Materials provided :
Nil

Examiner(s)	:	**Nurulanati Othman**
Chief Moderator	:	Hsien Loong Teow

*This paper consists of **3** printed pages, including the cover page*

DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING PROGRAMME (DEEI)
DIPLOMA IN MECHANICAL ENGINEERING PROGRAMME (DMEN)
MAT1135 & MAT1122: ENGINEERING MATHEMATICS 2
FINAL ALTERNATIVE ASSESSMENT: APRIL 2022 SESSION

Instructions: This paper consists of **FOUR (4)** questions. Answer **ALL** questions. All questions carry equal marks. Working must be shown.

Question 1

(a) A company supplies three types of electrical component in boxes to Laboratory P, Q and R. Table 1(a) below shows the number of boxes supplied to the laboratories in six months.

Table 1(a)

Laboratory	Resistor (boxes)	Inductor (boxes)	Capacitor (boxes)
P	5	8	9
Q	7	10	10
R	10	10	13

The full payment received by the company from Laboratory P, Q and R are RM1311, RM1575 and RM1965, respectively.

(i) Construct a system of linear equations to represent the above statements and a corresponding matrix equation for it.

(4 marks)

(ii) Thus, use inverse of the coefficient matrix by adjoint method to determine the cost of each box of resistor, inductor and capacitor.

(11 marks)

(b) The pressure P, temperature T, and volume V of a confined gas are related by $P = \frac{kT}{V}$, where k is a constant. Compute the percentage change in pressure if the temperature of a gas is increased 3% and the volume is increased 5%.

(10 marks)

Question 2

(a) Upon completing combustion process, 9 kg of a particular chemical, N, was accidentally released from the combustion engine into the nearest water stream. It is known to leave the stream at a rate directly proportional to the amount of the chemical in the water stream at time t, such as

$$\frac{dN}{dt} = -kN,$$

where k is a positive constant. After 7 hours, sample test revealed that 5 kg still remained in the water stream. Use separation variable method to find the approximate time (in hours) when the amount of chemical in the water stream was 0.1 kg.

(13 marks)

(b) The current, i, in a series *RLC* circuit can be found from the solution of

$$L\frac{d^2i}{dt^2}+R\frac{di}{dt}+\frac{1}{C}i=20,$$

where the inductance, $L=0.2$ henry, resistance $R=330$ ohms and capacitance $C=20\times10^{-6}$ F. Given that at $t=0$, $i=0$ and $\frac{di}{dt}=30$, thus use undetermined coefficient method to compute i in terms of t.

(12 marks)

Question 3

Velocity change of a throw-up solid can be modeled by differential equation of

$$\frac{dv}{dt}+\frac{c}{m}v=-g,$$

where $c=0.47$ is the proportionality constant, $m=0.01$kg is the mass of the solid and $g=9.81\text{m/s}^2$ is the gravitational acceleration. Assume that the solid is thrown with zero initial velocity, $v(0)=0$, use the following methods to express the velocity v in terms of time t.

(a) Method with an integrating factor.

(12 marks)

(b) Laplace transform.

(13 marks)

Question 4

A circuit can be modelled by a differential equation of

$$\frac{d^2I}{dt^2}-6\frac{dI}{dt}+8I=e^{3t},$$

where I is the current and t is time. Given that when $t=0$, $I=0$ and $\frac{dI}{dt}=2$, solve the differential equation using

(a) the method of undetermined coefficients.

(15 marks)

(b) Laplace transform.

(10 marks)

Laplace transform of derivatives: $\mathcal{L}\{y'\}=sY(s)-y(0)$; $\mathcal{L}\{y''\}=s^2Y(s)-sy(0)-y'(0)$

~THE END~