

**FINAL
ALTERNATIVE ASSESSMENT**

(COVER PAGE)

Session : January 2022

Programme : Diploma in Electrical & Electronic Engineering (DEEI)
Diploma in Mechanical Engineering (DMEN)

Course : MAT1122/MAT1134: Engineering Mathematics 2

Date of Examination : 7 March 2022 (Monday)

Time : 12.00noon – 2.30pm Reading Time : Nil

Duration : 2 Hours 30 Minutes

Special Instructions :

This paper consists of **FOUR (4)** questions. Answer **ALL** questions. All questions carry equal marks.

Material permitted : Non-Programmable Scientific Calculator

Materials provided : Mathematics Formulae Booklet

Examiner(s) : Dr Nurulanati, Manickampraslad M Sambasivam

Chief Moderator : Teow Hsien Loong

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: JANUARY 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 sold 2 cases of product x , 4 cases of product y , and 6 cases of product z for RM62. One case of product x , 3 cases of product y , and 3 cases of product z for RM36. Two cases of product x , 3 cases of product y , and 2 cases of product z for RM39.
- (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 a case of product x , y and z in RM. (11 marks)
- (b) The power P (measured in Watts) dissipated in a resistor is given by $P = \frac{E^2}{R}$, where E is the voltage and R is the resistance. Given that $E = 200$ V and $R = 8 \Omega$, compute and comment the approximate change in P when E increases by 3 V and R decreases by 0.2Ω . (10 marks)

Question 2

- (a) The rate at which a body loses speed at any instant as it travels through a resistive medium is given by
- $$\frac{dv}{dt} = -kv \text{ m/s}^2,$$
- where v is the speed of the body at that instant and k is a positive constant. If its initial speed is u m/s, use a suitable method to find the time taken, in terms of k , for the body to decrease its speed to $\frac{1}{2}u$ m/s. (12 marks)
- (b) The electrostatic potential V can be found from the solution of
- $$\frac{d^2V}{dr^2} + 2\frac{dV}{dr} = 0,$$
- where r is the radius. Given that $V = 110$ Volts when $r = 4$ cm and $V = 0$ Volts when $r = 8$ cm, thus compute V when $r = 5$ cm. (13 marks)

Question 3

The rate of change of the temperature of a motor is given by

$$\frac{d\theta}{dt} = 10 - k\theta,$$

where θ is the temperature, in degree Celsius, of the motor at time t second and k is a non-zero constant. Given that $\theta = 0$ °C when $t = 0$ s and $\theta = 30$ °C when $t = 5$ s. Use the following methods to show that $e^{-5k} = 1 - 3k$.

- (a) Method with an integrating factor.

(13 marks)

- (b) Laplace transform.

(12 marks)

Question 4

A certain weight stretches a spring beyond its natural length. If the weight is pushed downward from its equilibrium position with a certain initial velocity by a given force, its motion satisfies the differential equation of

$$\frac{d^2y}{dt^2} + y = 10t,$$

where y is the displacement of the weight from its equilibrium position at any time t . Given that at $t = 0$, $y = 0$ and $\frac{dy}{dt} = 1$, use the following methods to express y in terms of t .

- (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~

MAT1135 & MAT1122 (F)/ January2022 Session/ formatted