

FINAL

ALTERNATIVE ASSESSMENT

(COVER PAGE)

Session : April 2020

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

Course : MAT1121/MAT1134 : Engineering Mathematics 1

Date of Examination : August 3, 2020 (Monday)

Time : 12:00 pm – 2:15 pm Reading Time : Nil

Duration : 2 hours 15 mins

Special Instructions :

Answer **ALL FOUR (4)** questions.

Material permitted : Non-Programmable Calculator

Materials provided : Nil

Examiner(s) : Mohd Hafis Zakaria & Chong Mee Teng

Chief Moderator : Dr Chan Kah Yein

DIPLOMA IN ELECTRICAL & ELECTRONIC ENGINEERING PROGRAMME (DEEI)
 DIPLOMA IN MECHANICAL ENGINEERING PROGRAMME (DMEN)
 MAT1121/MAT1134: ENGINEERING MATHEMATICS 1
 FINAL ALTERNATIVE ASSESSMENT : APRIL 2020 SESSION

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

Question 1

- (a) Show that the equation $x^2 + (3\alpha - 4)x + 2\alpha(\alpha - 3) = 0$ has real distinct roots for all real values of α . (3 marks)
- (b) Express $y = -x^2 + 2x$ in the form $y = a(x + p)^2 + q$ where p and q are constants. Find p and q . Hence sketch the graph of $y = -x^2 + 2x$. (5 marks)
- (c) Solve the equation: $81^{2x+1} = \frac{1}{27}$. (3 marks)
- (d) Rationalize the denominator: $\frac{\sqrt{2x+y}}{\sqrt{2x-y}}$. (3 marks)
- (e) Solve the equation: $\log(x - 1) + \log x = -1 + \log 2x$. (6 marks)
- (f) If $x^2 - 1$ is a factor of $f(x) = 2x^3 + 3x^2 + ax + b$, find the value of a and b . Then, find the remainder when $f(x)$ is divided by $x - 3$. (5 marks)

Question 2

- (a) Solve $3\sin^2 x - \cos^2 x = \sin 2x$, for $0^\circ \leq x \leq 360^\circ$. (6 marks)
- (b) Prove the identity: $\cos^2 x (\operatorname{cosec}^2 x - \cot^2 x) \equiv \cos^2 x$. (4 marks)
- (c) Convert $(3, \frac{\pi}{6})$ from polar to rectangular coordinates. (3 marks)
- (d) Estimate the value of $\sqrt[5]{0.731}$ by using Binomial series. Give the answer correct to four decimal places. (6 marks)
- (e) Use Newton's Method to obtain a root of the equation $\ln x - 2 + x = 0$ with the initial value, $x_0 = 2$. Give your answer correct to three decimal places. (6 marks)

Question 3

- (a) Find $\frac{dy}{dx}$ for each of the following.
- (i) $y = x^2 \sin 3x$ (3 marks)
- (ii) $y = \frac{1}{(2x^4 - x^2 + 1)^3}$ (3 marks)
- (iii) $y = 2x^4 \ln 5x$ (3 marks)
- (b) Find the $\frac{dy}{dx}$ of the tangent to the curve $x^3 + 3xy + 12y^2 = 10$ at the point of $(-2, -1)$. (5 marks)
- (c) Find the stationary points of the function $y = x^3 - 3x^2 + 2$ and determine the nature of the stationary points. Hence sketch the graph of the function. (6 marks)
- (d) Let $y = \frac{1}{(2x+5)}$, find $\frac{dy}{dx}$. Hence, approximate change in y when x changes from 3 to 3.001. (5 marks)

Question 4

- (a) Find the following integrals.
- (i) $\int \csc^2 3x \, dx$ (3 marks)
- (ii) $\int \frac{x}{3x^2+2} \, dx$ (3 marks)
- (iii) $\int (3x^2 - 2\sqrt{x}) \, dx$ (2 marks)
- (b) Use the Simpson's rule to evaluate $\int_0^{\pi} \cos^2 x \, dx$ using six intervals. Show your working in the form of a table and give your final answer to 4 significant figures. (6 marks)

- (c) **Figure Q4 (c)** shows a side elevation of the inner surface of a bowl which can be represented by the equation $y = ax^2$. Find a and the volume, in cm^3 , of water needed to fill the bowl to a depth of 20 cm. (5 marks)

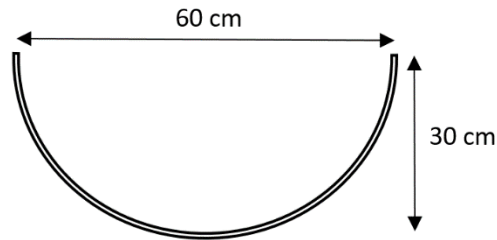


Figure Q4 (c)

- (d) Find the area of the region bounded by the curve $y = x^2$ and $y = 2 - x^2$ as shown in **Figure Q4 (d)**. (6 marks)

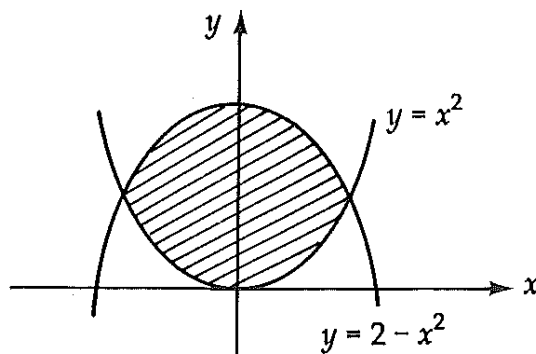


Figure Q4 (d)

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