

**FINAL
Examination Paper**

(COVER PAGE)

Session : April 2018

Programme : Diploma In Mechanical Engineering (DMEN)

Course : MAT1121 : Engineering Mathematics 1

Date of Examination : August 2, 2018 (Thursday)

Time : 11:00 am – 1:00 pm Reading Time: Nil

Duration : 2 Hours

Special Instructions :

This paper consists of FIVE (5) questions. Answer any FOUR (4) out of FIVE (5) questions in the answer booklet provided. All questions carry equal marks.

Materials permitted : Non-Programmable Scientific Calculator

Materials provided : Formula Booklet 1

Examiner (s) : Dennis Koh Mui Siang and Chong Mee Teng

Moderator : Assoc Prof Chan Kait Loon

This paper consists of 5 printed pages, including the cover page.

DIPLOMA IN MECHANICAL ENGINEERING PROGRAMME (DMEN)
MAT1121 : ENGINEERING MATHEMATICS 1
FINAL EXAMINATION : APRIL 2018 SESSION

Instructions: This paper consists of **FIVE (5)** questions. Answer only **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks. Working must be shown.

Question 1

- (a) By factorization method, solve $(x - 2)(x + 1) = 4$. (4 marks)
- (b) By completing the square, solve the quadratic equation $3x^2 + 1 = 5x$. (5 marks)
- (c) Find the values of p if the quadratic equation $px^2 + px + 3x + p = 0$. (6 marks)
- (d) When the polynomial $P(x) = 3x^3 + mx - 6$ is divided by $(x - 2)$, the remainder is 8. Find the value of m . (3 marks)
- (e) Given that the polynomial $P(x) = tx^4 + 3x^3 + 2x^2 + x - 8$ can be divided by $(x + 1)$. Find the value of t . (3 marks)
- (f) Expand $(3 + 4x)^4$ completely, using the binomial theorem. (4 marks)

Question 2

- (a) Simplify the following and write your answers with positive exponents.
- (i) $(125)^{-1/3}$ (2 marks)
- (ii) $(2\sqrt{x})(3\sqrt[3]{x})$ (3 marks)

(b) Solve the following equations.

(i) $5^{y+2} = 625$ (2 marks)

(ii) $49^{x^2} = \frac{1}{7^{3x-2}}$ (3 marks)

(c) Simplify the following and give your answers in surds.

(i) $\frac{1-\sqrt{3}}{\sqrt{5}}$ (2 marks)

(ii) $\frac{2}{\sqrt{3}-1} + \frac{1}{\sqrt{2}-2}$ (3 marks)

(d) Given $\log_2 3 = 1.59$ and $\log_2 5 = 2.32$, without the use of calculator, evaluate the following.

(i) $\log_2 0.6$ (2 marks)

(ii) $\log_2 3\frac{3}{5}$ (3 marks)

(e) Solve the following equations.

(i) $(\log x)^2 = \log x^3$ (2 marks)

(ii) $3x^4 e^{-2\ln x} + 2x - 1 = 0$ (3 marks)

Question 3

(a) Find x for trigonometric equation $3\sin^2 x - \cos^2 x = \sin 2x$ where $0^\circ \leq x \leq 360^\circ$. (8 marks)

(b) Prove the identity of the following trigonometric equation.

$$2 \tan x = \frac{\cos x}{\operatorname{cosec} x - 1} + \frac{\cos x}{\operatorname{cosec} x + 1} \quad (5 \text{ marks})$$

- (c) Given $270^\circ < A < 360^\circ$ and $\sin A = -\frac{5}{13}$. Without using calculator, determine the values of $\cos A$ and $\tan A$. (4 marks)
- (d) Convert $(2\sqrt{3}, -2)$ from rectangular to polar coordinates. (3 marks)
- (e) State the amplitude, period and phase shift of $y = -3\sin(4x - \pi)$. Hence, sketch the curve for one oscillation. (5 marks)

Question 4

- (a) Find $\frac{dy}{dx}$ for each of the following.
- (i) $y = x^3 \cos 2x$ (3 marks)
- (ii) $y = \frac{e^{2x}}{x - 3e}$ (3 marks)
- (iii) $y = \ln \frac{2-x}{3-x}$ (3 marks)
- (b) Find the equation of the tangent to the curve $2xy^2 + 3x^2 = 4y^2 - 5$ at the point of $(1, -2)$. (5 marks)
- (c) Find the stationary points of the function $y = x^3 - 8x + 2$ and determine the nature of the stationary points. Hence sketch the graph of the function. (6 marks)
- (d) Given that $y = (7 - 6x^2)^5$, find $\frac{dy}{dx}$ and hence, find the approximate change in y as x increases from 1 to 1.02. State whether to change in y is an increase or a decrease. (5 marks)

Question 5

(a) Find the following integrals.

(i) $\int (3\sin 2x + 4\cos \frac{1}{2}x) dx$ (3 marks)

(ii) $\int \frac{3x}{6-x^2} dx$ (3 marks)

(iii) $\int_1^2 (3e^{2x} + 3) dx$ (3 marks)

(b) Use the trapezoidal rule to evaluate $\int_0^1 x^2 e^x dx$ using 4 equal intervals. Show your working in the form of a table and give your final answer to 4 decimal places. (5 marks)

(c) Starting with $x_0 = 1$, find the third approximation x_3 to the root of the equation $e^x + x - 3 = 0$ using Newton method. Give your answer correct to three decimal places. (5 marks)

(d) Find the area enclosed by the curve $y = x(x - 1)(x + 2)$ and the x axis as shown in Figure Q5(d).

(6 marks)

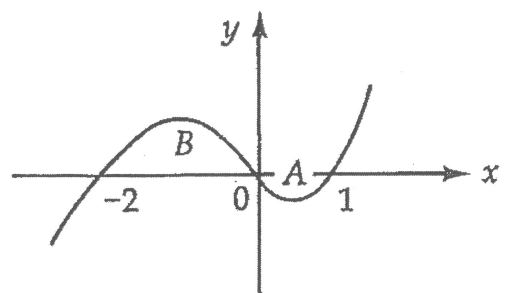


Figure Q5(d)

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