FINAL
ALTERNATIVE ASSESSMENT

(COVER PAGE)

Session	:	**August 2020**
Programme	:	Diploma in Electrical & Electronic Engineering (DEEI) Diploma in Mechanical Engineering (DMEN)
Course	:	**MAT1121/MAT1134: Engineering Mathematics 1**
Date of Examination	:	17 December 2020 (Thursday)
Time	:	4.00pm – 6.15pm Reading Time : Nil
Duration	:	2 Hours 15 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)	:	**Chong Mee Teng**
Chief Moderator	:	Dr Nurulanati Othman

*This paper consists of **4** printed pages, including the cover page*

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

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

Question 1

(a) Prove that $kx^2 + 2x - (k-2) = 0$ has real roots for any values of *k*. (3 marks)

(b) Express $y = 3x^2 - 6x + 5$ in the form of $y = 3(x-p)^2 + q$, where p and q are constant. Hence, find the minimum value of y and the value of x at which the minimum value occurs. Sketch the curve of $y = 3x^2 - 6x + 5$. (5 marks)

(c) Simplify $3^{1/4} \times 6^{3/4} \times 2^{5/4}$. (3 marks)

(d) Simplify $\dfrac{\sqrt{5}+3}{\sqrt{5}-2}$ by rationalizing the denominator. (3 marks)

(e) Solve $\log_3 x - 4\log_x 3 + 3 = 0$. (6 marks)

(f) Given that $P(x) = x^3 + ax^2 + bx + 6$, where *a* and *b* are constants. If $(x-2)$ is a factor of *P*(*x*), and that when *P*(*x*) is divided by $(x-1)$ the remainder is 4. Find the values of a and b. Hence, factorize the polynomial completely. (5 marks)

Question 2

(a) Solve $2\tan^2 x = 3(1+\sec x)$ for $0^o \le x \le 360^o$. (6 marks)

(b) Given that $\tan\theta = -\frac{4}{3}$ and $\cos\phi = \frac{4}{5}$, and that both θ and $\emptyset$ are in the same quadrant. Find the value of $\sin(\theta + \phi)$ without using a calculator. (4 marks)

(c) Change $(-12,\ 5)$ from rectangular coordinates to polar coordinates. (3 marks)

(d) Find the term independent of x in the binomial expansion of $\left(2x^3 - \frac{1}{x}\right)^{12}$. (6 marks)

(e) Use Newton's method to estimate a root of the equation $\ln x - 2 + x = 0$ with the initial value, $x_o = 2$. Give your answer correct to three decimal places. (6 marks)

Question 3

(a) Find $\frac{dy}{dx}$ for each of the following.

(i) $y = (1 + x^2)\sin^2 x$ (3 marks)

(ii) $y = e^{4-x^2}$ (3 marks)

(iii) $y = \log_4(x^2 + 1)$ (3 marks)

(b) Find the derivative, $\frac{dy}{dx}$ of $y^3 - 2x^2 = 3xy^2 + 19$ using implicit differentiation. (4 marks)

(c) Find the stationary points of the function $y = 2 + 3x - x^3$ and determine the nature of each stationary point. Hence, sketch the graph of the function. (6 marks)

(d) A spherical balloon is being blown up so that its volume increases at a constant rate of 1.5 cm^3/s. Find the rate of increase of the radius when the volume of the balloon is 56 cm^3. Give your answer in five decimal places. (6 marks)

Question 4

(a) Find the following integrals.

(i) $\int_0^4 x^2 - \sqrt{x}\, dx$ (3 marks)

(ii) $\int x(3x^2 + 1)^6\, dx$ (3 marks)

(iii) $\int \frac{3x^2}{x^3 - 4}\, dx$ (3 marks)

(b) Use the trapezoidal rule to evaluate $\int_1^2 \frac{1}{1+x^2} dx$ using $n = 5$. Show your working in the form of table and give your final answer to 4 decimal places. (5 marks)

(c) Find the volume of the solid of revolution generated by revolving the region under the graph of $y = x^2 + 3$ from $x = 0$ to $x = 5$ around the x-axis. (5 marks)

(d) Determine the area enclosed between the curve $y = x^2$ and the line $y = 9$. (6 marks)

~THE END~

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