INTI
INTERNATIONAL COLLEGE PENANG (507232-U)
LAUREATE INTERNATIONAL UNIVERSITIES

FINAL
Examination Paper

(COVER PAGE)

Session : April 2013

Programme : Diploma in Electrical and Electronic Engineering Programme

Course : **MAT1122 : ENGINEERING MATHEMATICS 2**

Date of Examination : 1 August 2013

Time : 2p.m. -4p.m. Reading Time : Nil

Duration : 2 Hours

Special Instructions :

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

Materials permitted :

Non Programmable Scientific Calculator

Materials provided :

Formula Booklet 1

Examiner(s) : **Dr. Ch'ng Pei Cheng**

Moderator : **Chan Ah Wah**

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

INTI INTERNATIONAL COLLEGE PENANG

DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING PROGRAMME (DEE/I)
MAT 1122: ENGINEERING MATHEMATICS 2

FINAL EXAM: APRIL 2013 SESSION

Instructions: This paper consists of **FIVE (5)** questions. Answer any **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks. **Show complete working.**

Question 1

(a) Find the roots of the equation $z^2 + z + 1 = 0$.

(4 marks)

(b) Find in exponential form $\left[\frac{(1+i\sqrt{3})^3}{(-1+i)^2}\right]^3$.

(5 marks)

(c) Find the roots of $z^3 + z(i-1) = 0$.

(6 marks)

(d) Solve the following set of linear equations by applying Inverse Cofactor method on the matrix:

$$\begin{aligned} 3x + 5y - 6z &= 7 \\ x - 7y + 4z &= -3 \\ 2x + 4y - 5z &= 4 \end{aligned}$$

(7 marks)

(e) Given that $A = \begin{bmatrix} 3 & 2 & 2 \\ 2 & 2 & 0 \\ 2 & 0 & 4 \end{bmatrix}$.

Show that $\mathbf{A}^3 - 9\mathbf{A}^2 + 18\mathbf{A} = \mathbf{0}$.

(3 marks)

Question 2

(a) Determine the following integrals:

(i) $\int \frac{5}{3+2x^2}\, dx$,

(4 marks)

(ii) $\int 2x \sin x \ dx$,

(4 marks)

(iii) $\int 24 \sin^5 x \cos x \ dx$.

(4 marks)

(b) Use Euler's method to find the values of y for $x = 2(0.2)3$ if

$$\frac{dy}{dx} = \sqrt{3x^2 + y^2} - y, \ y(2) = 0.$$

Give your answers correct to **four (4)** decimal places.

The formula of Euler's method is given below.

$$\frac{dy}{dx} = f(x, y)$$
$$x_1 = x_0 + h$$
$$y_{n+1} = y_n + hf(x_n, y_n)$$

(7 marks)

(c) If $z = \left(\frac{x}{y}\right) \ln y$.

(i) Show that $\frac{\partial z}{\partial y} = x \frac{\partial^2 z}{\partial y \partial x}$.

(4 marks)

(ii) Evaluate $\frac{\partial^2 z}{\partial y^2}$ when $x = -3$ and $y = 1$.

(2 marks)

Question 3

(a) The second moment of area of a rectangle is given by $I = \frac{bl^3}{3}$. If b and l are measured as 40mm and 90mm respectively and the measurement errors are −5mm in b and +8mm in l, find the approximate error in the calculated value of I.

(4 marks)

(b) (i) Use Maclaurin's series to find the expansion of $e^{\sin x}$ to the first three non zero terms.

(4 marks)

(ii) Hence, approximate $\int_{0.1}^{0.4} 2e^{\sin x}\, dx$.

(3 marks)

(c) Use Laplace transform to solve

$$y''-6y'+9y=t$$

satisfying the initial conditions $y(0)=0$, $y'(0)=1$.

(14 marks)

Question 4

(a) Find the following Laplace transforms:

(i) $L\{ t^3 - 4t + 5 + 2\sin 3t\}$,

(3 marks)

(ii) $L^{-1}\left\{\dfrac{4s+10}{s^2+9}\right\}$.

(4 marks)

(b) Solve the following problems:

(i) $(1+3y^2)\dfrac{dy}{dx}+2y\ln(1+x)=0$,

(5 marks)

(ii) $\dfrac{dy}{dx}=\dfrac{y^2}{xy-x^2}$,

(6 marks)

(iii) $y''-4y=x$.

(7 marks)

Question 5

(a) You have five books and are going to put three on a bookshelf. How many different ways can the books be ordered on the bookshelf?

(3 marks)

(b) The mean number of patients arriving at the emergency room of University Hospital on Saturday nights between 10:00 and 12:00 is 6.5. Assuming that the patients arrive randomly and independently, what is the probability that on a given Saturday night,

(i) exactly 2 patients arrive at the emergency room between 10:00 and 12:00?

(3 marks)

(ii) 2 or fewer patients arrive at the emergency room between 11 :00 and 12:00?

(4 marks)

(c) A package contains 50 similar components and inspection shows that four have been damaged during transit. If six components are drawn at random from the contents of the package determine the probabilities that in this sample

(i) one is damaged.

(3 marks)

(ii) less than three are damaged.

(4 marks)

(d) 500 tins of paint have a mean content of 1010ml and the standard deviation of the contents is 8.7ml. Assuming the volumes of the contents are normally distributed, calculate the number of tins likely to have contents whose volumes are

(i) less than 1025ml.

(4 marks)

(ii) between 1000ml to 1020ml.

(4 marks)

The End

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