CONFIDENTIAL

UNIVERSITI KUALA LUMPUR
MALAYSIAN INSTITUTE OF MARINE ENGINEERING TECHNOLOGY

FINAL EXAMINATION
JANUARY 2016 SEMESTER

COURSE CODE	:	LGB 10303
COURSE NAME	:	ENGINEERING MATHEMATICS 1
PROGRAMME NAME	:	BACHELOR OF ENGINEERING TECHNOLOGY IN NAVAL ARCHITECTURE AND SHIPBUILDING & MARINE ENGINEERING
DATE	:	24 MAY 2016
TIME	:	09.00 AM – 12.00 PM
DURATION	:	3 HOURS

INSTRUCTIONS TO CANDIDATES

1. Please CAREFULLY read the instructions given in the question paper.
2. This question paper has information printed on both sides of the paper.
3. This question paper consists of TWO (2) sections; Section A and Section B.
4. Answer ALL FIVE (5) questions in Section A. For Section B, answer THREE (3) questions ONLY.
5. Please write your answers on answer sheet provided.
6. Answer all questions in English language ONLY.
7. FORMULA has been appended for your reference.

THERE ARE 7 PAGES OF QUESTIONS, INCLUDING THIS PAGE.

SECTION A (Total: 40 marks)

INSTRUCTION: Answer ALL questions.
Please use the answer booklet provided.

Question 1

(a) A girls spends $\frac{3}{4}$ of her pocket money and has 90 cent left. How much did she have to start with?

(2 marks)

(b) List the example number for Integers and Irrational Numbers.

(2 marks)

(c) State the rules for significant figures (s.f.)

(4 marks)

Question 2

(a) State the value of remainder when $4x^4 - 6x^3 - 12x^2 - 10x + 2$ is divided by $x - 3$ using long division techniques.

(4 marks)

(b) Simplify each of the equations:

i. $24p - [2(3(5p - q) - 2(p + 2q)) + 3q]$

(2 marks)

ii. $(x^2y + x^2z) - xyz + 2x^2z + 3xz^2 - (x^2y - xyz + xz^2)$

(2 marks)

Question 3

(a) Solve the equation $\sinh(x) = 3$, correct to three decimal places

(4 marks)

(b) Show that $\tanh^2 x + \sec h^2 x = 1$

(4 marks)

Question 4

(a) A wooden door wedge as Figure 1 below is in the shape of a sector of radius 10 cm with the angle $24°$ and constant thickness 3 cm. Determine the volume of wood used in making the wedge.

(4 marks)

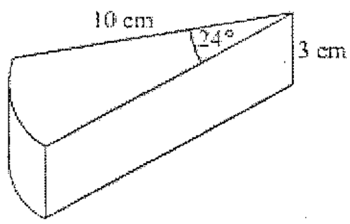

Figure 1

(b) The shaded area shows a segment of a circle of radius 64 cm as shown in Figure 2 below. The length of the chord AB is 100 cm. Determine the area of the segment shaded in figure.

(4 marks)

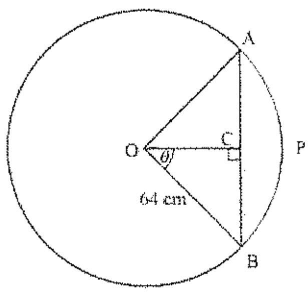

Figure 2

Question 5

(a) Differentiate $f(x) = \dfrac{4\cos(x)}{3(5-2x)^3}$.

(4 marks)

(b) Evaluate $\int_1^3 (5-3x^2)\,dx + \int_1^2 \frac{6}{x}\,dx$

(4 marks)

SECTION B (Total: 80marks)

INSTRUCTION: Total questions are FOUR but answer only THREE questions.
Please use the answer booklet provided.

Question 6

(a) Applying mesh-current analysis to an a.c circuit results in the following equations:

$$I_1 + I_2 + I_3 = 4$$
$$2I_1 - I_2 + 4I_3 = 33$$
$$3I_1 - 2I_2 - 2I_3 = 2$$

i. Name the method to solve simultaneous equation above.

(1 marks)

ii. Determine the current value for I_1, I_2 and I_2.

(9 marks)

(b) The total profit $P(x)$ in thousand Ringgit on the sale of ships 'x' that manufactured by Company ABC is given by $P(x) = x^3 - 4x^2 + 400x$.

i. Predict how many ships 'x' must be sold to get zero profit in order to return the capital of investment.

(6 marks)

ii. Solve $M(x) = Q(x) - G(x)$ whereby $G(x) = 405$ and the quotient equation, $Q(x)$ are from Question 6 (b)(i). Hence, factorize $M(x)$ using quadratic equation.

(4 marks)

Question 7

(a) Determine the solution of the following equation correct to two decimal places.

i. $10^{x+1} = 6^{2x}$

(5 marks)

ii. $\log_2(x+2) + \log(x-1) = 2$

(5 marks)

(b) Write (i) log 30 (ii) log 450 in terms of log2, log 3 and log 5 to any base.

(4 marks)

(c) If $Ae^{x} + Be^{-x} = 4\cosh x - 5\sinh x$, determine the values of A and B.

(6 marks)

Question 8

(a) Based on Figure 3 below, determine:

i. The length AC

(3 marks)

ii. The angle of ADC

(3 marks)

iii. The perimeter of the Figure 3

(4 marks)

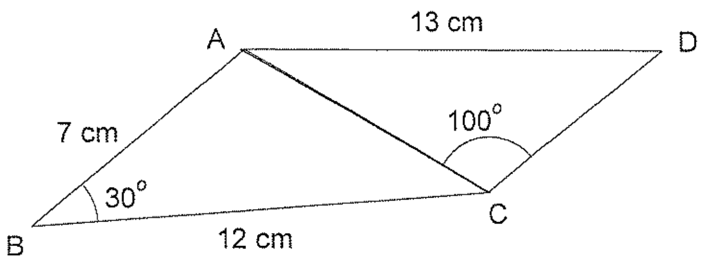

Figure 3

(b) Prove the following trigonometric equation:

$$\frac{\tan x + \sec x}{\sec x\left(1 + \frac{\tan x}{\sec x}\right)} = 1$$

(4 marks)

(c) Given that $A\left(\frac{\sin\theta}{\cos\theta}\right) = \frac{5}{\cos\theta} - \frac{B}{\tan\theta}$ with the value of A=7 and value of B=1 for the range of $0° < \theta < 360°$. Determine the possible value of θ.

(6 marks)

Question 9

(a) By using the concept of first principle of differentiation, differentiate the function $y = x + (x+2)^{\frac{1}{2}}$ and determine the slope of function if $x = 1$

(10 marks)

(b) Evaluate the total area of the region bounded by assuming that the given three curves, $y_1 = -x^2 - 6x - 5$, $y_2 = x^2 - 2x - 3$ and $y_3 = -x^2 - 4x + 21$ with the interval $-5 \le x \le 7$ as shown in Figure 4 below.

(10 marks)

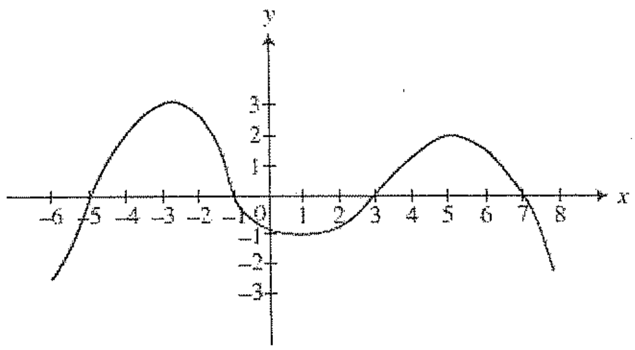

Figure 4

END OF QUESTIONS PAPER

TRIGONOMETRY IDENTITIES

FUNDAMENTAL IDENTITIES	FORMULAS FOR NEGATIVES
$\csc\theta = \dfrac{1}{\sin\theta}$	$\sin(-\theta) = -\sin\theta$
$\sec\theta = \dfrac{1}{\cos\theta}$	$\cos(-\theta) = \cos\theta$
$\cot\theta = \dfrac{1}{\tan\theta} = \dfrac{\cos\theta}{\sin\theta}$	$\tan(-\theta) = -\tan\theta$
$\cos^2\theta = \dfrac{1}{2}(1+\cos 2\theta)$	$\csc(-\theta) = -\csc\theta$
$\sin^2\theta + \cos^2\theta = 1$	$\sec(-\theta) = \sec\theta$
$1+\tan^2\theta = \sec^2\theta$	$\cot(-\theta) = -\cot\theta$
$1+\cot^2\theta = \csc^2\theta$	$\sin^2\theta = \dfrac{1}{2}(1-\cos 2\theta)$

ADDITION FORMULAS	SUBTRACTION FORMULAS
$\sin(A+B) = \sin A\cos B + \cos A\sin B$	$\sin(A-B) = \sin A\cos B - \cos A\sin B$
$\cos(A+B) = \cos A\cos B - \sin A\sin B$	$\cos(A-B) = \cos A\cos B + \sin A\sin B$
$\tan(A+B) = \dfrac{\tan A + \tan B}{1-\tan A\tan B}$	$\tan(A-B) = \dfrac{\tan A - \tan B}{1+\tan A\tan B}$

HALF-ANGLE FORMULAS	DOUBLE-ANGLE FORMULAS
$\sin\dfrac{\theta}{2} = \pm\sqrt{\dfrac{1-\cos\theta}{2}}$	$\sin 2\theta = 2\sin\theta\cos\theta$
$\cos\dfrac{\theta}{2} = \pm\sqrt{\dfrac{1+\cos\theta}{2}}$	$\cos 2\theta = \cos^2\theta - \sin^2\theta$ $\ldots\ldots\ldots = 1-2\sin^2\theta$ $\ldots\ldots\ldots = 2\cos^2\theta - 1$
$\tan\dfrac{\theta}{2} = \dfrac{1-\cos\theta}{\sin\theta} = \dfrac{\sin\theta}{1+\cos\theta}$	$\tan 2\theta = \dfrac{2\tan\theta}{1-\tan^2\theta}$

PRODUCT-TO-SUM FORMULAS	SUM-TO-PRODUCT FORMULAS
$\sin\alpha\cos\beta = \dfrac{1}{2}[\sin(\alpha+\beta)+\sin(\alpha-\beta)]$	$\sin\alpha + \sin\beta = 2\sin\dfrac{\alpha+\beta}{2}\cos\dfrac{\alpha-\beta}{2}$
$\cos\alpha\sin\beta = \dfrac{1}{2}[\sin(\alpha+\beta)-\sin(\alpha-\beta)]$	$\sin\alpha - \sin\beta = 2\cos\dfrac{\alpha+\beta}{2}\sin\dfrac{\alpha-\beta}{2}$
$\cos\alpha\cos\beta = \dfrac{1}{2}[\cos(\alpha+\beta)+\cos(\alpha-\beta)]$	$\cos\alpha + \cos\beta = 2\cos\dfrac{\alpha+\beta}{2}\cos\dfrac{\alpha-\beta}{2}$

DIFFERENTIATION

STANDARD FORM	GENERAL FORM
$\frac{d}{dx}(\sin x) = \cos x$	$\frac{d}{dx}(\sin f(x)) = f'(x)\cos f(x)$
$\frac{d}{dx}(\cos x) = -\sin x$	$\frac{d}{dx}(\cos f(x)) = -f'(x)\sin f(x)$
$\frac{d}{dx}(\tan x) = \sec^2 x$	$\frac{d}{dx}(\tan f(x)) = f'(x)\sec^2 f(x)$
$\frac{d}{dx}(\csc x) = -\csc x \cot x$	$\frac{d}{dx}(\csc f(x)) = -f'(x)\csc f(x)\cot f(x)$
$\frac{d}{dx}(\sec x) = \sec x \tan x$	$\frac{d}{dx}(\sec f(x)) = f'(x)\sec f(x)\tan f(x)$
$\frac{d}{dx}(\cot x) = -\csc^2 x$	$\frac{d}{dx}(\cot f(x)) = -f'(x)\csc^2 f(x)$

EXPONENTIAL FUNCTION

STANDARD FORM	GENERAL FORM
$\frac{d}{dx}e^x = e^x$	$\frac{d}{dx}e^{f(x)} = f'(x)e^{f(x)}$

LOGARITHMIC FUNCTION

STANDARD FORM	GENERAL FORM
$\frac{d}{dx}\ln x = \frac{1}{x}$	$\frac{d}{dx}\ln f(x) = \frac{f'(x)}{f(x)}$

INTEGRATION

STANDARD FORM	GENERAL FORM Where : $f(x) = ax + b$
$\int \cos x\, dx = \sin x + c$	$\int \cos f(x) dx = \frac{\sin f(x)}{f'(x)} + c$
$\int \sin x\, dx = -\cos x + c$	$\int \sin f(x) dx = \frac{-\cos f(x)}{f'(x)} + c$
$\int \sec^2 x\, dx = \tan x + c$	$\int \sec^2 f(x) dx = \frac{\tan f(x)}{f'(x)} + c$
$\int \sec x \tan x\, dx = \sec x + c$	$\int \sec f(x) \tan f(x) dx = \frac{\sec f(x)}{f'(x)} + c$
$\int \csc x \cot x\, dx = -\csc x + c$	$\int \csc f(x) \cot f(x) dx = \frac{-\csc f(x)}{f'(x)} + c$
$\int \csc^2 x\, dx = -\cot x + c$	$\int \csc^2 f(x) dx = \frac{-\cot f(x)}{f'(x)} + c$
$\int \tan x\, dx = \ln\lvert\sec x\rvert + c$	$\int \tan x\, dx = \frac{\ln\lvert\sec f(x)\rvert}{f'(x)} + c$
$\int \sec x\, dx = \ln\lvert\sec x + \tan x\rvert + c$	$\int \sec x\ dx = \frac{\ln\lvert\sec f(x) + \tan f(x)\rvert}{f'(x)} + c$
$\int \cot x\, dx = \ln\lvert\sin x\rvert + c$	$\int \cot x\, dx = \frac{\ln\lvert\sin f(x)\rvert}{f'(x)} + c$
$\int \csc x\, dx = -\ln\lvert\csc x + \cot x\rvert + c$	$\int \csc x dx = \frac{-\ln\lvert\csc f(x) + \cot f(x)\rvert}{f'(x)} + c$

EXPONENTIAL FUNCTION

STANDARD FORM	GENERAL FORM Where : $f(x) = ax + b$
$\int e^x dx = e^x + c$	$\int e^{f(x)} dx = \frac{e^{f(x)}}{f'(x)} + c$

LOGARITHMIC FUNCTION

STANDARD FORM	GENERAL FORM Where : $f(x) = ax + b$
$\int \frac{1}{x} dx = \ln\lvert x\rvert + c$	$\int \frac{1}{f(x)} dx = \frac{\ln\lvert f(x)\rvert}{f'(x)} + c$

HYPERBOLIC FUNCTION

STANDARD FORM
$\cosh^2 x - \sinh^2 x = 1$
$1 - \tanh^2 x = \text{sech}^2 x$
$1 - \coth^2 x = -\text{cosech}^2\ x$
$\cosh 2x = 2\cosh^2 x - 1$
$\cosh 2x = 1 + 2\sinh^2 x$
$\cosh x = 2\cosh^2 \frac{x}{2} - 1$
$\cosh x = 1 + 2\sinh^2 \frac{x}{2}$
$\tanh 2x = \dfrac{2\tanh x}{1 + \tanh^2 x}$