UNIVERSITI KUALA LUMPUR
MALAYSIAN INSTITUTE OF MARINE ENGINEERING TECHNOLOGY

FINAL EXAMINATION
JANUARY 2017 SEMESTER

COURSE CODE	:	LMB11303
COURSE NAME	:	ENGINEERING MATHEMATICS 1
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	:	BACHELOR OF ENGINEERING TECHNOLOGY (HONS) IN MARINE ENGINEERING
DATE	:	14/07/2017 FRI
TIME	:	9.00 AM - 11.30 PM
DURATION	:	2 HOURS 30 MINUTES

INSTRUCTIONS TO CANDIDATES

1. Please read CAREFULLY the instructions given in the question paper.
2. This question paper has information printed on both sides.
3. This question paper consists of TWO (2) sections; Section A and Section B. Answer ALL questions in Section A and THREE (3) questions from Section B.
4. Please write yours answers on the answer booklet provided.
5. Write your answers only in BLACK or BLUE ink.
6. Answer all questions in English.

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

In a certain three cylinder engine, the power developed in Cylinder A is 15% more than in Cylinder C and 5% less power is developed in Cylinder B than Cylinder C. If Cylinder C developed 500 kW power, calculate:

(a) the power developed by Cylinder A.

(2 marks)

(b) the power developed by Cylinder B.

(2 marks)

(c) the ratio of power developed by the three cylinder engines.

(4 marks)

Question 2

Given that $(2+\mathrm{y}\mathrm{i})(\mathrm{x}+2\mathrm{i})=8+\mathrm{i}$, where x and y are real numbers.

(a) Obtain TWO (2) equations involving x and y.

(3 marks)

(b) Determine the possible values of x and y that satisfy the equation $(2+\mathrm{y}\mathrm{i})(\mathrm{x}+2\mathrm{i})=8+\mathrm{i}$.

(5 marks)

Question 3

Given that $P(x) = x^3 + 2x^2 - 5x - 1$ and $Q(x) = x^3 + x^2 - 9x + 11$.

(a) If the polynomials have the same remainder when divided by $x - k$, determine the possible values of k.

(4 marks)

(b) By using the values of k obtained in (a), determine the remainder when $P(x) + 2Q(x)$ is divided by $x - \frac{1}{2}k$.

(4 marks)

Question 4

Solve for *x* for:

a) $4^{\log_2 x} = 64$.

(4 marks)

b) $5^{x+2} = 24 + 5^x$.

(4 marks)

Question 5

a) Solve $5\sin^2\theta = 5 - 3\cos\theta$ for $0^0 \le \theta \le 90^0$.

(4 marks)

b) Determine the number of terms in the Geometric Series $20 + 30 + 45 + ... + 341.72$.

(4 marks)

SECTION B (Total: 60 marks)

INSTRUCTION: Answer THREE(3) questions only.
Please use the answer booklet provided.

Question 6

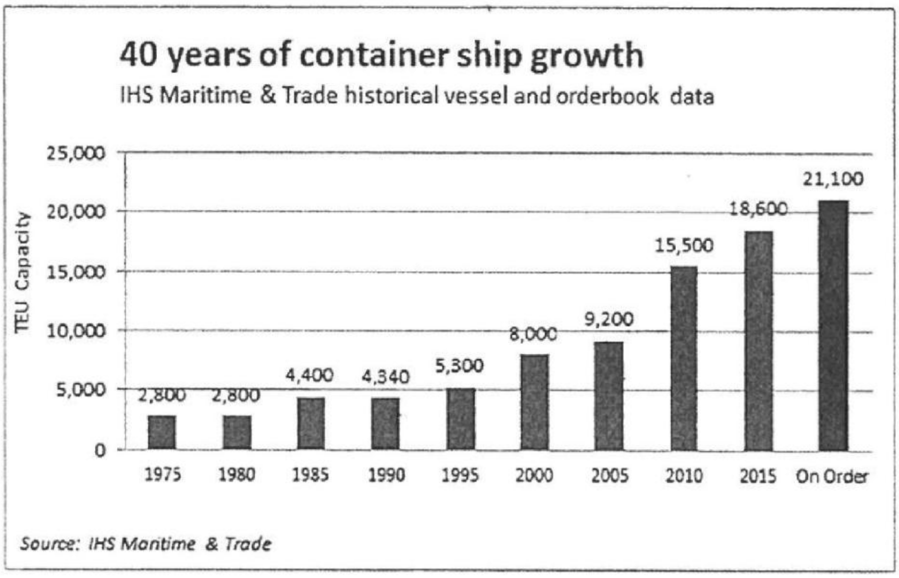

Figure 1

(a) Figure 1 shows 40 years of container ship growth starting from 1975. Calculate the percentage increment from 2010 to 2015.

(4 marks)

(b) The diameter in mm of coupling bolts should not be less thah that given by the formula:

$$d = \sqrt{\frac{D^3}{3.5 \times n \times R}}$$

where D = diameter of shafting in mm; n = number of bolts per coupling; and R = pitch circle radius in mm.

i. Express R in terms of other quantities.

(2 marks)

ii. Determine the pitch circle radius when d = 82.5mm, D = 381 mm and n = 8 bolts per coupling. (Give your answer correct to 5 decimal places).

(3 marks)

(c) The polynomial $P(x) = 2x^3 + mx^2 + 33x + 27$ has a factor $2x + 3$.

i. Determine the value of m.

(5 marks)

ii. Define the polynomial $Q(x)$ such that $P(x) = (2x + 3)Q(x)$.

(3 marks)

iii. Show that $Q(x) = 0$ has no real roots.

(3 marks)

Question 7

(a) The impedance in one part of a series circuit is 2 + 8j ohms, and the impedance in another part of the circuit is 4 - 6j ohms. Evaluate the total impedance in the circuit.

(2 marks)

(b) The voltage in a circuit is 45 + 10j volts and the impedance, Z, is 3 + 4j ohms. Calculate the current, I in the circuit in terms of *a+bj*. [HINT:E = IZ]

(8 marks)

(c) Represent the current in the circuit from (b) as a complex number in exponential form.

(10 marks)

Question 8

(a) Prove that $x\log_n\left(\frac{25}{32}\right)=\log_n 7$ if given $5^{2x}=7\left(2^{5x}\right)$.

(3 marks)

(b) Simplify $\frac{\log_8 36\times\log_{125} 8}{\log_{25} 6}$.

(7 marks)

(c) Solve the equation $3\cosh 2x = 2\sinh x + 11$ and give your answers in the form of $\ln p$.

(10 marks)

Question 9

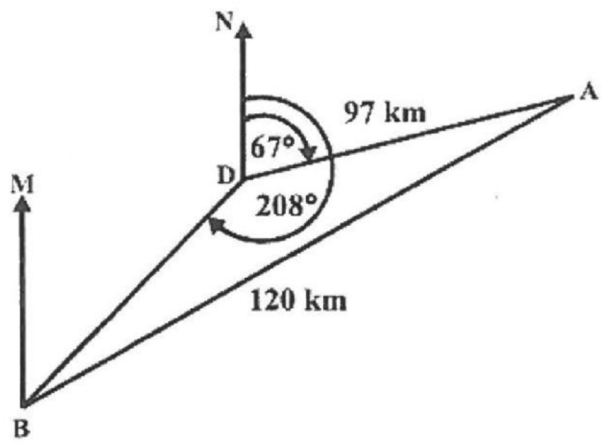

Figure 2

(a) Two ships, A and B are 120 km apart. Ship A is at bearing of 67^0 from D and 97 km, away from D. DN points due north. Ship B is at a bearing of 208^0 from D. Determine:

i. the bearing of ship A from Ship B (Angle MBA).

(7 marks)

ii. the distance from B to D.

(3 marks)

(b) Write down the first three terms in the expansion of $\left(1+2x^2\right)^5$.

(2 marks)

(c) Determine:

i. the middle term in the expansion of $\left(x^2+2x\right)^8$.

(3 marks)

ii. the coefficient of the term independent of x in the expansion of $\left(3x^2+\frac{2}{x}\right)^6$.

(5 marks)

END OF EXAMINATION PAPER

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 : $f(x)=ax+b$
$\int \cos x\,dx=\sin x+c$	$\int \cos f(x)dx=\frac{\sin f(x)}{f'(x)}+c$
$\int \sin x\,dx=-\cos x+c$	$\int \sin f(x)dx=\frac{-\cos f(x)}{f'(x)}+c$
$\int \sec^2 x\,dx=\tan x+c$	$\int \sec^2 f(x)dx=\frac{\tan f(x)}{f'(x)}+c$
$\int \sec x\tan x\,dx=\sec x+c$	$\int \sec f(x)\tan f(x)dx=\frac{\sec f(x)}{f'(x)}+c$

$\int \csc x \cot x \, dx = -\csc x + c$	$\int \csc f(x) \cot f(x) dx = \frac{-\csc f(x)}{f'(x)} + c$
$\int \csc^2 x \, dx = -\cot x + c$	$\int \csc^2 f(x) dx = \frac{-\cot f(x)}{f'(x)} + c$

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

$\cosh x = \frac{e^x + e^{-x}}{2}$
$\sinh x = \frac{e^x - e^{-x}}{2}$
$\tanh x = \frac{e^x - e^{-x}}{e^x + e^{-x}}$
$\sinh 2x = 2 \sinh x \cosh x$
$\sin^2 x + \cos^2 x = 1$
$\sinh^{-1} x = \ln(x + \sqrt{x^2 + 1})$
$\cosh^{-1} x = \ln(x \pm \sqrt{x^2 - 1})$ $= \pm \ln(x + \sqrt{x^2 - 1})$

PROGRESSION

ARITHMETIC

$$T_n = a + (n-1)d$$

$$S_n = \frac{n(a_1 + a_n)}{2}$$

$$= \frac{n(2a_1 + (n-1)d)}{2}$$

GEOMETRIC

$$T_n = ar^{n-1}$$

$$S_n = \frac{a(r^n - 1)}{r-1} \text{ when } |r| > 1$$

$$= \frac{a(1-r^n)}{1-r} \text{ when } |r| < 1$$

$$S_\infty = \frac{a}{1-r}$$

BINOMIAL THEOREM

$$(a+b)^n = \sum_{r=0}^{n} \binom{n}{r} a^{n-r} b^r$$

$$= \frac{n(n-1)(n-2) \times \ldots \times (n-r+1) a^{n-r} b^r}{r!}$$

$$T_{r+1} = \binom{n}{r} a^{n-r} b^r$$

MACLAURIN SERIES

$$f(x) = f(0) + xf'(0) + \frac{x^2}{2!} f''(0) + \frac{x^3}{3!} f'''(0) + \frac{x^4}{4!} f''''(0) + \ldots$$