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UNIVERSITI KUALA LUMPUR
MALAYSIAN INSTITUTE OF INFORMATION TECHNOLOGY

FINAL EXAMINATION
JANUARY 2016 SEMESTER

COURSE CODE	:	IGB10503
COURSE NAME	:	ENGINEERING MATHEMATICS 2
PROGRAMME LEVEL	:	BACHELOR
DATE	:	24 MAY 2016
TIME	:	2.00 pm – 4.30 pm
DURATION	:	2.5 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 FOUR (4) questions.
4. Please write your answers on the answer booklet provided.
5. Answer all questions in English ONLY.
6. Formula sheet has been appended for your reference.

THERE ARE 4 PAGES OF QUESTIONS, INCLUDING THIS PAGE.

INSTRUCTION: Answer ALL questions. (25 marks for every question)
Please use the answer booklet provided.

Question 1

(a) Let $\bar{s} = \overrightarrow{AB}$ and $\bar{t} = \overrightarrow{CD}$ be vectors, where $A = (-4, 2)$, $B = (1, 4)$, $C = (2, 3)$ and $D = (5, 7)$,

i. determine the x and y components for $\bar{s} + \bar{t}$ and $\bar{s} - \bar{t}$.

[4 marks]

ii. given $L = (-2, 1)$, determine M if $\bar{s} + \bar{t} = \overrightarrow{LM}$.

[4 marks]

iii. let $E = (-2, 4)$. Obtain F if $\bar{v} = 2\bar{s} = \overrightarrow{EF}$.

[4 marks]

(b) Obtain the parametric equation for the line through 2 points $P_o(2, 5, 3)$ and $P_1(4, 9, 7)$.

[5 marks]

(c) Given $\bar{s} = \bar{i} + 2\bar{j} + \bar{k}$ and $\bar{t} = 2\bar{i} - \bar{j} + 3\bar{k}$, Obtain:

i. $\bar{s} \bullet \bar{t}$

[1 mark]

ii. $\bar{s} \times \bar{t}$

[3 marks]

iii. The angle between $\bar{s}$ and $\bar{t}$.

[4 marks]

Question 2

(a) Given $y = 4\sin 2x$

i. State the amplitude and period.

[4 marks]

ii. Sketch the graph for one cycle beginning with $x = 0$.

[8 marks]

(b) Given that the square-wave function f defined by;

$$f(x)=\begin{cases} 0 & if \quad -\pi \le x \le 0 \\ 1 & if \quad 0 \le x < \pi \end{cases} \quad and \quad f(x+2\pi)=f(x)$$

i. Sketch the graph of the function.

[3 marks]

ii. Determine the Fourier Coefficients and Fourier series of the function.

[10 marks]

Question 3

(a) Consider the function $f(x,y,z)=xyz^2-xy^2+cos\left(\frac{\pi}{12}\right)$. Determine f_x, f_y and f_z.

Hence, obtain the gradient of the function at the point $(1,\ 0,\ -2)$.

[6 marks]

(b) Express w_r and w_s in terms of r and s $w=x^3+4y^5+2z,\ x=2r-s,\ y=r+3s,\ z=rs$

[10 marks]

(c) Identify and determine the local extremum values of the function
$f(x,y)=x^2+y^2+xy+3x-3y+4$

[9 marks]

Question 4

(a) Given $z=5+6i$ and $w=3-2i$. Determine:

i. $\overline{z-w}$

[3 marks]

ii. $w \bullet z$

[3 marks]

(b) Given $Z = 2 - 5i$,

i. Draw the Argand diagram.

[2 marks]

ii. Determine the modulus and the argument of Z.

[6 marks]

iii. Express the trigonometric form of Z.

[1 mark]

(c) If $Z_1 = 1 + 3i$ and $Z_2 = 5 - 6i$, compute $\dfrac{Z_1 \cdot Z_2}{Z_1 + Z_2}$.

[10 marks]

END OF EXAMINATION PAPER

LIST OF FORMULAS FOR ENGINEERING MATHEMATICS 2

1 The dot product of the vectors $\bar{s}$ and $\bar{t}$ is defined as

$$\bar{s} \bullet \bar{t} = s_1 t_1 + s_2 t_2 , \quad \cos\theta = \frac{\bar{s} \bullet \bar{t}}{\|\bar{s}\|\|\bar{t}\|}$$

2 Projection Vector

$$proj\,(\bar{u}, \bar{v}) = (\bar{u} \bullet \bar{v})\left(\frac{\bar{v}}{\|\bar{v}\|^2}\right)$$

3 **ODD AND EVEN FUNCTION**

If $f(x)$ is even:

$$\int_{-a}^{a} f(x)dx = 2\int_{0}^{a} f(x)dx$$

If $f(x)$ is odd:

$$\int_{-a}^{a} f(x)dx = 0$$

Fourier Series

$$f(x) = a_0 + \sum_{n=1}^{n=\infty}\left(a_n \cos\left(\frac{2n\pi x}{T}\right) + b_n \sin\left(\frac{2n\pi x}{T}\right)\right)$$

$$a_0 = \frac{1}{T}\int_{-\frac{T}{2}}^{\frac{T}{2}} f(x)dx$$

$$a_n = \frac{2}{T}\int_{-\frac{T}{2}}^{\frac{T}{2}} f(x)\cos\left(\frac{2n\pi x}{T}\right)dx$$

$$b_n = \frac{2}{T}\int_{-\frac{T}{2}}^{\frac{T}{2}} f(x)\sin\left(\frac{2n\pi x}{T}\right)dx$$

Table of derivatives

Function	Derivatives
Constant	0
x	1
kx	k
x^n	nx^{n-1}
kx^n	knx^{n-1}
e^x	e^x
e^{kx}	ke^{kx}
$\ln x$	$\frac{1}{x}$
$\ln kx$	$k\frac{1}{x}$
$\sin x$	$\cos x$
$\sin kx$	$k\cos kx$
$\sin(kx+\alpha)$	$k\cos(kx+\alpha)$
$\cos x$	$-\sin x$
$\cos kx$	$-k\sin kx$
$\cos(kx+\alpha)$	$-k\sin(kx+\alpha)$
$\tan x$	$\sec^2 x$
$\tan kx$	$k\sec^2 kx$
$\tan(kx+\alpha)$	$k\sec^2(kx+\alpha)$

Table of integrals

Function $f(x)$	Indefinite integral $\int f(x)dx$
Constant, k	$kx+c$
x	$\frac{x^2}{2}+c$
x^2	$\frac{x^3}{3}+c$
x^n	$\frac{x^{n+1}}{n+1}+c$; $n \neq 1$
$x^{-1}=\frac{1}{x}$	$\ln\lvert x\rvert+c$
$\sin x$	$-\cos x+c$
$\cos x$	$\sin x+c$
$\sin kx$	$\frac{-\cos kx}{k}+c$
$\cos kx$	$\frac{\sin kx}{k}+c$
$\tan kx$	$\frac{1}{k}\ln\lvert\sec kx\rvert+c$
$\sec kx$	$\frac{1}{k}\ln\lvert\sec kx+\tan kx\rvert+c$
e^x	e^x+c
e^{-x}	$-e^{-x}+c$
e^{kx}	$\frac{e^{kx}}{k}+c$

Integration by parts: $\int u\,dv = uv - \int v\,du$