UNIVERSITI KUALA LUMPUR
MALAYSIA ITALY DESIGN INSTITUTE

FINAL EXAMINATION
MARCH 2026 SEMESTER

COURSE CODE	:	PPB 10403
COURSE NAME	:	ENGINEERING MATHEMATICS 2
PROGRAM LEVEL	:	BACHELOR
DATE	:	25 JUNE 2026
TIME	:	9.00 AM – 11.30 AM
DURATION	:	2 HOURS 30 MINUTES

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.
2. This question paper has information printed on both sides of the paper.
3. This question paper consists only Section A.
4. Answer ALL questions
5. Please write your answers on the answer booklet provided.
6. Formula sheet is provided

THERE ARE 3 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

SECTION A (Total: 80 marks)

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

Question 1

(a) Determine $\frac{d}{dx}\left(\sin\left(5x^3-4\right)\right)^6$.

(4 marks)

(b) Evaluate $\int_1^3 \left(2x^2+3x-2\right)dx$.

(6 marks)

Question 2

Integrate the following functions:

(a) $\int\left(x^2+\frac{1}{x}-7x^3\right)dx$.

(3 marks)

(b) $\int\left(\cos 3x-\sin\left(5x+1\right)\right)dx$

(3 marks)

(c) $\int\left(e^{3x}+4x^3-x-3\right)dx$.

(4 marks)

Question 3

(a) The sides of a square cube are decreasing at a rate of $0.1 cms^{-1}$. Determine the rate of change of the area when the area of the square cube is $49\,cm^2$.

(8 marks)

(b) Solve $\int\frac{4x-5}{x^2-x-2}dx$ by using the partial fractions method.

(12 marks)

Question 4

(a) Consider the equation $y^4 - 3x^3 + 2x^2y = 5$.

i. Determine $\frac{dy}{dx}$ by implicit differentiation.

(7 marks)

ii. Hence, calculate the slope of the tangent to the curve at the point (2,3).

(3 marks)

(a) Given that $f(x) = \frac{e^{4x}}{6x^3 + 1}$.

i. Determine $f'(x)$ by using quotient rule.

(8 Marks)

ii. Hence, calculate the value of $f'(2)$.

(2 marks)

Question 5

(a) Determine the slope of the curve $xy^4 - 2x^3 + x^2y = 4$ using implicit differentiation.

(10 marks)

(b) Determine $\int_0^2 3x \sin 3x \, dx$ by using integration by part method.

(10 marks)

END OF EXAMINATION PAPER

LIST OF FORMULAS FOR MATHEMATICS

Integration

$$\int 1\,dx = x + C$$

$$\int x^n\,dx = \frac{x^{n+1}}{n+1} + C, \qquad n \neq -1$$

$$\int \frac{1}{x}dx = \ln|x| + C$$

$$\int \frac{1}{x^n}dx = \frac{x^{-n+1}}{-n+1} + C, \qquad n \neq 1$$

$$\int e^x\,dx = e^x + C$$

$$\int \sin x\,dx = -\cos x + C$$

$$\int \cos x\,dx = \sin x + C$$

$$\int \tan x\,dx = ln|\sec x| + C$$

$$\int \sec x\,dx = ln|\sec x + \tan x| + C$$

$$\int \csc x\,dx = ln|\cos x - \cot x| + C$$

$$\int \sec^2 x\,dx = \tan x + C$$

$$\int \sec x tan\, x\,dx = \sec x + C$$

By part

$$\int u\,dv = uv - \int v\,du$$

Identity Trigonometry

$$cosh^2x - sinh^2x = 1$$

$$cos^2x + sin^2x = 1$$

$$cos\ 2x = 1 - 2sin^2x$$

Function value

$$area = \int_a^b f(x)\,dx$$

$$V = \pi \int_a^b \big(A(x)\big)^2\,dx$$

$$= \pi \int_a^b [f(x)]^2 - [g(x)]^2\,dx$$

Surface Area:

$$S = \int_a^b 2\pi y \sqrt{1 + \left(\frac{dy}{dx}\right)^2}\,dx$$

Radius of Curvature:

$$R = \left[\frac{1 + \left(\frac{dy}{dx}\right)^2}{\frac{d^2y}{dx^2}}\right]^{3/2}$$

Length of curve :

$$S = \int_a^b \sqrt{1 + \left(\frac{dy}{dx}\right)^2}\,dx$$

Differentiation

$y = c\ (constant)$	$\frac{dy}{dx} = 0$
$y = x$	$\frac{dy}{dx} = 1$
$y = x^n$	$\frac{dy}{dx} = nx^{n-1}$
$y = \sin x$	$\frac{dy}{dx} = \cos(x)$
$y = \cos x$	$\frac{dy}{dx} = -\sin x$
$y = \tan x$	$\frac{dy}{dx} = \sec^2 x$
$y = e^x$	$\frac{dy}{dx} = e^x$
$y = \ln x$	$\frac{dy}{dx} = \frac{1}{x}$
$y = \cot x$	$\frac{dy}{dx} = -\text{cosec}^2\text{x}$
$y = cosec\ x$	$\frac{dy}{dx} = -cosec\ x cot\ x$

Product rule

$$\frac{dy}{dx} = v\frac{du}{dx} + u\frac{dv}{dx}$$

Quotient rule

$$\frac{dy}{dx} = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$$

Chain rule

$$\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$$

Second Order Differentiation

Consider : $y = e^{mx}$

Different roots

$$y = Ae^{m_1x} + Be^{m_2x}$$

Equal roots

$$y = (A + Bx)e^{mx}$$

Complex roots $(\alpha + \beta i)$

$$y = e^{\alpha x}(A\cos(\beta x) + B\sin(\beta x))$$

TABLE OF LAPLACE TRANSFORMS

$f(t) = \mathcal{L}^{-1}\{F(s)\}$ $f(t) = \mathcal{L}^{-1}\{F(s)\}$	$F(s) = \mathcal{L}\{f(t)\}$	$f(t) = \mathcal{L}^{-1}\{F(s)\}$	$F(s) = \mathcal{L}\{f(t)\}$
1. 1	$\frac{1}{s}$	14. e^{at}	$\frac{1}{s-a}$
2. $t^n, n = 1,2,3,\ldots$	$\frac{n!}{s^{n+1}}$	15. $t^p, p > -1$	$\frac{\Gamma(p+1)}{s^{p+1}}$
3. $\sqrt{t}$	$\frac{\sqrt{\pi}}{2s^{\frac{2}{3}}}$	16. $t^{n-\frac{1}{2}}, n = 1,2,3\ldots$	$\frac{1\cdot 3\cdot 5\cdots(2n-1)\sqrt{\pi}}{2^n s^{n+\frac{1}{2}}}$
4. $\sin(at)$	$\frac{a}{s^2+a^2}$	17. $\cos(at)$	$\frac{s}{s^2+a^2}$
5. $t\ \sin(at)$	$\frac{2as}{(s^2+a^2)^2}$	18. $t\cos(at)$	$\frac{s^2-a^2}{(s^2+a^2)^2}$
6. $\sin(at) - at\cos(at)$	$\frac{2a^3}{(s^2+a^2)^2}$	19. $\sin(at) + at\cos(at)$	$\frac{2as^2}{(s^2+a^2)^2}$
7. $\cos(at) - at\sin(at)$	$\frac{s(s^2-a^2)}{(s^2+a^2)^2}$	20. $\cos(at) + at\sin(at)$	$\frac{s(s^2+3a^2)}{(s^2+a^2)^2}$
8. $\sin(at+b)$	$\frac{s\sin(b)+a\cos(b)}{s^2+a^2}$	21. $\cos(at+b)$	$\frac{s\cos(b)-a\sin(b)}{s^2+a^2}$
9. $\sinh(at)$	$\frac{a}{s^2-a^2}$	22. $\cosh(at)$	$\frac{s}{s^2-a^2}$
10. $e^{at}\sin(bt)$	$\frac{b}{(s-a)^2+b^2}$	23. $e^{at}\cos(bt)$	$\frac{s-a}{(s-a)^2+b^2}$
11. $e^{at}\sinh(bt)$	$\frac{b}{(s-a)^2-b^2}$	24. $e^{at}\cosh(bt)$	$\frac{s-a}{(s-a)^2-b^2}$
12. $t^n e^{at}, n = 1,2,3,\ldots$	$\frac{n!}{(s-a)^{n+1}}$	25. $f(ct)$	$\frac{1}{c}F\left(\frac{s}{c}\right)$
13. $u_c(t) = u(t-c)$	$\frac{e^{-cs}}{s}$	26. $\delta(t-c)$	e^{-cs}