SECTION A

STRUCTURED (25 marks)

INSTRUCTION:

This section consists of **ONE (1)** compulsory structured question.

QUESTION 1

(a) Given that $Z_1 = -1+3i, Z_2 = 5-9i$ and $Z_3 = -2-6i$. Express each of the following in the form of $a+bi$.

i. $Z_1 + Z_2$ CLO 1 : C2 (2 marks)

ii. $2(Z_2 - Z_3)$ CLO 1 : C2 (2 marks)

iii. $\frac{Z_3}{Z_1}$ CLO 1 : C2 (4 marks)

(b) Given that $(2-9i) = (x-4)+(3yi)$ Find the value for x and y. CLO 1 : C2 (4 marks)

POLITEKNIK
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EXAMINATION AND EVALUATION DIVISION
DEPARTMENT OF POLYTECHNIC EDUCATION
(MINISTRY OF HIGHER EDUCATION)

MATHEMATICS, SCIENCE & COMPUTER DEPARTMENT

FINAL EXAMINATION
JUNE 2012 SESSION

BA201: ENGINEERING MATHEMATICS 2

DATE: 17 NOVEMBER 2012 (SATURDAY)

DURATION: 2 HOURS (2.30 PM – 4.30 PM)

This paper consists of **EIGHT (8)** pages including the front page.

Section A: Structured (1 question – answer all)
Section B: Structured (2 questions – answer one question only)
Section C: Structured (2 questions – answer one question only)
Section D: Structured (Answer ONE (1) MORE question from either Section B or Section C)

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DO NOT OPEN THIS QUESTION PAPER UNTIL INSTRUCTED BY THE CHIEF INVIGILATOR

(The CLO stated is for reference only)

SECTION B

STRUCTURED (25 marks)

INSTRUCTION:

This section consists of **TWO (2)** structured questions. Answer **ONE (1)** question only.

QUESTION 2

(a) Find the derivative for each of the following functions.

i. $y = 4x^3 + 2x^2 - 3x + 5$ CLO 2 : C1 (2 marks)

ii. $y = (3x^2 + 2)(x + 1)$ CLO 2 : C1 (3 marks)

iii. $y = \dfrac{4}{3(5-2x)^3}$ CLO 2 : C2 (4 marks)

iv. $y = \dfrac{(6+2x)^2}{(x-5)^3}$ CLO 2 : C2 (4 marks)

(b) Find the second derivative for the function. CLO 2 : C2 (3 marks)

$$s = \frac{4}{3}t^3 + 2t^2 - 4t + 2$$

(c) Sketch the following complex number using the Argand diagram.

i. $-3 + 4i$ CLO 1 : C2 (2 marks)

ii. $1 - 2.5i$ CLO 1 : C2 (2 marks)

(d) Calculate the modulus and the argument for $-5 + 7i$ and then express the complex number in the trigonometric form. CLO 1 : C2 (4 marks)

(e) Given that $Z_1 = 8(\cos 20^0 + i \sin 20^0)$ and $Z_2 = 16\angle 30^0$. CLO 1 : C2 (5 marks)

Find $Z_1 \times Z_2$ and $\dfrac{Z_2}{Z_1}$ in the trigonometric form.

SECTION C

STRUCTURED (25 marks)

INSTRUCTION:

This section consists of **TWO (2)** structured questions. Answer **ONE (1)** question only.

QUESTION 4

(a) Solve the following integrals.

i. $\int \frac{x^3}{2} - 2x - \frac{3}{x^5} \; dx$ CLO 3 : C 2

(3 marks)

ii. $\int (3m-5)(2+m) dm$ CLO 3 : C 2

(3 marks)

iii. $\int 4k(2k^2-1)^9 \; dk$ CLO 3 : C 2

(4 marks)

(b) Integrate each of the followings.

i. $\int 3x^2 e^{x^3} \; dx$ CLO 3 : C 3

(4 marks)

ii. $\int \frac{3x^2-3}{x^3-3x} \; dx$ CLO 3 : C 3

(4 marks)

(c) Evaluate $\int_{-2}^{1} \frac{x^2}{(x^3+1)^2} dx$ CLO 3 : C 3

(7 marks)

(c) Find the $\frac{dy}{dx}$ of the following parametric equations. CLO 2 : C3

(4 marks)

$x = t^4 + 3$ and $y = 2t^2 - 5$

(d) Find the $\frac{dy}{dx}$ for $y = \tan^4(3x-2)$ by using Chain Rule Technique. CLO 2 : C3

(5 marks)

QUESTION 3

(a) Find the coordinates of the turning points of $y = x^3 - x^2$ and determine their nature.

CLO 2:C3

(12 marks)

(b) A particle moves along a straight line that passes through a fixed point 0. The displacement S meter, from 0 at time t seconds is given by $S = 4t^3 - t^2$.

i. Find the displacement of the particle at $t = 3s$ and $t = 6s$. CLO 2:C3

(4 marks)

ii. Find the distance travelled in the 3rd second. CLO 2:C3

(5 marks)

iii. Find the initial acceleration of the particle. CLO 2:C3

(4 marks)

(c) Figure 6(c) shows the curve $x = 8y - 4y^2$.

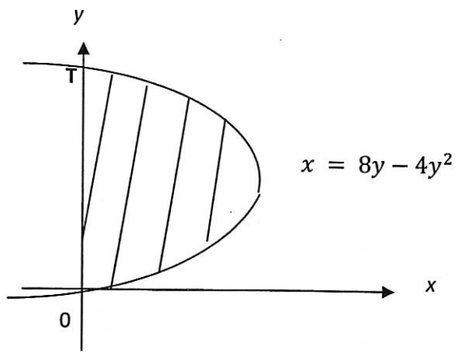

Figure 6(c)

i. Determine the coordinate of T . CLO 3 : C3 (4 marks)

ii. Determine the volume of revolution when the shaded region is rotated completely about y-axis in terms of π. CLO 3:C3 (7Marks)

SECTION D

STRUCTURED (25 marks)

INSTRUCTION:

For this section, answer **ONE (1) MORE** question from either **Section B** or **Section C.**

QUESTION 5

(a) Find the area of the region bounded by the curve $y = 6x - x^2$ between $x = 0$ and $x = 6$. CLO 3 : C3 (4 marks)

(b) A ball moves along a straight line from a fixed point *O*. Its acceleration is a m/s^2 , is given by $a = 10 - 4t$ where t is the time, in seconds, after leaving point *O*.

i. Find the acceleration when t= 5 s. CLO 3 : C3 (2 marks)

ii. Find the velocity and displacement at time t. CLO 3 : C3 (8 marks)

FORMULA BA201 - ENGINEERING MATHEMATICS 2

BASICS OF DIFFERENTIATION

1. $\frac{d}{dx}(x^n) = nx^{n-1}$

2. $\frac{d}{dx}(uv) = u\frac{dv}{dx} + v\frac{du}{dx}$

3. $\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$

4. $\frac{d}{dx}(\ln x) = \frac{1}{x}$

5. $\frac{d}{dx}(a^x) = a^x \ln a$

6. $\frac{d}{dx}(e^x) = e^x$

7. $\frac{d}{dx}(\sin x) = \cos x$

8. $\frac{d}{dx}(\cos x) = -\sin x$

9. $\frac{d}{dx}(\tan x) = \sec^2 x$

10. $\frac{d}{dx}(\cot x) = -\operatorname{cosec}^2 x$

11. $\frac{d}{dx}(\sec x) = sec x.\tan x$

12. $\frac{d}{dx}(u^n) = nu^{n-1}\frac{du}{dx}$
    $or\ \frac{d}{dx}(u^n) = \frac{dy}{du}x\frac{du}{dx}$

BASICS OF INTEGRATION

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

2. $\int \frac{1}{x}\,dx = \ln x + c$

3. $\int e^x\,dx = e^x + c$

4. $\int a^x\,dx = \frac{a^x}{\ln a} + c$

5. $\int \sin x\,dx = -\cos x + c$

6. $\int \cos x\,dx = \sin x + c$

7. $\int \sec^2 x\,dx = \tan x + c$

AREA UNDER A CURVE

1. $A_x = \int_a^b y\,dx$

2. $A_y = \int_a^b x\,dy$

VOLUME UNDER A CURVE

1. $V_x = \pi\int_a^b y^2\,dx$

2. $V_y = \pi\int_a^b x^2\,dy$

THE ROOTS OF QUADRATIC EQUATION

$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

TRIGONOMETRY IDENTITIES

1. $\sin^2\theta + \cos^2\theta = 1$

2. $\sec^2\theta = 1 + \tan^2\theta$

3. $\operatorname{cosec}^2\theta = 1 + \cot^2\theta$

4. $\sin 2\theta = 2\sin\theta\cos\theta$

5. $\cos 2\theta = \cos^2\theta - \sin^2\theta$
   $= 1 - 2\sin^2\theta$
   $= 2\cos^2\theta - 1$

6. $\tan 2\theta = \frac{2\tan\theta}{1 - \tan^2\theta}$

7. $a\sin\theta + b\cos\theta = R\sin(\theta + \alpha)$

8. $a\sin\theta - b\cos\theta = R\sin(\theta - \alpha)$

9. $a\cos\theta + b\sin\theta = R\cos(\theta - \alpha)$

10. $a\cos\theta - b\sin\theta = R\cos(\theta + \alpha)$