POLITEKNIK
MALAYSIA

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN MATEMATIK, SAINS DAN KOMPUTER

PEPERIKSAAN AKHIR

SESI JUN 2015

BA201: ENGINEERING MATHEMATICS 2

TARIKH : **28 OKTOBER 2015**
MASA : **2.30 PM – 4.30 PM (2 JAM)**

Kertas ini mengandungi **SEBELAS (11)** halaman bercetak.
Bahagian A: Struktur (1 soalan)
Bahagian B: Struktur (4 soalan)

Dokumen sokongan yang disertakan : Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SECTION A : 25 MARKS
BAHAGIAN A : 25 MARKAH

INSTRUCTION:
This section consists of **ONE (1)** compulsory structured questions.

ARAHAN:
Bahagian ini mengandungi SATU (1) soalan wajib berstruktur.

QUESTION 1
SOALAN 1

CLO1
C2

(a)   Given $z_1 = 6 - 5i$, $z_2 = -11 + 2i$ and $z_3 = -2 - 5i$. Express each of the following in the form of $a + bi$ (Cartesian Form).
Diberi $z_1 = 6 - 5i$, $z_2 = -11 + 2i$ dan $z_3 = -2 - 5i$. Terbitkan setiap berikut dalam bentuk $a + bi$ (Cartesian Form).

     i. $z_1 + z_2$ [2 marks]
                                                                [2 markah]

     ii. $z_2 z_3$ [2 marks]
                                                                 [2 markah]

     iii. $\dfrac{z_3}{z_1}$ [3 marks]
                                                                  [3 markah]

CLO1
C2

(b)   Find the values of a and b.
Dapat nilai bagi a dan b.

$(a + bi)(4 - 2i) = (-3 + 3i)$

                                                                 [4 marks]
                                                                [4 markah]

CLO1
C2

(c)   Sketch Argand's Diagram for the following complex numbers and express them in Polar, Trigonometric and Exponent forms.
Lakarkan Rajah Argand bagi nombor kompleks berikut dan terbitkan dalam bentuk Polar, Trigonometri dan Eksponen.

     i. $z = -3 + 5i$ [7 marks]
                                                                  [7 markah]

     ii. $z = 4 - 7i$ [7 marks]
                                                                  [7 markah]

SECTION B : 75 MARKS
BAHAGIAN B : 75 MARKAH

INSTRUCTION:
This section consists of **FOUR (4)** structured questions. Answer **THREE (3)** questions only.

ARAHAN:
*Bahagian ini mengandungi **EMPAT (4)** soalan berstruktur. Jawab **TIGA (3)** soalan sahaja.*

QUESTION 2

SOALAN 2

CLO2
C3

(a)   Differentiate each of the following functions :

Bezakan setiap fungsi yang berikut :

i. $y = 3x^4 + 5x^3 - 4x + 8$ [2 marks]

[*2 markah*]

CLO2
C3

ii. $y = (x-1)(2x^2 - 3)$ [3 marks]

[*3 markah*]

CLO2
C3

iii. $y = \dfrac{3}{2(7-3x)^2}$ [3 marks]

[*3 markah*]

CLO2
C3

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

[*4 markah*]

CLO2
C3

(b)   Find the $\dfrac{d^2w}{dm^2}$ for the function $w = \dfrac{1}{3}m^3 - 3m^{-2} + 5m$.   [4 marks]

Cari $\dfrac{d^2w}{dm^2}$ bagi fungsi $w = \dfrac{1}{3}m^3 - 3m^{-2} + 5m$.   [*4 markah*]

CLO2
C3

(c)   Find the $\dfrac{dy}{dx}$ for the following parametric equations:

$$x = 3t^5 - 15 \text{ and } y = t^4 - 9$$

Cari $\dfrac{dy}{dx}$ bagi persamaan parametrik yang berikut:

$$x = 3t^5 - 15 \text{ dan } y = t^4 - 9$$

[4 marks]

[*4markah*]

CLO2
C3

(d)   Find the derivative of $y = sin^4(2x+3)$ by using Chain Rule method.

Cari pembezaan bagi $y = sin^4(2x+3)$ dengan menggunakan kaedah Petua Rantai.

[5 marks]

[*5 markah*]

QUESTION 3
SOALAN 3

CLO2 C3

(a)   Determine the gradient of $y = 10x^2 + 2x$ when $x = 5$.

      Tentukan kecerunan bagi $y = 10x^2 + 2x$ apabila $x = 5$.

                        [4 marks]
                        [4 markah]

CLO2 C3

(b)   Find the coordinates of the stationary points for the curves $y = 4x^3 + x^2 - 4$ and determine their nature.

      Kirakan koordinat-koordinat titik pegun bagi lengkung $y = 4x^3 + x^2 - 4$ dan tentukan sifat bagi titik pegun tersebut.

                        [12 marks]
                        [12 markah]

CLO2 C3

(c)   A mini truck moves along a straight way that passes through a fixed point O. The displacement s meter from O at the time t seconds is given by

      $s = 4t^3 + 5t$.

      Sebuah trak mini bergerak di sepanjang satu jalan lurus yang melalui titik tetap O. Sesaran s meter dari O pada masa t saat adalah diberi persamaan

      $s = 4t^3 + 5t$.

      i.   Find the distance travelled in the 4th second.   [5 marks]

           Cari jarak yang dilalui dalam saat keempat.   *[5 markah]*

      ii.   Find the velocity of the mini truck after 15 seconds.   [4 marks]

           Cari halaju bagi trak mini selepas 15 saat.   *[4 markah]*

QUESTION 4
SOALAN 4

(a)   Complete the following integrals.

      Lengkapkan kamiran berikut.

CLO3 C3

      i. $\int 6x^2 + 8x - 1\, dx$ [2 marks]

                            [2 markah]

CLO3 C3

      ii. $\int 4x(4x^2 - 1)\, dx$ [3 marks]

                              [3 markah]

CLO3 C3

      iii. $\int \dfrac{4x^3 + 3x^2 - 2}{x}\, dx$ [4 marks]

                              [4 markah]

(b)   Complete the following integrals using substitution.

      Lengkapkan kamiran berikut menggunakan gantian.

CLO3 C3

      i. $\int 3x^2 e^{x^3}\, dx$ [4 marks]

                              [4 markah]

CLO3 C3

      ii. $\int (x-1)\sec^2(x^2 - 2x)\, dx$ [5 marks]

                              [5 markah]

CLO3 C3

(c)   Evaluate $\int_2^4 (1 - 3x)(1 + 2x)\, dx$ [7 marks]

      Nilaikan $\int_2^4 (1 - 3x)(1 + 2x)\, dx$ *[7 markah]*

QUESTION 5
SOALAN 5

CLO3
C3

(a)   Find the area of the bounded region enclosed by the curve $y = 3 + x$ and x-axis, between the range $x = 2$ and $x = 4$.

Cari luas kawasan yang di batasi lengkuk $y = 3 + x$ dan paksi-x, julat di antara

$x = 2$ dan $x = 4$.

[4 marks]
[4 markah]

CLO3
C3

(b)   From the fixed point O an object B moves in a straight line. Its acceleration is $a = m/s^2$ is given by $a = 12t - 6$ where t is the time, in seconds.

Satu objek B bergerak lurus bermula dari titik O. Jika pecutan $a = m/s^2$ diberi adalah $a = 12t - 6$ di mana t adalah masa dalam sebutan saat.

i.   Calculate the acceleration when $t = 3s$.   [2 marks]

Kirakan pecutan jika masa. $t = 3s$ [2 markah]

ii.   Find its velocity when $t = 4s$.   [5 marks]

Cari halaju apabila $t = 4s$.   [5 markah]

iii.   What is the velocity when its acceleration is zero?   [4 marks]

Apakah halaju apabila pecutan adalah sifar?   [4 markah]

CLO3
C3

(c)   Figure 5(c) shows the curve $y = x^3$. The line $y = 27$ intersect with the curve at point A.

Rajah 5(c) menunjukkan lengkung $y = x^3$. Garis $y = 27$ bersilang dengan lengkung pada titik A
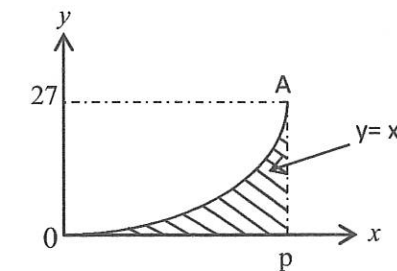

Figure 5(c)

i.   Find the coordinates of P.   [2 marks]

Cari titik koordinat P.   [2 markah]

ii.   Determine the volume of revolution when the shaded region is rotated through 360^0 about x-axis.

Dapatkan isipadu janaan yang terhasil apabila rantau berlorek diputarkan 360^0 pada paksi-x.   [8 marks]

[8 markah]

SOALAN TAMAT

FORMULA SHEET FOR BA201

COMPLEX NUMBER			
1.	$Modulus\ of\ z = \sqrt{a^2 + b^2}$	2.	$Argument\ of\ z = tan^{-1}\left[\dfrac{b}{a}\right]$
3.	Cartesian Form $z = a + bi$	4.	Polar Form $z = r\angle\theta$
5.	Trigonometric Form $z = r[cos\theta + isin\theta]$		Exponential Form $z = re^{i\theta}$

BASICS OF DIFFERENTIATION			
1.	$\dfrac{d}{dx}(ax^n) = anx^{n-1}$	2.	$\dfrac{d}{dx}(ax+b)^n = n(ax+b)^{n-1} \times \dfrac{d}{dx}(ax+b)$
3.	$\dfrac{dy}{dx} = \dfrac{du}{dx} \times \dfrac{dy}{du}$ [Chain Rule]	4.	$\dfrac{d}{dx}(uv) = u\dfrac{dv}{dx} + v\dfrac{du}{dx}$ [Product Rule]
5.	$\dfrac{d}{dx}\left(\dfrac{u}{v}\right) = \dfrac{v\dfrac{du}{dx} - u\dfrac{dv}{dx}}{v^2}$ [Quotient Rule]	6.	$\dfrac{d}{dx}[\ln(ax+b)] = \dfrac{1}{ax+b} \times \dfrac{d}{dx}(ax+b)$
7.	$\dfrac{d}{dx}(\ln x) = \dfrac{1}{x}$	8.	$\dfrac{d}{dx}(e^{ax+b}) = e^{ax+b} \times \dfrac{d}{dx}(ax+b)$
9.	$\dfrac{d}{dx}(e^x) = e^x$	10.	$\dfrac{d}{dx}(\cos x) = -\sin x$
11.	$\dfrac{d}{dx}(\sin x) = \cos x$	12.	$\dfrac{dy}{dx} = \dfrac{dy}{dt} \times \dfrac{dt}{dx}$ [Parametric Equation]
13.	$\dfrac{d}{dx}(\tan x) = \sec^2 x$		
14.	$\dfrac{d}{dx}[\sin(ax+b)] = \cos(ax+b) \times \dfrac{d}{dx}(ax+b)$		
15.	$\dfrac{d}{dx}[\cos(ax+b)] = -\sin(ax+b) \times \dfrac{d}{dx}(ax+b)$		
16.	$\dfrac{d}{dx}[\tan(ax+b)] = \sec^2(ax+b) \times \dfrac{d}{dx}(ax+b)$		
17.	$\dfrac{d}{dx}[\sin^n u] = n\sin^{n-1} u \times \cos u \times \dfrac{du}{dx}$		

18.	$\dfrac{d}{dx}[\cos^n u] = n\cos^{n-1} u \times -\sin u \times \dfrac{du}{dx}$		
19.	$\dfrac{d}{dx}[\tan^n u] = n\tan^{n-1} u \times \sec^2 u \times \dfrac{du}{dx}$		

BASIC OF INTEGRATION			
1.	$\displaystyle\int ax^n dx = \dfrac{ax^{n+1}}{n+1} + c \ ; \{n \neq -1\}$	2.	$\displaystyle\int (ax+b)^n dx = \dfrac{(ax+b)^{n+1}}{(a)(n+1)} + c \ ; \{n \neq -1\}$
3.	$\displaystyle\int \dfrac{1}{x} dx = \ln x + c$	4.	$\displaystyle\int \dfrac{1}{ax+b} dx = \dfrac{1}{a} \times \ln(ax+b) + c$
5.	$\displaystyle\int e^x dx = e^x + c$	6.	$\displaystyle\int e^{ax+b} dx = \dfrac{1}{a} \times e^{ax+b} + c$
7.	$\displaystyle\int k\ dx = kx + c \ ; k\ is\ a\ constant$	8.	$\displaystyle\int \sin x\ dx = -\cos x + c$
9.	$\displaystyle\int \cos x\ dx = \sin x + c$	10.	$\displaystyle\int \sec^2 x\ dx = \tan x + c$
11.	$\displaystyle\int \sin(ax+b)\ dx = -\dfrac{1}{a} \times \cos(ax+b) + c$		
12.	$\displaystyle\int \cos(ax+b)\ dx = \dfrac{1}{a} \times \sin(ax+b) + c$		
13.	$\displaystyle\int \sec^2(ax+b)\ dx = \dfrac{1}{a} \times \tan(ax+b) + c$		
14.	$\displaystyle\int_a^b f(x)dx = [F(x)]_a^b = F(b) - F(a)$		

Identity Trigonometry			
1.	$\cos^2\theta + \sin^2\theta = 1$	2.	$\begin{aligned}\cos 2\theta &= 2\cos^2\theta - 1 \\ &= 1 - 2\sin^2\theta \\ &= \cos^2\theta - \sin^2\theta\end{aligned}$
3.	$\sin 2\theta = 2\sin\theta\cos\theta$	4.	$\sec^2\theta = 1 + \tan^2\theta$
5.	$\tan 2\theta = \dfrac{2\tan\theta}{1 - \tan^2\theta}$	6.	$cosec^2\theta = 1 + \cot^2\theta$
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.	$a\cos\theta - b\sin\theta = R\cos(\theta + \alpha)$

AREA UNDER CURVE		
1. $A_x = \int_a^b y\, dx$	**2.**	$A_y = \int_a^b x\, dy$
VOLUME UNDER CURVE		
1. $V_x = \pi \int_a^b y^2\, dx$	**2.**	$V_y = \pi \int_a^b x^2\, dy$
QUADRATIC FORMULA		
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$		