DDPB 3

UNIVERSITI TEKNOLOGI MALAYSIA

Sekolah Pendidikan Profesional dan
Pendidikan Berterusan
(UTMSPACE)

FINAL EXAMINATION / *PEPERIKSAAN AKHIR*
SEMESTER 2 – SESSION 2015 / 2016
PROGRAM KERJASAMA

COURSE CODE *KOD KURSUS*	:	DDPS2033 / DDPS2213
COURSE NAME *NAMA KURSUS*	:	HIGHER ENGINEERING MATHEMATICS *MATEMATIK KEJURUTERAAN TINGGI*
YEAR / PROGRAMME *TAHUN / PROGRAM*	:	2 / DIPLOMA IN ENGINEERING *2 / DIPLOMA KEJURUTERAAN*
DURATION *TEMPOH*	:	2 HOURS 30 MINUTES *2 JAM 30 MINIT*
DATE *TARIKH*	:	APRIL 2016

INSTRUCTIONS:
ARAHAN:

1. Answer **ALL** questions.
   *Jawab **SEMUA** soalan.*
2. A list of formulae and tables are given for reference.
   Senarai formula dan jadual disertakan sebagai rujukan.

(You are required to write your name, college and your lecturer on your answer script)
(Pelajar dikehendaki tuliskan nama, kolej dan nama pensyarah pada skrip jawapan)

NAME / *NAMA*	:	....
I.C NO. / *No. K.P*	:	....
YEAR/COURSE *TAHUN/KURSUS*	:	....
COLLEGE / *KOLEJ*		

1. **Use the method of separation of variables to solve the equation:**

Guna kaedah [redacted]

4. **(a)** **Find the partial derivatives f_x , f_y , f_{yx} and f_{yy} :**

Dapatkan terbitan separa f_x , f_y , f_{yx} dan f_{yy} :

$$f(x,y) = x^3 + y^3 \sin 2x - 3y$$

(6M)

(b) **If $z = x^2 + y^2$, where $x = r\cos t$ and $y = r\sin t$,**

use the chain rule to find $\frac{\partial z}{\partial r}$ and $\frac{\partial z}{\partial t}$.

Jika $z = x^2 + y^2$, dengan $x = r\cos t$ dan $y = r\sin t$,

gunakan aturan rantai untuk mendapatkan $\frac{\partial z}{\partial r}$ dan $\frac{\partial z}{\partial t}$.

(5M)

(c) **Find the maximum, minimum and saddle points of the function:**

Dapatkan titik maksimum, titik minimum dan titik pelana bagi fungsi:

$$f(x,y) = x^3 - xy + y^3$$

(7M)

5. **Evaluate the double integral**

Nilaikan kamiran gandadua

(a) $\int_0^{\pi/2} \int_0^{\pi} (\sin x + \cos y)\, dx dy$

(b) $\iint_R \frac{x}{y^2+1}\, dA$; R **is the region in the first quadrant bounded by** $y = x^2$,

$y = 4$ **and** $x = 0$.

R ialah rantau dalam sukuan pertama yang dibatasi oleh

$y = x^2$, $y = 4$ *dan* $x = 0$.

(10M)

6. Use polar coordinates to evaluate the integral

Gunakan kamiran kutub untuk menilaikan kamiran

$$\iint_R \left(4+\sqrt{x^2+y^2}\right)\ dA$$

R **is enclosed in the semicircle** $x^2+y^2=1,\ y\geq 0$.

R *tertutup dalam semibulatan* $x^2+y^2=1,\ y\geq 0$.

(7M)

END OF QUESTION PAPER

KERTAS SOALAN TAMAT

APPENDIX

A. Formulae

Derivatives	Integrals
$\frac{d}{dx}\left(u^{n}\right)=nu^{n-1}\frac{du}{dx}$	$\int u^{n}\,du=\frac{1}{n+1}u^{n+1}+C;\;n\neq-1$
$\frac{d}{dx}\left(e^{u}\right)=e^{u}\frac{du}{dx}$	$\int e^{u}\,du=e^{u}+C$
$\frac{d}{dx}\left(\ln\lvert u\rvert\right)=\frac{1}{u}\frac{du}{dx}$	$\int\frac{1}{u}\,du=\ln\lvert u\rvert+C$
$\frac{d}{dx}(\sin u)=\cos u\frac{du}{dx}$	$\int\cos u\,du=\sin u+C$
$\frac{d}{dx}(\cos u)=-\sin u\frac{du}{dx}$	$\int\sin u\,du=-\cos u+C$
$\frac{d}{dx}\left(\sin^{-1}u\right)=\frac{1}{\sqrt{1-u^{2}}}\frac{du}{dx}$	$\int\frac{1}{\sqrt{a^{2}-u^{2}}}du=\sin^{-1}\left(\frac{u}{a}\right)+C$
$\frac{d}{dx}\left(\cos^{-1}u\right)=-\frac{1}{\sqrt{1-u^{2}}}\frac{du}{dx}$	$\int\frac{1}{\sqrt{a^{2}-u^{2}}}du=-\cos^{-1}\left(\frac{u}{a}\right)+C$
$\frac{d}{dx}\left(\tan^{-1}u\right)=\frac{1}{1+u^{2}}\frac{du}{dx}$	$\int\frac{1}{a^{2}+u^{2}}du=\frac{1}{a}\tan^{-1}\left(\frac{u}{a}\right)+C$

Note: u and v are functions of x.

B. The method of undetermined coefficients

Solution of homogeneous equation: $ay'' + by' + cy = 0$

Auxiliary equation: $am^2 + bm + c = 0$

Roots of $am^2 + bm + c = 0$	General solution, y_h
1. real and unequal: m_1 and m_2	$y_h = Ae^{m_1 x} + Be^{m_2 x}$
2. real and equal: $m = m_1 = m_2$	$y_h = (A + Bx)e^{mx}$
3. complex numbers: $m_1 = \alpha + \beta i$; $m_2 = \alpha - \beta i$	$y_h = e^{\alpha x}(A\cos\beta x + B\sin\beta x)$

Particular integrals of nonhomogeneous equation: $ay'' + by' + cy = f(x)$

$f(x)$	Roots of auxiliary equation: m_1, m_2	y_p
$A_n x^n + A_{n-1}x^{n-1} + \cdots + A_1 x + A_0$	$m_1 \neq 0$ and $m_2 \neq 0$	$B_n x^n + B_{n-1}x^{n-1} + \cdots + B_1 x + B_0$
	$m_1 = 0$ or $m_2 = 0$	$(B_n x^n + B_{n-1}x^{n-1} + \cdots + B_1 x + B_0)x$
$Ke^{\alpha x}$	$m_1 \neq \alpha$ and $m_2 \neq \alpha$	$Ce^{\alpha x}$
	$m_1 = \alpha$ or $m_2 = \alpha$	$Cxe^{\alpha x}$
	$m_1 = \alpha$ and $m_2 = \alpha$	$Cx^2 e^{\alpha x}$
$K\cos\beta x$ or $K\sin\beta x$	$m_1 \neq i\beta$ and $m_2 \neq i\beta$	$C_1\cos\beta x + C_2\sin\beta x$
	$m_1 = i\beta$ or $m_2 = i\beta$	$(C_1\cos\beta x + C_2\sin\beta x)x$

C. Table of Laplace Transforms $\mathcal{L}\{f(t)\} = F(s)$

$f(t)$	$F(s)$
a	$\frac{a}{s}$
e^{at}	$\frac{1}{s-a}$
$\sin at$	$\frac{a}{s^2+a^2}$
$\cos at$	$\frac{s}{s^2+a^2}$
$e^{at}f(t)$	$F(s-a)$
$e^{at}\sin bt$	$\frac{b}{(s-a)^2+b^2}$
$e^{at}\cos bt$	$\frac{(s-a)}{(s-a)^2+b^2}$
$t^n,\ n=1,\ 2,\ 3,\ \ldots$	$\frac{n!}{s^{n+1}}$
$t^n e^{at}$	$\frac{n!}{(s-a)^{n+1}}$
$y(t)$	$Y(s)$
$y'(t)$	$sY(s)-y(0)$
$y''(t)$	$s^2Y(s)-sy(0)-y'(0)$