UNIVERSITI MALAYA
UNIVERSITY OF MALAYA

PEPERIKSAAN IJAZAH SARJANA MUDA KEJURUTERAAN
EXAMINATION FOR THE DEGREE OF BACHELOR OF ENGINEERING

SESI AKADEMIK 2016/2017 : SEMESTER II
ACADEMIC SESSION 2016/2017 : SEMESTER II

KIX1002: MATEMATIK KEJURUTERAAN 2
ENGINEERING MATHEMATICS 2

JUN 2017 Masa : 2 jam
JUNE 2017 Time : 2 hours

ARAHAN KEPADA CALON:
INSTRUCTIONS TO CANDIDATES:

Jawab **SEMUA** soalan
*Answer **ALL** questions*

(Kertas soalan ini mengandungi 4 soalan dalam 5 halaman yang dicetak)
(This question paper consists of 4 questions on 5 printed pages)

SOALAN 1
QUESTION 1

Diberikan fungsi $f(x, y, z)$ dan titk, P_o *(2, 0, -1)*

Given the function of $f(x, y, z)$ *and point,* P_o *(2, 0, -1)*

$$f(x, y, z) = 3x^2y^2 - 2xz^3 + ze^{2y}$$

(a) Kira vector kecerunan fungsi f pada P_o.

Compute the gradient vector of the function, f *at* P_o.

(7 markah/*marks*)

(b) Kira satah tangen dan garis normal kepada fungsi f pada P_o

Compute the tangent plane and normal lines to the function, f *at* P_o.

(3 markah/*marks*)

(c) Kira terbitan berarah fungsi, f pada P_o dalam arah Q, diberi bahawa *Q(5, 5, 5).*

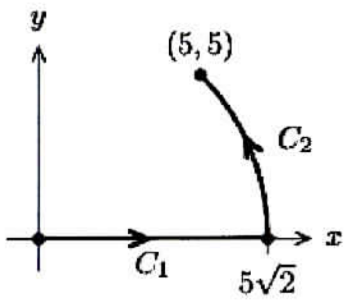
Compute the directional derivative of the function, f *at* P_o *in the direction of Q, given that Q(5, 5, 5).*

(5 markah/*marks*)

SOALAN 2
QUESTION 2

(a) Biar C menjadi laluan dari (0,0) to (5,5) yang terdiri daripada garisan lurus bermula dari (0,0) hingga $(5\sqrt{2}, 0)$ diikuti lengkungan daripada $(5\sqrt{2}, 0)$ hingga (5,5) yang merupakan sebahagian daripada bulatan dengan jejari $5\sqrt{2}$ berpusat di titik asal.

Let C be the path from (0,0) to (5,5) consisting of the straight line from (0,0) to $(5\sqrt{2}, 0)$ *followed by the arc from* $(5\sqrt{2}, 0)$ *to (5,5) that is the part of the circle radius* $5\sqrt{2}$ *centered at the origin.*



(i) Kira $\int_c F.dr$ bila $F = x\tilde{\imath} + y\tilde{\jmath}$

Compute $\int_c F.dr$ *when* $F = x\tilde{\imath} + y\tilde{\jmath}$

(5 markah/*marks*)

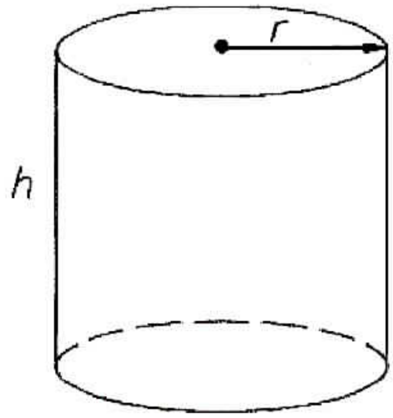
(i) Kira $\int_c F.dr$ bila $F = x\tilde{\jmath}$ (petunjuk: guna koordinat polar di mana $0 \leq t \leq 4$)

Compute $\int_c F.dr$ *when* $F = x\tilde{\jmath}$ *(hint: use polar coordinate where* $0 \leq t \leq 4$*)*

(5 markah/*marks*)

(b) Cari luas elips yang memotong satah $2x + 3y + 6z = 60$ oleh silider bulat (seperti yang ditunjukkan dalam Gambarajah 1) $x^2 = y^2 = 2x$ (Petunjuk: guna luas kamiran permukaan)

Find the area of the ellipse cut on the plane $2x + 3y + 6z = 60$ *by the circular cylinder (as shown in Figure 1)* $x^2 = y^2 = 2x$ *(Hint: use area of surface integral)*



Silinder bulat dengan r=1 berpusat di (1,0). Luas satu bulatan ialah π

Circular cylinder with r=1 with centered at (1,0). Area of a unit circle is π

Gambarajah 1
Figure 1

(5 markah/*marks*)

SOALAN 3
QUESTION 3

Sesaran longitud $u(x,t)$ bagi suatu batang kenyal bergetar dimodelkan oleh persamaan gelombang

$$\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$$

Jika batang tersebut diikat pada satu hujung dan bebas pada hujung yang lain, syarat-syarat sempadan diberi sebagai $u(0,t) = 0$ dan $u_x(L,t) = 0$.

Jika sesaran awal adalah $u(x,0) = f(x)$ dan halaju awal adalah sifar, carikan sesaran $u(x,t)$ dengan

The longitudinal displacement $u(x,t)$ of a vibrating elastic bar is modeled by the wave equation

$$\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$$

If the bar is fastened at one end and free at the other, the boundary conditions are given by $u(0,t) = 0$ and $u_x(L,t) = 0$.

If the initial displacement is $u(x,0) = f(x)$ and initial velocity is zero, find the displacement $u(x,t)$ by

(a) memisahkan pembolehubah-pembolehubah untuk mendapatkan dua ODE.

separating variables to obtain two ODEs.

(5 markah/*marks*)

(b) mencari nilai eigen dan fungsi eigen masalah nilai sempadan ini.

finding the eigenvalues and eigenfunctions of this boundary value problem.

(6 markah/*marks*)

(c) mendapatkan penyelesaian lengkap masalah nilai sempadan ini dengan menggunakan siri Fourier.

obtaining the complete solution of this boundary value problem using Fourier series.

(4 markah/*marks*)

SOALAN 4
QUESTION 4

(a) Satu keping logam sekenaan dengan segiempat tepat di satah *xy* di mana bucu-bucunya adalah (0, 0), (1, 0), (1, 1) dan (0,1). Kedua-dua muka kepingan itu ditebat, dan kepingan adalah nipis di mana pengaliran haba boleh dianggap sebagai dua dimensi. Tepi-tepi kepingan yang selari dengan paksi-x adalah ditebat, dan tepi sebelah kiri mengekalkan suhu malar 0. Jika taburan suhu $u(1, y) = f(y)$ dikekalkan sepanjang tepi sebelah kanan, bangunkan masalah nilai sempadan bagi suhu keadaan mantap $u(x, y)$ plat tersebut.

A sheet of metal coincides with the square in the xy-plane whose vertices (0, 0), (1, 0), (1, 1) and (0, 1). The two faces of the sheet are insulated, and the sheet is so thin that heat flow in it can be regarded as two-dimensional. The edges parallel to the x-axis are insulated, and the left-hand edge is maintained at the constant temperature 0. If the temperature distribution $u(1, y) = f(y)$ is maintained along the right-hand edge, Set up the boundary-value problem for the steady-state temperature distribution $u(x, y)$ of the plate.

(6 markah/*marks*)

(b) Pertimbangkan masalah berikut:

Consider the following problem

$$\frac{\partial u}{\partial t} - \frac{\partial^2}{\partial x^2} = e^{-t}\sin 3x \qquad 0 < x < \pi, \qquad t > 0$$

$$u(0,t) = 0 \qquad u(\pi,t) = 1 \qquad t \geq 0$$

$$u(x,0) = f(x) \qquad 0 < x < \pi$$

Penyelesaian u adalah dalam bentuk $u(x,t) = v(x,t) + \Psi(x)$. Carikan fungsi $\Psi(x)$ dan masalah nilai sempadan $v(x,t)$ yang baru.

The solution u is in the form $u(x,t) = v(x,t) + \Psi(x)$. Find the function $\Psi(x)$ and the new boundary –value problem $v(x,t)$.

(9 markah/*marks*)

TAMAT / *END*