UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020

COURSE NAME	:	CALCULUS FOR ENGINEER
COURSE CODE	:	BDA14403
PROGRAMME	:	4 BDD
EXAMINATION DATE	:	DECEMBER 2019/JANUARY 2020
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FIVE(5)** QUESTIONS **ONLY**.

THIS QUESTION PAPER CONSISTS OF **THREE (3)** PAGES

Q1 (a) Sketch the domain of the function $f(x,y) = \sqrt{(x^2+y^2-4)(-x^2-y^2+25)}$ and find the range of the function.

(6 marks)

(b) Sketch the contour plot of function $f(x,y) = 4 - \sqrt{(x-1)^2+(y+5)^2}$ using three level curve. Then, sketch the surface of $f(x,y)$.

(10 marks)

(c) Evaluate the $\lim_{(x,y)\to 0,0} \frac{xy^4}{x^2+y^8}$ if it exist. If not, show that the limit does not exist.

(4 marks)

Q2 (a) Determine if the function $f(x,y) = \frac{4x^2-2y^2}{\sqrt{2x^2-y^2}}$ is continous at 0,0.

(6 marks)

(b) Given $4x^2z^4 - 5yz^3 + xy^2 - 3z^2 = x$ where $z = f(x,y)$, find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$

(4 marks)

(c) Find the slopes of the surface, $f(x,y) = -4x^2 - y^2 + 6$ at the point (1,1,1) in x-direction and y-direction. Illustrate the surface in the first octant and its' slope.

(10 marks)

Q3 (a) Use the total differential for the function $f(x,y) = \ln(x-3y)$ and find the approximate value using total differential and also the exact value for $f(6.9,2.06)$

(10 marks)

(b) Find the local extreme value of $f(x,y) = 2x^2 - y^3 - 2xy$

(10 marks)

Q4 (a) By using double integrals, find the surface area of the portion of sphere $z^2 + x^2 + y^2 = 4$ that lies between plane z=1 and xy-plane.

(10 marks)

(b) By using cylindrical and spherical coordinates, find the volume of solid bounded above sphere $z^2 + x^2 + y^2 = 2z$ and below by cone $z = \sqrt{x^2 + y^2}$

(10 marks)

Q5 (a) Find the volume of the solid enclosed by planes $4x + \frac{y}{2} + 3z = 3$, x=0, y=0, z=0.

(6 marks)

(b) By changing polar coordinate, evaluate $\int_0^1 \int_{-\sqrt{1-y^2}}^0 2 - x^2 - y^2 \, dxdy$

(4 marks)

(c) Find the centroid of the solid of constant density ρ bounded by the right circular zone $z = \sqrt{x^2 + y^2}$ and plane z=4. Given that the mass of the solid is $\frac{64}{3}\pi\rho$.

(10 marks)

Q6 (a) Find the moment inertia about the origin (or z axis) for the lamina which the surface, σ is the upper half of the sphere $z^2 = -x^2 - y^2 + 16$. Given that the density function is constant.

(10 marks)

(b) Compute the flux of water through the cone $z = 4 - \sqrt{x^2 + y^2}$ that lies above plane z=0, oriented by an upward unit normal vector. The velocity vector, $\boldsymbol{v} = \boldsymbol{F}(x, y, z) = 3x\boldsymbol{i} + 3y\boldsymbol{j} + 6\boldsymbol{k}$ is measured in m/sec. [Water has the density ρ = 1 tan/m^3]

(10 marks)

-END OF QUESTION-