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Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(ONLINE)
SEMESTER II
SESSION 2019/2020

COURSE NAME	:	CALCULUS FOR ENGINEER
COURSE CODE	:	BDA 14403
PROGRAMME CODE	:	BDD
EXAMINATION DATE	:	JULY 2020
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWERS **FIVE** QUESTIONS **ONLY**

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

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Q1 (a) Let $f(x, y, z) = 8x^5 - x^3 2y^2 + y^2 z^3$. Find f_x, f_y and f_z and evaluate them at (3,2,1)
(6 marks)

(b) Determine the $\frac{\partial f}{\partial s}$, where $f(x,y,z) = \sin(x^2y^3 + 2z^3)$, $x = sr^2$, $y = r + 2s^2$ and $z = r^3$
(6 marks)

(c) Evaluate the rate of change of the volume of a right circular cone with radius 2 cm and height 13 cm, if the increasing rate if base radius is 1.3 cm/s meanwhile the decreasing rate of height is 8.0 cm/s.
(8 marks)

Q2 (a) By using double integral find the area of regions enclosed by $y = x - 1$, $y = x - 3$, $y = 2$ and $y = -x - 3$
(5 marks)

(b) Find the surface area of the portion of paraboloid $z = 11 - x^2 - y^2$ between plane $z = 2$ and $z = 7$ in the first quadrant.
(5 marks)

(c) Sketch the solid enclosed outside by hemisphere $z = \sqrt{x^2 + y^2 + 16}$, below by xy-plane and inside by cylinder $x^2 + y^2 = 4$. Find the moment of intertia about z axis for that solid. Given the density function is $\rho(x, y, z) = z$.
(5 marks)

(d) Given a lamina that occupies the region bounded by $y = \sqrt{x}$ and $y = x^2$. Find the moment of mass about y-axis. The density function $\delta(x, y) = \frac{1}{\sqrt{x}} + \frac{y}{x}$.
(5 marks)

Q3 (a) Evaluate $\int_C (3y + z)dx + yzdy + (z + 2x)dz$ where C is line segment from the point (0, 2, 2) to (1, 3, 1).
(8 marks)

(b) Verify the Green's Theorem for the line integral $\oint_C xy^2 dx + \frac{y}{\sqrt{x^2 + y^2}} dy$ if C is the closed triangular path from origin to (1, 0), (1, 3) and back to the origin in that order.
(12 marks)

Q4 (a) Given the force field $\mathbf{F}(x,y,z) = 5y^3\,\mathbf{i} + 2xy\,\mathbf{j} + yz\,\mathbf{k}$ and oriented outward Suppose that σ is the surface of the plane $x + y + z = 1$.

(i) Sketch the graph of the surface σ

(ii) State the suitable theorem to express surface integral as line integral.

(iii) Then, evaluate the surface integral in part (ii).

(10 marks)

(b) Use Gauss's Theorem to evaluate $\iint_{\sigma} F.nds$ where $\mathbf{F}(x, y, z)=xy^2\mathbf{i}+yz^3\mathbf{j}+x^2z\mathbf{k}$ and σ is the surface bounded by hemisphere $x^2+y^2+z^2=4$ and below by cone $z=\sqrt{x^2+y^2}$ in the first quadrant.

(10 marks)

Q5 (a) Find domain and range of $f(x,y)=\frac{\sqrt{x+y-1}}{x-1}$. Then, sketch the domain.

(5 marks)

(b) Find the limit of the multivariable function or show that the limit does not exist.

$$\lim_{(x,y)\to(0,0)} \frac{x^4-4y^2}{x^2+2y^2}$$

(5 marks)

(c) Given the force field $\mathbf{F}\ (x,y,z) = \left(z^3\cos x + 2xy^2\right)\mathbf{i} + \left(2x^2y-2\right)\mathbf{j} + \left(3z^2\sin x - 4\right)\mathbf{k}$

(i) Prove that **F** is conservative

(ii) By using formula $\nabla\emptyset = \mathbf{F}$, find a scalar potential $\emptyset$ for **F**.

(iii) Hence, compute the amount of work done against the force field F in moving an object from the point (0, -1, 1) to ($\frac{1}{2}\pi$, 2, 2).

(10 marks)

Q6 (a) A box with square base and height t is measured with the possible error of 0.03 cm. Calculate the maximum possible error for its volume if the length is 11 cm and the height is 4 cm.

(5 marks)

(b) Given the function $f(x,y) = \ln(x^3+6y^3)$, evaluate the approximate value and the exact value for $f(9.5, 4.5)$.

(5 marks)

(c) Find the mass of lamina enclosed in polar coordinate R , where R common to circle $r = 3\sin\theta$ and the cardioid $r = 1+\sin\theta$, in the first quadrant. Sketch the region R. Given density function $\delta(\theta, r) = \frac{1}{r}$

(10 marks)

-END OF QUESTION-

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