National University of Computer & Emerging Sciences **MT 2008: Multi-Variable Calculus** **Section: A,B (Fall 2021)**			**A06** [Marks: 50]
Instructor: Dr. Farah Jabeen Awan **TA:** Huda Shoaib (i190828@nu.edu.pk)	**Lectures:**	**Launch:** 06-12-21	**Submit Date:** **10-12-21**

1. **CLO-03:** **Apply** change of variables theorem, and calculate iterated integrals in two and three dimensions.

Submit on GCR by Submit Date – Late Assignments not accepted		
Submitted by:	**Roll #:**	**Section:**
Check here: ☐	I agree that there is ZERO Tolerance Policy for plagiarism and cheating in all assessments. First plagiarism case gets zero. Subsequent plagiarism cases get ZERO in all assignments. A gross violation may be reported to the Department Discipline Committee (DDC).	

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1. This is a graded assignment; students are advised to revise all concepts before attempting.
2. Submit a **single PDF** in **GCR** by the submit date mentioned in GCR; SLATE/email not accepted.
3. Any pics or images used in the PDF must be scanned with **ClearScanner** app.
4. Do not use CamScanner or MS Lens as it deteriorates the image quality and the writing at the back of the page is also visible.
5. Submitting individual pictures or attaching multiple files not accepted.
6. Late submission not accepted.
7. Be sure to fill and checkmark the agreement in the submission box. If not filled or checked, submission not accepted.

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1. Collaboration is permitted with limitations as defined below.
2. All collaboration to be strictly done on GCR -> Assignment Collaboration Channel. May not post/discuss on any other forum.
3. Permitted forms of collaboration include (but not limited to) asking questions, answering questions, explaining intent of the question, explaining concepts, highlighting methods, discussion of all types, etc.
4. Forbidden forms of collaboration include (but not limited to) uploading solutions or partial solutions, letting know the partial or final answers, etc.
   This Channel will be monitored continuously. Anyone indulging in forbidden activities will be removed from the channel, their posts deleted, and zero marks assigned in the assignment.

Assignment Problem:

Question 1:

Find the gradient of the following scalar fields:

(a) $V = e^{-z} \sin 2x \cosh y$

(b) $U = \rho^2 z \cos 2\phi$

(c) $W = 10r \sin^2 \theta \cos \phi$

Question 2:

Determine the divergence of the following vector fields and evaluate them at the specified points.

(a) $\mathbf{A} = yz\mathbf{a}_x + 4xy\mathbf{a}_y + y\mathbf{a}_z$ at $(1, -2, 3)$

(b) $\mathbf{B} = \rho z \sin \phi \, \mathbf{a}_\rho + 3\rho z^2 \cos \phi \, \mathbf{a}_\phi$ at $(5, \pi/2, 1)$

(c) $\mathbf{C} = 2r \cos \theta \cos \phi \, \mathbf{a}_r + r^{1/2}\mathbf{a}_\phi$ at $(1, \pi/6, \pi/3)$

Question 3:

Determine the curl of the vector fields

(a) $\mathbf{P} = x^2yz \, \mathbf{a}_x + xz \, \mathbf{a}_z$

(b) $\mathbf{Q} = \rho \sin \phi \, \mathbf{a}_\rho + \rho^2 z \, \mathbf{a}_\phi + z \cos \phi \, \mathbf{a}_z$

(c) $\mathbf{T} = \dfrac{1}{r^2} \cos \theta \, \mathbf{a}_r + r \sin \theta \cos \phi \, \mathbf{a}_\theta + \cos \theta \, \mathbf{a}_\phi$

Question 4:

Compute

$\int_C ye^x \, ds$ where C is the line segment from $(1, 2)$ to $(4, 7)$

$\int_C z \cos(xy) \, ds$ along the line segment from $(1, 0, 1)$ to $(2, 2, 3)$.

Question 5:

In each part, evaluate the integral

$$\int_C (3x + 2y) \, dx + (2x - y) \, dy$$

along the stated curve.

a) The parabolic arc $y = x^2$ from $(0, 0)$ to $(1, 1)$.

b) The curve $y = \sin(\pi x/2)$ from $(0, 0)$ to $(1, 1)$.

Question 6:

Find the work done by the force field

$$\mathbf{F}(x, y) = \frac{1}{x^2 + y^2}\mathbf{i} + \frac{4}{x^2 + y^2}\mathbf{j}$$

on a particle that moves along the curve C shown in the figure.

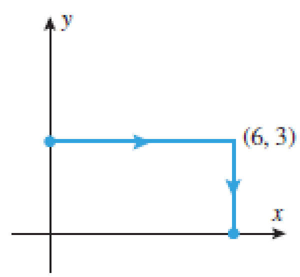
Question 7:

Evaluate $\int_C x^4\,dx + xy\,dy$, where C is the triangular curve consisting of the line segments from $(0, 0)$ to $(1, 0)$, from $(1, 0)$ to $(0, 1)$, and from $(0, 1)$ to $(0, 0)$.

Question 8:

Evaluate $\oint_C (3y - e^{\sin x})\,dx + \left(7x + \sqrt{y^4 + 1}\right) dy$, where C is the circl

$$x^2 + y^2 = 9.$$



Question 9:

Compute the surface integral $\iint_S x^2\,dS$, where S is the unit sphere

$$x^2 + y^2 + z^2 = 1.$$

Question 10:

Compute the flux of $\mathbf{F} = \langle x, y, z^4 \rangle$ across the cone $z = \sqrt{x^2 + y^2}$, $0 \le z \le 1$, in the downward direction.