dNational University of Sciences & Technology
School of Electrical Engineering and Computer Science
Department of Basic Sciences

MATH-243: Vector Calculus (3+0): BEE-2k20-ABC Fall 2021

Assignment # 2	
CLO-2: Solve line- and surface integrals directly or by using known integrals theorems.	
Maximum Marks: 10	Instructor: Dr. Naila Amir
Announcement Date: 26th November 2021	Due Date: 26th November 2021

Instructions:

- Understanding the question is part of the assignment and copying is not allowed.
- Express your answer in the most simplified form. Direct calculations using calculator are not allowed, you need to show the detail of your work to get the maximum marks.
- This is a group assignment. Each group having **5 members** only. All group members are required to contribute equally. Each member of group will attempt one question and afterwards will discuss his/her attempt with other group members so that all group members have an idea of the solution of whole assignment. Name of student should be mentioned in the following table against the question attempted by him/her.
- Assignment must be neatly handwritten on A4 papers and properly bound. Do not use files or folders for submission of assignment.
- There are two pages in this assignment, including this cover page. These three pages should be part of every assignment.
- This is a class assignment and needs to be submitted at the end of class. Assignment is not acceptable after deadline.

Tasks: Attempt all questions.

Sr. No.	Students Name	CMS Id.	Question Attempted	Marks Obtained
1			Q # 1	
2			Q # 2	
3			Q # 3	
4			Q # 4	
5			Q # 5	

Total Marks	**Marks Obtained**	**Weight in 10**
50 Marks		

Q - 1: [10 marks]

Determine the moments of inertia about the coordinate axes of a thin wire lying along the curve:

$$\mathbf{r}(t) = t\,\mathbf{i} + \frac{2\sqrt{2}}{3}t^{3/2}\,\mathbf{j} + \frac{t^2}{2}\,\mathbf{k};\ \ 0 \le t \le 2,$$

if the density function is $\rho(x, y, z) = \frac{1}{x+1}$.

Q - 2: [10 marks]

Calculate the surface area of the surface $4x^2 + 4y^2 + z^2 - 6z + 5 = 0$ oriented inward.

Q - 3: [10 marks]

Determine an equation for the plane tangent to the circular cylinder:

$$x^2 + (y-3)^2 = 9; \qquad 0 \le z \le 5,$$

at the point $\left(\frac{3\sqrt{3}}{2}, \frac{9}{2}, 0\right)$.

(**Hint:** Parametrize the surface first)

Q - 4: [2 + 4 + 4 = 10 marks]

1. For constants a, b, c, and e consider the vector field:

$$\mathbf{F} = \langle ax + by + 5z, x + cz, 3y + ex \rangle .$$

   (a) Suppose that the flux of $\mathbf{F}$ through any closed surface is 0. What does this tell us about the value of the constants a, b, c, and e?

   (b) Suppose instead that the line integral of $\mathbf{F}$ around any closed curve is 0. What does this tell us about the values of the constants a, b, c, and e?

2. Let S be the boundary surface of the solid given by $0 \le z \le \sqrt{4 - y^2}$ and $0 \le x \le \pi/2$. Determine the outward unit normal vector field on each of the four sides of S.

Q - 5: [10 marks]

Use the divergence theorem to calculate the outward flux of the field:

$$\mathbf{F}(x, y, z) = \langle z^2 x, y^3/3 + \tan z\,, x^2 z + y^2 \rangle,$$

through the surface S where S is surface $z = \sqrt{1 - x^2 - y^2}; z > 0$ oriented upward.