National University of Computer and Emerging Sciences

Lahore Campus

Multivariable Calculus (MT1008)

Sessional-II Exam

Total Time (Hrs.): 1

Total Marks: 55

Total Questions: 3

Date: April 3rd 2024

Course Instructor(s)

Dr. Mazhar Hussain (Moderator)

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Ms. Hina Dilawar

Ms. Sara Asghar

[redacted] Roll No

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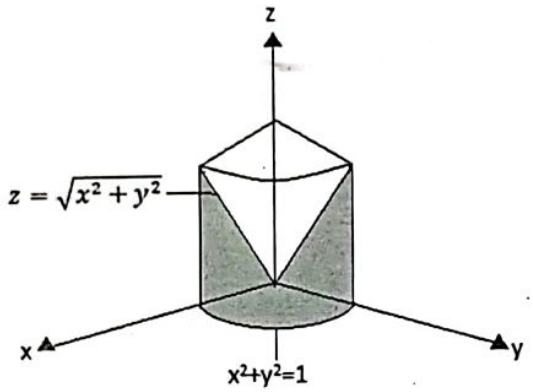
Attempt all the questions.

1. **Sketch the region of integration and change the Cartesian integral into an equivalent polar integral. Then evaluate the polar integral.**

$$\int_1^2 \int_0^{\sqrt{2x-x^2}} \frac{1}{(x^2+y^2)^2}\, dydx$$

[10]

2. **Write an iterated triple integral for the integral of $f(x,y,z) = 6 + 4y$ over the region in the first octant bounded by the cone $z = \sqrt{x^2+y^2}$, the cylinder $x^2 + y^2 = 1$, and the coordinate planes in (a) Rectangular coordinates, (b) Cylindrical coordinates, and (c) Spherical coordinates. Then (d) find the integral of f by evaluating one of the triple integrals.**



[20]

3.

a) Define a vector field $\vec{F}$, flow integral, circulation around a curve C and flux of a vector field $\vec{F}$ across C.

b) Define a conservative field and write its equivalent statements .

c) Show that $F = (e^x cosy + yz)\hat{\imath} + (xz - e^x siny)\hat{\jmath} + (xy + z)\hat{k}$ is conservative over its natural domain and find a potential function $f(x, y, z)$ for it.

d) Evaluate the line integral for the vector field $\vec{F} = x^2 i - y\, j$ along the curve $x = y^2$ from $(4, 2)$ to $(1, -1)$.

[4+6+8+7]