

END SEMESTER EXAM SPRING

NUTECH



Subject: Calculus II
Department: Civil Engineering Technology
Total Marks: 50

Faculty Name: Dr. Abdul Wahb
Total Time: 03 hrs -
Date: 1st July, 2019

Instructions:

Calculators are allowed. However, programmable calculators are NOT allowed.

- Q.1 Suppose that $x = 2u + v$, $y = u/v$ and $z = e^{xy}$. Use an appropriate form of the chain rule to find $\partial z/\partial u$ and $\partial z/\partial v$. [CLO 3, PLO 1, Marks 7]
- Q.2 Locate all the relative extrema and saddle points of $f(x, y) = 3x^2 - 2xy + y^2 - 8y$. [CLO 3, PLO 1, Marks 6].
- Q.3 Suppose that the temperature at a point (x, y) on a metal plate is $T(x, y) = 4x^2 - 4xy + y^2$. An ant, walking on the plate, traverses a circle of radius 5 centered at the origin. What are the highest and lowest temperatures encountered by the ant? [CLO 2, PLO 1, Marks 5].
- Q.4 The rooftop of a building is designed in the form of an inclined plane through the point $(4, 3, 0)$ and parallel to the beams represented by the vectors $\mathbf{i} + \mathbf{k}$ and $2\mathbf{j} - \mathbf{k}$. Find the equation of the rooftop. [CLO 1, PLO 1, Marks 7].
- Q.5 Find the triple integral of $f(x, y, z) = z$ over the slice of the hemisphere shown in Figure 1 using the triangular "shadow" in the xy -plane. [CLO 4, PLO 1, Marks 7]

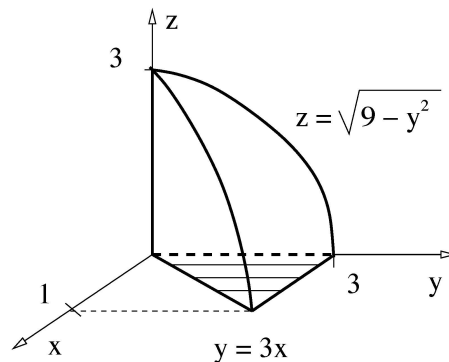


Figure 1: Hemisphere and the shadow region.

- Q.6 Express the integral $I = \int_0^2 \int_0^y x dx dy$ as a polar integral. [CLO 4, PLO 1, Marks 6]
- Q.7 Evaluate the integral $\int_0^3 \int_{x^2}^9 x^3 e^{y^3} dy dx$ by first reversing the order of integration. [CLO 4, PLO 1, Marks 6]
- Q.8 Suppose that a semicircular wire has the equation $y = \sqrt{25 - x^2}$ and that its mass density is $\delta(x, y) = 15 - y$. Find the mass of the wire using line integrals over the curve C representing the wire and the standard parametrization of the semi-circle, i.e., $x(\theta) = r \cos \theta$ and $y(\theta) = r \sin \theta$ with parameter θ . [CLO 4, PLO 1, Marks 6]

Signature of Faculty: _____

Approved by Respective HoD: _____