Concordia University

ENGR 233/P: Applied Advanced Calculus

Term Test 2

Monday, 15 Nov 2021

Duration: 1 hr

Maximum Marks: 50

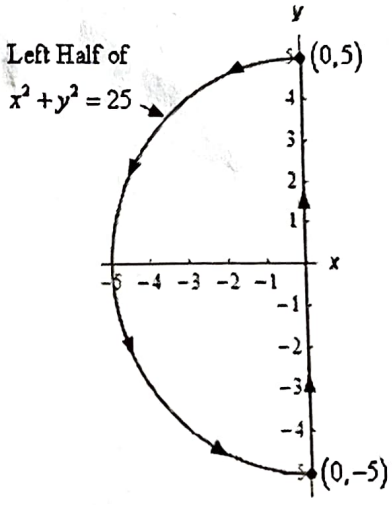
Note: All questions are compulsory and carry equal marks.

Q1. Test whether the force field $\vec{F}(x,y,z) = (e^x \cos y + yz)\hat{\imath} + (zx - e^x \sin y)\hat{\jmath} + (xy + z)\hat{k}$ is conservative. If so, find its potential function.

Q2. Find the center of mass of the lamina having a variable density $\rho(x,y) = x + y$ occupying the region R, which is bounded by the parabola $y = x^2$ and the portion of the $x - axis$ from 0 to 2.

Q3. Compute $\oint_C \vec{F} \cdot d\vec{r}$ where $\vec{F} = \langle e^x - x^2y, e^y + xy^2 \rangle$ and C is the curve consisting of the line segments from (0,0) to (0,1) to (1,1) to (1,0) and back to (0,0).

Q4. Use Green's theorem to evaluate the line integral $\int_C yx^2dx - x^2dy$ along the curve C as shown below.



Q5. Find the mass of the surface of the paraboloid $z = 4x^2 + 4y^2$ that lies within the cylinder $x^2 + y^2 = 1$, if the density at any point on that surface is directly proportional to its distance from the x-y plane.