UNIVERSITY OF SWAZILAND

FACULTY OF SCIENCE

Department of Electronic and Electrical Engineering

July 2017

SUPPLEMENTARY EXAMINATION

Title of the Paper:

Electromagnetic Fields I

Course Code: **EE341**

Time Allowed: **Three Hours.**

Instructions:

1. Answer all questions, no choice.
2. The answer must be written in the space provided in the question book. Use the answer book as a scratch pad. Consider valid the only answer under the assigned the space.
3. This paper has 6 pages, including this page.

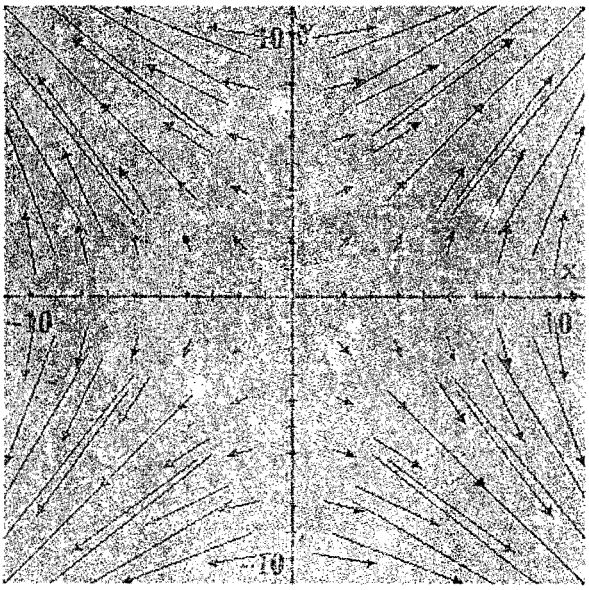
DO NOT OPEN THE PAPER
UNTIL PERMISSION HAS BEEN GIVEN BY THE INVIGILATOR.

Q1 20 pts: Given a scalar function $f(x,y,z) = x^2 \cdot y + z$, find (i) $\int f \cdot d\vec{l}$ and (ii) $\int f \cdot dl$ along straight lines from (0,0,2) to (1,0,2) then to (1,1,2).

Q3, 20 pts: Given a field patterns shown in Fig. Q3-1, by inspection determine and mark 2 small areas which has curl≠0 or div≠0 or both ≠0 of the pattern. Then analytically calculate the non-zero curl or divergence to prove. Take closed surface anywhere in the pat- tern but must be specified. The fields are in xy-plane only, no contribution in z- axis top and bottom. The closed surface may be cubically or circinately bounded.

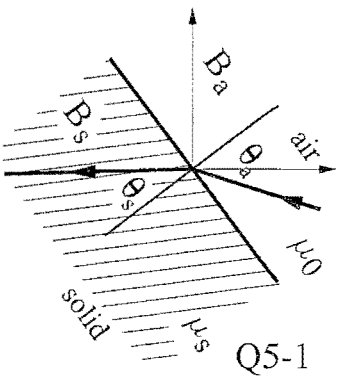
$$\mathbf{A} = \hat{\mathbf{x}}\, xy^2 + \hat{\mathbf{y}}\, x^2 y,$$

for $-10 \le x, y \le 10$



Q4, 20 pts: A long parallel plate cable has a width w and a separation d with insulation material ε/μ_o. Consider no end fringing effects. The cable is energized by a potential 100 V and terminated with a resistor 100 Ohm. (i). Find the electric and magnetic field intensity in the cable per meter. (ii). Graph the fields' directions in the cable

Q5, 20 pts: (i) A space divided into two parts, one part is in the air and the other in a solid with material ε_s / μ_0. The boundary plane is through the Cartesian origin and its unit normal vector is (0.8, 0.6). If an E-field, (4. 3) is coming from the air through the boundary into the solid. Find the E-field in the solid. (ii) Construct the dual question in the magnetic field and answer likewise.



Q5-1