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UNIVERSITY EXAMINATIONS 2023/2024

FIRST YEAR, SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR
OF SCIENCE IN COMPUTER TECHNOLOGY AND BACHELOR OF SCIENCE IN
MATHEMATICS

SPS 3111: GENERAL PHYSICS

DATE: APRIL 2024

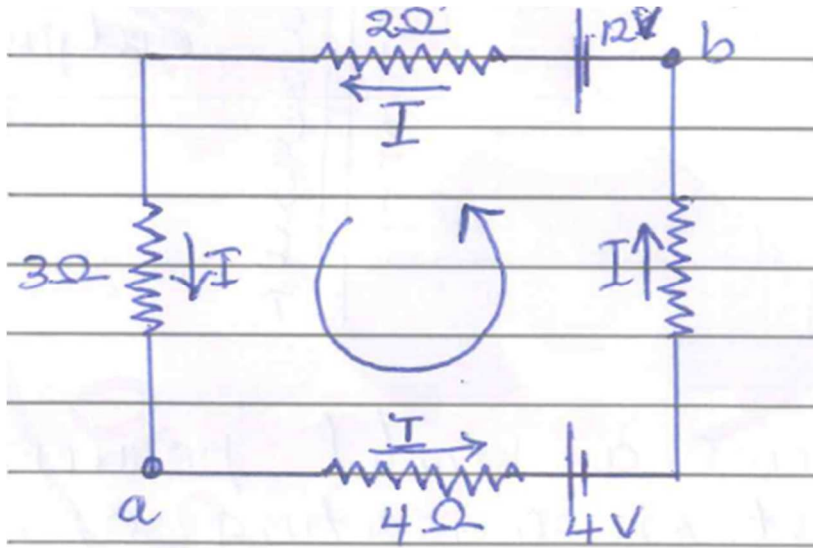
TIME: 2 HOURS

INSTRUCTIONS: Answer Question ONE and any other TWO questions.

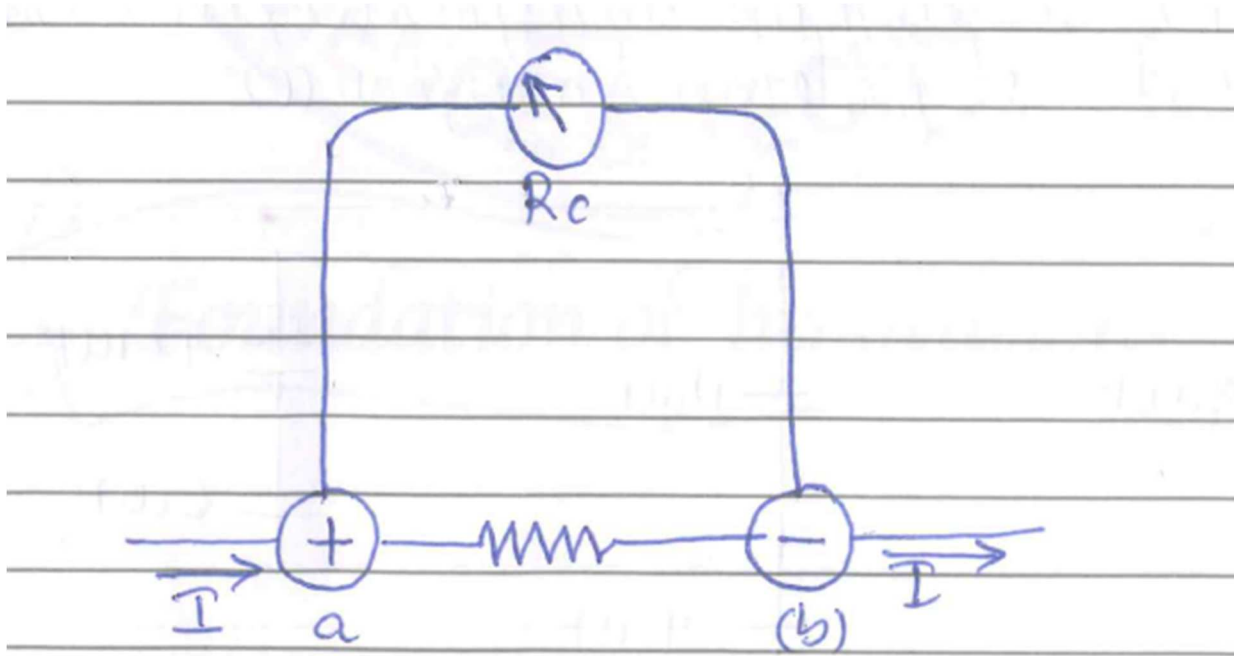
QUESTION ONE (30 MARKS)

- a) i. State Kerchoff's laws (4 Marks)
- ii. The circuit shown below contains two batteries each with an emf and an internal resistance and two resistors.
- Find.
- I. The current in the circuit (2 Marks)
- II. The potential difference V_{ab} (2 Marks)
- III. The power output of the emf of each battery (3 Marks)



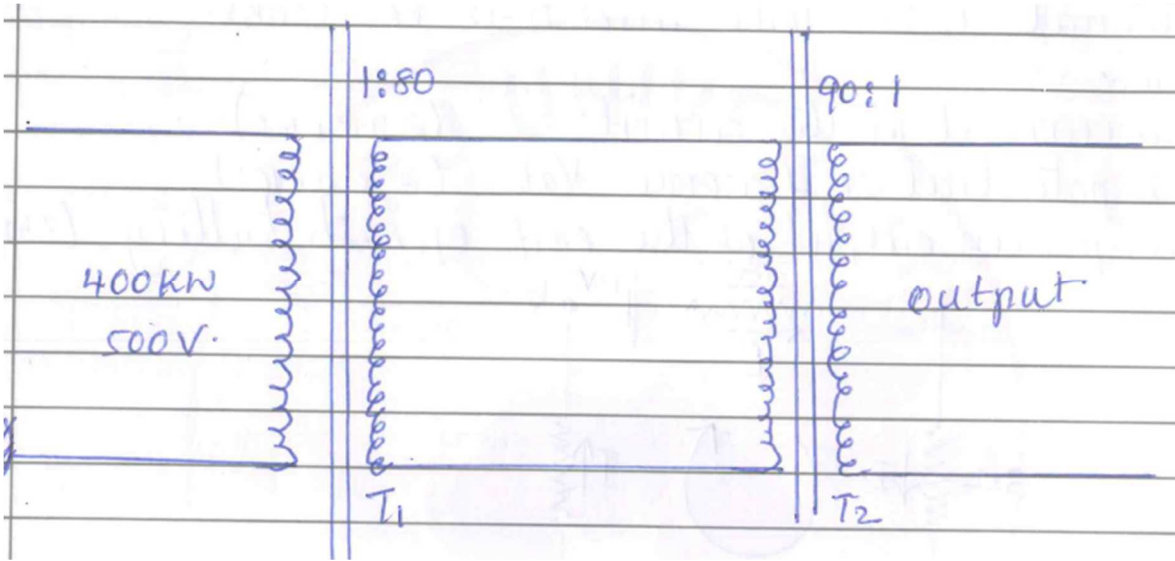


b)

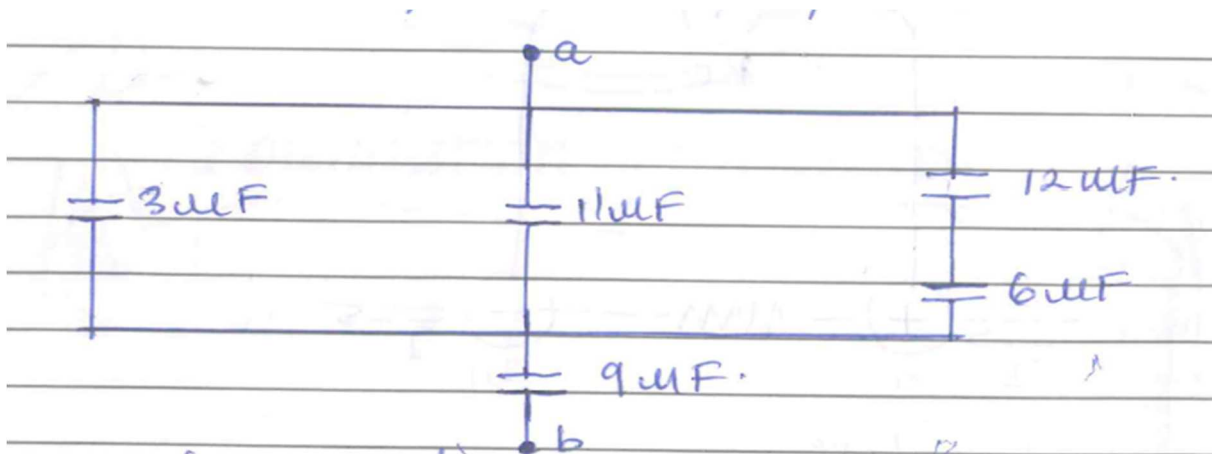


The ammeter shown above handle a maximum current $I_{\alpha} = 50.0 \times 10^{-3} A$. The coil resistance is $R_c = 20.0 \Omega$ and the meter shows full scale deflection when the current through the coil is $I_{fs} = 1.0 \times 10^{-3} A$. Find the equivalent resistance R_{eq} . (3 Marks)

- c) Find the equivalent capacitance of the five capacitor network shown in the figure below. (4 Marks)



- d) The fig below shows a model power transmission system consisting of a power generator a step up transformer, transmission cables and a stepdown transformer.

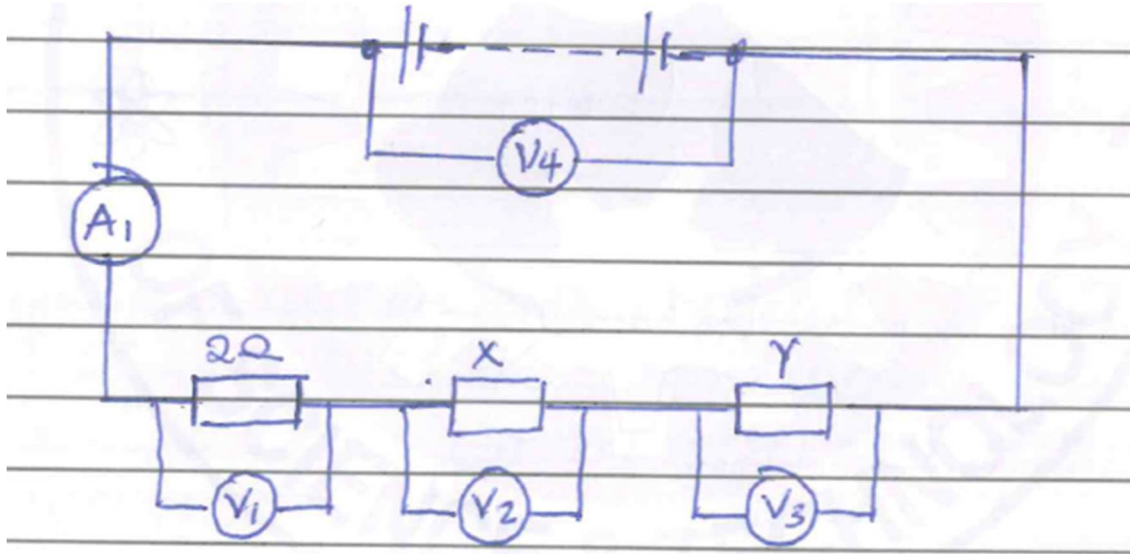


The generator produces 400 Kw, at 500 V₁ which is fed into transformer T₁, whose ratio of primary to secondary turns is 1:80 the power to then transmitted through cables whose total resistance is 200Ω to a stepdown transformer T₂. Given that the efficiency of T₁ is 100% and that of T₂ is 95%. Calculate

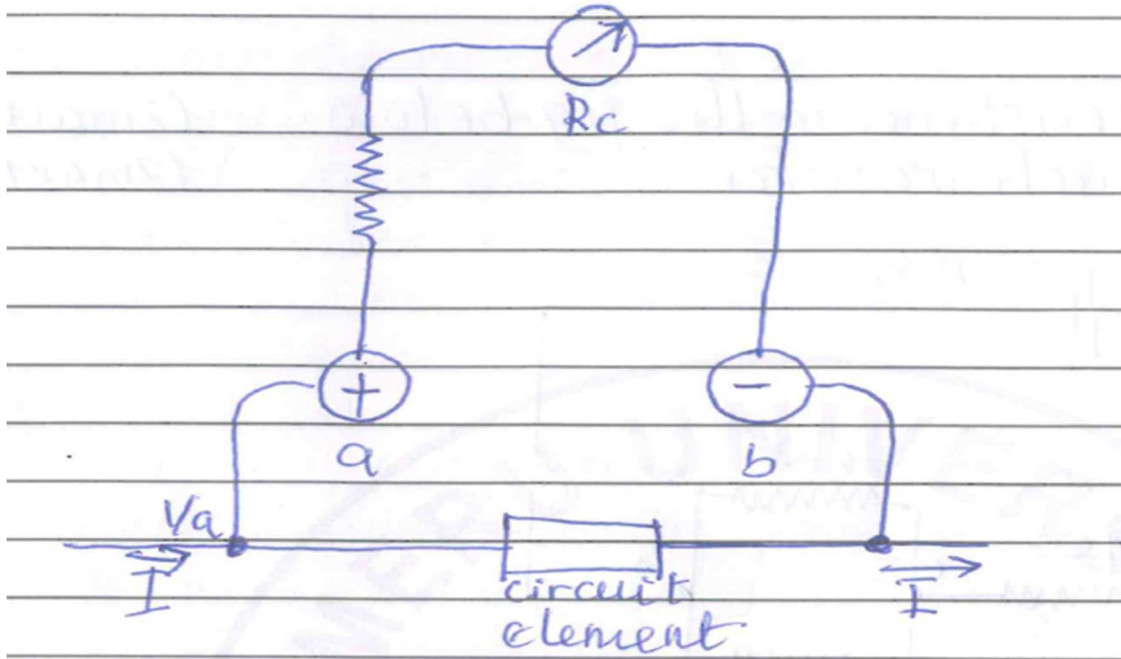
- a) Current through primary of T_1 (3 Marks)
- b) Voltage across secondary of T_2 (3 Marks)
- c) Voltage across the primary of T_2 (3 Marks)
- d) Maximum power output of T_2 (3 Marks)

QUESTION TWO (20 MARKS)

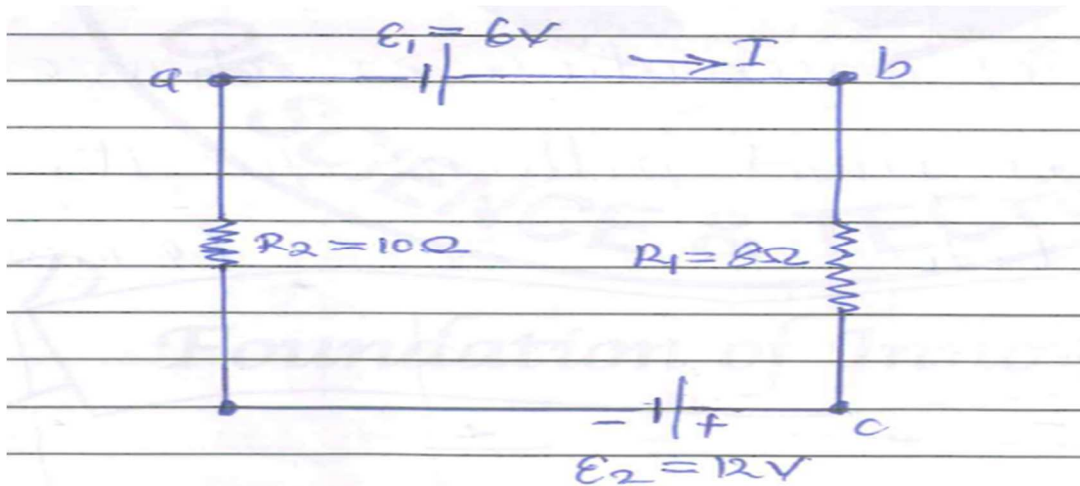
- a) i. Give two functions of a dielectric (2 Marks)
- ii. The fig below shows a parallel circuit containing three identical resistors and a 3-volt power supply.
 - I. What is the p.d across each resistor? (2 Marks)
 - II. If a current of 0.5 A flows through one resistor, what current flows through the power supply.



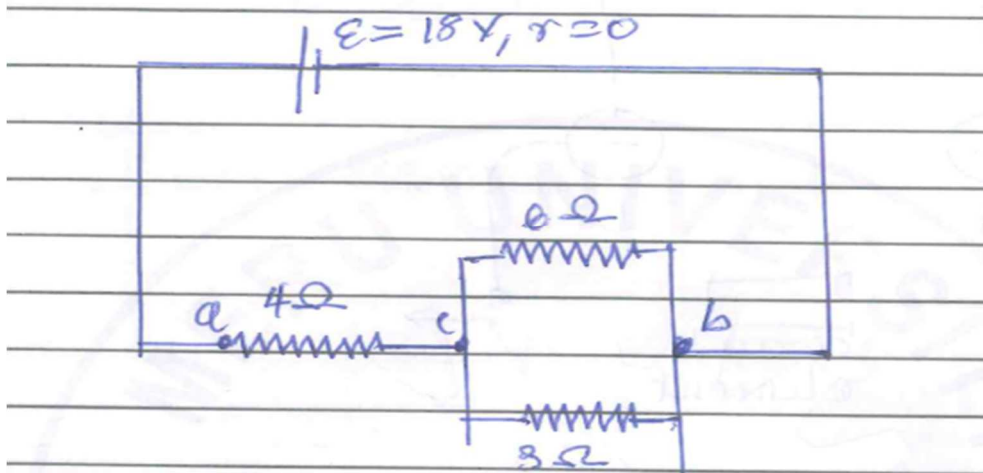
- b) i. Define a potentiometer (2 Marks)
- ii. What series resistance is required to make the 1.0 mA, 20Ω meter described below into a voltmeter with a range of 0 to 10V. (3 Marks)



c) a single loop circuit contains two external resistors and two seats of *emf* as shown.

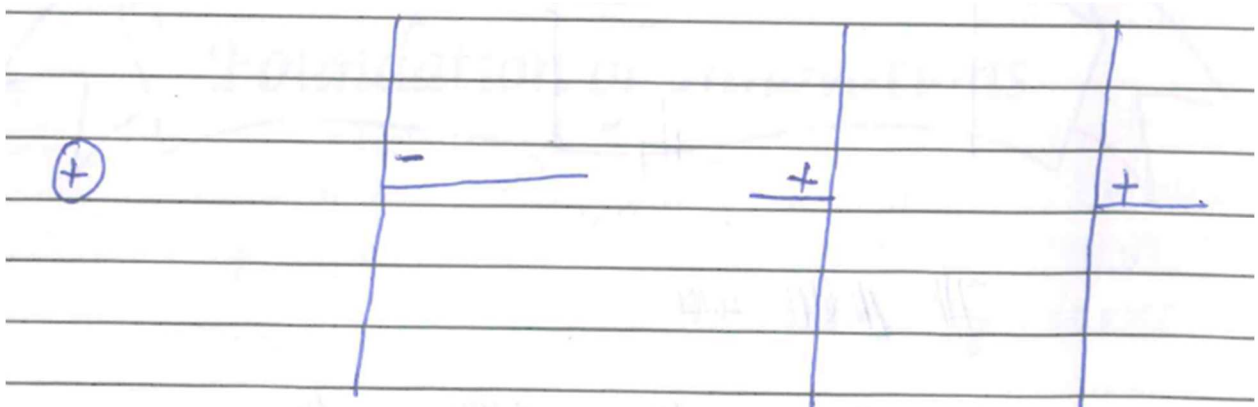


- i. find the current in the circuit. (2 Marks)
 - ii. what is the power lost in each resistor. (2 Marks)
- d) find
- i. Equivalent resistance in the fig below. (2 Marks)
 - ii. Current in each resistor. (2 Marks)



QUESTION THREE (20 MARKS)

- a) i. State the principle of conservation of charge. (2 Marks)
 ii. Draw the electric field patterns for the systems shown below. (4 Marks)

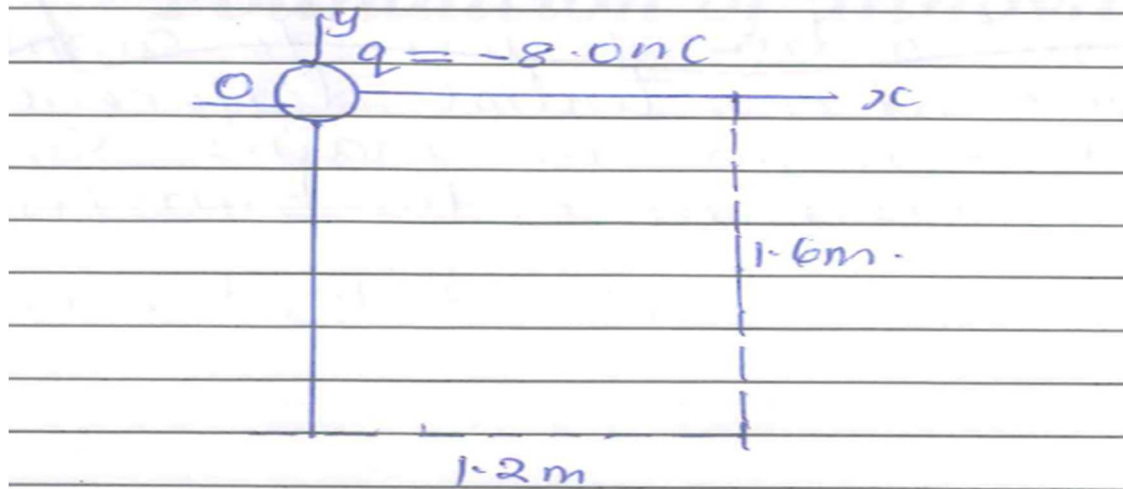


(a)

(b)

- b) two point charges $q_1 = 25nC$ and $q_2 = -75nC$ are separated by a distance $r = 3.0\text{ cm}$. Find the magnitude and direct of the electric force.
- i. That q_1 exerts on q_2 (2 Marks)
 ii. That q_2 exerts on q_1 (2 Marks)
- c) What is the magnitude of the electric field \vec{E} at a field point 2.0m from a point charge $q = 4.0nC$. (3 Marks)

- d) i. Define the term electric field \vec{E} at a point. (2 Marks)
- ii. A point charge $q = 8.0 \text{ Nc}$ is located at the origin find the electric field vector at the point $X = 12\text{m}, y = -1.6\text{m}$ (5 Marks)



QUESTION FOUR (20 MARKS)

- a) i. Give two factors that affect magnitude of induced e.m.f. (4 Marks)
- ii. State Lenz's law (2 Marks)
- b) i. Define the term material induction (2 Marks)
- ii. Draw the circuit symbol of a step down transformer. (2 Marks)
- c) i. Define the term turn ratio (2 Marks)
- ii. Give and explain three energy losses in a transformer (6 Marks)
- d) a student designed a transformer to supply a current of 10A at a potential difference of 60 V. to a motor from an a.c mains supply of 240V if the efficiency of the transformer is 80%. Calculate the power supplied to the transformer (2 Marks)