UNIVERSITY OF JOHANNESBURG

PROGRAM	: BACHELOR OF ENGINEERING TECHNOLOGY [**BEng Tech**] IN ELECTRICAL ENGINEERING. B6ELEQ & B6ELXQ
MODULE	: **Foundation Electrotechnology**
CODE	: **ELTED01**
DATE	: SUMMER **SUPP** EXAMINATION 06/01 JANUARY 2020
DURATION	: 3 HOURS
CALCULATION CRITERIA	: 50 [SEMESTER]: 50 [EXAM]
NQF	: 5
TOTAL MARKS	:100

EXAMINER	:	MS. LUTENDO MUREMI
MODERATOR	:	PROF. THOKOZANI SHONGWE
NUMBER OF PAGES	:	5 PAGES

INSTRUCTIONS	:	QUESTION PAPERS MUST BE HANDED IN.
REQUIREMENTS	:	2 SHEETS OF LINEAR GRAPH PAPER.

INSTRUCTIONS TO CANDIDATES:

1. 100 MARKS = 100%.
2. ATTEMPT ALL QUESTIONS.
3. ANSWER QUESTIONS CONSIDERING THE MARK ALLOCATION.
4. QUESTIONS MAY NOT BE ANSWERED IN ANY ORDER AND **ALL PARTS OF A QUESTION MUST BE KEPT TOGETHER**.
5. ALL DIAGRAMS AND SKETCHES MUST BE DRAWN NEATLY AND LABELED CLEARLY.
6. ALL WORK DONE IN PENCIL EXCEPT DIAGRAMS AND SKETCHES WILL BE CONSIDERED AS ROUGH WORK.
7. **MARKS WILL BE DEDUCTED** FOR WORK WHICH IS POORLY PRESENTED.
8. ANSWER ALL THE QUESTIONS.

QUESTION 1 (27 MARKS)

1.1 Complete the following table for comparison between Magnetic and Electric circuit (7)

Magnetic Circuit	**Electric Circuit**
Magnetic Flux (Wb)	1.
2.	e.m.f (V)
3.	Current density (A/sq.m)
Reluctance (AT/Wb)	4.
5.	Conductance
Reluctivity	6.
Permeability	7.

1.2 Plot the V/I characteristic for a 4.7 kΩ resistor, given that the applied voltage range is 0–5 Show all the calculations (5)

1.3 A mass of 500 kg is raised to a height of 6 m in 30 s. Calculate:

1.3.1 the work done (2)

1.3.2 the power developed. Take acceleration of $a = 9.81\ m/s^2$. (3)

1.4 A source e.m.f. of 10 V supplies a current of 0.9 A for 10 minutes. How much energy is provided in this time? (4)

1.5 Determine the colour coding for a 47 kΩ resistor having a tolerance of ±5%. (2)

1.6 State Ohm's law. (2)

1.7 State Faraday's law. (2)

QUESTION 2 (29 MARKS)

2.1 When the switch in the circuit shown is closed the reading on voltmeter 1 is 40 V and that on voltmeter 2 is 15 V. Determine the reading on the ammeter and the value of resistor of R_x. (5)

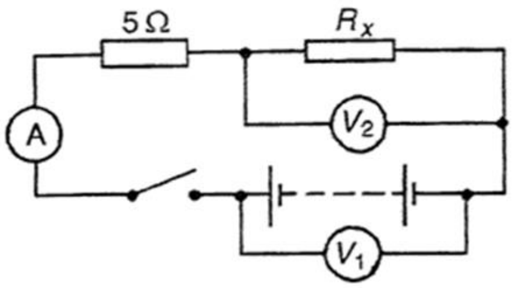

FIGURE 1

2.2 Two resistors are connected in series across a 44 V supply and a current of 4 A flows in the circuit. If one of the resistors has a resistance of 3.5 Ω, draw the circuit and calculate:

2.2.1 the value of the other resistor. (3)

2.2.2 the p.d. across the 3.5 Ω resistor using voltage divider rule. (3)

2.2.3 if the circuit is connected for 30 hours, how much energy is used. (3)

2.3 A steady current of 7 A flows into a previously uncharged capacitor for 3.3 ms when the p.d. between the plates is 2.5 kV. Find the capacitance of the capacitor. (3)

2.4 For the network given in **FIGURE 2**, apply the thevenin analysis method and answer the following questions.

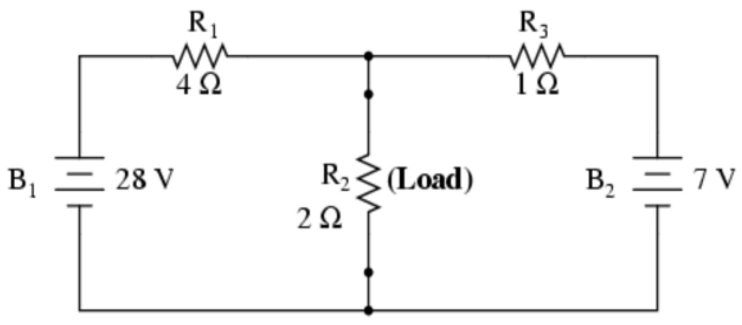

FIGURE 2

2.4.1 Determine the equivalent thevenin voltage across the load. (5)

2.4.2 Determine the equivalent circuit resistance (4)

2.4.3 The current flowing on the load (3)

QUESTION 3(24 MARKS)

3.1 For the circuit shown below, determine:

a) the total circuit capacitance, (6)

b) the total energy in the circuit, and (3)

c) the charges in the capacitors shown as C_1 and C_2. (4)

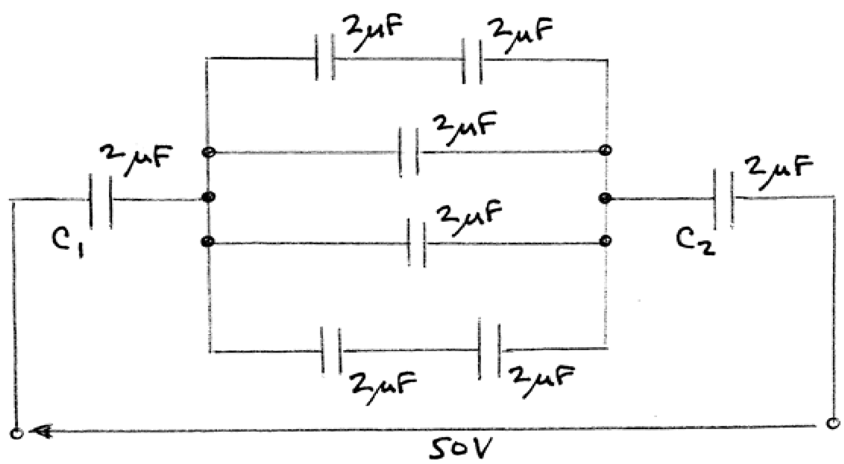

Figure 3

3.2 A capacitor is made of four metal plates and separated by sheets of mica having thickness of 200 mm, permittivity of free space of $(\varepsilon_o = 8.854 \times 10^{-12})$ and a relative permittivity$(\varepsilon_r = 3)$, is connected across a 180 V supply . The area of one side of each plate is 50 cm^2. Calculate the total capacitance in microfarad (6)

3.3 A coil of copper wire has a resistance of 95 Ω when its temperature is 0 ℃. Determine its resistance at 70 ℃. If the temperature coefficient of resistance of copper at 0 ℃ is 0.0063/ ℃ (5)

QUESTION 4 (20 MARKS)

4.1 The field coils of a 6-pole d.c. generator each having 800 turns, are connected in series. When the field is excited, there is a magnetic flux of 0.05 Wb/pole. If the field circuit is opened in 0.04 second and residual magnetism is 0.005 Wb/pole, calculate:

4.1.1 The average voltage which is induced across the field terminals. (6)

4.1.2 In which direction is this voltage directed relative to the direction of the current. (2)

4.2 A flux of 0.5 Wb is produced by a coil of 900 turns wound on a ring with a current of 3 A in it. Calculate:

4.2.1 the inductance of the coil. (4)

4.2.2 the e.m.f. induced in the coil when a current of 5 A is switched off, assuming the current to fall to zero in 1 millisecond and, (4)

4.2.3 the mutual inductance between the coils, if a second coil of 600 turns is uniformly wound over the first coil. (4)

TOTAL : 100