UNIVERSITY OF JOHANNESBURG

PROGRAM	:	NATIONAL DIPLOMA *ENGINEERING: COMPUTER SYSTEMS* *ENGINEERING: ELECTRICAL*
SUBJECT	:	**ELECTROTECHNOLOGY (EXTENDED)**
CODE	:	**FELT 1111**
DATE	:	SUMMER EXAMINATION 21ST NOVEMBER 2016
DURATION	:	(SESSION 1) 08:30 - 11:30
WEIGHT	:	40 : 60
TOTAL MARKS	:	108

EXAMINER	:	MR A.F. COTTRELL	2009
MODERATOR	:	MR P. BOKORO	
NUMBER OF PAGES	:	5 PAGES (including this page)	

INSTRUCTIONS TO STUDENTS (TO BE READ):

1. WORK IN PENCIL WILL NOT BE MARKED;
2. ALL WORK WITH THE EXCEPTION OF THE DIAGRAMS MUST BE IN INK.
3. ALL CALCULATIONS MUST BE SHOWN, NO MARKS FOR ANSWERS ONLY.
4. 1 MARK = 1%
5. QUESTIONS MAY BE ANSWERED IN ANY ORDER.
6. ANY HAND-HELD CALCULATORS ARE PERMITTED

QUESTION 1

1.1 An electrical coil having 675 turns, is wound on a cylindrical former. The average diameter of each turn is 52 mm, and the diameter of the wire used is 1 mm. If the resistivity of the wire at 25°C, is 0.0176 μΩ.m, determine:

1.1.1 The resistance of this coil. (5)
1.1.2 The D.C. voltage that must be applied to this coil in order to circulate 230 mA through it (2)
1.1.3 The power dissipated in this coil. (2)
1.1.4 If the temperature coefficient of resistance of the wire is 0.004264/°C, at 0°C, what will the new resistance and current be, if the applied voltage remains the same, and the temperature of the coil rises to 65°C? (4)

1.2 Figure 1 shows a simple series-parallel circuit with parameters shown. Use your knowledge of Ohm's law and electric circuits, to find:

1.2.1 Resistance, R_3. (2)
1.2.2 The voltage across resistor, R_3. (2)
1.2.3 Resistance, R_1. (2)
1.2.4 The voltage across Resistance, R_5. (2)
1.2.5 The total current, I_T. (4)
1.2.6 The current through R_4. (2)
1.2.7 The power dissipated in R_1. (2)

[29]

QUESTION 2

2.1 Figure 2 shows a simple D.C. circuit. Use Kirchhoff's laws to solve for the unknown currents. Use the current and loop directions given, when setting up your simultaneous equations. (10)

2.2 A conductor having an effective length of 20 meters moves at 36 m/s, at right angles to a magnetic flux having a density of 0.43 tesla. Determine:

2.2.1 The e.m.f. induced into the conductor. (2)
2.2.2 If there is an external load of 11 Ω (and neglecting the resistance of the wire), find the current that will flow. (2)
2.2.3 If the physical length of the 1.5 mm^2 wire is 34 meters, and its resistivity, 0.018 μΩ.m, what will the current be, now? (4)
2.2.4 What force must be applied to the conductor in order to develop this power? (2)

[20]

QUESTION 3

Figure 3 shows a steel-cored torroid with all information & dimensions, and alongside, a B/H curve for the steel. Determine for this magnetic circuit:

3.1	The density of the flux in the core.	(2)
3.2	The magnetic field strength needed to produce this flux.	(1)
3.3	The mmf.	(3)
3.4	The current.	(2)
3.5	The reluctance of the core.	(2)
3.6	But…if a gap of 1mm was cut through the ring (having the same cross section as the ring), find, for this new situation, if the magnetic flux is to be maintained constant:	
3.6.1	The magnetic field strength of the gap.	(2)
3.6.2	The new m.m.f. of the combination.	(2)
3.6.3	The new current.	(2)

[16]

QUESTION 4

4.1 Convert the numbers given as per instruction:

a.) 547_{10} into Binary. c.) 793_8 into Binary.

b.) 10110100_2 into Decimal d.) 1673_{10} into Octal (8)

4.2 Consider Figure 4. Name each of the gates in the space provided, and fill in the truth table for each. (6)

[14]

QUESTION 5

5.1 Differentiate between "N-type" and "P-type" semi-conductor material. (8)

5.2 How is an ideal characteristic curve for a P-N junction diode different from a practical characteristic? Make a labelled sketch of each graph, and point out the differences. (12)

[20]

QUESTION 6

6.1 Three impedances in series have the following voltage drops, expressed in trigonometric form:

$$v_1 = 64.13Sin(\omega t + 48.4^o)\ volt$$

$$v_2 = 186Sin(\omega t - 29.6^o)\ volt$$

$$v_3 = 115.4Sin(\omega t + 22.38^o)\ volt$$

Determine the voltage supplied across the whole circuit. [9]

TOTAL **[108]**

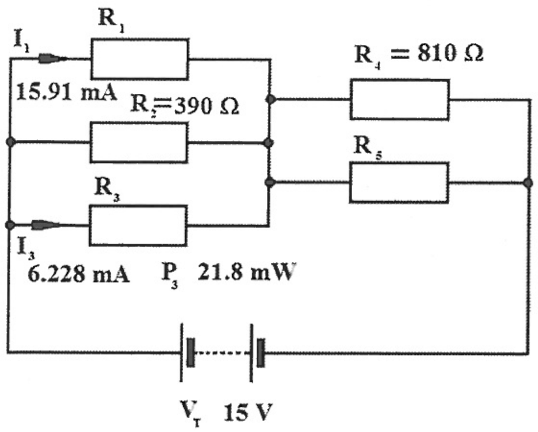


Figure 1

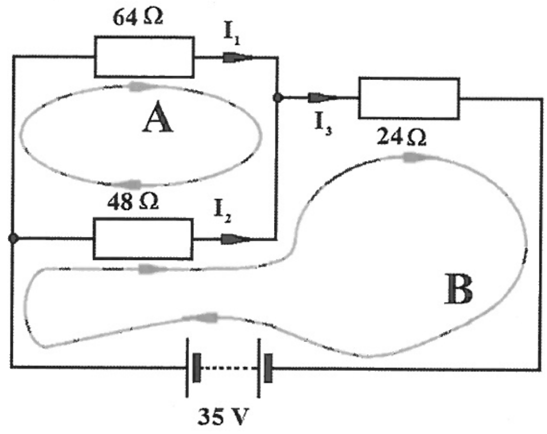
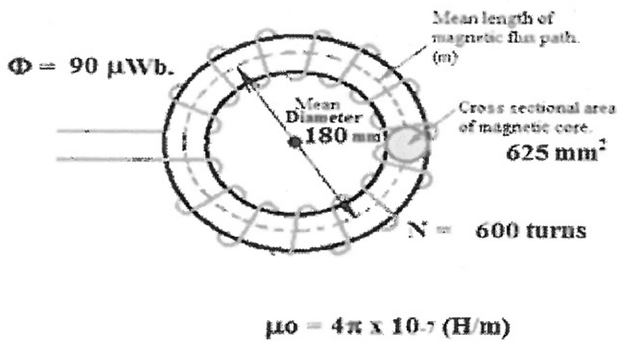


Figure 2



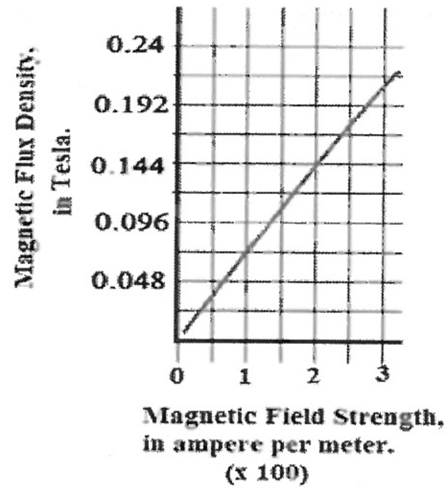


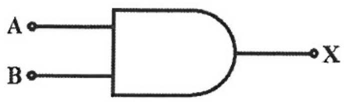
Figure 3

PLEASE HAND IN THIS PAGE. PUT IT INSIDE YOUR ANSWER SCRIPT

SURNAME: ______________________________ (OPTIONAL)

STUDENT NUMBER: ______________________

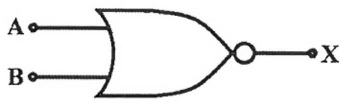
QUESTION 4.2



A	B	X
0	0	
0	1	
1	0	
1	1	

(a) Gate Name:

____



A	B	X
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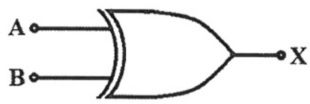
0	1	
1	0	
1	1	

(b) Gate Name:

____



A	B	X
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0	1	
1	0	
1	1	

(c) Gate Name:

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Figure 4