



COLLEGE OF ENGINEERING, SCIENCE AND TECHNOLOGY  
SCHOOL OF ELECTRICAL AND ELECTRONIC ENGINEERING

TRADE DIPLOMA PROGRAMME

EEE460 INTRODUCTION TO ELECTRICAL AND ELECTRONIC  
ENGINEERING

**EXAMINATION (TRIMESTER 1, 2016)**

DATE/TIME/ROOM – Refer to Exam Timetable

**INSTRUCTIONS TO CANDIDATES**

1. You are allowed 10 minutes extra time during which you are not to write.
2. Write all your answers in the allocated Answer Booklet.
3. Begin each answer on a fresh new page and use both sides of the sheets.
4. Write your identification number on the top of each attached sheet.
5. Insert all written foolscaps, graph paper, drawing paper, etc in their correct sequence and secure with string provided.
6. For all sheets of paper in which has been done, cross it through and you must attach to your answer script.
7. Write clearly the number(s) of the question(s) attempted on the top of each sheet.
8. There are 10 Questions in this Exam Paper. Attempt All Questions .

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All Questions are Compulsory.

**QUESTION 1 - SAFETY (10 Marks)**

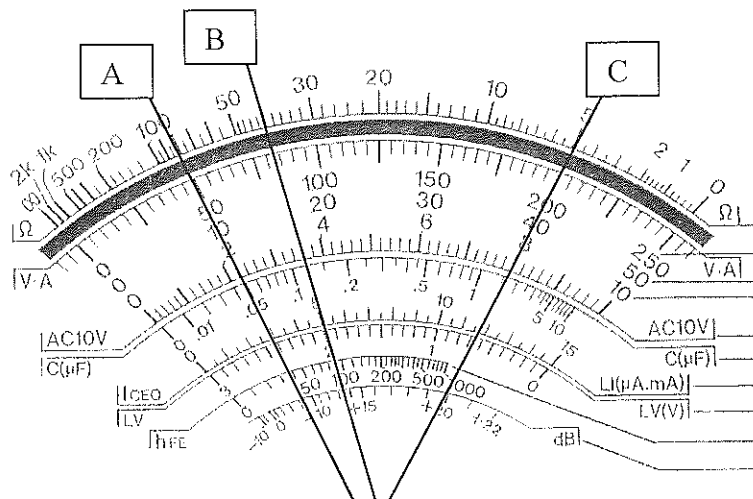
- 1.1 In choosing the correct safety clothing for certain engineering application, describe a feature that you would be looking for? (2 marks)
- 1.2 Referring to the table in *Appendix 1*, describe the effect of electricity on the human body. (5 marks)
- 1.3 Apply electrocution prevention exercise by listing three things one must do in order to be safe. (3 marks)

**QUESTION 2 - CIRCUIT CONCEPT (10 Marks)**

- 2.1 Complete the following table by filling in the blanks: (4 marks)

Element	Atomic Number	No. of electrons in the valence shell	Property of element (Conductor, semiconductor or insulator)
Aluminium	13	(a)	(b)
Silicon	14	(c)	(d)
Phosphorus	15	(e)	(f)
Copper	29	(g)	(h)

- 2.2 Consider the meter scale reading below :



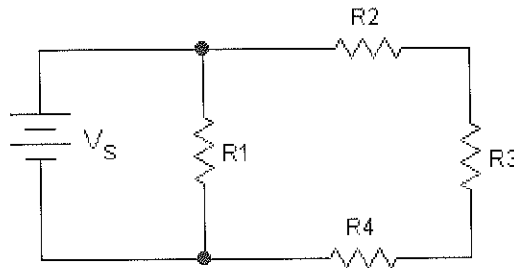
Determine the readings for the needle indication at :

- (a) A (resistor reading) (2 marks)
- (b) B (resistor reading) (2 marks)
- (c) C (AC voltage with range of 250V) (2 marks)

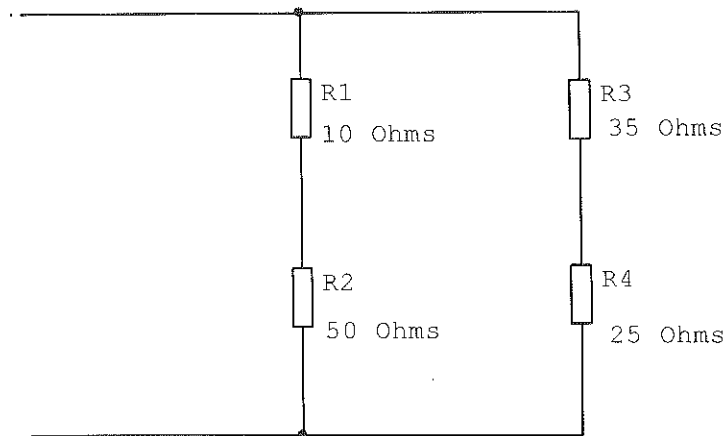
**QUESTION 3 - BASIC ELECTRICAL CIRCUIT (10 Marks)**

3.1 From the series-parallel circuit below,  $V_s = 24V$ ,  $R_1 = 100\Omega$ ,  $R_2=200\Omega$ ,  $R_3=50\Omega$  and  $R_4=50\Omega$ . Determine the following :

- a) Total resistance. (2 mark)
- b) Total current. (1.5 mark)
- c) Current through  $R_1$  (1.5 marks)
- d) Branch current flowing in  $R_2$ ,  $R_3$  and  $R_4$  (2 marks)

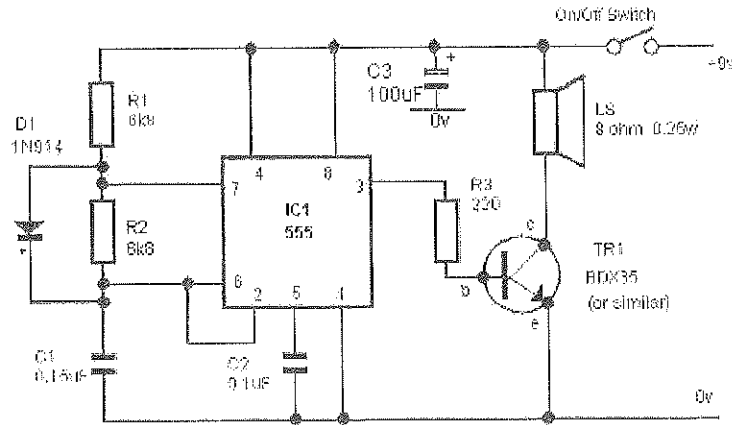


3.2 Determine the total resistance for the circuit shown below: (3 marks)



**QUESTION 4 - ELECTRONIC COMPONENT AND DEVICES (10 marks)**

4.1 Consider the following alarm circuit :



Illustrate your knowledge of circuit symbol by correctly naming the following devices as shown in the circuit above :

- (a) D1 (1 mark)
- (b) C2 (1 mark)

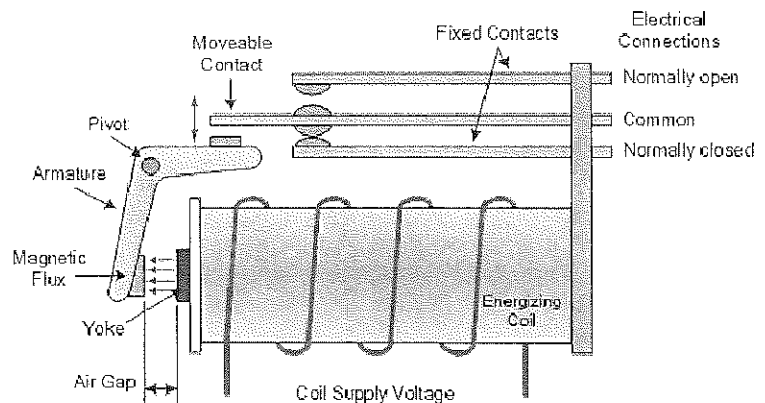
4.2 In reference to the colour coding table in Appendix 2, find the values and tolerances only of the following 4 and 5 band carbon resistors :

- (a) Red, Green, Yellow, Silver (2 marks)
- (b) Green, Black, Brown, Gold (2 marks)
- (c) Brown, Brown, Orange, Yellow, Silver (2 marks)
- (d) Orange, Green, Brown, Blue, Gold (2 marks)

**QUESTION 5 - SWITCHES AND ACTUATORS (10 marks)**

5.1 Most relays are electrically operated using the principle of *electromagnetism* or the *solenoid effect*. By referring to the diagram of a relay on the right, fully explain how this particular relay works.

(4 marks)

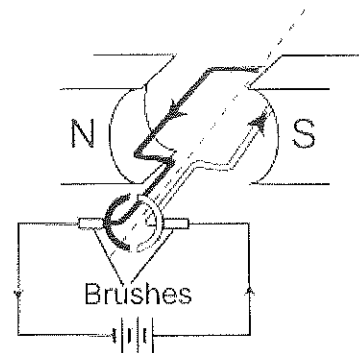


5.2 The application of *actuators* allows for movements like opening and closing of bus doors. Explain how the following types of actuators initiate linear movements :

- (a) Hydraulic actuator (2 marks)
- (b) Pneumatic actuator (2 marks)
- (c) Electric actuator (2 marks)

**QUESTION 6 - ELECTRICAL MOTORS (10 marks)**

6.1 Illustrate by showing the direction of the force acting on the current carrying conductor as shown on the right. Will the armature be rotating clockwise or anticlockwise?



(3 marks)

6.2 *Series-excited* motors have high torques at low speed and are suitable for starting motors at very heavy loads.

- (a) Draw the circuit diagram of a series-excited motor. (2 marks)
- (b) Draw its *Speed vs Load Current* curve. (2 marks)
- (c) Give two applications of series-excited motors (2 marks)
- (d) How can you change the direction of rotation of a DC motor? (1 mark)

**QUESTION 7 - TRANSFORMERS (10 marks)**

7.1 Draw and label fully the construction of a transformer. (5 marks)

7.2 A step down transformer is to be designed. Its primary winding is to be 1000 turns, primary voltage to be 240V ac and secondary voltage to be 110V ac.

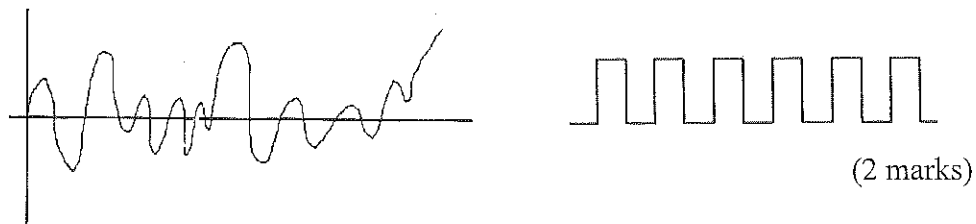
- (a) Determine its secondary winding. (2 marks)
- (b) Calculate this transformers supply current if its load current is 0.7 A. (2 marks)
- (c) What would be the number of turns in the secondary of this transformer if the design requires an isolation transformer to be created? (1 mark)

**QUESTION 8 - POWER SUPPLIES (10 marks)**

- 8.1 Sketch the flow diagram of a basic power supply and briefly explain the main processes that takes place before a good, clean DC voltage is produced. (8 marks)
- 8.2 Illustrate by sketching the DC output pulse with filtering action of the capacitor. (2 marks)

**QUESTION 9 – DIGITAL ELECTRONIC DEVICES (10 marks)**

- 9.1 What are the differences between digital signal and analog in terms of their signal waveform? Refer to the diagram given :



- 9.2 Draw the *circuit symbol* and *truth table* for AND and OR gates. (4 marks)
- 9.3 Convert the following binary numbers to decimal. (Show full working)

- (a) 111011 (2 marks)
- (b) 1110001 (2 marks)

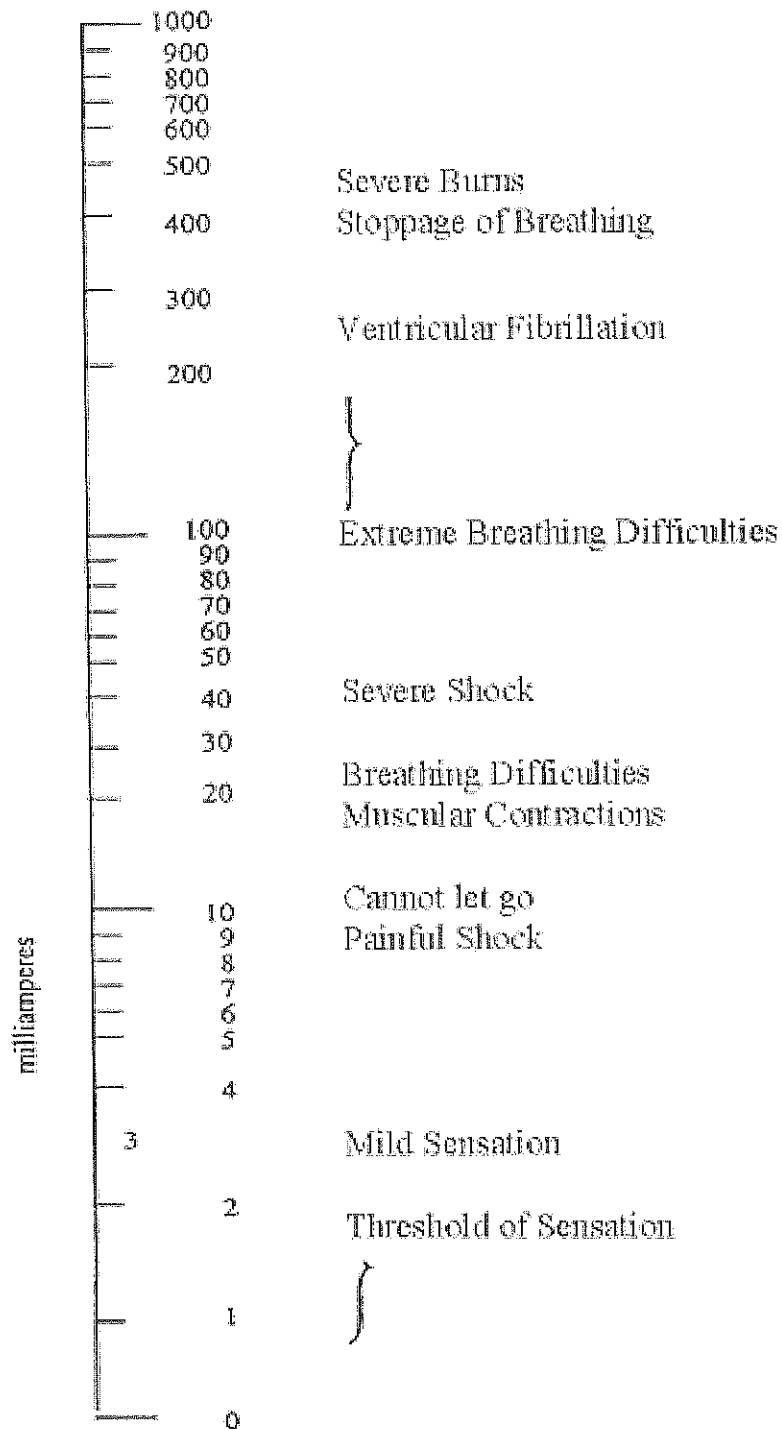
**QUESTION 10 – DISCREET DEVICES IN CIRCUITS (10 marks)**

- 10.1 A PN junction is common to most semiconductor devices.  
Explain the creation of P type and N type materials through the process of doping (5 marks)
- 10.2 Explain the characteristics of a zener diode. (5 marks)

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End

## Appendix 1

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## Appendix 2

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Color	Digit	Multiplier	Tolerance (%)
Black	0	$10^0$ (1)	
Brown	1	$10^1$	1
Red	2	$10^2$	2
Orange	3	$10^3$	
Yellow	4	$10^4$	
Green	5	$10^5$	0.5
Blue	6	$10^6$	0.25
Violet	7	$10^7$	0.1
Grey	8	$10^8$	
White	9	$10^9$	
Gold		$10^{-1}$	5
Silver		$10^{-2}$	10
(none)			20