



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

ALL TRADE DIPLOMA PROGRAMMES

**EEE460 INTRODUCTION TO ELECTRICAL AND ELECTRONIC
ENGINEERING**

EXAMINATION (TRIMESTER 1, 2015)

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. Begin each answer on a fresh new page and use both sides of the sheets.
3. Write your identification number on the top of each attached sheet.
4. Insert all written foolscaps, graph paper, drawing paper, etc in their correct sequence and secure with string provided.
5. For all sheets of paper in which has been done, cross it through and you must attach to your answer script.
6. Write clearly the number(s) of the question(s) attempted on the top of each sheet.
7. Use the Answer Sheet in this Question Paper to answer Section A and attach to your Answer Booklet
8. Section A is compulsory .
9. Section B has 12 Questions, candidates are to choose any 8 questions of their choice.

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SECTION A – MULTIPLE CHOICE QUESTIONS**(20 MARKS)**

Choose only *ONE* correct answer from the choices given, Use the Answer Sheet attached at the back of this Question Paper and attach to your Answer Booklet.

1. What is the reading of the dc current as shown in the diagram if the range is selected as 10V.

- (a) 50 A
- (b) 2.8 A
- (c) 75A
- (d) 5.6A
- (e) 2.8 V

2. Which is the correct unit for measuring *resistance*?

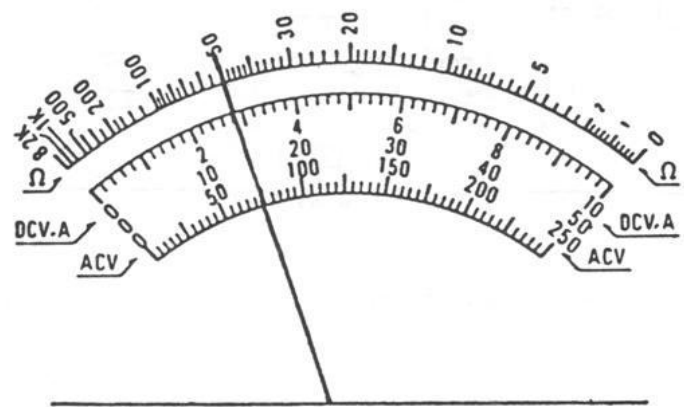
- (a) farads
- (b) ohms
- (c) henrys
- (d) pico
- (e) nano

3. Choose the correct statement which defines a *capacitor*?

- (a) Two terminal device used to vary the current in the circuit
- (b) Three terminal device used to vary the voltage in a circuit
- (c) A device that stops the flow of current.
- (d) Two terminal device used for storing voltage.
- (e) Four terminal device used as switch.

4. Which statement is the correct definition of a *resistor*?

- (a) Two terminal device used to vary the current in the circuit
- (b) Three terminal device used to vary the voltage in a circuit
- (c) A two terminal device that resist the flow of current.
- (d) Two terminal device used for storing voltage.
- (e) Four terminal device used as switch



5. Choose the correct definition of a *motorized actuator*
- (a) type of device used in military
 - (b) type of switch for controlling speed
 - (c) type of motor for moving or controlling
 - (d) type of switch used in big transport
 - (e) type of memory buffer
6. What effect would the *step up transformer* have on its input voltage ?
- (a) Controls the output
 - (b) Split the voltages into two phase
 - (c) Decrease the voltages
 - (d) Increase the voltages.
 - (e) Decrease the current
7. What effect would an *step down transformer* have on its input voltage ?
- (a) Isolates the input voltage and output voltage
 - (b) Split the voltages into two phase
 - (c) Decrease the voltages.
 - (d) Increase the voltages.
 - (e) Decrease the current
8. What is the purpose of *rectifier circuit* in a power supply circuit?
- (a) inverts ac to dc voltage
 - (b) converts pulsating dc to filtered dc voltage
 - (c) blocks ac voltages and allow dc voltage
 - (d) converts pulsating ac to filtered ac voltage
 - (e) inverts ac to dc voltage
9. What do you call the electronic devise that is suited for voltage regulation ?
- (a) zener diode
 - (b) normal diode
 - (c) transistor
 - (d) inductor
 - (e) capacitor

10. In terms of the voltage signals in digital logic, the *logic high* or *1* is represented by
- (a) 2.5 – 5v
 - (b) 1 – 2v
 - (c) 0 – 1v.
 - (d) 2 – 5v
 - (e) 0.4 – 2.5v
11. What are the main device in rectifier circuits ?
- (a) capacitors
 - (b) inductor.
 - (c) OR gate
 - (d) inverter
 - (e) diode
12. To overcome the barrier potential at the P-N junction, a small voltage is required to switch on the diode, what is the name of this voltage?
- (a) forward biasing voltage
 - (b) short circuit voltage.
 - (c) breakdown voltage.
 - (d) reverse breakdown voltage.
 - (e) leakage voltage.
13. In a parallel inductive circuit of 60mH, 30mH and 20mH , what is the total inductance of the circuit ?
- (a) 12 mH.
 - (b) 47 mH.
 - (c) 10 mH.
 - (d) 22 mH.
 - (e) 110 mH.
14. In a sequential logic circuit, which two input will determine the output state?
- (a) clock and reset
 - (b) data input and clock
 - (c) clear input and data input.
 - (d) data input and reset .
 - (e) clear input and reset

15. How many stable states does the flip-flop have...?
- (a) 1
 - (b) 2
 - (c) 3
 - (d) 6
 - (e) 8
16. A capacitance of a capacitor is measured to be 250pF. What is this equal to ?
- (a) 250 farads
 - (b) 250 milli farads
 - (c) 250×10^{-6} farads
 - (d) 250×10^{-12} farads
 - (e) 250×10^{-6} micro farads
17. When connecting a silicon diodes into a circuit, how much voltage you will need to turned the diode on
- (a) 5v
 - (b) 0.3v
 - (c) 12 v
 - (d) 0.7v
 - (e) 0.10v
18. Which statement best defines an *inductor*?
- (a) Two terminal device used to vary the current in the circuit
 - (b) Three terminal device used to vary the voltage in a circuit
 - (c) A two terminal device that resist the flow of current.
 - (d) Two terminal device used for storing voltage.
 - (e) Four terminal device used as switch
19. What is the value of this resistor which have the following colour code combination...brown, black, red, gold
- (a) $1\text{k}\Omega, \pm 5\%$.
 - (b) $100\Omega, \pm 5\%$
 - (c) $10\text{k}\Omega, \pm 10\%$.
 - (d) $100\Omega, \pm 10\%$
 - (e) $1\text{k}\Omega, \pm 10\%$.

20. Diodes are made from p and n type materials. Which statement best describes *n* type materials?

- (a) Silicon doped with elements having 3 valence electrons
- (b) Silicon doped with elements having 4 valence electrons
- (c) Silicon doped with elements having 5 valence electrons
- (d) Silicon doped with Germanium
- (e) Silicon doped with a negatively charged element

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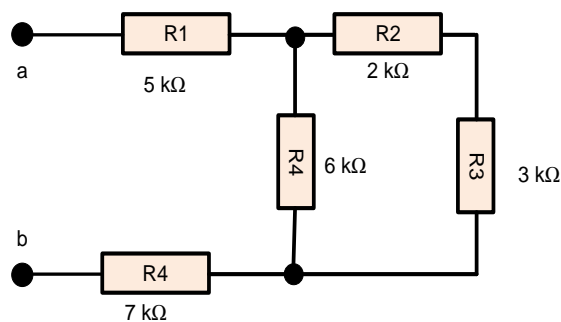
SECTION B – CALCULATIONS AND LONG ANSWERS**(80 MARKS)**

There are 12 Questions in this section. Answer only 8 Questions of your choice.

Question 1 (10 Marks)

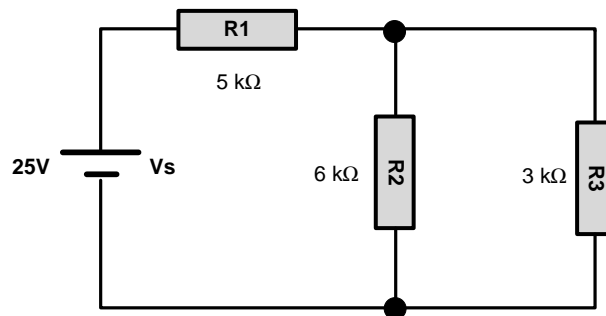
1.1 Find the total resistance for the circuit shown in figure below.

(4 marks)



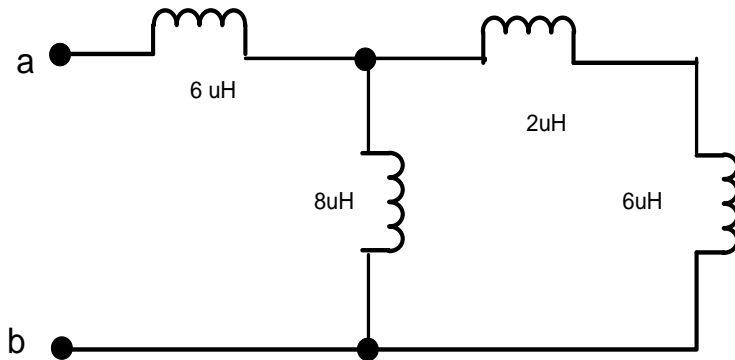
1.2 From the series-parallel circuit below, determine the following :

- a) Total resistance. (1 mark)
- b) Total current. (1 mark)
- c) Voltage drop across each resistor. (2 marks)
- d) Branch current flowing in R_2 & R_3 (2 marks)

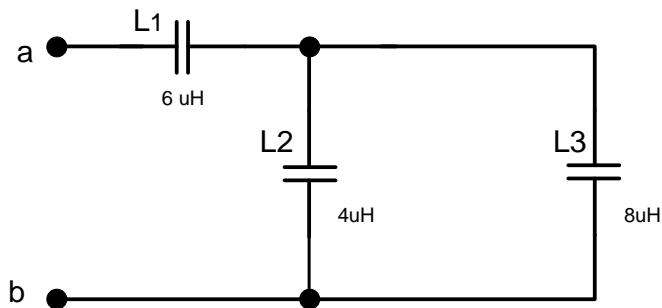


Question 2 (10 marks)

2.1 Find the total equivalent inductive circuit. (5 marks)



2.2 Find the total equivalent capacitive circuit. (5 marks)



Question 3 (10 marks)

3.1 Convert the following into decimal numbers to binary numbers. Show full working

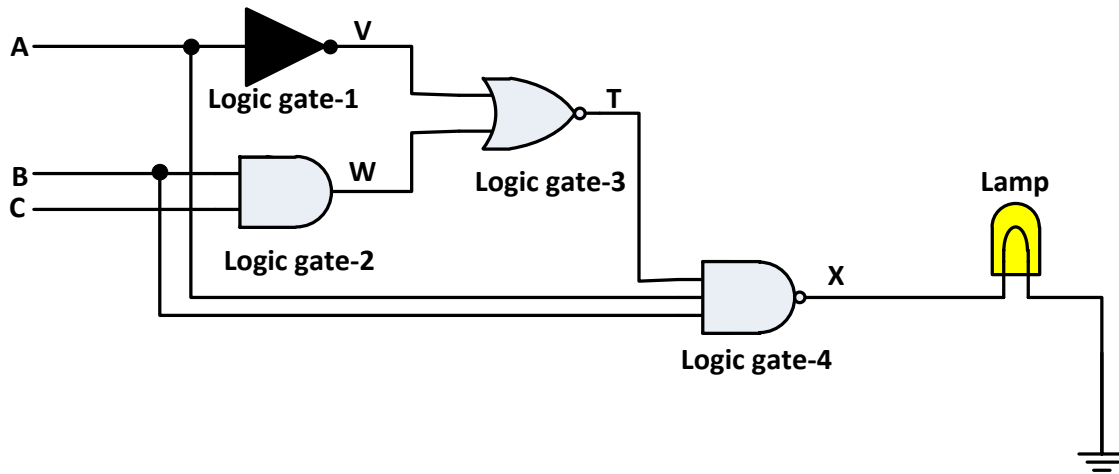
- (a) 229 (1 mark)
- (b) 45 (1 mark)
- (c) 150 (1 mark)
- (d) 80 (1 mark)

3.2 Illustrate the circuit symbol and truth table for the following logic gates :

- (a) AND (2 marks)
- (b) NOR (2 marks)
- (c) OR (2 marks)

Question 4 (10 marks)

Consider the digital circuit designed below.



- (a) Draw a truth-table for this design
- (b) State the name given to *logic gate 1* and *logic gate 2*
- (c) Determine the number of input of the above circuit
- (d) Determine the number of output it will generate.
- (e) Determine one input combination that will light the Lamp.
- (f) Determine two input combination wont light the lamp

Question 5 (10 marks)

5.1 Calculate the back emf in volts of a DC motor with 2A armature current, 24V supply and an armature resistance of 0.075 ohms. (2 marks)

5.2 Explain with the aid of diagram how an electro magnet can be created and explain the solenoid effect that takes place. (8 marks)

Question 6 (10 marks)

6.1 Specify by explaining the construction and function of the following electronic devices:

- (a) Capacitors (2 marks)
- (b) Carbon Resistors (2 marks)
- (c) Transistors (2 marks)

6.2 Determine the values and the % tolerances of the following 4-band resistors :

- (a) Red, Blue, Green, Silver (2 marks)
- (b) Green, Red, Black, Gold (2 marks)

Question 7 (10 marks)

7.1 Apply the right hand screw rule to the current carrying conductor shown to illustrate the direction of the magnetic field line around it. (2 marks)



7.2 Illustrate with diagrams to fully explain the effect of placing a current carrying conductor between a north and south pole of a magnet. (5 marks)

7.3 A motor has four poles with a magnetic flux of 3 webers per pole. The armature current is 1.5A. The number of effective armature conductors is 12 and wave wound. Calculate the torque produced in this motor in newton-metres. (2 marks)
(Use $T = p\phi IZ/2\pi a$)

7.4 State the function of the *slip ring* in the motors? (1 mark)

Question 8 (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 Briefly explain why a zener diode is best suited for the regulation of dc voltage. (2 marks)

Question 9 (10 marks)

- 9.1 Draw the construction diagram of a transformer on no load and explain what happens when the primary winding is connected to the supply. (8 marks)
- 9.2 Calculate the secondary voltage of a transformer if it has the following parameters :
Number of Primary Coil = 1500, Number of Secondary Coil = 1200,
Primary Voltage = 60V (2 marks)

Question 10 (10 marks)

Differentiate between *dc series excited* motors and *dc shunt field* motors .
Illustrate difference in terms of *circuit diagram* and *speed vs load current* characteristic curve. (10 marks)

Question 11 (10 marks)

- 11.1 Compare and state the difference between a *push button switch* and a *thermostat switch* used in an air conditioning unit. (4 marks)
- 11.2 Identify what type of switch should be used for the following situations and draw its circuit symbol :
- (a) One supply point passing current to two separate circuits (2 marks)
 - (b) Two supplies (2 phases) supplying to two sets of circuits (2 marks)
 - (c) One supply (1 phase) supplying one circuit (2 marks)

Question 12 (10 marks)

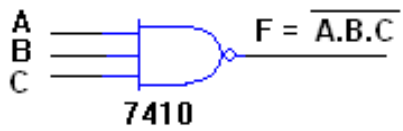
Illustrate the concept of electrical motor by sketching a basic motor model and labeling the motor parts. Also state the functions of the parts labeled (10 marks)

APPENDIX 1 – COLOR CODING TABLE

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

APPENDIX 2 – 3 INPUT NAND GATES

SYMBOL :

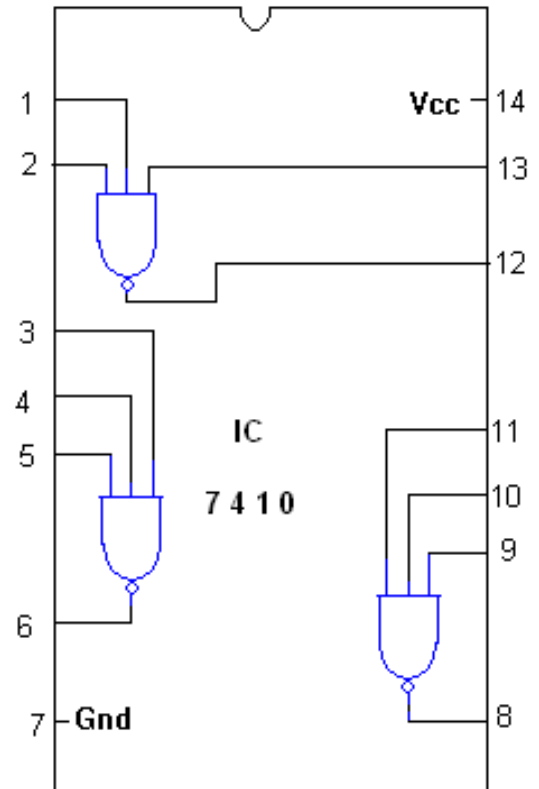


TRUTH TABLE

A	B	C	$\overline{A.B.C}$
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

OUTPUT

PIN DIAGRAM :



ANSWER SHEET (TO BE ATTACHED TO YOUR ANSWER BOOKLET)

SECTION A (MULTIPLE CHOICE), CIRCLE CORRECT ANSWER

Q1	A	B	C	D	E
Q2	A	B	C	D	E
Q3	A	B	C	D	E
Q4	A	B	C	D	E
Q5	A	B	C	D	E
Q6	A	B	C	D	E
Q7	A	B	C	D	E
Q8	A	B	C	D	E
Q9	A	B	C	D	E
Q10	A	B	C	D	E
Q11	A	B	C	D	E
Q12	A	B	C	D	E
Q13	A	B	C	D	E
Q14	A	B	C	D	E
Q15	A	B	C	D	E
Q16	A	B	C	D	E
Q17	A	B	C	D	E
Q18	A	B	C	D	E
Q19	A	B	C	D	E
Q20	A	B	C	D	E