



**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 2, 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.

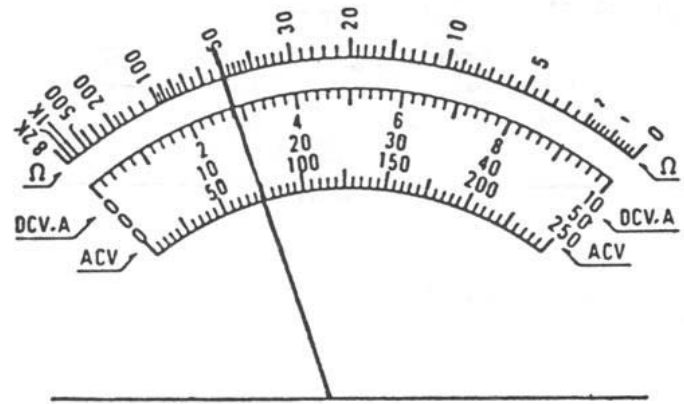
. . . .

**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 ohmmeter as shown in the diagram on the right.

- (a) 50 A
- (b) 2.8  $\Omega$
- (c) 50  $\Omega$
- (d) 60  $\Omega$
- (e) 60 A



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

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

3. An electronic device consists of 2 conducting plates sandwiching a semiconductor material called dielectrics. It has storage capability depending on the dielectric material, the size of the plates and the distance between the plates. Name this device.

- (a) Transistor
- (b) Resistor
- (c) Actuator
- (d) Capacitor
- (e) Relay

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 *pneumatic actuator*
- (a) type of switch which uses oil as its mechanism to control a linear motion
  - (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 switch which uses air as its mechanism to control a linear motion
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. If a step down transformer is to be created, which of the following statements will facilitate its operation?
- (a) The iron core window would have to be decreased
  - (b) The iron core window would have to be increased
  - (c) The thickness of the winding in the primary side would have to be increased
  - (d) The thickness of the winding in the secondary side would have to be increased
  - (e) The number of turns of winding in the primary side would have to be greater than those in the secondary side.
8. What is the purpose of *rectifier circuit* in a power supply circuit?
- (a) converts 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 dc to ac voltage

9. What do you call the electronic device that is suited for the filtering of ripple voltages in power supply system ?
- (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. A zener diode is rated at 3V. What does this rating mean?
- (a) It cannot be supplied with a voltage less than 3V
  - (b) It can produce a ripple voltage of 3V
  - (c) When the supply voltage is greater than 3V, the diode will be damaged
  - (d) When a reverse-biased voltage of 3V is reached, the diode will be damaged
  - (e) The output voltage of the diode will be stabilized at 3V irrespective of the supply voltage.
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 series 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. What the three terminals of a *bipolar transistor* called?
- (a) clock, set and reset
  - (b) data input, set and clock
  - (c) base, emitter and collector
  - (d) collector, npn and pnp
  - (e) base, emitter and junction
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 170  $\mu\text{F}$ . What is this equal to ?
- (a) 170 farads
  - (b) 170 milli farads
  - (c)  $170 \times 10^{-6}$  farads
  - (d)  $170 \times 10^{-12}$  farads
  - (e)  $170 \times 10^{-6}$  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...red, brown, green, yellow, gold

- (a) 2.15 M $\Omega$ ,  $\pm$  5%.
- (b) 215  $\Omega$ ,  $\pm$  5%
- (c) 2.15 M $\Omega$ ,  $\pm$  10%.
- (d) 215  $\Omega$ ,  $\pm$  10%
- (e) 215 m $\Omega$ ,  $\pm$  5%

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

. . . . .

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

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

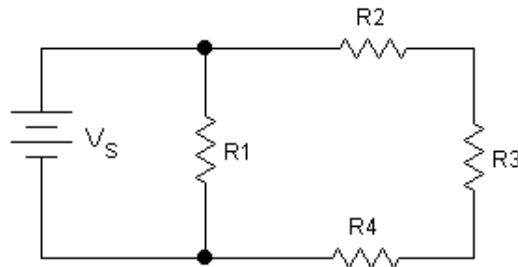
**Question 1 (10 Marks)**

1.1 Four resistors with resistor values  $20\ \Omega$ ,  $2\ \Omega$ ,  $500\ \Omega$  and  $100\ \Omega$  were connected in parallel.

- (a) Determine its total resistance. (2 marks)  
(b) Determine its total resistance if connected in series. (1 mark)

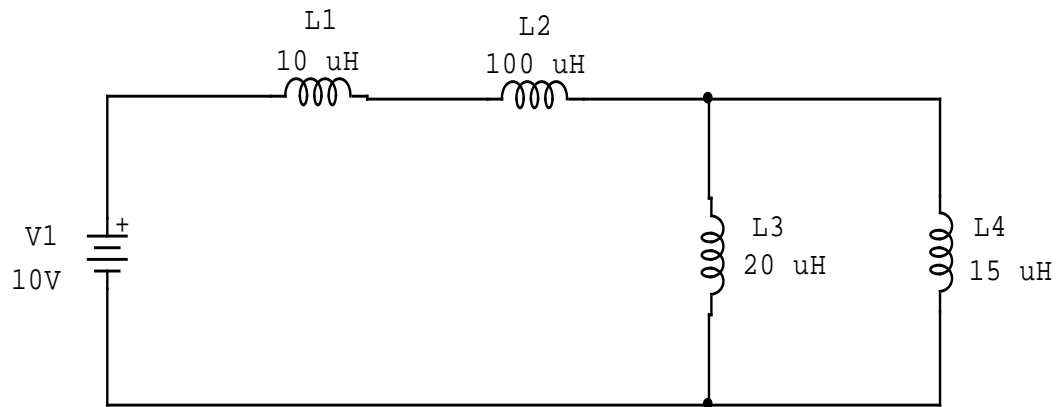
1.2 From the series-parallel circuit below,  $V_s = 24V$ ,  $R_1 = 100\ \Omega$ ,  $R_2 = 200\ \Omega$ ,  $R_3 = 50\ \Omega$  and  $R_4 = 50\ \Omega$ . Determine the following :

- 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)

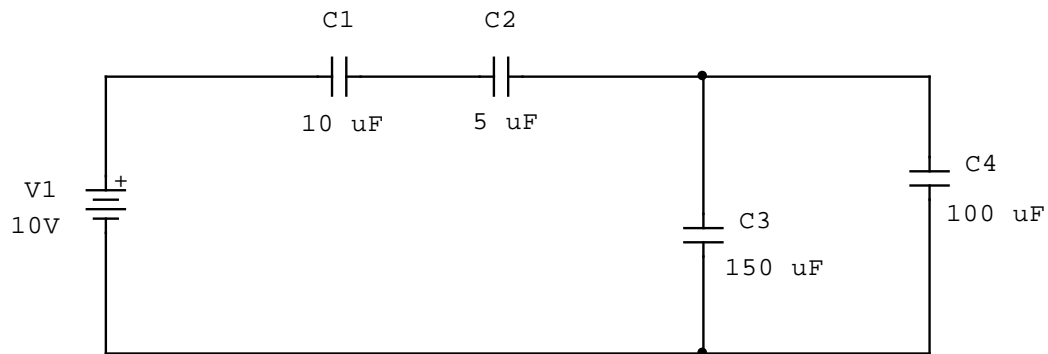


**Question 2 (10 marks)**

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) 200 (1 mark)
- (b) 40 (1 mark)
- (c) 250 (1 mark)
- (d) 80 (1 mark)

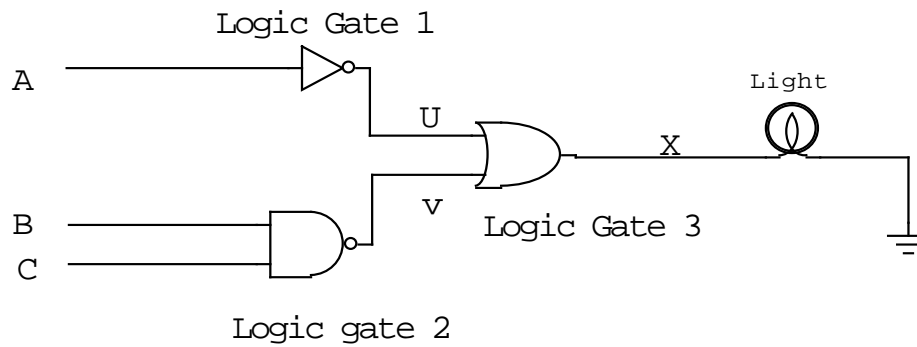


3.2 Illustrate the circuit symbol and truth table for the following logic gates :

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

**Question 4 (10 marks)**

Consider the digital circuit designed below.



- (a) State the name given to logic gates 1, 2 and 3 (3 marks)
- (b) Complete the truth table below. (6 marks)
- (c) Which input combination will lit the light at the output X (1 mark)

A	B	C	U	V	X
0	0	0			
0	0	1			
0	1	0			
0	1	1			
1	0	0			
1	0	1			
1	1	0			
1	1	1			

**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 5-band resistors :
- (a) Yellow, Red, Blue, Green, Silver (2 marks)
  - (b) Blue, 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.

(Use  $T = p\phi IZ/2\pi a$ )

(2 marks)

- 7.4 State the function of the *poles* 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 Illustrate by sketching the DC output pulse with filtering action of the capacitor.

(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 A transformer is to be designed for use in a domestic application which uses a 240V supply. The transformer is to produce an AC voltage of 110V in its secondary side while its primary winding is to be 1500 turns. What should be the number of turns in the secondary winding?

(2 marks)

### **Question 10 (10 marks)**

- 10.1 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.

(8 marks)

- 10.2 Explain how the direction of a DC motor can be reversed.

(2 marks)

**Question 11 (10 marks)**

- 11.1 Explain how a *thermostat switch* is used in an air conditioning unit. (2 marks)
- 11.2 Compare and state the difference between a relay and an actuator. (2 marks)
- 11.3 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 *armature, stator, brushes and commutator*. Also state the functions of the parts labeled.

(10 marks)

.....  
End

**APPENDIX 1 – RESISTOR COLOR CODING TABLE**

<b>Color</b>	<b>Digit</b>	<b>Multiplier</b>	<b>Tolerance (%)</b>
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

**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