



**COLLEGE OF ENGINEERING, SCIENCE AND TECHNOLOGY**

**SCHOOL OF ELECTRICAL AND ELECTRONICS  
ENGINEERING**

**PENSTER 2/2014**

**EEE448 – ELECTRONICS FOR ELECTRICIAN 2**

**SOLUTION**

**Candidate No:** .....

**Section A**

**Multiple-Choice Matrix**

**[30 marks]**

Circle the correct letter (A, B, C or D) against each of numbers 1 through 30.

Remove and attach to your Answer Booklet.

1	A	B	C	D
2	A	B	C	D
3	A	B	C	D
4	A	B	C	D
5	A	B	C	D
6	A	B	C	D
7	A	B	C	D
8	A	B	C	D
9	A	B	C	D
10	A	B	C	D
11	A	B	C	D
12	A	B	C	D
13	A	B	C	D
14	A	B	C	D
15	A	B	C	D
16	A	B	C	D
17	A	B	C	D
18	A	B	C	D
19	A	B	C	D
20	A	B	C	D
21	A	B	C	D
22	A	B	C	D
23	A	B	C	D
24	A	B	C	D
25	A	B	C	D
26	A	B	C	D
27	A	B	C	D
28	A	B	C	D
29	A	B	C	D
30	A	B	C	D

## **SECTION B (10 MARKS)**

### **Matching**

1	E
2	J
3	H
4	F
5	B
6	D
7	I
8	C
9	G
10	A

(1 mark for each)

## **SECTION C (20 MARKS)**

1.

- High 'open loop' (in other words no feedback) gain: typically 100.000 ohms to 1.000.000 ohms
- High input impedance; typically 100M ohms
- Low output impedance; typically 75 ohms
- Double ended power supplies (to supply both the inverting and non inverting legs); ranging between 3V and 15V
- Frequency response of up to 1MHz with negative feedback

( Choose any 4 for 1 mark each = Total 4 marks)

2.

- Observation of waveforms in electrical circuit.
- Measurement of electrical quantities such as voltage, current, power and phase angle.
- Comparisons between known and unknown frequencies
- Measurement of short time intervals.

- Examining the characteristics of magnetic materials
- Modulation measurement in transmitters.

( Choose any 4 for 1 mark each = Total 4 marks)

3.

<b>Name of the Test Equipments</b>	<b>Function</b>	<b>Operating Parameters (Voltage / Current)</b>	<b>Application of such Test Meters/Equipments</b>
Series Test Lamp	It is used to test for the presence of voltage	480 Volts 15 watts	Used by Technician on work field as a rough guide to the voltage at test points.
Clamp meter	Is a meter used to detect the presence and quantity of current	Milliamps – 2000 Amps	Used in workfield and commercial for testing voltages and current that makes no electrical contact
Neon Test Lamp (Screwdriver)	It provides a more accurate voltage indication	50 to 500Vac	Use in workfield to test voltage
Logic Probes	It is a self powered device to check the output state of digital circuit	2 – 5 volts At 20MHz	To check high and low of the input and output of digital circuit

(1 Mark for each test equipment = Total 4 marks)

4.

**i. Switching Element**

This block is simply a transistor used as a switch. The on/off time of the transistor is controlled by the output from the pulse width modulator. The wider the pulse, the longer this transistor is on and ultimately the higher the voltage at the output. (2 marks)

ii. Error Amplifier

This block contains a differential amplifier and compares the output from the Sample Block and the DC Voltage Reference Block. The output is a DC error voltage representing the difference between the two. (2 marks)

iii. High Frequency Oscillator

This block provides a fixed amplitude triangular wave of approximately 20kHz frequency. The output is applied to one input of the comparator in the pulse width modulator circuit.

(2 marks)

iv. Pulse Width Modulator (PWM)

This block consists of an op-amp comparator. It compares the output of the error amplifier block with the output of the high frequency oscillator and produces a pulsed output. (2 marks)

**SECTION D (40 MARKS)**

1.

a. Time = 6 division x 5mS  
**= 30mS** (1 mark)

b. Frequency = 1/T  
= 1/30mS  
**= 33.33Hz** (1 mark)

c.  $V_{P-P} = 4.3 \text{ division} \times 20\text{mV}$   
**= 86mV** (1 mark)

d.  $V_P = 86\text{mV}/2$   
**= 43mV** (1 mark)

e.  $V_{RMS} = V_P \times 0.707$   
 $= 43\text{mV} \times 0.707$   
**= 30.4mV** (1 mark)

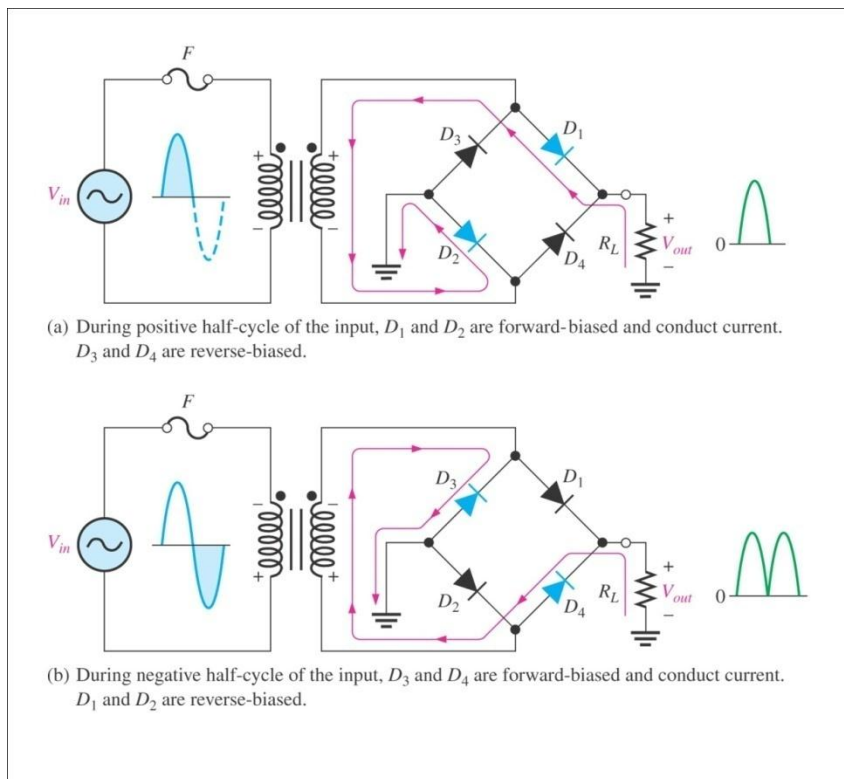
2.

- For normal operation the digital instrument is more accurate.
- Both types of meters need an internal battery source of power
- Both types of meters uses a rectifier circuit to convert ac to dc but the analogue meter has to use a separate scale for ac voltage.

- Ohmmeter functions in an analogue meter use a non linear scale while digital meter has no scale

( Choose any 3 for 1 mark each)

3.



Marks: Cct-2, Waveforms-2, Operation-2 = Total 6 marks)

5. i. Summing Amplifier (1 mark)

ii. Gain =  $-R_f/R_{in}$

$$A_1 = -10\text{k}\Omega/1\text{k}\Omega \quad (1)$$

$$= -10$$

$$A_2 = -10\text{k}\Omega/2\text{k}\Omega \quad (1)$$

$$= -5$$

$$\underline{V_{out} = - (10(2\text{mV}) + 5 (5\text{mV})) = - 45\text{mV}} \quad (1) \quad (3 \text{ marks})$$

6.

a. Astable or free running oscillator (1 mark)

b.  $f = \frac{1.44}{(R1+2R2)C1}$

$$= \frac{1.44}{(1K\Omega+2 \times 10K\Omega)0.1 \times 10^{-6}}$$
$$= \underline{685.7\text{Hz}}$$

(3 marks)

7.

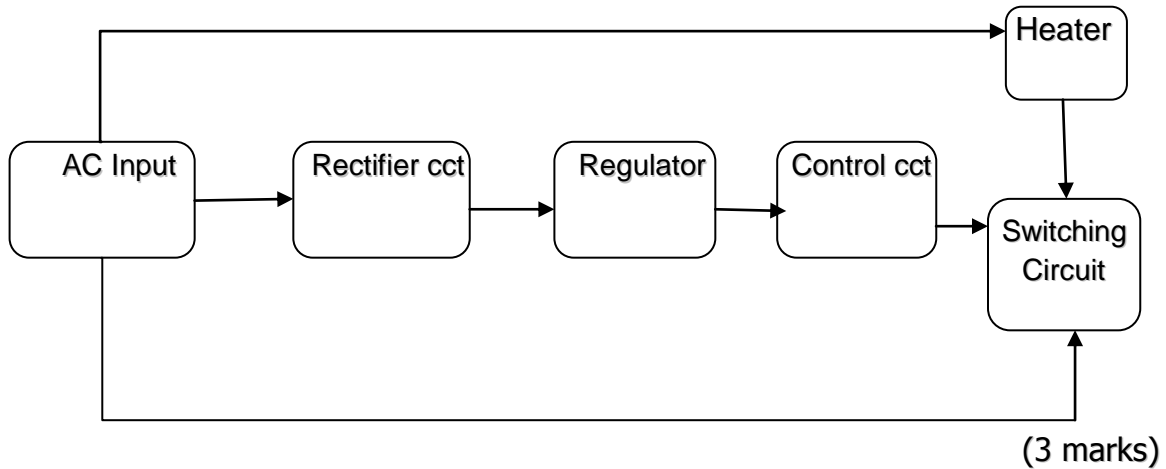
Inputs			Outputs			
A	B	C	U	V	W	X
0	0	0	1	0	1	1
0	0	1	0	1	1	0
0	1	0	1	0	0	1
0	1	1	0	0	0	1
1	0	0	1	0	0	1
1	0	1	0	1	0	1
1	1	0	1	0	0	1
1	1	1	0	0	0	1

(1.5 marks for inputs A,B and C, 1 mark for U, 1.5 marks each for outputs V, W and X = Total 7 marks)

8.

1. a) Heater control circuit (1 mark)

b)



c)

- i)  $D_5$ , Zener diode – Provides 20V regulated dc to the control circuit.
- ii)  $R_T$ , Thermistor – senses set temperature
- iii)  $Q_2$ , Unijunction transistor – provides relaxation oscillator to the pulse transformer.
- iv)  $T_1$ , Pulse transformer – provides gate pulse to the TRIAC to turn on. ( 1 mark each = 4 marks)

9.

a. The filter eliminates the fluctuations in the rectified voltage and produces a relatively smooth dc voltage. (1 mark)

b.

