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Subject Fundamental of Electrical and Electronics Engg. Branch C.S.E. Sem. II

Expt No.	EXPERIMENT JOB	Date of Performance	Date of Submission	Signature/ Remark
1	Identify various basic components			
2	Test and identify diode, transistor			
3	RLC circuit in series, parallel			
4	Test diode, Transistor as Electronic switch			
5	Find current gain of transistor			
6	To test OP-AMP as integrating			

Experiment no: 1

Object: Identify the various basic components in circuit and measure the value with help of Color code method, multimeter and L.C.R. meter.

Apparatus Required: LCR meter, Multi-meter, Color code chart.

Theory: Resistor, Capacitor and Inductor are the basic components used in circuit. These components provide proper functioning of circuit as per input and requirement of output.

Resistor: Resistor are normally used to limit amount of current or divide the voltage in circuit. Each resistor has two main characteristics i.e. its resistance (R) in ohm or its power rating in watt. The resistor having wide range of resistance value from a fraction of ohm to many mega ohms.

(i) Fixed resistors: The resistors that value have fixed value of resistance are called fixed resistors. These resistors may be carbon composition resistors or wire bound resistors.

(a) Carbon Composition resistors:

The carbon composition resistors are most common in electronic circuits with low power rating (2W or less). This type of resistors made of mixture of carbon or graphite and these two materials are mixed in the preposition needed for desired value of (R). The resistor element is enclosed in a plastic case as shown in fig for insulation and mechanical strength. The leads made of tinned copper are joined to the ends of carbon resistance elements shown in fig. The carbon composition resistors are available with 1000 ohm to 5 mega ohm and power rating is $\pm 1/2$ W to 2 W. The value of these resistors can be found through color code method.

(b) Wire bound Resistors: A wire bound resistor as shown in fig. Wire bound resistors are constructed by wrapping resistance wire of Nichrome, Tungsten, Megonin around a hollow porcelain cylindrical core. These resistances are available in values ranging from 1 ohm to 100 k ohm and more power rating varies from 2 W to 500 W with tolerance range of 5 to 20%. The value and power rating directly printed on cover.

(ii) Variable Resistors: In electronics circuit it becomes necessary to adjust the values of current and voltages. This adjustment can be made with the help of variable resistors, the variable resistors mostly carbon composition resistors.

Capacitor: Capacitors are used to store energy in form of electric charge. Its unit is Farad, which measure in terms of Farad (F), micro farad (uF), nano-farad (nF) and pico Farad (pF). These are different types of capacitor.

(a). Fixed valve Capacitor: These capacitor can store fixed amount of charge and its capacitance value are fixed. These are different type like Electrolytic, Ceramic, paper, film and super capacitors

(b) Variable valve Capacitor: This capacitor provides variable valve of capacitance.

Inductor: Basically, Inductor is a coil which may be air core or metal core. In case of metal core many magnetic core materials are within the four basic types: ferrite, powdered iron, alloy and high flux, and tape wound are used.

Method of Measurment:

Resistor:

(i) Colour Code method: The method normally used in case of Carbon composition resistors. There are coloured bands on the body of resistor,

which are used for calculating resistance values using given procedure:

(ii) In case of wire wound and variable resistors the value of and power of resistor directly printed on body.

(iii) Accurate measurment is possible using digital multimeter. Place the selector nob on OHM/R and then find the resistance value on display by connecting resistor terminals across the measuring lead of multi-meter.

Capacitor:

Electrolytic capacitors are polarized nature The short terminal indicates negative and long terminal for positive polarity. The value and power directly printed on body of capacitor. These are large value capacitor.

In case of ceramic and mica capacitors, three digital number is printed on body. The first two digit indicate value and third digit is multiplier of 10 to the power. The final value is in

picofarad. Ex. $104 = 10 \times 10^4$ pF

The value of capacitance of variable capacitor can be obtained using L.C.R. meter.

Inductor:

Mostly the inductance value of coil printed on cover of inductor or can be measured using L.C.R. meter.

LCR Meter Measurment:

Digital L.C.R. Meter is a versatile measurment equipment. By using the instructions given in manual the accurate value of components (R, C, L) can be obtained in digital form.

Observation

S.no	Components	Measurment Method			
		Manuals	Multi-Meter	L.C.R	Meter
1.	Resistor				
2.	Capacitor				
3.	Inductor				

Conculsion: After completing this experiment, the students are able to identify different

components fixed in a circuit and then find out their value manually or using measurement equipment.

Experiment no. 2

Object: To test and identify terminals of a different types of Diode and transistor.

Apparatus required: Digital multimeter, components.

Course outcome: Identify different types of electronic component.

Learning outcome: To identify terminal of different types of diode and Transistor.

Theory: The diodes are two terminal device i.e. Anode and Cathode. For forward biased condition anode must be connected to positive supply, and cathode to the negative supply. The reverse power supply connection is called reverse biased condition. In forward biased condition diode works like a close switch and shows a certain resistance and voltage. In reverse biased condition it like an open switch and infinite resistance

Draw a table below and make necessary entry.

Terminal	1-2	1-3	2-3	2-1	3-1	3-2
Voltage						
Conclusion						

Connect the black probe of multi-meter with terminal-1 of transistor and connect the red probe to other terminals one by one and find out reading on multi-meter and make entry in table.

Now connect black probe to terminal-3 and repeat same process again.

On the basis of voltage entries, type of transistor (NPN) (PNP) and terminal can be find out.

The voltage between C-B is more than B-C voltage. One this basis emitter and collector terminal can be find out.

Diodes are used as an electronics switch in different circuits, display system, sensor etc.

Transistor are three terminal device i.e. Emitter, Base, Collector. There are two types of transistor one is NPN and other is PNP. Transistor may consider as two diode back to back connected. Transistor are used for amplification and oscillations purpose.

Testing Procedure: There are two types to identify the terminal of diode and transistor.

1. By their structure design:

The position of terminals are fixed in components as per their structure design. Hence just by seeing the terminal can be identify. Following are the procedure.

Semiconductor diode and Zener diode contain a white / black band at one side. The band side terminal is called cathode and other one is anode of diode.

Other different types of diode like LED, photo diode, having length of one terminal is more than other one so the lengthy terminal is positive (anode) and other is cathode.

The terminals of transistor can also be identify on the basis of structure by just seeing as shown in figure.

The type of diode / transistor (NPN-PNP) can be found by their unique number with the help of data sheet.

2. Testing of component by digital multi meter:

Testing of diode:

Place the multimeter selecter switch on diode test position.

Connect the red probe to V, mA terminal of multimeter and black probe in COM terminal of multimeter.

Connect red probe to any terminal of diode and black probe to other terminal, if multi-meter shows open circuit (-1) then interchange the probe position with the diode.

Now multimeter shows certain voltage in this connection the red probe terminal is anode and other terminal is cathode.

If in both position multimeter shows open circuit (-1) it mean diode is open circuit and if in both position multi-meter shows certain minimum resistance diode is short circuit.

As in special case, the testing of photo diode a light source (simple Bulb) must be place near the diode.

Finding type of transistor and their terminal Using multi-meter.

Set the digital multi-meter selector on diode test position.

Describe three terminals as 1, 2, 3.

Conclusion: Identification of components and their terminals are very useful in circuit design and analysis.

Experiment - 3

Object: Connect various components (R, L, C) in series and parallel on bread board and measure its value using digital multimeter.

Apparatus Required: Digital multimeter (0 - 10MΩ), Capacitors, Inductors, Resistance, Connecting leads, bread board etc.

Theory

(i) Resistance connection in series:

The total resistance $R_T = R_1 + R_2 + R_3$

The effect of connecting resistance in series is to increase the total value of resistance in the circuit.

(ii) Resistance connection in parallel:

The total resistance in parallel:

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

Total resistance value in parallel is the addition of reciprocal of individual resistances value. The effect of connecting resistances in parallel is to decreases the total value of resistance in the circuit.

(iii) Inductance connection in Series:

Total inductance in series is,

$$L_T = L_1 + L_2 + L_3$$

The effect of connecting inductance in series is to increase the total value of Inductance.

(iv) Inductance connection in parallel:

The total Inductance in parallel is,

$$\frac{1}{L_T} = \frac{1}{L_1} + \frac{1}{L_2} + \frac{1}{L_3}$$

The inductance in parallel is to decrease the total value of inductance in the circuit.

(v) Capacitance connection in series:

The total capacitance in series is

$$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$$

The capacitor in series is to reduce the total value of capacitance in the circuit.

(vi) Capacitance connection in parallel:

The total capacitance in parallel is

$$C_T = C_1 + C_2 + C_3$$

The connecting capacitor in parallel is to increase the total value of capacitance in the circuit.

Procedure:

a. First Find out theoretical and measured value of supplied components individually using Multimeter and L.C.R. meter

b. Connect resistance in series on bread board and measure value using multimeter

c. Connect resistance in parallel and measure final value using digital multimeter

d. The final value of series/parallel connected capacitor & inductor measure with the help of L.C.R. meter.

e. Compare theoretical and measured value of above combination and find out deviation in value.

Observation Table:

	Resistance R_1 R_2 R_3 Se. Pa.	Capacitance C_1 C_2 C_3 Se. Pa.	Inductance L_1 L_2 L_3 Se. Pa.
Theoretic value			
Practical value			

Conclusion: After completing this experiment Students are able to know about the effect on components value due to different combinations and able to measure the final value of combination. This outcome will be helpful in obtaining particular required value of components by combination during design and fabrication of circuit.

Experiment -4

Object: Test the performance of Diode and Transistor as an electronic switch.

Apparatus Required: 30 MHz CRO, 3 MHz Function Generator, DC regulated power supply, Digital Multimeter and experimental board.

Theory: Diode and Transistor work as a high-speed electronic switch.

The diode is a two terminal device that has a PN junction. When PN junction is in forward biased satate it acts as a close circuit. When the junction is in a reverse bias state, the diode acts as open-circuited Thus, when the state of the PN junction changes from reversed biased no forward bias or vice versa the diode acts as a switch. The PN junction diode acts as an electronic switch.

Similarly, A transistor can function as a single-pole single throw switch controlled by an electronic signal driving the base terminal. When the control signal on the base terminal turns the transistor off it acts like an open switch. When the control signal on the base terminal turns the transistor on it acts like a closed switch. When transistor is used for switching, it is in one of two states on or off. In the off state, the base bias current is zero and the transistor is cut off in the on state the base bias current is set large enough to drive the transistor into saturation.

Diode as Switch:

1. Connect the diode circuit as in figure
2. Connect two way switch to ON point, diode forward biased and LED glow up means diode close switch.
3. Connect two way switch to OFF point, Diode reverse biased and LED remain off, means diode switch open.

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Transistor as Switch:

1. Connect the circuit as shown in figure.
2. Apply 5V, 1kHz square wave to the base emitter junction.
3. Apply +5V DC voltage to collector
4. Observe the input and output waveform simultaneously on DSO and observe behavior of transistor as a switch.

Conclusion:

Diode and transistor both work as fast electronic switch. This property is used in automation of circuit for controlling on-off through interfacing with microprocessor etc. After performing this experiment student will be understood the working of diode, transistor as an electronic switch.

Experiment no. 5

Object: Draw the characteristics of transistor as CE configuration and find out the current gain.

Apparatus Required: Variable power supply 0-30V (02 No), 50 μA Ammeter, 50 mA Ammeter (02 No), 10V Voltmeter (02 No) and connecting leads.

Theory: A bipolar transistor is a two junction three terminal electronic component. These three regions are called emitter, base and collector. emitter is highly doped region, which emits most of carriers. Base region is lightly doped region which control flow of carrier from emitter to collector. While collector region is for collecting the mobile carriers. Therefore, its area is greater than other two regions. Also, the dopping is less than emitter but greater than base. In common emitter configuration emitter terminal common between input and output port. This configuration provides higest current gain, therefore most commonly used for amplification purpose.

1. V_{EC} - Input power supply, for forward biasing emitter.

2. V_{CC} - Output power supply, for reverse biasing collector

3. I_B - Input base current

4. I_C - Output collector current

5. V_{BE} - Voltage drop across emitter base leads.

6. V_{CE} - Voltage drop across collector - base leads

Ratio of = $\frac{\text{Output current } I_C}{\text{Input current } I_B} = \beta$ = current gain

Procedure:

1. Input characteristics: Input characteristics obtained between I_B versus V_{BE} for different value of V_{CE}

2. First set up $V_{CE} = 0V$ by shorting collector and emitter leads and varies V_{BE} take corresponding reading of I_B. Take at least 05 readings.

3. Now set up $V_{CE} = 5V$ and again varies V_{BE}, take corresponding reading of I_B. Draw the graph Take at least 05 reading in both cases and draw the graph.

4 Output characteristics: Output characteristics are between I_C versus V_{CE} for different value of I_B.

5. First set $I_B = 5\mu A$ and vary V_{CE} from 0V to 6V with the help of variable power supply V_{cc} and take corresponding reading of I_C.

6. Repeat this process for I_B 10 μA, 15 μA, 20 μA so on and take at least 7-8 reading in both conditions draw the graph.

Observations:

Input Characteristics:

S.no	V_{CE} = V		V_{CB} = V	
	V_{BE} (in V)	I_B (in μA)	V_{BE} (in V)	I_E (in μA)
1.				
2.				

Output Characteristics:

S.no	I_B = 0		I_B = 10 μA		I_B = 20 μA		I_B = 30 μA	
	V_{CE}	I_C	V_{CE}	I_C	V_{CE}	I_C	V_{CE}	I_C
1.								
2.								

Calculation:

1. DC current gain, $\beta_{dc} = \frac{I_C}{I_B}$

Conclusion: After completing this experiment student came to know that the Commen emitter configuralion most commonly used configuretion for amplification of signal, as it provides higest current gain. Students also understand the location of diffrent regions in characteristics graph.

Experiment - 6

Object: To Test the performance of OP-Amp as an integrating amplifier.

Apparatus Required: Trainer Board, Digital multimeter (0 - 10 MΩ)
Function generator, oscilloscope (0 - 20 MΩ)

Theory: Integrator is special case of inverting amplifier in which feedback resistance are replaced by capacitor then the circuit work as an integrator whose output will be,

$$V_o = (-1)/$$
$$V_o = -1/R_1 C_f (\int V_{in}\, dt)$$

For integrator, If sine wave is apply at input then it gives 90° out of phase sine wave i.e cosine wave if square wave is apply it give triangular wave. Integrator works as active low pass filter.

Procedure:

1. Connections are made according to circuit digram.
2. Switch on the dual power supply.
3. Apply sine wave input signal (1 Vp-p) from function generator and observe the output on CRO/DSO
4. Similarly apply square wave input signal (1 Vp-p) and again observe the output on CRO/DSO
5. Trace the necessary input and output waveform on simple graph paper.

Observation Table:

Sno.		Input Waveform		Output Waveform	
	Type	Magnitude	Frequency	Magnitude	Frequency
1.	Sine wave				
2.	Square wave				

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Conclusion:

After completing this experiment student are able to understand effect of integrator on input waveform and also know how to view these signals on CRO / DSO.