8. LAB DETAILS

8.3 ELECTRONIC DEVICES AND CIRCUITS LAB

8.3.1 Objectives and Relevance

8.3.2 Scope

8.3.3 Syllabus - JNTU

8.3.4 Suggested Books

8.3.5 Websites

8.3.6 Experts' Details

8.3.7 Lab Schedules

8.3 ELECTRONIC DEVICES AND CIRCUITS LAB

8.3.1 OBJECTIVE AND RELEVANCE

The objective of this course is to study various electronic components and design of various electronic circuits like power supply, audio and power amplifiers. This course is considered as foundation course for electronics and electrical engineers. The subjects to be studied in higher semesters require thorough knowledge on electronic devices and circuits.

8.3.2 SCOPE

This laboratory session provides learning opportunities that should enable the student to do the following upon completion of this course:

- Set up a bias point in a transistor.
- Verify the working of diodes, transistors and their applications.
- Build a common emitter/base/collector amplifier and measure its Voltage gain.
- Understand the use of RPS and CRT.
- Learn to design different types of filters and its importance.

8.3.3 SYLLABUS – JNTU

PART A: (Only for Viva-voce Examination)

Electronic Workshop Practice (In 3 Lab Sessions):

1. Identification, Specifications, Testing of R, L, C Components (Color Codes), Potentiometers, Switches (SPDT, DPDT, and DIP), Coils, Gang Condensers, Relays, Bread Boards, PCB's
2. Identification, Specifications and Testing of Active Devices, Diodes, BJT's, Low power JFET's, MOSFET's, Power Transistors, LED's, LCD's, SCR, UJT.
3. Study and operation of
   i) Multimeters (Analog and Digital)
   ii) Function Generator
   iii) Regulated Power Supplies
   iv) CRO.

PART B: (For Laboratory Examination – Minimum of 10 experiments)

1. Forward & Reverse Bias Characteristics of PN Junction Diode.
2. Zener diode characteristics and Zener as voltage Regulator.
3. Input & Output Characteristics of Transistor in CB Configuration and h-parameter calculations.
4. Input & Output Characteristics of Transistor in CE Configuration and h-parameter calculations.
5. Half Wave Rectifier with & without filters.
6. Full Wave Rectifier with & without filters.
7. FET characteristics.
8. Design of Self-bias circuit.
9. Frequency Response of CC Amplifier.
10. Frequency Response of CE Amplifier.
11. Frequency Response of Common Source FET amplifier .
12. SCR characteristics.
13. UJT Characteristics

PREAMBLE

The JNTU syllabus covers the experiments in Electronic Devices and Circuits Subject and is divided into two parts. The part-A has 03 study experiments and gives the general awareness of the various components, equipments and other details required to carry out the prescribed experiments without much difficulty to the students.

The part-B has 13 experiments out of which only 10 experiments are required to be conducted. The experiments are distributed from all the chapters of theory. They are designed in a way that the students gain good knowledge of the basic concepts by conducting practical. At the end of the course, the student will Understand different types of diodes operation and its characteristics, Design and analyze the DC bias circuitry of BJT . To analyze and design diode application circuits, amplifier circuits and oscillators employing BJT, FET devices.

APPLICATIONS

The experiments prescribed in the syllabus are all application oriented mainly used for the development of DC regulated power supplies, CROs, audio and video amplifiers, frequency and function generators, etc.

EXPERIMENT NO. 1

Identification, specifications, testing of R,L,C Components (Color Codes), Potentiometers, Switches (SPDT, DPDT, and DIP), Coils, Gang Condensers, Relays, Bread Boards. (JNTU Sl. No. 1)

OBJECTIVE
To study the behaviour of various passive electronic components, identification and their specifications.

PREREQUISITES
Definition and working of all above components.

THEORY

RESISTOR
In electronic circuit applications, resistance is inserted to oppose the flow of current and to produce the voltage drop. Resistors of different values and ratings are available from 1 ohm to several M ohm. Power ratings may vary from ¼ watt to 5 watt or more.

INDUCTOR
When current flows through a wire that has been coiled, it generates a magnetic field. The magnetic field reacts so as to oppose any change in the current. Inductance is used to control the flow of current and keep them at Steady state. Inductance is measured in Henrys.

CAPACITOR
Capacitors are used to store electric charge and the capacitance is measured in Farads. Types of capacitors are named according to dielectric used. Most common dielectrics are air, paper, mica, ceramic, and electrolytic.

POTENTIOMETERS
The small variable resistors commonly used in electronic circuits are called potentiometers. Potentiometers can be either linear or non-linear.

SWITCHES
Switch is a device which can connect two points in a circuit or disconnect.

a. **SPDT (Single Pole Double Throw):** There are two independent slots to be connected two throws but still connecting one pole
b. **DPDT (Double Pole Double Throw):** It connects two poles to two throws.

c. **SPST (Single pole Single Throw):** It connects one pole to one throw.
d. **DPST (Double pole Single Throw):** It connects two poles to one throw.

GANG CAPACITOR

Gang capacitor is nothing but stack of several capacitors connected by a common knob. If you change the knob position then automatically the effective capacitance will be changed.

RELAYS

Relays are primarily switching devices employed to control large power or to perform switching operation. Relays are current operated devices. The current required to operate the relay depends on the application.

BREAD BOARDS

Bread board is a plastic board with internal wirings connected horizontally and vertically which facilitates making power supply and ground connections vertically and horizontally.

DESCRIPTION

a. Introduction to all electrical and electronic components with color coding and specifications- 30min.
b. To measure the corresponding values of various electrical and electronic components
c. Identifying the components based on its specifications

APPLICATIONS

Experiment deals with various devices which are mainly used for design and construction of DC power supplies, regulated power supplies and other devices such as CRO.

EXPERIMENT NO. 2

Identification, Specification and Testing of Active Devices, Diodes, BJTs, Low power JFETs, MOSFETs, Power Transistors, LEDs, LCDs, Optoelectronic Devices, SCR, UJT, DIACs TRIACs, Linear and Digital ICs (JNTU Sl. No. 2)

OBJECTIVE

To identify and testing procedure for various active devices like BJT, FET, SCR, UJT., DIACs TRIACs, Linear and Digital ICs etc., and to study their pin diagrams, operations and characteristics.

PREREQUISITES

Definition, Operation of all active and passive Devices

DESCRIPTION

a. Introduction to all components-30 min
b. Identification, Specification, testing procedure for active devices
c. Operating principles of all active devices
d. Study of pin configuration of various active devices.

APPLICATIONS

Experiment deals with various devices which are mainly used for design of power amplifiers, audio amplifiers and other related electronic industrial controllers using SCR, UJT, etc.

EXPERIMENT NO. 3

Study of operation of

i) Millimeters (Analog and Digital)
ii) Function Generator
iii) Regulated Power Supplies
iv) CRO **(JNTU Sl. No. 3)**

OBJECTIVE

To study the operation of devices like multimeter, function generators and RPS and different operating modes of CRO.

PREREQUISITES

Specifications and working of multimeters function generators and RPS and CRO.

THEORY

i. Analog and Digital multimeters are used to measure voltage, current and resistance values. In analog multimeter, indicating instruments are used to point the corresponding values of V, I and R. The digital multimeters use LCD for indicating different values according to the ranges provided on the instrument.

ii. Function Generators are electronic instruments used to provide input frequency and voltage to various electronic circuits. There is a provision to generate sinusoidal, square and triangular waveforms at convenient frequencies in a required range for electronic circuits.

iii. Regulated Power Supplies : These are DC regulated power supplies and provide DC voltage for Electronic Circuits. Usual ranges are 0 to 30 Volts at 2 Amps, and 0 to 15 Volts.

iv. CRO: It is one of the most widely used measuring device in electronic and testing lab oratories CRO gives visual display of an input signal current or voltages). This enables not only measurement of the quantity, but also analysis and manipulation of its waveform.

DESCRIPTION

a. Introduction to equipments
b. Operation of equipments
c. Measuring methodology
d. Block diagram and types of CROs
e. Front panel controls and observation of waveforms
f. Measurement of basic quantities and of unknown frequency and phase angle
g. Lissajous patterns and Component Testing.

PART – B

UNIT - I

EXPERIMENT NO. 1
PN Junction diode characteristics (Forward bias, Reverse bias)
(JNTU Sl. No. 1)

OBJECTIVE

Experimental determination of junction diode characteristics.

PREREQUISITES

Theoretical background of diode and V-I characteristics in forward and reverse bias mode.

DESCRIPTION

a. Introduction to experiment-30 min.
b. To plot the V-I characteristics of junction diode in forward bias mode
c. To plot the V-I characteristics of junction diode in reverse bias mode

APPLICATIONS
Use for design and construction of power supplies.

UNIT – I

EXPERIMENT NO. 2
SCR characteristics. **(JNTU Sl. No. 12)**

OBJECTIVE
Experimental determination of SCR characteristics.

PREREQUISITES
Theoretical background of SCR and V-I characteristics in forward and reverse bias mode.

DESCRIPTION
a. Introduction to experiment-30 min.
b. To plot the V-I characteristics of SCR in forward bias mode
c. To plot the V-I characteristics of SCR in reverse bias mode

APPLICATIONS
Design of rectifiers, switches, power and speed control circuits.
UNIT – I

EXPERIMENT NO. 3
UJT Characteristics **(JNTU Sl. No. 13)**

OBJECTIVE
Experimental determination of UJT characteristics.

PREREQUISITES
Theoretical background of UJT and V-I characteristics in forward and reverse bias mode.

DESCRIPTION
a. Introduction to experiment-30 min.
b. To plot the V-I characteristics of UJT in forward bias mode
c. To plot the V-I characteristics of UJT in reverse bias mode

APPLICATIONS
Design of trigger devices, relaxation oscillators and timing circuits.

UNIT – II

EXPERIMENT NO. 4
Zener diode characteristics and Zener as voltage Regulator.
(JNTU Sl. No. 2)

OBJECTIVE
1.Experimental determination of zener diode characteristics.
2. Experimental determination of zener diode as voltage regulator.

PREREQUISITES
Theoretical background of zener diode and its characteristics and working of voltage regulator.

DESCRIPTION
a. Introduction to experiment-30 min.
b. To plot the V-I characteristics of zener diode in forward bias mode.
c. To plot the V-I characteristics of zener diode in reverse bias mode and find its break down voltage value.
d. To verify the working of zener diode as voltage regulator

APPLICATIONS
Design and construction of Regulated DC power supplies.

UNIT – II

EXPERIMENT NO. 5
Half Wave Rectifier with & without filters. **(JNTU Sl. No. 5)**

OBJECTIVE
Experimental determination of conversion efficiency, ripple factor of half wave rectifier with and without filters.

PREREQUISITES
Theoretical background of rectifiers and filters.

DESCRIPTION
a. Introduction to experiment-30 min
b. Determine the efficiency, ripple factor etc; for half wave rectifier
c. Determine the efficiency, ripple factor etc., using Capacitor-filter for half wave rectifier.

d. Compare theoretical values of efficiency, ripple factor etc., with experimental values.

APPLICATIONS

Design and construction of Regulated DC power supplies.

UNIT – II

EXPERIMENT NO. 6

Full Wave Rectifier with & without filters. **(JNTU Sl. No. 6)**

OBJECTIVE

Experimental determination of conversion efficiency, ripple factor of a diode in full wave rectifier with and without filter circuits.

PREREQUISITES

Theoretical background of rectifiers and filters.

DESCRIPTION

a. Introduction to experiment-30 min
b. Determine the efficiency, ripple factor etc; for full wave rectifier
b. Determine the efficiency, ripple factor etc., using Capacitor-filter for full wave rectifier
c. Compare theoretical values of efficiency, ripple factor etc., with experimental values

APPLICATIONS

Design and construction of Regulated DC power supplies

UNIT – III

EXPERIMENT NO. 7

Input & Output Characteristics of Transistor in CE Configuration and h-parameter calculations **(JNTU Sl. No. 3)**

OBJECTIVE

To study the behaviour of transistor connected in CE configuration and trace the characteristics and calculate h-parameter values.

PREREQUISITES

Theoretical background of transistor in CE configuration and h-parameter.

DESCRIPTION

a. Introduction to experiment-30 min
b. Study the input characteristics of transistor in CE configuration
c. Study the output characteristics of transistor in CE configuration

d. Calculate the h-parameter values in CE configuration.

APPLICATIONS

Design and development of audio amplifiers, switches.

UNIT – III

EXPERIMENT NO. 8

Input & Output Characteristics of Transistor in CB Configuration and h-parameter calculations **(JNTU Sl. No. 4)**

OBJECTIVE

To study the behaviour of transistor connected in CB configuration and trace the characteristics and calculate h-parameter values.

PREREQUISITES

Theoretical background of transistor in CB configuration and h-parameter.

DESCRIPTION

a. Introduction to experiment-30 min
b. Study the input characteristics of transistor in CB configuration
c. Study the output characteristics of transistor in CB configuration
d. Calculate the h-parameter values in CB configuration.

APPLICATIONS

Design and development of amplifiers and radio frequency applications.

UNIT – III

EXPERIMENT NO. 9

Frequency Response of CC Amplifier. **(JNTU Sl. No. 9)**

OBJECTIVE

Experimental determination of frequency response curve of CC Amplifier.

PREREQUISITES

Theoretical background of CC configuration and amplifier.

DESCRIPTION

a. Introduction to experiment-30 min.
b. To plot the frequency response curve of CC Amplifier
c. To measure the bandwidth, voltage gain, operating point, input and output impedances.

APPLICATIONS
Design of amplifiers, wave generation and switching.

UNIT – III

EXPERIMENT NO. 10
Frequency Response of CE Amplifier. **(JNTU Sl. No. 10)**

OBJECTIVE
Experimental determination of frequency response curve of CE Amplifier.

PREREQUISITES
Theoretical background of CE configuration and amplifier.

DESCRIPTION
a. Introduction to experiment-30 min.
b. To plot the frequency response curve of CE Amplifier
c. To measure the bandwidth, voltage gain, operating point, input and output impedances.

APPLICATIONS
Design of amplifiers, wave generation and switching.

UNIT – IV

EXPERIMENT NO. 11
Design of Self-bias circuit. **(JNTU Sl. No. 8)**

OBJECTIVE
Experimental determination of stability of self-bias circuit.

PREREQUISITES
Theoretical background of biasing techniques

DESCRIPTION
a. Introduction to experiment-30 min.
b. To calculate the stability factor of circuit.

APPLICATIONS
Design of linear circuits.

UNIT – V

EXPERIMENT NO. 12

FET characteristics **(JNTU Sl. No. 7)**

OBJECTIVE

Experimental determination of FET characteristics.

PREREQUISITES

Theoretical background of FET and V-I characteristics in forward and reverse bias mode.

DESCRIPTION

a. Introduction to experiment-30 min.
b. To plot the V-I characteristics of FET in forward bias mode
c. To plot the V-I characteristics of FET in reverse bias mode

APPLICATIONS

Design and development of audio and video amplifiers.

UNIT – V

EXPERIMENT NO. 13

Frequency Response of Common Source FET amplifier . **(JNTU Sl. No. 11)**

OBJECTIVE

Experimental determination of Frequency Response curve of Common Source FET amplifier.

PREREQUISITES

Theoretical background of FET amplifier.

DESCRIPTION

a. Introduction to experiment-30 min.
b. To plot the frequency response curve of CE Amplifier
c. To measure the bandwidth and voltage gain

APPLICATIONS

Design and development of voltage amplifiers.

8.3.5 SUGGESTED BOOKS

1. Millman's Electronic Devices and Circuits – J. Millman, C.C.Halkias, and Satyabrata Jit, 2 Ed.,1998, TMH.
2. Electronic Devices and Circuits – Mohammad Rashid, Cengage Learing, 2013
3. Electronic Devices and Circuits – David A. Bell, 5 Ed, Oxford
4. Integrated Electronics – J. Millman and Christos C. Halkias, 1991 Ed., 2008, TMH.
5. Electronic Devices and Circuits – R.L. Boylestad and Louis Nashelsky, 9 Ed., 2006, PEI/PHI.
6. Electronic Devices and Circuits – B. P. Singh, Rekha Singh, Pearson, 2Ed, 2013.
7. Electronic Devices and Circuits - K. Lal Kishore, 2 Ed., 2005, BSP.
8. Electronic Devices and Circuits – Anil K. Maini, Varsha Agarwal, 1 Ed., 2009, Wiley India Pvt. Ltd.
9. Electronic Devices and Circuits – S.Salivahanan, N.Suresh Kumar, A.Vallavaraj, 2 Ed., 2008, TMH.
10. Electronic Devices and Circuits,T.F. Bogart Jr.J.S.Beasley and G.Rico, Pearson Education 6th edition, 2004
11. Principles of Electronic Circuits, S.G. Burns and P.R.Bond, Galgotia Publications, 2nd Edition, 1998.
12. Microelectronics, Millman and Grabel, Tata McGraw Hill, 1988.
13. Electricity Electronics Fundamentals, A TEXT - LAB MANUAL - Fourth Edition Paul B.Zbas.Joseph Sloop, TMH.
14. Electronic components, D.V.Prasad, PPH Publications.
15. Practical's in basic electronics, G.K. Mithal, G.K. Publication.

8.3.6 WEBSITES

1. www.reed.electronics.com
2. www.uoquelph.ca/nantoon/circ
3. www.ece.ufl.edu
4. www.circuitmaker.com
5. www.ciebookstore.com
6. www.neptal.com

8.3.7 EXPERTS' DETAILS

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