Course Name : Electrical Engineering Group

Course Code : EE/EP

Semester : Third

Subject Title : Basic Electronics (Electrical)

Subject Code : 17321

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
04	--	02	03	100	25#	--	25@	150

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

Rationale:

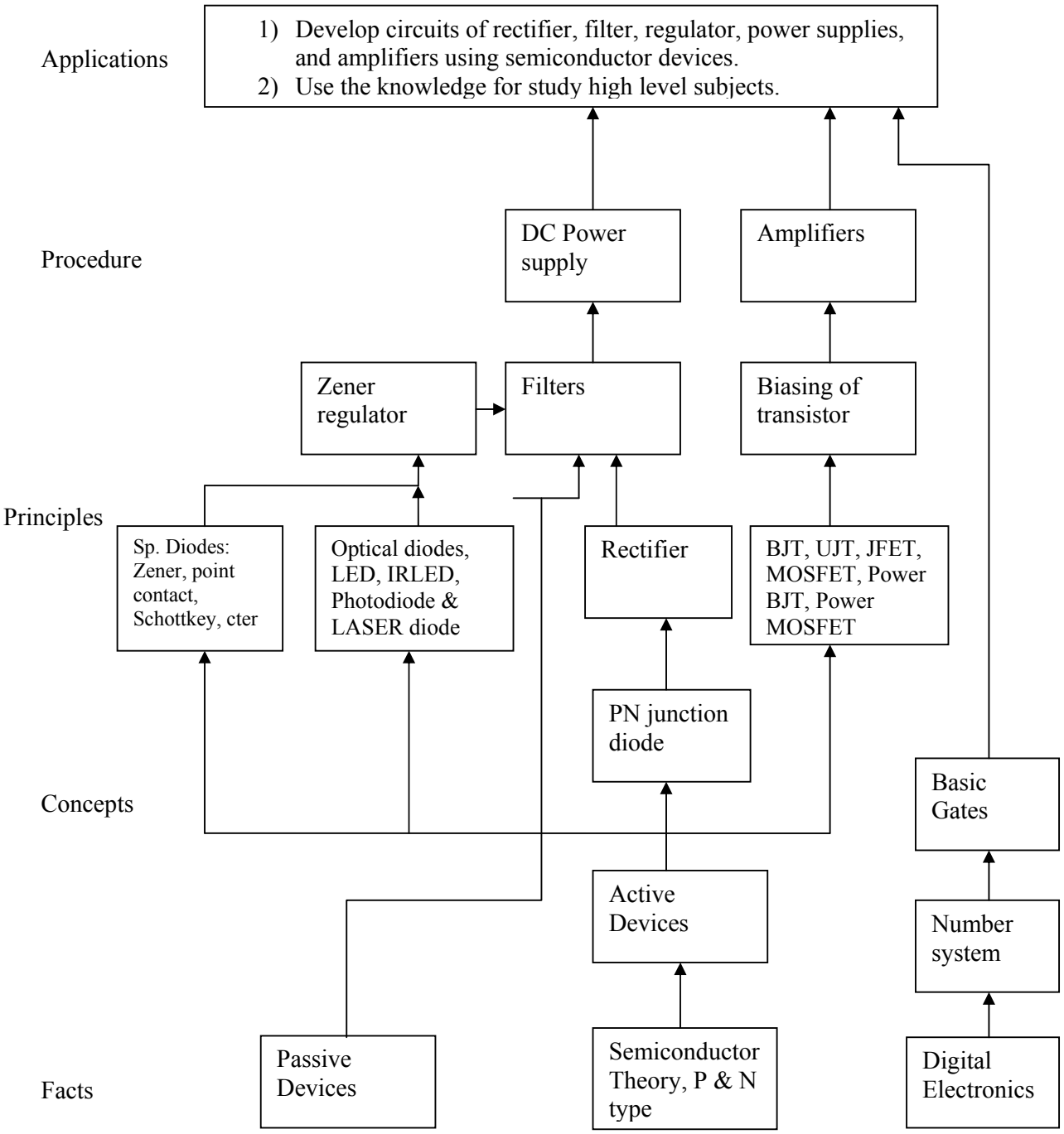
Electronics plays very important role in our day to day life. Basic electronics is the base for all engineering trades. It starts with the semiconductor material. Next the working principle of PN junction will help the students to understand the working of most of the semiconductor devices. Study of optical diodes gives basics for all optical devices such as scanner, Xerox machine, fax machine etc. Students should understand basics of power supply, since most of the electronic devices work on DC power supply. Study of MOSFET is essential since 95% of the semiconductor market is devices are controlled by MOSFETs. Introduction to digital electronics gives the students idea about working of microprocessor.

Objectives:

Students will be able to:

1. Define the scope of electronics.
2. State some applications of electronics in our day-to-day life.
3. State the latest trends in the field of electronics.
4. Draw the symbol, characteristics & applications of some important active devices.
5. Testing of active & passive components.
6. List the specifications of active & passive components.
7. Reading the data sheets of electronic components.

Learning Structure:



Theory:

Topic and Detailed Content	Hours	Marks
Topic 1: Semiconductor Diode **Specific Objectives:** ➢ Select specific diode according to application. ➢ Select the diode with required specification. **Contents:** **1.1 Semiconductor Theory** • Review of semiconductor theory (No questions to be set in Theory Paper) • Intrinsic semiconductor, Extrinsic semiconductor, doping, dopant • Trivalent & pentavalent impurities, P- Type and N- Type semiconductor. **1.2 Semiconductor Diode** • PN Junction. • Junction theory: Barrier voltage, Depletion region, Junction capacitance, Forward and reverse biased junction • V- I characteristics of P-N junction diode. • Circuit diagram for characteristics(Forward & Reverse) **1.3 Specifications of diode** • Forward Voltage Drop, Reverse Saturation Current, Maximum Forward Current, Power Dissipation. • Ideal Diode Model. **1.4 Zener diode** • Construction & symbol • Circuit diagram for characteristics(Forward & Reverse) • Specification of zener diode: zener voltage(VZ), Maximum power dissipation(PD(max)) , Break over current(I_{ZK}), zener resistance. • Special purpose diodes: Schottkey diode, Point-contact diode, Varacter diode (Construction, symbol, Characteristics and applications). • Optical diodes: LED, IRLED, Photodiode and LASER diode (Symbol, operating principle and applications of each)	08	12
Topics 2: Rectifiers and Filters **Specific Objectives:** ➢ Select the specific rectifier & filter according to the requirement ➢ Lists various types of filter circuits with advantages & disadvantages. **Contents:** **2.1 Rectifiers** • Need of rectifier • Types of rectifier: Half wave rectifier, Full wave rectifier(Bridge and Centre tapped) • Working with waveform(IP /OP waveformsfor voltage and current, Average (DC) value of current and voltage (No derivation) • Ripple, ripple factor, ripple frequency, PIV of diode used, transformer utilization factor, efficiency of rectifier. • Comparison of three types of rectifiers (HWR. FWR (bridge & centre tapped). **2.2 Filters** • Need of filters • Types of filters: shunt capacitor, series inductor, LC filter, π filter (circuit diagram, operation, DC O/P voltage, ripple factor (formula), ripple	06	08

frequency, Dependence of ripple factor on load. • I/P and O/P waveforms, Limitations and Advantages of all types of filters.		
Topic : 3 Bipolar Junction Transistor **Specific Objectives:** ➢ Identify the transistor configuration according to application. ➢ Lists types of biasing & coupling. ➢ Select the specific amplifier type according to application. **Contents:** **3.1 Transistor 16 Marks** • Transistor definition • Types: NPN, PNP junction transistors (Symbols, operating principle (NPN only) • Transistor configuration: Common emitter (CE), common collector (CC), common base (CB). • Characteristics in CE configuration (Circuit diagram, I/P and O/P characteristics, different points of characteristics (Cut-off, Active and Saturation), input resistance, output resistance, current gain (α and β) Transistor Biasing: • Need of biasing, DC load line, Operating point • Types of biasing circuits**:** Fixed bias circuit, Base biased with emitter feedback, Base biased with collector feedback, Voltage divider bias, Emitter biased **3. 2 Transistor as an amplifier (CE configuration only) 12 Marks** • Graphical representation, Current gain, Voltage gain, Power gain (No derivation), Input output resistance, Phase shift between input and output. • AC Load line • Single Stage CE amplifier: Circuit diagram, Function of each component, Frequency response and bandwidth. **Need of Cascaded amplifier** • Types of coupling : RC couple, Transformer couple, Direct couple (Circuit diagram and function of each component) • Application of each amplifier • Transistor as a switch – (Circuit diagram, operation, application) **3.3 Power amplifier 08 Marks** • Introduction, classification : class A, class B, class AB, class C (Efficiency of each). • Single stage class A power amplifier (Circuit operation, IP/OP waveforms, graphical analysis and efficiency) • Transformer couple resistive load single stage power amplifier. • Class A push pull amplifier. • Class B push pull amplifier. • Class AB push pull amplifier. • Concept of cross over distortion. • Need of heat sink. **UJT** • Symbol, characteristics and working principle of UJT.	24	36
Topic : 4 Field Effect Transistor (Unipolar Transistor) **Specific Objectives:** ➢ Differentiate between BJT & FET. ➢ Identify the type of unipolar transistor to suit the application. **Contents:**	08	12

4.1 FET • Types, Symbols and working principle • Characteristics of FET, Circuit diagram for drain characteristics, Operating regions of characteristics. • Drain resistance, Mutual capacitance, amplification factor and their relation, Pinch off voltage of FET • Comparison of BJT and FET.(Types of carriers, switching speed, Thermal stability, space in case of IC fabrication, control parameter, input impedance, offset voltage, power gain at audio frequencies) **4.2 MOSFET** • Types, symbol, working principle • Application of FET and MOSFET.		
Topic : 5 Regulated Power Supply **Specific Objectives:** ➢ Identify the regulator IC with specification. ➢ Select the regulator IC to meet the application. **Contents:** • Definition of regulator, Need of regulator, Voltage regulation factor, • Concept of load regulation and line regulation • Zener diode as a voltage regulator. • Basic block diagram of DC power supply • Transistorized Series voltage regulator, Transistorized Shunt voltage regulator, (Circuit diagram and operation) **Regulator IC's** • IC's 78XX, 79XX (Functional Pin diagram) • IC 723 as fixed, variable and Dual regulator.	04	12
Topic: 6 Oscillators **Specific Objectives:** ➢ State the concept of feedback & Barkhausen criteria. ➢ Select the specific oscillator circuit according to application. **Contents:** • Definition and block diagram of oscillator. • Concept of feedback, Types of feedback, Positive feedback, Negative feedback, Barkhausen's criterion **Classification of oscillators** • LC oscillators • Hartley oscillators • Colpitt's oscillators • RC oscillator • Crystal Oscillator **(Circuit Diagram & Working)**	08	12
Topic : 7 Digital Electronics **Specific Objectives:** ➢ Identify various gates with truth table. ➢ Describe the basics of Micro Processor. **Contents:** • Digital circuit, Digital signal, Use of digital circuit and signal. • Number System: Introduction to binary, octal decimal and hexadecimal number system **Logic Gates** • Logic symbol, Logical expression and truth table of AND, OR, NOT,	06	08

EX-OR, & EX-NOR gates. • Universal gates : NAND gate and NOR gate • Application of Digital Electronics • Basic block diagram of Microprocessor.		
Total	**64**	**100**

Practical:
Skills to be developed:

Intellectual Skills:
1. Identification & selection of components.
2. Interpretation of circuits.
3. Understand working of rectifier, filter, amplifier & oscillator circuits.

Motor Skills:
1. Ability to draw the circuits
2. Ability to measure various parameters.
3. Ability to test the components using multimeter.
4. Ability to read data sheets of components.
5. Follow standard test procedures.

List of Practicals:
1. Forward & Reverse characteristics of diode.
2. Forward & Reverse characteristics of zener diode.
3. Study of Rectifiers (Half wave & Full wave) & Filters(Capacitor & Inductor Filter)
4. Input & output characteristics of transistor in CE mode.
5. Characteristics of FET.
6. Characteristics of UJT.
7. Load & Line regulation characteristics of Zener Diode Regulator.
8. Frequency response of single stage RC coupled amplifier.
9. Determine waveforms of LC & RC oscillator circuits.
10. Verifying truth tables of logic gates using ICs.

Learning Resources:
Books:

Sr. No.	Author	Title	Publisher
1	N. N. Bhargava, D.C. Kulashreshtha, S.C. Gupta – TTTI Chandigharh	Basic Electronics & Linear Circuits	Tata McGraw Hill
2	Albert Malvino David J Bates	Electronic Principles	Tata McGraw Hill
3	Debashis De	Basic Electronics	Pearson
4	B Basavaraj H N Shivashankar	Basic Electronics	Vikas
5	Vijar Baru Rajendra Kaduskar Sunil T. Gaikwad	Basic Electronics Engineering	Dreamtech
6	J. P. Bandyopadhyay	Basic Electronics Engineering	Vikas
7	David A Bell	Electronic Devices & circuits	Oxford