

GUJARAT TECHNOLOGICAL UNIVERSITY

COURSE NAME : ELECTRONIC DEVICES AND CIRCUITS - I

1. RATIONALE:

The aim of introducing this course is to impart knowledge of basic Electronics devices to the students of Electronics Engineering. Through the study of this course the students will get, knowledge of construction, working & characteristics of various types of diodes and transistors. The study of the devices will be helpful to understand the various basic and applied technology courses.

2. SCHEME OF TEACHING

Sr.No.	Topics	Th.	Pra.	Total
1.	Semiconductor physics and diodes	04	02	06
2.	Diode applications and other terminal devices.	08	14	22
3.	Transistor	06	10	16
4.	Transistor amplifier	06	06	12
5.	Transistor biasing circuits and thermal stability	04	06	10
6.	Frequency response of small signal transistor amplifier	06	04	10
7.	Hybrid parameter.	04	04	08
8.	Regulated Power Supply	04	10	14
TOTAL		42	56	98

3. TOPICS AND SUBTOPICS:

1. SEMICONDUCTOR PHYSICS AND DIODES:

- 1.1 Energy levels of conductors, semiconductors and insulators.
- 1.2 Extrinsic material N & P type.
- 1.3 Ideal diode basic construction & characteristics.
- 1.4 D.C. & A.C. resistance of diode.
- 1.5 Diode equivalent circuits.
- 1.6 Drift and diffusion currents.
- 1.7 Transition and diffusion capacitance.

2. DIODE APPLICATION AND OTHER TERMINAL DEVICES:

- 2.1 Series and parallel diode configuration with d.c. inputs.
- 2.2 The half-wave, full-wave and bridge rectifier and determination of PIV.
- 2.3 Determination of average d.c. current, voltage, ratio of rectification and ripple factor.
- 2.4 Disadvantage of half wave rectifier.
- 2.5 Requirement of filters.
- 2.6 Simple capacitor filter & induction filter.
- 2.7 Diode clamper and clipper.
- 2.8 Voltage doubler and multipliers.
- 2.9 Zener diode characteristics & operation.
- 2.10 Schottky barrier diode.

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- 2.11 Varactor/diode tunnel diode.
- 2.12 Photo diode , LDR, photo volatic cell, photo transistor .
- 2.13 Light emitting diode & Optocoupler, opto-isolator
- 2.14 Seven Segment display

3. TRANSISTOR :

- 3.1 Transistor construction (NPN silicon planner transistor)
- 3.2 Transistor operation and amplifying action.
- 3.3 Common base configuration.
- 3.4 Common emitter configuration.
- 3.5 Relation between current gain, alpha and beta.

4. TRANSISTOR AMPLIFIERS :

- 4.1 Principle of an amplifier.
- 4.2 Tr. common base amplifier working.
- 4.3 D.C. load line & operating point in CB amplifier.
- 4.4 Determination of A_v , A_i , A_p , R_i , R_o in CB amplifier.
- 4.5 Tr. common emitter amplifier.
- 4.6 Load line consideration & operating point in CE Amplifier, Determination of A_v , A_i , A_p , R_o , R_i in CE amplifier.
- 4.7 Tr. common collector amplifier.
- 4.8 Comparison of CB, CE and CC amplifier.
- 4.9 Darlington pair

5. TRANSITOR BIASING CIRCUITS AND THERMAL STABILITY:

- 5.1 Transistor biasing circuits.
- 5.2 Reasons for thermal instability.
- 5.3 Stability factor.
- 5.4 Stability factor of a CE amplifier.
- 5.5 Collector to base biasing methods for stabilisation.
- 5.6 Emitter biasing methods for stabilisation and emitter bypass capacitor.
- 5.7 Potential divider method of biasing, Thermal resistance & requirements of heat sink.

6. FREQUENCY RESPONSE OF SMALL SIGNAL TRANSISTOR AMPLIFIER

- 6.1 Different methods of coupling in amplifier.
- 6.2 Circuits of R.C. coupled amplifier. using single stage (CE)
- 6.3 Two stage RC coupled amplifier.
- 6.4 Low frequency response of R-C coupled CE Amplifier.
- 6.5 Low frequency response and effect of coupling and emmitter bypass capacitor
- 6.6 Low frequency response to a pulse.
- 6.7 High frequency response to a pulse.
- 6.8 High frequency Model for CE Amplifier.

7. HYBRID PARAMETERS

- 7.1 Transistor Amplifier as a four terminal network (Black Box Concept)
- 7.2 Hybrid parameter & derivation
- 7.3 Hybrid parameters for transistor Amplifier
- 7.4 Transistor amp analysis using H-parameters

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8. REGULATED POWER SUPPLY

- 8.1 Simple series voltage regulators with over current and over voltage protection
- 8.2 Shunt regulator using transistor
- 8.3 SMPS (Switch mode power supply)
- 8.4 Three terminal voltage regulators like 7805, 7812, 7905 & 7912
- 8.5 Basic working principle and advantage of stabilizer & uninterrupted power supply (UPS)

4. LABORATORY EXPERIENCES:

- 1. To study the C.R.O.
- 2. To study function generator & T.P.S.U.
- 3. To study Multimeter.
- 4. Identification of components.
- 5. To study forward & reverse V-I characteristics of diode.
- 6. To study zener diode characteristic.
- 7. To study the characteristics of LED.
- 8. To study the characteristics of photodiode.
- 9. To test Half-wave rectifier.
- 10. To test full-wave rectifier with capacitor filter.
- 11. To test Bridge rectifier with choke filter.
- 12. To study the positive & negative clipping.
- 13. To study the positive & negative clamping.
- 14. To study the LDR characteristic.
- 15. To verify I/P & O/P characteristic of CB configuration.
- 16. To verify I/P & O/P characteristic of CE configuration.
- 17. To test CE amplifier & obtain the frequency response.
- 18. To test darlington pair.
- 19. To study colour coding of resistors, capacitors.
- 20. To Measure the load regulation and line regulation of Regulated Power Supply / SMPS
- 21. To study different types of capacitors.

5. REFERENCES:

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|-------------------------------------|-------------------|---------|
| 1. Electronics Principles | A.P.Malvino | TMH |
| 2. Electronic device & Circuits | Allen Mottershead | MGH |
| 3. Electronic devices & Ckts.theory | Robert Boylestand | PHI |
| | Louis Nashelsky | |
| 4. Electronic devices & Ckts. | Millman-Halkias | MGH |
| 5. Electronic devices & Ckts. | V. K. Mehta | S.Chand |
| 6. Integrated Electronics | Millman & Halkias | |