**3.4 ELECTRONICS - II**

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**RATIONALE**

The purpose of the introduction of electronics in the electrical engineering diploma course has been already explained in the rationale of the subject Basic Electronics in this course topic like Amplifiers, Oscillators and Wave Shape Circuits have been dealt with.

**LEARNING OUTCOMES**

After undergoing the subject, students will be able to:

* Differentiate the voltage and power amplifier
* Analyze amplifier and enhance the gain of amplifier
* Design a wave shaping circuit
* Realize regulated power supply circuit using voltage regulator IC
* Use Op-Amp as amplifiers, adder, comparator, integrator and differentiator

**DETAILED CONTENTS**

1. Transistor Audio Power Amplifier (09 periods)

* 1. Difference between voltage and power amplifier
  2. Important terms in Power Amplifier, collector efficiency, distortion and dissipation capability
  3. Classification of power amplifier class A, B and C
  4. Class A single-ended power amplifier, its working and collector efficiency
  5. Impedance matching in a power amplifier using transformer
  6. Heat sinks in power amplifiers
  7. Push-pull amplifier: circuit details, working and advantages (no mathematical derivations)
  8. Principles of the working of complementary symmetry push-pull amplifier

2. Tuned Voltage Amplifier (06 periods)

* 1. Introduction
  2. Series and parallel resonance ( No mathematical derivation)
  3. Single and double tuned voltage amplifiers
  4. Frequency response of tuned voltage amplifiers
  5. Applications of tuned voltage amplifiers

3. Feedback in Amplifiers ( 06 periods)

* 1. Feedback and its importance, positive and negative feedback and their need A
  2. Voltage gain of an amplifier with negative feedback A = ---------- 1+βA

3.3 Effect of negative feedback on voltage gain, stability, distortion, band width, output   and input impedance of an amplifier (No mathematical derivation)

3.4 Typical feedback circuits

3.5 Effect of removing the emitter by-pass capacitor on a CE transistor amplifier

* 1. Emitter follower and its applications

4. Sinusoidal Oscillators (06 periods)

1. Sinusoidal Oscillators – positive feedback in amplifiers
2. Difference between an oscillator and an alternator
3. Essentials of an oscillator
4. Circuit details and working of LC oscillators viz. Tuned Collector, Hartley and Colpitt’s oscillators
5. R-C oscillator circuits, phase shift and Wein bridge oscillator circuits
6. Introduction to piezoelectric crystal and crystal oscillator circuit

5. Wave-Shaping and Switching Circuits (11 periods)

5.1 Concept of Wave-shaping

5.2 Wave-shaping circuits

a. R-C differentiating and integrating circuits

b. Diode clipping circuits

c. Diode clamping circuits

d. Applications of wave-shaping circuits

* 1. Transistor as a switch (explanation using CE transistor characteristics)

5.4 Collector coupled astable, monostable, bistable multivibrator circuits (explanation using wave shapes). Brief mention of uses of multivibrators

5.5 Working and applications of transistor inverter circuit using power transistors

6. Power supplies: (04 periods)

Working Principles of different types of power supplies viz. CVTs, IC voltage regulator (78 XX,79XX)

7. Operational Amplifier(06 periods)

1. The basic operational amplifier. The differential amplifier. The emitter coupled differential amplifier. Offset even voltages and currents
2. Basic operational amplifier applications, integrator and differentiator, summer, subtractor
3. Familiarization with specifications and pin configuration of IC 741
4. Block diagram and operation of 555 IC timer

LIST OF PRACTICALS

1. To study the effect of coupling capacitor on lower cut off frequency and upper cut off frequency by plotting frequency response curve of a two stage RC coupled amplifier
2. To measure (a) optimum load (b) output power (c) signal handling capacity of a push-pull amplifier
3. To measure (a) voltage gain (b) input and output impedance for an emitter follower circuit

To measure frequency generation in (a) Hartley (b) R-C Phase Shift oscillator

1. To observe the differentiated and integrated square wave on a CRO for different values of R-C time constant
2. Clipping of both portion of sine-wave using:
   1. diode and dc source
   2. /\*zener diodes

Clamping a sine-wave to:

* 1. Negative dc voltage
  2. Positive dc voltage

1. To generate square-wave using an astable multivibrator and to observe the wave form on a CRO and verify the result using p-spice software
2. To observe triggering and working of a bistable multivibrator circuit and observe its output wave form on a CRO
3. To use the op-Amp (IC 741) as inverting one and non-inverting amplifiers, adder, comparator, integrator and differentiator and verify the result using p-spice software
4. To study the pin configuration and working of IC 555 and its use as monostable and astable multivibrator

INSTRUCTIONAL STRATEGY

The teacher should bring electronic components and devices in the class while taking lectures and explain and make students familiar with them. Also he may give emphasis on practical applications of these devices and components in the field. In addition, the students should be encouraged to do practical work independently and confidently.

**MEANS OF ASSESSMENT**

* Assignments and quiz/class tests
* Mid-term and end-term written tests
* Laboratory and practical work
* Model prototype making
* Viva—voce

RECOMMENDED BOOKS

1. A text book of Basic Electronics and Linear Circuits by NN Bhargava and others, Tata McGraw Hill, New Delhi
2. Electronics Principles by SK Sahdev, Dhanpat Rai and Co., New Delhi
3. Electronics Principles by Albert Paul Malina, Tata McGraw Hill, New Delhi
4. Operational Amplifiers and Linear Circuits by Rama Kant and A. Gayakwad, Prentice Hall of India, New Delhi
5. Electronic Devices Circuits by Rama Reddy, Narosa Publishing House Pvt. Ltd., New Delhi
6. Electronic Devices and Circuits by Millman and Halkias, McGraw Hill, New Delhi
7. Analog Electronics – II by DR Arora, Ishan Publication, Ambala
8. Electronic Devices and Circuits by JC Karhara, King India Publication, New Delh
9. Electronic Devices and Circuits-I, Eagle Prakashan, Jalandhar

10. Electronic Devices Circuits by JB Gupta, SK Kataria and Sons, New Delhi

11. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

**Websites for Reference:**  http://swayam.gov.in

**SUGGESTED DISTRIBUTION OF MARKS**

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| --- | --- | --- | --- |
| **Sr. No** | **Topic** | **Time Allotted (hrs)** | **Marks Allocation (%)** |
| **1** | Transistor Audio Power Amplifier | 09 | 20 |
| **2** | Tuned Voltage Amplifier | 06 | 12 |
| **3** | Feedback in Amplifiers | 06 | 12 |
| **4** | Sinusoidal Oscillators | 06 | 12 |
| **5** | Wave-Shaping and Switching Circuits | 11 | 24 |
| **6** | Power Supplies | 04 | 08 |
| **7** | Operational Amplifier | 06 | 12 |
|  | **Total** | **48** | **100** |