

**ST JOSEPH'S UNIVERSITY
BENGALURU-27**



DEPARTMENT OF ELECTRONICS

Syllabus for the Bachelor of Sciences

Under State Education Policy

For Batch 2024-2026

Name of the Degree Programme : B.Sc.

Discipline Core : Electronics

Starting year of implementation : 2024-25

Semester- I

EL124: ELECTRONIC DEVICES AND CIRCUITS

Unit 1

12 Hours

Electronic Components: Electronic passive and active components, types and their properties, Concept of Voltage and Current Sources, electric energy and power. (Qualitative only). Ohms law and Kirchhoff's law, Voltage Divider Rule and Current Divider Rule, Network Theorems: Superposition, Thevenin's, Norton's, Maximum Power Transfer, and Reciprocity Theorems. DC and AC analysis of RC and RL circuits, RLC series and parallel Resonant Circuits (no derivation).

Unit 2

12 Hours

PN junction diode: Ideal and practical diodes, Formation of Depletion Layer, Diode Equation and I-V characteristics. Idea of static and dynamic resistance, Zener diode, Reverse saturation current, Zener and avalanche breakdown. Rectifiers-Half wave and Full wave (center tapped and bridge) rectifiers, expressions for output voltage, ripple factor and efficiency (mention only), Shunt capacitor filter. (Numerical examples wherever applicable).

Voltage regulator: Block diagram of regulated power supply, Line and Load regulation, Zener diode as voltage regulator – circuit diagram, load and line regulation, disadvantages. Clippers (shunt type) and clampers (Qualitative analysis only), Voltage Multipliers.

Unit 3

8 Hours

Bipolar Junction Transistor: Construction, types, CE, CB and CC configurations (mention only), V-I characteristics of a transistor in CE mode, Regions of operation (active, cut off and saturation), leakage currents (mention only), Current gains α , β and their inter-relations, dc load line and Q point. Applications of transistor as amplifier and switch - circuit and working. (Numerical examples wherever applicable).

Unit 4

8 Hours

Transistor biasing: Thermal runaway, stability and stability factor, Stabilization circuits- Fixed Bias and Voltage Divider Bias. Amplifier: Small signal analysis of single stage CE amplifier using re' model. Input and Output impedances, Current and Voltage gains. CC amplifier as a buffer amplifier. (Numerical problems wherever applicable).

Self-study

05 Hours

Special semiconductor diodes: Varactor diode, Schottky diode, Tunnel diode, - construction, characteristics, working, symbol, and applications for each. LED, LCD and solar cell – construction, operation and applications, 7-segment display, concept of common anode and common cathode types, optocouplers.

Practical I

EL 1P1: Practical

(11 sessions 3 hours/week)

List of experiments

Study of resistance color code, test and measuring instruments and Ohm's Laws (1 practical class)

1. Charging and discharging of capacitor
2. Superposition Theorem
3. Thevenin's Theorem
4. Maximum Power Transfer Theorem
5. Semiconductor diode and Zener diode characteristics
6. *Half wave rectifier*, and Center tap full wave rectifier with & without capacitor filter
7. Voltage quadrupler using diodes
8. Zener regulator- Line and Load regulation
9. Fixed bias circuit with emitter resistor
10. Voltage divider bias circuit
11. CE amplifier- Frequency response

Semester- II

EL224: AMPLIFIERS, OSCILLATORS AND OP-AMP

UNIT 1: AMPLIFIERS

16 Hours

Multistage Amplifiers: Need & use of multistage amplifiers, overall gain, cascade Vs cascode. RC coupled amplifier. Darlington amplifier – circuit, current gain, Z_i , Z_o , advantages.

Power amplifiers: Voltage Vs Power amplifiers, need for power amplifiers, Classification Class A, Class C (mention only)

Class B: push pull amplifier, working, efficiency (derivation), cross over distortion, harmonic distortion, complimentary symmetry (transformer less). Comparison.

Tuned amplifiers: need for single tuned and double tuned, working, frequency response curve, advantages & disadvantages, note on coupling.

JFET–Types - p-channel and n-channel, working and I-V characteristics - n-channel JFET, parameters and their relationships, Comparison of BJT and JFET. Common Source Amplifier, MOSFET: E&D, **MOSFET** – n-channel and p-channel, Construction, working, symbols, biasing, drain and transfer characteristics, CMOS logic, CMOS inverter - circuit, working and characteristics.

UNIT 2: FEEDBACK AMPLIFIERS AND OSCILLATORS

10 Hours

Feedback: Types of Feedback Positive and Negative, Block Diagrams, Effect of Feedback on A_v , BW, Z_i , and Z_o (only for Voltage Series Feedback Amplifier Circuit).

Need for oscillators; positive feedback, Tank circuit – oscillations, resonant frequency. Barkhausen criterion for oscillation, LC tuned oscillator - Colpitts and Hartley's oscillator, frequency of oscillation (no derivation), minimum gain, advantages & disadvantages, RC Oscillators - phase shift & Wein bridge oscillator (no derivation), frequency and minimum gain, crystal oscillator, piezoelectric effect, equivalent circuit, series & parallel resonant circuits, Q factor.

Non-Sinusoidal oscillators: Astable Multivibrator, Working waveforms, frequency formula (mention only), Monostable multivibrator, bistable multivibrator (flip flop concept).

UNIT 3: Integrated circuits

04 Hours

IC555 block diagram & pin diagram. IC555 Applications – Astable (derivation) and Monostable multivibrators, Voltage controlled oscillator. Schmitt trigger. IC Regulators: LM317, IC78XX, 79XX series (block diagram)

UNIT 4: Operational Amplifier (Op-Amp) - Theory and Applications

11 Hours

Op-Amp block diagram, pin diagram IC741, specifications, characteristics of ideal and practical op amp parameters-input bias current, input offset voltage, output offset voltage, CMRR, slew rate SVRR, offset null, open loop Op-Amp limitations, Closed loop Op-Amp. Block Diagram of negative series feedback amplifier, Inverting and non-inverting feedback circuit, gain, R_{if} , R_{of} . Virtual ground, unity gain bandwidth product.

Applications: Adder - inverting and non-inverting, subtractor, scale changer, buffer, integrator, differentiator (ideal and practical). Comparator, zero crossing detector, Active filters - Butterworth first order low pass, high pass, band pass, band stop, all pass filters. Second order Filters (mention only).

Self-study :

04 Hours

IC fabrication techniques.

Recommended Text Books

- 1, Operational amplifier and linear circuits, Ramakanth Gayakwad PHI, 5th Edition, 2015.
2. A Text Book of Applied Electronics, R.S. Sedha

Reference Books

1. Electronic Devices and circuits, T.F. Bogart and Beasley, Pearson Education, 6th Edition, 2004.
2. Electronics Principle-AP Malvino, Tata McGraw-Hill, 6th edition, 2005.
3. Electronic Devices and Circuits, T. L. Floyd, PHI, 5th Edition 2005.
4. Microelectronics Circuits, Sedra and Smith, 5th Edition, Oxford University Press
5. Basic Electronics- A Text Lab Manual, Paul B Zbar, A.P. Malvino, TMH, 7th Edition, 1995.

Practical II**EL2P1: PRACTICALS****(11 sessions 4 hours/week)****List of experiments**

- [1] Colpitts Oscillator
- [2] Construction of regulated power supply using IC 7805 and IC 7905
- [3] Op-amp Adder, subtractor and scale changer
- [4] Phase-shift oscillator using IC 741
- [5] Wien-Bridge oscillator using IC 741
- [6] Op-amp comparator
- [7] Hartley Oscillator
- [8] Astable multivibrator using transistors
- [9] Current and voltage regulation using IC LM 317
- [10] Op – amp as inverting and non-inverting amplifier.
- [11] Astable multivibrator using IC555.
- [12] Tuned amplifier.
- [13] FET CS amplifier