**3.4 ANALOG & DIGITAL ELECTRONICS**

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**RATIONALE**

This subject gives the knowledge of fundamental concepts and principles of basic

electronics and aims at providing the students with basic understanding of various types of

materials based on their conductivity. Students will study p-n junction, rectifiers and their

significance, filters, basic structure and working principle of transistors in various configurations.

This course also gives the knowledge to make the students know about the fundamental

principles of digital electronics and gain familiarity with the available IC chips.

**COURSE OUTCOMES**

After completing this course, student will be able to:

CO1: Describe different Semiconductor devices and explain their characteristics

CO2: Acquire the knowledge of different types of transistor and transistor as an

amplifier.

CO3: Evaluate and realize the various digital circuits by using number system and

logic gates.

CO4: Analyze sequential and combinational digital circuits and converters.

**DETAILED CONTENTS**

**UNIT I**

**Semiconductor Devices**

1.1 Concept of insulators, conductors and semiconductors. Intrinsic and extrinsic

semiconductor, P and N type semiconductor and their conductivity. Effect of temperature

on conductivity of intrinsic semiconductor etc.

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1.2 PN junction diode, mechanism of current flow in PN junction, forward and reverse biased

PN junction, potential barrier, drift and diffusion currents, depletion layer. V-I

characteristics of diodes. Diode as half-wave, full wave and bridge rectifiers. Peak Inverse

Voltage, rectification efficiencies and ripple factor calculations, Concept of filters. Types

of diode, characteristics and applications of Zener diodes.

**UNIT II: BIPOLAR-TRANSISTORS AND FIELD EFFECT TRANSISTORS**

2.1 Concept of a bipolar transistor, PNP and NPN transistors. CB, CE, CC configurations of

a transistor. Transistor as an amplifier in CE Configuration, Current amplification factors,

Comparison of CB, CE and CC Configurations.

2.2 Construction, operation and characteristics of FETs. FET as an amplifier. Construction,

operation and characteristics of a MOSFET. Comparison of JFET, MOSFET and

BJT.

**UNIT III: DIGITAL ELECTRONICS**

3.1 Distinction between analog and digital signal. Decimal, Binary, octal and hexadecimal

number system. Conversion from decimal and hexadecimal to binary and vice-versa.

Binary addition and subtraction.

3.2 Definition, symbols and truth tables of Logic gates (AND, OR, XOR, NOT, NAND,

NOR and XNOR).

**UNIT IV: SEQUENTIAL AND COMBINATIONAL CIRCUIT**

4.1 Sequential Circuits such as Half adder, Full adder, Mux, De-Mux, Encoder and Decoder.

Combinational Circuits like Latch, Flip Flops, shift registers and counters.

4.2 A/D and D/A Converters and its Applications.

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**PRACTICAL EXERCISES**

1. To Plot V-I characteristics of a PN junction diode.

2. To Plot V-I characteristics of a Zener diode.

3. Observe the output of waveform:

4. Half-wave rectifier circuit using one diode

5. Full-wave rectifier circuit using two diodes

6. Observe the output of waveform of Bridge-rectifier circuit using four diodes.

7. Plotting of input and output characteristics and calculation of parameters of transistors in

CE configuration.

8. Plotting of input and output characteristics and calculation of parameters of transistors in

CB configuration.

9. Plotting of V-I characteristics of a FET.

10. Basic logic operations of AND, OR, NOT gates.

11. Verification of truth tables for NAND, NOR and Exclusive OR (EX-OR) and Exclusive

NOR (EX-NOR) gates.

12. Realization of logic functions with the help of NAND or NOR gates.

13. To design a half adder using XOR and NAND gates and verification of its operations.

14. Construction of a fu Construction of a full adder circuit using XOR and NAND gates and

verify its operation

15. Verification of truth table for IC flip-flops (At least one IC each of D latch, D flip-flop,

JK flip-flops).

16. Verification of truth table for encoder and decoder ICs.

17. Verification of truth table for Mux and De-Mux.

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**RECOMMENDED BOOKS**

1. Kulshreshta and S.C. Gupta, Basic Electronics and linear circuit by Tata Mc Graw Hill

Education Pvt. Ltd., New Delhi.

2. V.K. Mehta, Principles of Electrical and Electronics Engineering by S Chand Co., New Delhi.

3. Millman and Halkias, Electronics Device and Circuit by Mc Graw Hill.

4. Albert Paul Malvino,“Principles of Electronics” by Tata Mc Graw Hill Education Pvt Ltd

5. S K Sahdev,“ Electronic Principles ”by Dhanpat Rai & Co., New Delhi.

6. J B Gupta,“ Basic Electronics ”by S K Kataria and Sons, New Delhi

7. Schultz Grob's, Basic Electronics, Altext Lab Manual by Tata Mc Graw Hill Education Pvt.

Ltd., New Delhi.

8. Anand Kumar“ Fundamentals of Digital Circuits” PHI

9. Anil K. Maini “Digital Electronics: Principles And Integrated Circuit”, Wiley Publications

10. R P Jain- “Modern Digital Electronics”-Tata McGraw Hill.

**SUGGESTED WEBSITES**

1. http://swayam.gov.in

2. https://nptel.ac.in/

**INSTRUCTIONAL STRATEGY**

After making the student familiar with semiconductors, they should be made conceptually clear

about the constructional features and make them confident in making connection of various

electronic devices. This subject contains four units of equal weightage.

**DIPLOMA**