

Syllabus for Core Subjects

Course Title: ELE - CT2: ANALOG AND DIGITAL ELECTRONICS-II	Course Credits: 3
Total Contact Hours: 56 Hrs.	Duration of ESA: 4 Hrs.
Formative Assessment Marks: 20 marks	Summative Assessment Marks: 80 marks

Course Outcomes (COs):

At the end of the course the student should be able to:

1. Understand and study the behavior of the semiconductor devices i.e., I-V characteristics of various MOSFET devices the knowledge can be extended for understanding the behavior /characteristics/ response of unknown / novel devices.
2. Applying the standard device models to explain/calculate critical internal parameters of semiconductor devices.
3. Understanding and characterizing the behavior of known/unknown/novel power electronic devices such as UJT, SCR, Diac, Triac etc.
4. Understanding and operation and applications of linear integrating circuit – Op-amp and using it for various applications.
5. Understanding the working of basic logic gates, concepts of Boolean algebra and techniques to reduce/simplify Boolean expressions and their applications.
6. Synthesizing and Analyzing combinatorial and sequential circuits and their applications in electronics, designing the registers and counters.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6
Understand and study the behavior of JFET device.	x					
Understanding and characterizing the behavior of known/unknown/novel power electronic devices such as UJT, SCR, Diac, Triac etc.	x					
Acquainting and familiarization of the experimental skills to determine the behavior of semiconductor devices.	x					
Capable of analyzing the device characteristics and responses.	x					
Understanding the working of basic logic gates, concepts of Boolean Algebra and techniques to reduce/simplify Boolean expressions and their applications.	x					
Synthesizing and Analyzing combinatorial and sequential circuits and their applications in electronics	x					

UNIT – 1 14 Hrs.

Varactor diode, Schottky diode, Tunnel diode - LED, LCD, Solar Cell: working and applications for each.

JFET: Types, working, characteristics of n-channel JFET, parameters and their relationships, Comparison of BJT and JFET.

MOSFET: Types, CMOS – inverter, circuit and working, IGBT construction and working.

UJT: working, equivalent circuit and characteristics, intrinsic stand-off ratio, Relaxation oscillator.

SCR: working, characteristics, equivalent circuit, applications.

Diac and Triac: characteristics, equivalent circuit, working and applications for each.

UNIT – 2 14 Hrs.

Op-Amp: Differential Amplifier, Block diagram of Op-Amp, Characteristics of an Ideal and Practical Op-Amp, Open and closed loop configuration, Frequency Response, CMRR, Slew Rate and concept of Virtual Ground.

Applications of Op-Amps: Inverting and non-inverting amplifiers, Summing amplifier, Differentiator, Integrator, Logarithmic amplifier, Comparator.

Filters: First order active Low pass, High pass and Band pass Butterworth filters.

Oscillators: Barkhausen criterion for sustained oscillations, crystal oscillators, Phase Shift oscillator, Wien-bridge oscillator using Op-amp.

IC 555Timer: Astable and Mono stable multivibrator circuits.

UNIT – 3 14 Hrs.

Logic Families: Pulse characteristics, Logic Families-classification of digital ICs.

Characteristics of logic families, circuit description of TTL NAND gate with totem pole and open collector. TTL IC terminology. CMOS NAND, Comparison of TTL and CMOS families.

Digital to Analog Converter: DAC with binary weighted resistor and R-2R resistor ladder network. Analog to Digital converter: Successive approximation method-performance characteristics.

Sequential Logic Circuits: Flip-Flops - SR Latch, Level and Edge Triggered concept, Clocked RS, D, JK and T Flip-Flops. Preset and Clear operations. Race-around conditions in JK Flip-Flop. Master-Slave JK Flip-Flops. Applications of Flip-Flops in semiconductor memories, RAM, ROM and types.

UNIT – 4 14 Hrs.

Registers and Counters: Types of Shift Registers (up to 4-bits), its applications. Ring counter, Johnson counter applications. Asynchronous Counters: Logic diagram, Truth

table and timing diagrams of 4-bit ripple counter, modulo-n counters, 4-bit Up-Down counter, Synchronous Counter: 4-bit counter, Design of Mod 3, Mod 5 and decade Counters using K-maps.

Basic computer system: Block diagram, Input and output devices, interfacing techniques, expansion of memory, programming techniques, flowchart, types of languages.

REFERENCES:

1. Robert L Boylestad, "Introductory circuit analysis", 5th edition. Universal Book 2003.
2. Electronic Devices Conventional Current Version by Thomas L. Floyd, 10th edition, Pearson, 2018
3. David A. Bell "Electronic Devices and Circuits", 5th Edition, Oxford Univesity Press, 2015
4. OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edn., Prentice Hall., 2000
5. Operational Amplifiers and Linear ICs, David A. Bell, 3rd Edition, Oxford University Press. 2011,
6. R S Sedha, "A Text book of Applied Electronics", 7th edn., S Chand and Company Ltd., 2011
7. Thomas L. Floyd, Digital Fundamentals, Pearson Education Asia, 1994
8. Digital Principles and Applications, A.P. Malvino, D P Leach and Saha, 7th Edition, TMH, 2011.
9. Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, PHI Learning Pvt. Ltd. 2009
10. Digital Circuits and Systems, K R Venugopal and K Shyla, Tata McGraw Hill, 2011
11. Digital Circuits and systems, Venugopal, Tata McGraw Hill. 2011
12. Digital Systems: Principles & Applications, R.J.Tocci, N.S.Widmer, PHI Learning. 2001
13. Digital Principles, Schaum's Outline Series, R. L. Tokheim, TMH., 1994
14. Digital Electronics, S.K. Mandal, 1st Edition, McGraw Hill., 2010.

Course Title: ELE-CP2: ANALOG AND DIGITAL ELECTRONICS - II Lab	Course Credits: 2
Total Contact Hours: 56 Hrs.	Duration of ESA: 4 Hrs.
Formative Assessment Marks: 10 marks	Summative Assessment Marks: 40 marks

Course Outcomes (COs):

At the end of the course the student should be able to:

1. Aptitude to apply Logic thinking and Basic Science knowledge for problem solving in various fields of electronics both in industries and research.
2. To acquire experimental skills, analyzing the results and interpret data.
3. Ability to design / develop / manage / operation and maintenance of sophisticated electronic gadgets / systems / processes that conforms to a given specification within ethical and economic constraints.
4. Capacity to identify and implementation of the formulae to solve the electronic related issues and analyze the problems in various sub disciplines of electronics.
5. Capability to use the Modern Tools / Techniques.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6
Aptitude to apply Logic thinking and Basic Science knowledge for problem solving in various fields of electronics both in industries and research						
To acquire experimental skills, analyzing the results and interpret data.	x					
Ability to design / develop / manage / operation and maintenance of sophisticated electronic gadgets / systems / processes that conforms to a given specification within ethical and economic constraints.	x					
Capacity to identify and implementation of the formulae to solve the electronic related issues and analyze the problems in various sub disciplines of electronics.						
Capability to use the Modern Tools / Techniques.	x					

ELE-CP2: ANALOG AND DIGITAL ELECTRONICS –II Lab

(Hardware and Circuit Simulation Software)

(Minimum **Eight** Experiments)

1. Study of JFET characteristics – determination of parameters.
2. Study of single stage JFET amplifier.
3. UJT characteristics and relaxation oscillator
4. SCR characteristics.
5. Design of inverting and non-inverting amplifier using Op-amp & study of frequency response.
6. Op-amp inverting and non-inverting adder, subtractor and averaging amplifier.
7. Design and study of differentiator and integrator using op-amp for different input waveforms.
8. Design and study of Wien bridge oscillator using op-amp.
9. Design and study of RC phase shift oscillator using op-amp.
10. Design and study of first order high-pass and low-pass filters using op-amp.
11. Study of Crystal oscillator using op-amp.
12. Astable multivibrator using IC-555 timer.
13. Monostable multivibrator using IC-555 timer.
14. Digital to Analog Converter using binary weighted resistor method.
15. Study of Clocked RS and D Flip-Flops using NAND gates.
16. Study of Clocked JK and T Flip-Flops using NAND gates.
17. Study of mod-16 asynchronous counter using JK Flip-Flop.
18. Study of decade counter using JK Flip-Flop.
19. Study of 4-bit Shift Register – SISO.

Using analog simulator (LT spice, Circuit Logix, NI Multisim, Circuitmake, EasyEDA, Every Circuit, PSpice, Docircuits, etc.,) at least Five experiments are to be performed.