

Program: Diploma in Electrical & Electronics Engineering	
Course Code: 3031	Course Title: Analog & Digital Circuits
Semester : 3	Credits: 3
Course Category: Program Core	
Periods per week: 4 (L:3 T:1 P:0)	Periods per semester: 60

Course Objectives:

- To understand the analog and digital electronic circuits.
- To use these circuits in electrical engineering applications.

Course Prerequisites:

Topic/Description	Course Code	Course Title	Semester
<ul style="list-style-type: none"> ● Knowledge of electronics components ● Transistor biasing & configuration of transistors ● Transistor Operation as switch 		Fundamentals of electrical and electronics engineering	2

Course Outcomes

CO _n	Description	Duration (Hours)	Cognitive Level
CO1	Classify amplifiers and oscillators	15	Understanding
CO2	Explain operational amplifiers and applications	14	Understanding
CO3	Apply K- Map to simplify Boolean expressions	14	Applying
CO4	Explain the various combinational, sequential and data conversion circuits	15	Understanding
	Series Test	2	

CO-PO Mapping

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2						
CO2	2						
CO3	3						
CO4	2						

3-Strongly mapped, 2-Moderately mapped, 1-Weakly mapped

Course Outline

Module Outcome	Description	Duration (Hours)	Cognitive Level
CO1	Classify amplifiers and oscillators		
M1.01	Compare various power amplifiers	6	Understanding
M1.02	Illustrate the concepts of feedback and explain Barkhausen's criterion.	2	Understanding
M1.03	Explain the classification and operation of sinusoidal oscillators.	3	Understanding
M1.04	Explain the classification and operation of non-sinusoidal oscillators.	4	Understanding
<p>Contents:</p> <p>Multistage transistor amplifier -coupling schemes- types(listing only) - importance of coupling -RC coupled transistor amplifier (basic two stage operation only)</p> <p>Power amplifiers: introduction- characteristics- Class A, Class B and Class C (comparisons only-Push pull amplifiers -Complementary symmetry Push pull amplifier (class B operation only)</p> <p>Feedback- positive and negative feedback(block diagram approach only)</p> <p>Oscillators - elements in an oscillator circuit-comparison between amplifier and oscillator-Barkhausen's criterion for oscillations-classification of oscillators</p> <p>Sinusoidal oscillators-classification (listing only) – RC-phase shift oscillator - crystal oscillator(basic operation with diagram)</p> <p>Non sinusoidal oscillators- classification(listing only)-multi vibrators- astable - bistable(basic operation with diagram) -applications of oscillators</p>			

CO2	Explain operational amplifiers and applications		
M2.01	Explain the parameters and properties of ideal and practical op-amps	3	Understanding
M2.02	Illustrate the inverting and non-inverting operation of op-amps	3	Understanding
M2.03	Summarize the applications of operational amplifiers.	4	Understanding
M2.04	Outline the operation of comparators and precision rectifiers using op-amps	4	Understanding
	Series Test - 1	1	
<p>Contents:</p> <p>Operational amplifiers-Introduction (block diagram approach)- characteristics of ideal and practical op amps - concept of virtual ground – parameters of op amp (listing and definitions)</p> <p>Op amp circuits -inverting amplifier(derivation of expression for output voltage needed), non inverting amplifier (derivation not needed),</p> <p>Op amp amplifiers- Summing amplifier- integrators, differentiators (derivation of output equation needed)</p> <p>Applications of op amp-Comparators- positive and negative voltage level detector -zero crossing detector-rectifier using Op amps- half-wave precision rectifier (operation with circuit and waveforms)</p>			
CO3	Apply K- Map to simplify boolean expressions		
M3.01	Identify the different number systems, conversions and binary operations	5	Applying
M3.02	Classify logic gates and interpret their truth tables	2	Understanding
M3.03	Apply Demorgan's theorem to simplify boolean expressions	3	Applying
M3.04	Apply K-Map reduction technique to simplify SOP Expressions	4	Applying

Contents:

Number systems-Introduction– decimal-binary – hexadecimal - conversion of binary and hexadecimal numbers to decimal - conversion of decimal numbers to binary and hexadecimal - binary coded decimal - arithmetic operations on binary numbers -addition-subtraction- multiplication- division

Negative number representation - one's and two's complement methods - binary subtraction using two's complement method.

Logic gates-basic logic gates -universal gates -special gates- XOR gate(symbols and truth tables)

Boolean algebra -important laws and rules (statement only) - Demorgan's theorems(Statement only) - simplification of expressions

Boolean function representations-Standard forms of SOP and POS expressions - K Map up to three variables -Simplification of Boolean expressions using K Map (SOP only)

CO4	Explain the various combinational, sequential and data conversion circuits		
M4.01	Illustrate various combinational logic circuits	3	Understanding
M4.02	Illustrate the operation of various flip flops	3	Understanding
M4.03	Outline the working of sequential logic circuits	7	Understanding
M4.04	Summarize the concept of data conversion circuits	2	Understanding
	Series Test-2	1	

Contents:

Combinational logic circuits- half adder-half subtractor-(implementation using basic gates)- full adder (implementation using half adders) - truth table -basic logic diagram-multiplexer(4x1) - de multiplexer(1x4)

Flip flops – SR, D, JK, T – symbolic representations and truth tables only– list applications of flip flops

Sequential logic circuits - shift registers-list the classification-4 bit shift registers SISO - SIPO - PIPO - PISO (logic diagram and working using negative edge triggered D flip flops only) -applications of shift registers

counters – list the classification-difference between synchronous and asynchronous counters –asynchronous counter(using negative edge triggered JK flip flop only) -mod 8 ripple counter (up counter and down counter)-mod 7 and mod 6 ripple counters (up counter only)

Data conversion circuits - digital to analog conversion – binary weighted R - 2R ladder type DAC (diagram and fundamental concept only) - analog to digital conversion – ramp type ADC (diagram and fundamental concept only)

Text/References

T/R	Book Title/Author
T1	V.K.Mehta, Principles of Electronics. S Chand & co.
T2	Ramakant A. Gayakwad, Op-amps and Linear Integrated Circuits, Pearson Education
T3	A. Anand Kumar, Fundamentals of Digital circuits, PHI Learning
R1	R.S. Sedha, Applied Electronics. S Chand & co
R2	B.L.Theraja, Electrical Technology. Vol-IV, S Chand & co.
R3	Albert Paul Malvino & Donald P. Leach, Digital Principles and Applications, McGraw-Hill
R4	Floyd and Jain,-Digital Fundamentals- Pearson
R5	Anil K. Maini, Digital Electronics: Principles, Devices and Applications, Wiley Publications

Online resources

Sl.No	Website Link
1	NPTEL/SWAYAM: Analog Electronics Circuits https://nptel.ac.in/courses/117/103/117103063
2	https://nptel.ac.in/courses/108/105/108105158
3	https://nptel.ac.in/courses/108/102/108102112
4	https://nptel.ac.in/courses/108/105/108105113
5	NPTEL/SWAYAM: Digital circuits https://nptel.ac.in/courses/108/105/108105132
6	https://nptel.ac.in/courses/117/106/117106086
7	https://nptel.ac.in/courses/117/106/117106114
8	Virtual lab http://vlabs.iitkgp.ernet.in/be
9	http://vlabs.iitb.ac.in
10	http://vlabs.iitkgp.ac.in/dec
11	https://www.iitg.ac.in
12	NPTEL channel: www.youtube.com/channel/UC640y4UvDAlya_WOj5U4pfA
13	www.electrical4u.com