Curriculum
Integrated Certificate and Diploma Programme

ICD (DEC-CTV)

In

Electronics & Communication Engineering

Department of Electronics & Communication Engineering

Sant Longowal Institute of Engineering & Technology
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VISION

The Department of Electronics & Communication Engineering shall strive to create engineering technocrats for addressing the global challenges in relevant areas to cater the ever changing needs of society at National and International level.

MISSION

1. To ensure dissemination of knowledge through effective teaching and learning in Electronics and Communication Engineering.
2. To excel in Research and Development activities in emerging areas.
3. To promote industry-institute and institute-institute linkages for sustainable development of academic, research, training and placement activities.
4. To establish center of excellence in thrust areas to nurture the spirit of innovation and creativity among faculty and students.

Sarbjeet Singh Dilip Kumar Ajay Pal Singh J.S. Ubhi A. Marwaha A.P. Singh Surinder Singh

Programme Educational Objectives (PEOs)

The Integrated Certificate and Diploma programme (DEC-CTV) shall produce skilled professionals who are:

1. Technically competent in service, repair and maintenance of audio video equipment.
2. Effective in communication and capable to work in a team.
3. Ethically and socially responsible for the development of country and community.
4. Able to demonstrate entrepreneurship skills and lifelong learning for successful career.
5. Able to adapt themselves with new technological challenges in relevant field.

Programme Outcomes (POs)

After successful completion of ICD (DEC-CTV) program, student will be able to:

1. Apply technical skill to troubleshoot, repair, service & maintenance of televisions.
2. Apply knowledge of science and humanities for personality development.
3. Demonstrate basic electronics engineering principles and conduct related experiments including programming skills.
4. Identify and analyze well-defined electronic engineering problems.
5. Use appropriate tools and techniques to solve well-defined electronic engineering problems systematically.
6. Assist in the design and development of engineering solutions.
7. Demonstrate technical skills in utilizing modern electronic engineering tools.
8. Communicate effectively with the engineering community and the society at large.
9. Demonstrate awareness for societal, health, safety, legal and cultural issues and the consequent responsibilities for sustainable development.
10. Develop entrepreneurship skills.
11. Understand professional ethics, responsibilities, and norms of electronic engineering practices.
12. Function effectively as an individual or in teams with leadership qualities.

INTEGRATED CERTIFICATE AND DIPLOMA (DEC-CTV)

Semester-I							
S. No	**Sub. Code**	**Subject Name**	**L**	**T**	**P**	**Hrs.**	**Credits**
1.	AM-111	Mathematics- I	4	1	0	5	5
2.	PH-111	Physics-I	4	0	2	6	5
3.	CY-111	Chemistry-I	4	0	2	6	5
4.	HU-111	Communication Skills-I	2	0	0	2	2
5.	EE-111	Fundamental of Electrical Engineering	3	0	2	5	4
6.	WS-122	Workshop Practice	0	0	4	4	2
7.	EC-112	Electronic Devices	2	0	2	4	3
		Total	**19**	**1**	**12**	**32**	**26**
Semester-II							
S. No	**Sub. Code**	**Subject Name**	**L**	**T**	**P**	**Hrs.**	**Credits**
1	AM-121	Mathematics- II	4	1	0	5	5
2	PH-121	Physics-II	4	0	2	6	5
3	CY-121	Chemistry-II	4	0	2	6	5
4	ME-121	Engineering Drawing	0	0	4	4	2
5	EC-121	Digital Electronics	3	0	4	7	5
6	EC-122	Electronic Workshop Practice-I	0	0	4	4	2
		Total	**15**	**1**	**16**	**32**	**24**
Semester-III (A)							
	TP-201	Two Weeks Practical Training during summer vacations				80	**S/US**

Semester-III (B)							
S. No	**Sub. Code**	**Subject Name**	**L**	**T**	**P**	**Hrs.**	**Credits**
1	HU-211	Communication Skills-II	1	0	2	3	2
2	CS-216	Computer Fundamentals	3	0	2	5	4
3	EC-212	Fundamental of Television Engineering	3	1	2	6	5
4	EC-213	Electronics Measurement & Instrumentation	3	1	2	6	5
5	EC-214	Analog Communication	3	1	2	6	5
6	EC-216	Maintenance & Repairing of Televisions	0	0	4	4	2
7	MC-211	Moral values and Professional ethics	1	0	0	1	0
		Total	**14**	**3**	**14**	**31**	**23**
Semester-IV							
S. No	**Sub. Code**	**Subject Name**	**L**	**T**	**P**	**Hrs.**	**Credits**
1	AM-221	Applied Mathematics	3	1	0	4	4
2	EC-222	Audio Video System	3	0	2	5	4
3	EC-223	Fundamentals of Microprocessor & Microcontroller	3	1	4	8	6
4	EC-224	Troubleshooting of Audio Video Equipment	0	0	6	6	3
5	EC-228	Network Theory	3	1	0	4	4
6	EC-229	Troubleshooting of Electronic Equipment-II	0	0	4	4	2
		Total	**12**	**3**	**16**	**31**	**23**
Semester-V(A)							
	TP301	Four Weeks Industrial Training during summer vacations				160	

Semester-V (B)							
S. No	**Sub. Code**	**Subject Name**	**L**	**T**	**P**	**Hrs.**	**Credits**
1	MC-311	Environmental Studies	2	0	0	2	2
2	HU-311	Entrepreneurship	2	0	0	2	2
3	EC-311	Electromagnetic Field Theory	3	0	0	3	3
4	EC-312	Linear IC's & Application	3	1	4	8	6
5	EC-313	Digital Communication	3	1	2	6	5
6	EC-314	Electronic Workshop Practice-II	0	0	4	4	2
7	EC-315	Principles of Microwave Engineering	2	1	0	3	3
8	TP-301E	Industrial Training					**S/US**
Total			**15**	**3**	**10**	**38**	**23**
Semester-VI							
S. No	**Sub. Code**	**Subject Name**	**L**	**T**	**P**	**Hrs.**	**Credits**
1	EC-321	Industrial Electronics	3	1	4	8	6
2	EC-322	Wireless & Mobile Communication	3	0	0	3	3
3	EC-323	Microprocessor & Microcontroller Applications	3	1	2	6	5
4	EC-324	Antenna Wave Propagation	3	0	0	3	3
5	EC-325	Microelectronics	3	0	2	5	4
7	EC-327	Project	0	0	4	4	2
Total			15	2	12	29	23
Total Theory & Practical Load for Diploma			**90**	**13**	**80**	**183**	**142**

Note:	The required credits for certificate programme	**96**
	The required credits for ICD programme	**142**
	Maximum courses in one semester	**7**
	Maximum Contact Hrs.	**32**
	The common courses and their credits are fixed for all ICD programmes.	

Courses offered to other Departments:

S. No	**Sub Code**	**Subject Name**	**L**	**T**	**P**	**Hrs..**	**Credits**
1	EC-211	Fundamental of Electronics Engineering	3	0	2	5	4
2	EC-221	Fundamental of Electronics Engineering	3	0	2	5	4

EC-112
Electronic Devices

	L	T	P	Credits
	2	0	2	3
	Sessional Marks			50
	End Semester Examination Marks			50

Course Objectives: The course intends to provide the basic concept and characteristics of the electronics devices such as diode, BJT, FET, etc. Also aims to provide the understanding application of different electronics devices and simple circuits.

Course Outcomes:

1. To acquire knowledge about semiconductor physics for intrinsic and extrinsic materials.
2. This course gives an overview of various semiconductor devices.
3. Acquired knowledge about active and passive components, voltage, and current sources.
4. Able to understand the working principles of electronic circuits e.g., Rectifiers, Filters, Regulated circuits, etc.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√		√								
CO2	√	√	√									
CO3	√	√		√								
CO4		√	√	√	√	√						

Unit-I — **8 hrs.**

Voltage and Current: Resistance, Ohm's law, V-I Characteristics, Resistors, Capacitors, Inductors.

Active and Passive Components: Introduction to active and passive components; fixed and variable resistances, their various types fixed and variable capacitors, their various types and important specifications and color codes.

Voltage and current sources – Voltage and Current sources, Symbols and Graphical representation, characteristics of ideal and practical sources. Overview of AC, DC, Cells and Batteries, Energy and Power.

Unit-II — **6 hrs.**

Introduction: Classification of materials into conducting and insulating materials through a brief reference to atomic structure, Conducting Materials, Insulating Materials, Semi-conductor Material, Effects of temperature on Conductivity of semiconductor.

Unit-III — **10 hrs.**

Semiconductor Diodes: Atomic structure of Germanium and Silicon semi-conductors; intrinsic and extrinsic semiconductors, PN junction, basic principles of operation and VI characteristics of PN junction diode, static and dynamic resistance of a diode. Use of a diode in rectifiers, half wave, full wave and bridge rectifier with shunt capacitor filter, series inductor filter, Zener diode and its applications, as a voltage regulator, light emitting diode (LED), Introduction to Filters, Clippers, Clampers.

Unit-IV	**8 hrs.**
Transistors: Introduction to a transistor, working of a PNP and NPN transistor, input and output characteristics, transistor configurations, biasing of a transistor, amplifying action of a transistor, comparison of different configurations, common emitter amplifier circuit, load line, concept, field effect transistor FET, JFET, MOSFET, their characteristics and applications, unijunction transistor (UJT).	

RECOMMENDED BOOKS

Title	**Author**	**Publisher**
1. Basic Electronics and Linear Circuitis	N N. Bhargava and Kulshreshta	McGraw Hill
2. Electronics Devices and Circuits	Miliman and Halkias	McGraw Hill

Electronic Devices Lab	
Course Objectives:	To reinforce learning through hands-on experience by examining the electrical characteristics of various semiconductor devices, such as diodes, BJTs and FETs. To provide the student with the capability to measure and record the experimental data, analyze the results of various semiconductor devices.
Course Outcomes:	**1.** To understand the functioning of various electronic instruments like CRO, signal generator and multimeter. **2.** To understand the characteristics of diode and BJT and verify their responses. **3.** To construct various electronic circuits on the bread board and analyses their output.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√		√									
CO2			√			√						
CO3	√				√	√						

List of Experiments:

1. To measure values of different resistors by using the color coding chart.
2. To calculate the value of various passive components using multimeter.
3. To observe the front panel of CRO.
4. To observe the front panel of signal generator.
5. To observe the VI characteristics of semiconductor diode in forward bias.
6. To observe the VI characteristics of Zener diode in reverse bias.
7. To verify the NPN and PNP transistors.
8. To construct half-wave rectifier, wave shape of the electrical signal and calculate its ripple factor.
9. To construct full-wave rectifier, wave shape of the electrical signal and calculate its ripple factor.
10. To study the application of Zener diode as a voltage regulator.

EC-121
Digital Electronics

	L	T	P	Credits
	3	0	4	5
	Sessional Marks			**50**
	End Semester Examination Marks			**50**

Course Objectives: This course will provide the introduction of the basic principles, characteristics and operations of a digital system. Next focus is to give the detail description about Boolean algebra and the various methods of Boolean function reduction, designing of combinational circuits by using logic gates, design and analyses of asynchronous and synchronous sequential Circuits using flip flops and at last to understand principle of operation of shift resistors and D/A an A/D converters.

Course Outcomes:

1. Learn to apply Boolean laws/K-Map-method method to reduce a given Boolean function.
2. Able to design & realize combinational logic circuits using logic gates for various practical applications.
3. Able to demonstrate the operation of flip-flops, counters, and shift registers.
4. Able to understand various A/D and D/A converters.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√		√	√	√						
CO2		√			√	√						
CO3		√	√	√	√	√						
CO4	√	√	√			√						

Unit-I — **10 hrs.**

Introduction: Basic difference between analog and digital Signals, applications and Advantages of Digital Signals, digital systems, and their application
Review of number system: Decimal, Binary, Octal, and hexadecimal number system and their inter-conversions Signed and unsigned number, Binary operations-addition; Subtraction, Multiplication and division; Excess 3 code, Gray code and ASCII code

Unit-II — **12 hrs.**

Logic gates: Definitions, symbols and truth table of NOT, OR, AND, NAND, NOR, XOR, XNOR gates, De-Morgan's theorems, realization of basic gates using universal gates; realization of simple Boolean equations using universal gates, introduction to k-map (up to 4 variables)
Combinational Circuits: Combinational circuit design, adders, subtractor, code converters, multiplexers, demultiplexer, encoders and decoders.

Unit-III — **16 hrs.**

Sequential Circuits: Introduction, Logic diagram, truth table, timing diagram and operation of following latches and flip flops, NOR latch, NAND latch, RS, T, D, and JK, Master / Slave JK flip flops. Operation using waveforms and truth tables of RS, T, D, and Master/Slave JK flip flops.
Counters: Introduction to Asynchronous and Synchronous counters, Binary counters, Divide by N ripple counters, Up/down counter, Ring counter with timing diagram.
Shift Resistors: Introduction, Serial in parallel out, serial in serial out, parallel in serial out, parallel in parallel out.

Unit-IV	**10 hrs.**
A/D and D/A converters: Binary Weighted D/A converter, R/2R ladder D/A converter, Stair step Ramp A/D converter, Dual Slope A/D converter, Successive Approximation A/D Converter.	

RECOMMENDED BOOKS

Title	**Author**	**Publisher**
1. Fundamentals of Digital Electronics	A. Anand Kumar	PHI 2nd Edition
2. Digital Electronics	R P Jain	McGraw Hill Education 4th Edition
4. Digital Logic Designs	Morris Mano	PHI 5th Edition
5. Digital Systems: Principles and Applications	R J Tocci	PHI 10th Edition

Digital Electronics Lab	
Course Objectives:	To make students familiar with different types of designs as sequential logic circuits, combinational logic circuits, trouble shooting of various digital systems & study of various digital systems. Knowledge of basic electronics & digital techniques is useful in understanding theory and practical of the subject.
Course Outcomes:	**1.** To analyses and design digital combinational circuits like decoders, encoders, multiplexers, and de-multiplexers as well as arithmetic circuits (half adder, full adder and multiplier). **2.** To analyses and design sequential digital circuits like flip-flops, registers, counters. **3.** Understand the importance and need for verification, testing of digital logic and design for testability.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√		√	√	√						
CO2		√	√	√		√						
CO3	√	√			√	√						

List of Experiments:

1. Verification and interpretation of truth tables for AND, OR, NOT NAND, NOR and Exclusive OR (EXOR) and Exclusive NOR (EXNOR) gates.
2. Realization of logic functions with the help of NAND or NOR gates.
3. To design a half adder using XOR and NAND gates and verification of its operation.
4. Construction of a full adder circuit using XOR and NAND gates and verify its operation.
5. To design a NOR Gate Latch and verification of its operation.
6. Verification of truth table for positive edge triggered, negative edge triggered, level triggered IC flip-flops (At least one IC each of D latch, D flip-flop, JK flip-flops).
7. Verification of truth table for encoder and decoder ICs, Mux and Demux.
8. To design a 4 bit SISO, SIPO, PISO, PIPO shift registers using JK/D flip flops and verification of their operation.
9. To design a 4 bit ring counter and verify its operation.
10. Asynchronous Counter ICs

    Use of IC 7490 or equivalent TTL (a) divide by 2 (b) divide by 10 Counter

EC-122
Electronics workshop Practice-I

	L	T	P	Credits
	0	0	4	2

Course Objectives: The objective is to understand basic electronic instrument terminology and to learn how to calibrate and monitor a variety of electronic instruments so as to apply measurement principles to field applications.

Course Outcomes:

1. Operate the electronic instruments like digital and analog multimeter, CRO *etc.*
2. To recognize and test various active and passive electronic components like resistors, capacitors, diodes, transistors etc.
3. To design and implement electronic circuits on PCB.s

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√									
CO2	√	√	√									
CO3	√		√			√						

List of Experiments:

1. **Study of Electronic measuring Instruments:** (Multimeter - Digital and Analog): This topic covers the use of multimeter to check voltage, current and also to check various electronic components and (Study of CRO)**:** This topic covers the procedure to check the frequency and amplitude of a signal waveform.
2. **Study of electronic components:** This topic covers the familiarization of some basic electronic components and circuit symbols (Resistors, Capacitors, Diodes, Transistors, IC's etc.) and identification of component values.
3. **Testing of electronic components:** This topic covers how to test electronic components using multimeters (Active and passive components)
4. To study and visualize the soldering kit and various soldering precautions.
5. **Soldering practice:** Circuit assembling practice using printed circuit board with electronic components.
6. To solder the IC base on a general purpose PCB.
7. To use a Zener diode as a voltage regulator.
8. To find the Q point for common emitter configuration.
9. To study the input and output V-I characteristics of common Emitter configuration.
10. To study the input and output V-I characteristics of common Base configuration.
11. To study the amplifying characteristics of NPN and PNP transistor.
12. **Assembling of simple electronic circuits**: This topic covers the use of breadboards for assembly of the following circuits
    a. Half wave rectifier circuit with and without filter
    b. Full wave rectifier circuit with and without filter
    c. Simple LED flashing circuit using Transistors / ICs
    d. DC regulated power supply.

TP-201 **Two Weeks Practical Training during summer vacations**												
Course Objectives:	Students have to undergo two – week practical training in Department of Electronics & Communication Engineering so that they become aware of the practical application of theoretical concepts studied in the classrooms.											
Course Outcomes:	**1**. Gain experience in various domains such as hardware, software, maintenance, and testing.											
Mapping of course outcomes with program outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√	√	√			√						

EC-212
Fundamentals of Television Engineering

	L	T	P	Credits
	3	1	2	5
	Sessional Marks			**50**
	End Semester Examination Marks			**50**

Course Objectives:	The course aim is to give the basic knowledge and working about each part of BW and Color TV. Student will learn the basic idea of Amplitude and frequency modulation. Basic concepts of Composite video signal and picture tube have been presented.
Course Outcomes:	**1.** Understand the basic idea of AM and FM modulation **2.** Understand the function of each block of AM transmitter and receiver **3.** Understand the basic concept of composite video signal **4.** Understand the working of each block of Mono Chrome and Colour TV.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√									
CO2	√	√		√								
CO3	√		√									
CO4	√	√		√	√							

Unit-I — **10 hrs.**

Idea Of Modulation: Concept of amplitude modulation (AM), frequency modulation (FM), Frequency spectrum of AM and FM, Idea of double side band and single side band for AM systems, Basic concepts of antenna, Yagi antenna.
Transmitter And Receiver: Block diagram of an AM transmitter and function of various blocks, Block diagram of an AM Receiver and function of various blocks.

Unit-II — **12hrs**

Elements Of TV System: TV transmission (video and audio), TV reception (video and audio), Synchronization, Scanning, Flicker, Interlaced scanning, Aspect ratio, Video, and audio signals. **Concept Of Composite Video Signal:** Video signal dimensions, Horizontal synchronous details, Vertical synchronous details, Scanning sequence details.

Unit-III — **12 hrs.**

Signal Transmission and Channel Bandwidth: Channel bandwidth, Vestigial sideband transmission, Vestigial sideband reception, TV standards.
Picture Tube and Camera Tube: Monochrome picture tube construction, its characteristics and circuit control. Basic concepts of TV camera tubes for example image orthicon, vidicon, plumbicon.

Unit-IV	**14 hrs.**
TV Receiver: Block diagram of a TV receiver, Brief description of each stage, EHT **Color television:** Block diagram of color TV camera, color signal generation, compatibility of color and black and white signal, natural light and three colors theory, the luminance signal, line saturation, band width requirement, modulation of color deference signal, weighing factors. Introduction to SECAM and NTSC system, PAL–TV system, PAL–D system, PAL color receivers.	

RECOMMENDED BOOKS

Title	**Author**	**Publisher**
1. Monochrome and color TV	RR Gulati	New Age International, New Delhi
2. Color TV theory and practice	SP Bali	TMH, New Delhi

Fundamentals of Television Engineering Lab												
Course Objectives:	The course aim is to give the basic knowledge and working about each section of BW and Color TV and observe them experimentally.											
Course Outcomes:	**1.** Understand the working of monochrome television transmitter and receiver systems. **2.** Understand the various monochrome and colour television sections.											
Mapping of course outcomes with program outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√		√									
CO2	√			√								

List of Experiments:

1. Draw the block diagram and observe working principle of B & W TV.
2. Observe the ICs used in different sections of B & W TV.
3. Observe the input/output signals of a 20" B & W receiver.
4. Observe the internal and external controls of B & W TV.
5. Observe the alignment and adjustment procedure of B & W TV receiver.
6. Observe the horizontal oscillator, vertical oscillator and sync separator sections.
7. Observe the EHT section of B & W TV.
8. Draw the block diagram and observe working principle of color TV.
9. Observe the operating unit and tuner of color TV.
10. Observe the audio and video IF section of color TV.
11. Observe the EHT section of color TV.
12. Observe the SMPS section of color TV.
13. Observe the video amplifier section of color TV.

EC-213
Electronic Measurements and Instrumentations

	L	T	P	Credits
	3	1	2	5
	Sessional Marks			**50**
	End Semester Examination Marks			**50**

Course Objectives:	Aim of the course is to study the basics of unit, dimensions and standards. It also gives deep insight into the PMMC instrument and bridges. It discusses the CRO in detail. Finally, it introduces signal generator and analyzer.
Course Outcomes:	**1**. Able to understand the various types of errors introduced in measurements. **2.** Able to understand the PMMC instruments and bridge theory. **3.** Able to understand the CRO, signal generators and analysers.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√										
CO2	√	√	√	√	√							
CO3	√	√	√		√							

Unit-I — **12 hrs.**

Unit, dimensions, and standards: Scientific notations and metric prefixes. SI electrical units, SI temperature scales, dimension, and standards. Measurement Errors: Gross error, systematic error, absolute error and relative error, accuracy, precision, resolution and significant figures, Measurement error combination, basics of statistical analysis.

Unit-II — **12 hrs.**

PMMC instrument, galvanometer, DC ammeter, DC voltmeter, series ohm meter. AC electronic voltmeter, digital voltmeter systems, digital multimeters, digital frequency meter system, Wheatstone bridge, low resistance measurements, low resistance measuring instruments.AC bridge theory, capacitance bridges, Inductance bridges, Q meter.

Unit-III — **12 hrs.**

CRO: CRT, wave form display, time base, dual trace oscilloscope, measurement of voltage, frequency, and phase by CRO, oscilloscope probes, oscilloscope specifications and performance.

Unit-IV — **12 hrs.**

Signal generator and analyzer: Signal generator: Sine wave, non-sinusoidal signal, and function generators. Spectrum analyzer and distortion.

RECOMMENDED BOOKS

Title	Author	Publisher
1. Electronic Instrumentation and Measurements	David A. Bell	2nd Ed., PHI, New Delhi 2008.
2. Electronic Measurements and Instrumentation	Oliver and Cage	TMH, 2009.
3. Measurement and Instrumentation Principles	Alan S. Morris	Elsevier (Butterworth Heinmann), 2008

Electronic Measurements and Instrumentations Lab	
Course Objectives:	To introduce the concept of measurement and the related instrumentation requirement as a vital ingredient of electronics and communication engineering.
Course Outcomes:	**1.** Understand basic measurement concepts. **2.** Able to measure the values of inductance, resistance and capacitance using various bridges **3.** Able to operate signal generator and signal analyzer for electronic measurements.

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1			√			√						
CO2	√			√	√							
CO3	√	√	√		√		√					

List of Experiments:

1. To observe the waveform on a storage Oscilloscope.
2. To observe the dynamic recording of different signals on oscillographic recorders.
3. Measurement of Inductance by Maxwell's bridge.
4. Measurement of small resistance by the Kelvin's Bridge.
5. Measurement of Capacitance of the Schering Bridge.
6. Measurement of medium resistance with the help of Wheat stone bridge.
7. To find Q of a coil by a series resonance method and verify it by using Q-meter.
8. To study & observe the recording of different signals from sensors on magnetic tape recorder.
9. To study & observe the acquisition of data from strain gauge-based transducer on data acquisition system.
10. Displacement measurement using LVDT, Inductive pick up and capacitive pick up.
11. To measuring the temperature of soldering by using thermocouple. Plot the variation of temperature with respect of voltage.

EC-214
Analog Communication

	L	T	P	Credits
	3	1	2	5
	Sessional Marks			**50**
	End Semester Examination Marks			**50**

Course Objectives: The focus of the course is on understanding the importance and theories of analog communication systems. The students will understand the various analog communication techniques, AM, FM generation, detection, transmission and reception methods, analog pulse modulation techniques.

Course Outcome:

1. To gain knowledge about the fundamental concepts of various analog communication systems.
2. To study the methods of generation and detection of AM and FM
3. Acquire knowledge about AM and FM transmission and reception.
4. To study various pulse communication schemes.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√								
CO2	√	√	√	√								
CO3	√	√	√			√						
CO4		√	√	√								

Unit-I — **12 hrs.**

Introduction: Communication, information, Message and Signals, Electromagnetic Spectrum, Classification of signals, Periodic and non-periodic signals, Analog and digital signals, Deterministic and random signals, The elements of a communication system, Modulation, Definition, Types of modulation, Need for modulation.

Amplitude Modulation: Definition, Expression of AM wave, modulation index, frequency, spectrum, bandwidth, power contents of sidebands and carrier.

Unit-II — **14 hrs.**

Frequency Modulation: Modulation index, frequency deviation, frequency spectrum and bandwidth of FM wave, Power contents in FM, Phase modulation.

Generation of AM and FM Waves: DSB-SC, DSB-SC, SSB-SC, their comparison and areas of applications, Basic principle of AM generation, Generation of DSB and SSB signals. Basic principle of FM generation, Varactor diode modulator.

Unit-III — **12 hrs.**

Radio Transmitter and Receiver: Block diagram of AM and FM transmitter, Working principle with block diagram of AM and FM receiver (Superhetrodyne).

Demodulation: AM diode detection, envelope detector, FM detection, basic principle of slope detection, balanced slope detector.

Unit-IV		**10 hrs.**
Pulse Modulation: Sampling process, Sampling theorem, Basic idea about PAM, PWM and PPM and typical applications, Reconstruction of message, Pulse code modulation.		
RECOMMENDED BOOKS		
Title	**Author**	**Publisher**
1. Electronic communication systems	Kennedy	Tata McGraw Hill
2. Electronic Communications System: Fundamentals Through Advanced,	by Wayne Tomasi	5th Edition, Pearson Education
3. Electronic communications	Roddy and Coolen	Prentice Hall of India
4. Principles of communication systems	Taub and Schilling	Tata McGraw Hill
5. Communication system (Analog and Digital)	Sanjay Sharma	Katson Books

Analog Communication Lab												
Course Objectives:	This lab aims to provide basic practical knowledge about different AM and FM modulation techniques by observing the output waveforms on CRO.											
Course Outcomes:	**1.** Calibrate modulated as well as demodulated waveforms on CRO. **2.** Generate DSB-SC, SSB and FM signals. **3.** Analyse super heterodyne AM receiver and measurement of its parameters like sensitivity and selectivity.											
Mapping of course outcomes with program outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1			√	√	√							
CO2		√	√			√						
CO3	√	√		√			√					

List of Experiments:

1. To observe amplitude modulation and its waveform on CRO.
2. To obtain Amplitude modulated Envelop and determine depth of modulation.
3. To observe envelop detector for demodulation of AM signal.
4. Generation of DSB-SC signal using balanced modulator.
5. Generation of single side band signal.
6. To observe frequency modulation and its waveform on CRO.
7. To generate a FM Signal and measure depth of modulation.
8. To study super heterodyne AM receiver and measurement of receiver parameters viz. sensitivity and selectivity.
9. To observe the waveform of demodulated FM signal with the help of ratio detector
10. To observe the waveform of demodulated FM signal with the help of Phase locked-loop detector.

EC-216
Maintenance & Repairing of Televisions

Course Objectives:	This lab aims to explore practically about components used in Televisions (BW and Color) for diploma students. Students will learn the working of each section of TV e.g., IC's used, Horizontal/ Vertical oscillator, sync separator section, audio and video section and various fault finding in IF, EHT and SMPS section.
Course Outcomes:	**1.** Gain Knowledge about various ICs used in different sections of colour TV. **2.** Understand various important sections of TV receiver. **3.** Detect fault in IF, EHT and SMPS section.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√			√								
CO3	√			√								

List of Experiments:

1. To study the operation of LED Television.
2. To study the function of front panel controls and remote control.
3. To study and measure the voltages of power section of LED TV.
4. To study and observe the waveform / signals of Tuner section.
5. To study and observe the waveform / signals of Audio section.
6. To study and observe the waveform / signals of LED Display Interface section.
7. To study switch faults and troubleshooting in Audio-Video input section.
8. To study switch faults and troubleshooting in Audio-Video output section.
9. To study switch faults and troubleshooting in LED Display interface section.
10. To study switch faults and troubleshooting in front panel control and Logic Board.

EC-211
Fundamentals of Electronics Engineering

	L	T	P	Credits
	3	0	2	4
	Sessional Marks			**50**
	End Semester Examination Marks			**50**

Course Objectives:	The course intends to provide the basic concept and characteristics of the electronics devices such as diode, BJT, FET, etc. Also aims to provide the understanding application of different electronics devices and simple circuits.
Course Outcomes:	**1.** To acquire knowledge about semiconductor physics for intrinsic and extrinsic materials. **2.** This course gives an overview of various semiconductor devices. **3.** Acquired knowledge about active and passive components, voltage and current sources. **4.** Able to understand the working principles of electronic circuits e.g. Rectifiers, Filters, Regulated circuits, etc.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√		√								
CO2	√	√	√									
CO3	√	√		√								
CO4		√	√	√	√	√						

Unit-I — **10 hrs.**

Active and Passive Components: Introduction to active and passive components; fixed and variable resistances, their various types fixed and variable capacitors, their various types and important specifications and color codes.

Voltage and current sources – concept of constant voltages and constant current sources, symbol and graphical representation, characteristics of ideal and practical sources.

Unit-II — **8 hrs.**

Introduction: Classification of materials into conductors, semi-conductors, and insulators, Atomic structure of Germanium and Silicon semi-conductors; intrinsic and extrinsic semiconductors.

Unit-III — **14 hrs.**

Semiconductor Diodes: PN junction, basic principles of operation and VI characteristics of PN junction diode, static and dynamic resistance of a diode. Use of a diode in rectifiers, half wave, full wave and bridge rectifier with shunt capacitor filter, series inductor filter, Zener diode and its applications, as a voltage regulator, light emitting diode (LED).

Unit-IV	**14 hrs.**
Transistors: Introduction of BJT, working of PNP and NPN transistor, input and output characteristics, transistor configurations, biasing of a transistor, amplifying action of a transistor, comparison of different configurations, MOSFET, their characteristics and applications.	

RECOMMENDED BOOKS

Title	**Author**	**Publisher**
1. Basic Electronics and Linear Circuits	N N Bhargava and Kulshreshta	McGraw Hill
2. Electronics Devices and Circuits	Millman and Halkias	McGraw Hill

Fundamentals of Electronics Engineering Lab	
Course Objectives:	To reinforce learning through hands-on experience by examining the electrical characteristics of various semiconductor devices, such as diodes, BJTs and FETs. To provide the student with the capability to measure and record the experimental data, analyze the results of various semiconductor devices.
Course Outcomes:	**1.** To understand the functioning of various electronic instruments like CRO, signal generator and multimeter. **2.** To understand the characteristics of diode and BJT and verify their responses. **3.** To construct various electronic circuits on the bread board and analyses their output.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√		√									
CO2			√			√						
CO3	√				√	√						

List of Experiments:

1. To measure values of different resistors by using the color coding chart.
2. To calculate the value of various passive components using multimeter.
3. To observe the front panel of CRO.
4. To observe the front panel of signal generator.
5. To observe the VI characteristics of semiconductor diode in forward bias.
6. To observe the VI characteristics of Zener diode in reverse bias.
7. To verify the NPN and PNP transistors.
8. To construct half-wave rectifier, wave shape of the electrical signal and calculate its ripple factor.
9. To construct full-wave rectifier, wave shape of the electrical signal and calculate its ripple factor.
10. To study the application of Zener diode as a voltage regulator.

EC-222
Audio Video Systems

	L	T	P	Credits
	3	0	2	4
	Sessional Marks			**50**
	End Semester Examination Marks			**50**

Course Objectives: The objective of teaching this subject is to give students an in depth knowledge of various electronic audio and video recording and playback systems. Further this subject will introduce the students with working principles, main features of consumer electronics gadgets/goods/devices like PA Systems, CD systems VCR, LCD, Plasma, LED and HD-TV which in-turn will develop in them capabilities of assembling, fault diagnosis and rectification in a systematic way.

Course Outcome:

1. Acquired knowledge of various types of microphones and loudspeakers.
2. Learn various stages of Public Address systems.
3. Acquired knowledge of working principle of magnetic tape recording and optical recording, Video recording and various VCR formats.
4. Understand various Display TV's like LCD, LED and HD- TV's.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√									
CO2		√	√									
CO3		√	√	√								
CO4	√	√	√									

Unit-I **8 hrs.**

Microphones: Working principle of condenser microphone, collar microphone, Types of microphones.
Loudspeakers: piezoelectric moving coil Horn type speaker, woofer, tweeter, mid-range speaker, Crossover network.

Unit-II **8hrs**

Public address system: Type of amplifier, Horn unit, echo unit, mixer-their working principle and specification.
CD/DVD recorder/player: Block diagram and its explanation; explanation of various controls; audio recording and playback; heads, stereo recording; tape speed, signal biasing.

Unit-III **8 hrs.**

Video CD player/recorder: Principles of video recording on magnetic tapes; video tape recording medium, video cassette format; video cassette specification.
Amplifiers: Hi-Fi system, pre-amplifiers, amplifiers and equalizers, Stereo amplifiers.

Unit-IV **8 hrs.**

Television: Introduction to LCD, Plasma, LED, and High Definition Television.
Sound Recorder: Sound Recording on magnetic tape, its principles, block diagram and tape transport mechanism, Digital sound recording on tape and Disc.

RECOMMENDED BOOKS

Title	Author	Publisher
1. Audio Visual Systems	Sanjay Attri.	BPB Publishers New Delhi.
2. Audio Video Systems	R.G.Gupta	TMH, New Delhi India

Audio Video Systems Lab												
Course Objectives:	The objective of this lab is to provide the basic principle and working of public address system, LED T.V., CD/DVD player, VCD player. Further the students will be able to plot the directional pattern of various audio and video equipment.											
Course Outcomes:	**1.** Understand the working principle of different audio- video systems. **2.** Understand the response of loudspeaker, audio amplifier and microphones.											
Mapping of course outcomes with program outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√		√			√						
CO2	√			√		√						

List of Experiments:

1. To plot the directional pattern of a loudspeaker.
2. To plot the directional pattern of a moving coil microphone
3. To study the block diagram and working of an audio tape recorder.
4. To understand the recording and playback process of an audio tape recorder.
5. To study & plot the frequency response of Audio Amplifier.
6. To study & plot the frequency response of cross-over network used in stereo-amplifier.
7. To study the block diagram and working of Public address system.
8. To study the block diagram and working principle of LED T.V.
9. To study the block diagram and working of a CD/DVD player trainer.
10. To study the block diagram and working of a VCD player trainer.

EC-223
Fundamentals of Microprocessor & Microcontroller

	L	T	P	Credits
	3	1	4	6
	Sessional Marks			**50**
	End Semester Examination Marks			**50**

Course Objectives: The objective of the course is to expose to the students to the evolution of microprocessors, the architecture and instruction set of typical 8-bit microprocessor 8085. It also deals with Assembly Language Programming and input-output techniques. Next focus is to introduce the architecture, programming, and interfacing of 8051 microcontrollers.

Course Outcomes:

1. Understand the evolution of computers.
2. Analyse the architecture of the Intel 8085 microprocessor and 8051 microcontroller for its various applications.
3. Apply the programming techniques in designing simple assembly language programs for solving simple problems by using instruction sets of microprocessor and microcontroller.
4. Use the addressing modes and timing diagram for executing program efficiently.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√		√	√							
CO2		√	√	√								
CO3		√	√	√	√							
CO4		√	√		√							

Unit-I **14 hrs.**

Introduction: Typical organization of a microcomputer system and functions of its various blocks, Microprocessor, its evolution, function, and its applications.
Introduction to 8-bit Microprocessor Architecture: Concept of Bus, bus organization of 8085, functional block diagram of 8085, functions of each block of 8085 architecture, pin details of 8085 and related signals.

Unit-II **8hrs.**

Memories and I/O Interfacing: Memory organization, concept of memory mapping, partitioning of total memory space, address decoding, concept of I/O, mapped I/O and memory mapped I/O. Basic Concept of RAM, ROM, PROM, EPROM and EEPROM**.**

Unit-III **12hrs.**

Programming using 8085 Microprocessor: 8085: 8085 programming model, brief ideas of machine and assembly languages, machines and mnemonic codes, basic idea of instruction format and addressing modes, basic concept of instruction set for data transfer group, arithmetic group, logic group, stack, subroutine, I/O and machine control group, writing assembly language programs.

Unit-IV		**14hrs.**
Architecture of 8051 Microcontroller: Architecture of 8051, I/O ports in 8051, basic concept of memory in 8051, basic idea of addressing Modes in 8051, basic idea of instructions in 8051.		
RECOMMENDED BOOKS		
Title	**Author**	**Publisher**
1. Microprocessor Architecture- Programming & Applications with 8085/8080A	Ramesh S Gaonkar	5th Edition, Penram International Publishing
2. Introduction of Microprocessors & Microcomputers	Ram B	4th Edition, Dhanpat Rai Publisher (P) Ltd.
3. The 8051 Microcontroller	Kenneth J. Ayala	3rd Edition, Cengage Learning, 2004

Fundamentals of Microprocessor & Microcontroller Lab	
Course Objectives:	The objective of this lab is to familiarize the students with architecture, pin configuration and programming of 8085 microprocessor kit. Further students will perform various arithmetic operations on microprocessor kit. The basic concept of 8051 microcontroller has also been included in this lab.
Course Outcomes:	**1.** Understand the architecture and pin configuration of 8085 microprocessor and 8051 microcontroller. **2.** Implement various programs on 8085 microprocessor kit and 8051 microcontroller kit.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√	√	√								
CO2		√	√	√	√	√						

List of Experiments:

1. To study the architecture of 8085 Microprocessor.
2. To get familiarize with Pin Configuration of 8085 Microprocessor.
3. Familiarization of different keys of 8085 microprocessor kit.
4. To familiarize with entering various steps of a program in 8085 kit.
5. Steps to enter, modify data/program and to execute a programme on 8085 kit.
6. Writing and execution of program for addition of two 8 bit numbers.
7. Writing and execution of program for subtraction of two 8 bit numbers.
8. Writing and execution of program for multiplication of two 8 bit numbers.
9. Writing and execution of program for division of two 8 bit numbers.
10. To study the architecture of 8051 Microcontroller.
11. To get familiarize with Pin Configuration of 8o51 Microcontroller.
12. Familiarization of different keys of 8051 microcontroller kit.
13. To familiarize with entering various steps of a program in 8051 kit.
14. Steps to enter, modify data/program and to execute a programme on 8051 kit.

EC-224
Troubleshooting of Audio- Video Equipment

	L	T	P	Credits
	0	0	4	2

Course Objectives: The objective of this lab is to give students an in depth knowledge of various electronic audio and video devices and systems. Further this subject will introduce the students with working principles, block diagram, main features of electronic gadgets/goods/devices like audio-systems, LCD TV, LED TV, VCD player, CD/DVD recorder/player etc. Which in-turn will develop in them capabilities of assembling, fault diagnosis and rectification in a systematic way.

Course Outcomes:
1. Troubleshoot various sections of LED TV.
2. Fault finding in PA systems, Cassette Tape recorder, CD/DVD/VCD player, telephone.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√			√	√							
CO2	√			√	√							

List of Experiments:

1. To study the block diagram and working of Public address system.
2. To measure the AC/DC voltage and waveform at different points in different sections of PA system.
3. Fault Finding in Public address system.
4. To understand the recording and playback process of an audio tape recorder.
5. Fault Finding in Tape Transport Mechanism of a Cassette Tape Recorder
6. To study the block diagram and working principle of telephone trainer.
7. To measure the AC/DC voltage and waveform at different points in different sections of telephone trainer.
8. Fault finding in different sections of telephone trainer.
9. To study the block diagram and working principle of LED T.V.
10. To measure the AC/DC voltage at different points in Different sections of LED TV Trainer.
11. To find out fault in different sections of LED TV trainer.
12. To study the block diagram and working of a CD/DVD player trainer.
13. To measure the AC/DC voltage and waveform at different points in different sections CD/DVD player trainer
14. To find out fault in different sections of CD/DVD player trainer.
15. To study the block diagram and working of a VCD player trainer.
16. To measure the AC/DC voltage and waveform at different points in different sections of VCD player trainer.
17. To find out fault in different sections of VCD player trainer.

EC-228
NETWORK THEORY

	L	T	P	Credits
	3	1	0	4
	Sessional Marks			**50**
	End Semester Examination Marks			**50**

Course Objectives: The subject aims to provide the student with an understanding to analyse any given electrical network with help of fundamental techniques such as Kirchoff's laws, mesh and node analysis, network theorems, etc. Also aims to provide necessary background for understanding of various circuits and networks.

Course Outcomes:

1. Able to apply the nodal and mesh methods of circuit analysis.
2. Analyze the circuit using Kirchhoff's law and Network simplification theorems.
3. Able to analyze resonant circuits and magnetically coupled circuits.
4. Able to use Laplace transformation to solve various circuits and use of test signals.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√		√		√						
CO2		√		√	√							
CO3		√		√		√						
CO4		√		√	√	√						

Unit-I **14 hrs.**

Introduction: Voltage and current sources, relation between current, voltage, power and energy of DC sources, Source transformation, formation of branch, node and loop, Applications of Kirchoff's Current Law (KCL) by using nodal current method and Kirchoff's Voltage Law (KVL) using loop current method and branch current method for solving network problems, star-delta conversion.

Unit-II **12 hrs.**

Network Theorems: Superposition theorem, Thevenin's theorem, Norton's theorem, reciprocity theorem, maximum power transfer theorem and Tellegen's theorem for the solution of networks with DC excitation and AC excitation.

Unit-III **12 hrs.**

Resonance and Magnetically Coupled Circuits: Introduction to resonance, Series resonance, Parallel resonance, Concept of self-inductance and mutual inductance, coupling coefficient, magnetically coupled circuits, Simple series and parallel circuits, Dot convention.

Unit-IV **10 hrs.**

Standard Test Signals: Unit step, ramp, impulse, gate and shifted functions and their Laplace transforms, **Filters:** Introduction to low pass, high pass, band pass and band elimination filters, prototype LC and RC filters.

RECOMMENDED BOOKS		
Title	**Author**	**Publisher**
1. Fundamentals of Electric Circuits	Charles K. Alexander and Matthew N.O. Sadiku	Tata McGraw Hill
2. Network Analysis	Van Valkenburg	Prentice Hall of India
3. Networks and Systems	D. Roy Choudhary	New Age International
4. Circuit and Networks: Analysis and Synthesis	A. Sudhakar and S. Palli	Tata McGraw Hill

EC-229
Troubleshooting of Electronics Equipment-II

	L	T	P	Credits
	0	**0**	**4**	**2**

Course Objectives:	The course provides the students with necessary knowledge and competency to diagnose the faults for trouble shooting and for systematic repair and maintenance of electronic equipment and testing of components.
Course Outcomes:	**1.** Find faults as well as repair various electronic equipment like mobile telephones, C.R.O, function generator, power supplies, digital multimeter **2.** Analyse the detailed functioning, fault finding and repair of UPS and home inverter system.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√		√	√							
CO2		√		√	√							
CO3												

List of Experiments:

1. Demonstration and practice of fault finding and repair of mobile telephones.
2. Demonstration and practice of fault finding and repair of C.R.O.
3. Demonstration and practice of fault finding and repair of Function Generator.
4. Demonstration and practice of fault finding and repair of Power supplies.
5. Demonstration and practice of fault finding and repair of Digital multimeter.
6. To study the block diagram and working principle of UPS system trainer.
7. To measure the AC/DC voltage and waveform at different point in Different section of UPS system trainer.
8. To study the block diagram and working principle of home inverter system trainer.
9. To measure the AC/DC voltage and waveform at different point in Different section of Home inverter system trainer.
10. Demonstration, practice of fault finding and repair of UPS system.
11. Demonstration, practice of fault finding and repair of home inverter system.
12. Testing of Integrated Circuits (ICs).
13. Use of digital tools for troubleshooting digital equipment.

EC-221
Fundamentals of Electronics Engineering

	L	T	P	Credits
	3	0	2	4
	Sessional Marks			**50**
	End Semester Examination Marks			**50**

Course Objectives:	The course intends to provide the basic concept and characteristics of the electronics devices such as diode, BJT, FET, etc. Also aims to provide the understanding application of different electronics devices and simple circuits.
Course Outcomes:	**1.** To acquire knowledge about semiconductor physics for intrinsic and extrinsic materials. **2.** This course gives an overview of various semiconductor devices. **3.** Acquired knowledge about active and passive components, voltage and current sources. **4.** Able to understand the working principles of electronic circuits e.g. Rectifiers, Filters, Regulated circuits, etc.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√		√								
CO2	√	√	√									
CO3	√	√		√								
CO4		√	√	√	√	√						

Unit-I — **10 hrs.**

Active and Passive Components: Introduction to active and passive components; fixed and variable resistances, their various types fixed and variable capacitors, their various types and important specifications and color codes.

Voltage and current sources – concept of constant voltages and constant current sources, symbol and graphical representation, characteristics of ideal and practical sources.

Unit-II — **10 hrs.**

Introduction: Classification of materials into conductors, semi-conductors, and insulators, Atomic structure of Germanium and Silicon semi-conductors; intrinsic and extrinsic semiconductors.

Unit-III — **12 hrs.**

Semiconductor Diodes: PN junction, basic principles of operation and VI characteristics of PN junction diode, static and dynamic resistance of a diode. Use of a diode in rectifiers, half wave, full wave and bridge rectifier with shunt capacitor filter, series inductor filter, Zener diode and its applications, as a voltage regulator, light emitting diode (LED).

Unit-IV	**12 hrs.**
Transistors: Introduction of BJT, working of PNP and NPN transistor, input and output characteristics, transistor configurations, biasing of a transistor, amplifying action of a transistor, comparison of different configurations, MOSFET, their characteristics and applications.	

RECOMMENDED BOOKS

Title	**Author**	**Publisher**
1. Basic Electronics and Linear Circuits	N. N. Bhargava and Kulshreshta	McGraw Hill
2. Electronics Devices and Circuits	Miliman and Halkias	McGraw Hill

Fundamentals of Electronics Engineering Lab	
Course Objectives:	To reinforce learning through hands-on experience by examining the electrical characteristics of various semiconductor devices, such as diodes, BJTs and FETs. To provide the student with the capability to measure and record the experimental data, analyze the results of various semiconductor devices.
Course Outcomes:	**4.** To understand the functioning of various electronic instruments like CRO, signal generator and multimeter. **5.** To understand the characteristics of diode and BJT and verify their responses. **6.** To construct various electronic circuits on the bread board and analyses their output.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√		√									
CO2			√			√						
CO3	√				√	√						

List of Experiments:

1. To measure values of different resistors by using the color coding chart.
2. To calculate the value of various passive components using multimeter.
3. To observe the front panel of CRO.
4. To observe the front panel of signal generator.
5. To observe the VI characteristics of semiconductor diode in forward bias.
6. To observe the VI characteristics of Zener diode in reverse bias.
7. To verify the NPN and PNP transistors.
8. To construct half-wave rectifier, wave shape of the electrical signal and calculate its ripple factor.
9. To construct full-wave rectifier, wave shape of the electrical signal and calculate its ripple factor.
10. To study the application of Zener diode as a voltage regulator.

EC-311
Electromagnetic Field Theory

	L	T	P	Credits
	3	0	0	3
	Sessional Marks			50
	End Semester Examination Marks			50

Course Objectives: The objective of this course is to impart fundamental concepts in the area of electromagnetic field and wave propagation. Various parameters related to a field like potential, flux, charge density, field intensity and energy density is covered. Next focus is to give the brief description about Maxwell's equation for electromagnetic field and their propagation. Basic idea about transmission lines is also covered.

Course Outcomes:

1. Understand fundamental terms related to electromagnetic field.
2. Apply Maxwell's equations for electromagnetic wave propagation.
3. Understand fundamental terms related to transmission lines.
4. Understand fundamentals of wave transmission in different media.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√		√	√							
CO2		√		√	√							
CO3		√		√	√							
CO4		√		√	√	√						

Unit-I — **12 hrs.**

Introduction to Vector Analysis: Introduction to vectors, addition, subtraction and multiplication of vectors, different co-ordinate systems, cartesian, cylindrical and spherical systems, transformation between different co-ordinate systems, line integral, surface integral and volume integral.

Static Electric Field: Force between point charges, coulombs law, electric field intensity, electric scalar potential, charge density, gradient of potential, electric flux, flux density, Gauss's law, energy density in capacitor, divergence theorem.

Unit-II — **12hrs.**

Static Magnetic Field: Biot-Savart law, force on moving charge and current element, magnetic flux, magnetic flux density, Amperes law, Maxwell equations, energy density in inductor, magneto static potential.

Time Varying Fields: Faraday's law, moving conductor in a changing magnetic field, Stoke's theorem, Maxwell equation from Faraday's law, displacement current, Maxwell's equation from amperes law, Maxwell equation for free space.

Unit-III — **12 hrs.**

Wave Transmission: Maxwell equations, plane waves, EM wave in a homogeneous medium, uniform plane wave equation for a conducting medium, sinusoidal time variations, reflection coefficient, wave equations for waves in space, plane waves at interfaces, group velocity, phase velocity, power and energy relations, pointing vector, reflection of wave.

Unit-IV — **12 hrs.**

Transmission Lines: Introduction, basic principles, termination lines with load, voltage and current distribution, characteristic impedance, propagation constant attenuation constant, phase constant, reflection coefficient, VSWR, open and short circuited transmission lines and their impedances, stub matching, types of high frequency transmission lines.

RECOMMENDED BOOKS		
Title	**Author**	**Publisher**
1. Electromagnetic Engineering	Hayt	Mcgraw Hill
2. Field theory	Gangadhar	Khanna
3. Electromagnetic	Karus	Mcgraw Hill
4. Electromagnetic Fields and Waves	K.D. Prasad	Satya Prakashan

EC-312
Linear IC's & Applications

	L	T	P	Credits
	3	1	4	6
	Sessional Marks			**50**
	End Semester Examination Marks			**50**

Course Objectives: Learning op-amp and its characteristics. Ability to design different configurations of op-amp circuits and design linear and non-linear op-amp applications, active filters, and detectors. Also analyses of 555 timer IC.

Course Outcomes:

1. Acquired knowledge of fundamental characteristics of op-amps.
2. To analyze op-amps with and without using feedback and determine how negative feedback effects the performance of op-amps.
3. To learn the linear applications of operational amplifiers.
4. To study various applications using 555 timer.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√		√								
CO2		√		√	√	√						
CO3		√		√	√	√						
CO4		√		√	√	√						

Unit-I **14 hrs.**

Introduction: Basic Op-amp and its schematic symbol, Block diagram of a typical Op-Amp, integrated circuits and their types, IC package types, 741 pin configuration, characteristics and performance parameters of Op-Amp, equivalent circuit of an Ideal and practical Op-Amp and its voltage transfer curve.
Practical Op-Amp: Input offset voltage, Input bias current, Input offset current, total output offset voltage, Thermal drift, Variation of op-amp parameters with supply voltage and temperature, Noise, CMRR, slew rate.

Unit-II **14 hrs.**

Operational amplifier applications: Op-amp as inverting amplifier, non-inverting amplifier, Differential amplifier, voltage follower, comparator, adder, subtractor, integrator, differentiator, zero crossing detector, level detector, square wave generator, voltage to current converter, current to voltage converter.
Negative feedback in op-amps: Block diagram representation of feedback configurations, Voltage-current, Voltage- voltage, Current-current, Current- voltage topologies.

Unit-III **10 hrs.**

Voltage regulator ICs: Concept of regulation, principal of series and shunt regulator, three terminals voltage regulator ICs (positive, and negative) and their applications (78XX and 79XX).

Unit-IV	**10 hrs.**
Specialized IC applications: 555 timer IC and its pin configuration, Block diagram, application of 555 as Monostable and Astable Multivibrator.	

RECOMMENDED BOOKS

Title	**Author**	**Publisher**
1. Op Amps & Linear Integrated circuits	Ramakant Gayakwad	Pearson Education
2. Operational Amplifiers and linear integrated circuits	R.F. Coughlin & F.F. Driscol	Prentice Hall
3. Design with Operational Amplifiers and Analog Integrated Circuits	S. Franco	Tata Mc-Graw Hill

Linear IC's and Applications Lab												
Course Objectives:	This lab aims to study the basic principles, configurations and practical limitations of op-amp. To understand the various linear and non-linear applications of op-amp.											
Course Outcomes:	**1.** Analyse and deign basic op-amp circuits, particularly various linear and non-linear circuits, active filters, signal generators, and data converters. **2.** Analyse and deign op-amp oscillators, single chip oscillators and frequency generators. **3.** Examine the operation of a PLL and verification of hardware results in using SPICE											
Mapping of course outcomes with program outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1		√	√	√		√						
CO2		√	√	√		√						
CO3			√		√		√					

List of Experiments:

1. To study comparator using op amp.
2. To measure the performance parameters of an Op-amp.
3. Application of Op amp as Inverting amplifier.
4. Application of Op-amp as Non Inverting amplifier.
5. To use the Op-Amp as summing, scaling & averaging amplifier.
6. To Design differentiator and Integrator using Op-Amp.
7. Application of Op-amp as Low-pass and High-pass filter.
8. Application of Op Amp as Square wave generator.
9. Application of Op Amp as Zero Crossing detector and window detector.
10. Design series regulators with an error amplifier to provide an output voltage of 5 volt at a load current of 1.5 Amp. Use a 741 Op-Amp and specify the Zener voltage necessary transistor gain and the maximum power dissipation of the transistor.
11. To Design a delay circuit using555.
12. To Design a +5V unregulated power supply.
13. To Design +5V regulated power supply.
14. To Design dual regulated power supply.
15. To design Voltage to current and current to Voltage convertor.

EC-313
Digital Communication

	L	T	P	Credits
	3	1	2	5
	Sessional Marks			**50**
	End Semester Examination Marks			**50**

Course Objectives: The course aims at studying the concepts of digital communication with the introduction to various components of digital communication systems. The students will understand the procedures and modulation techniques involved in developing digital communication system and explore the utility of digital signals for extended applications.

Course Outcomes:
1. Gain knowledge about the fundamental concepts of digital communication systems.
2. Convert analog signal into digital signal and apply suitable line codes
3. Identify the benefits of digital signals for applying suitably in multiple access techniques
4. Acquire knowledge about digital modulations schemes.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√	√	√								
CO2		√	√	√	√							
CO3		√	√		√							
CO4		√	√	√		√						

Unit-I — **12 hrs.**

Elements of Digital Communication: Block diagram of Digital Communication system, Digital representation of Analog signals, Advantages and Disadvantages of Digital Communication system,

Concept of amount of Information and entropy: Rate of information, Shannon Fano Source Coding, Huffman source coding.

Unit-II — **14 hrs.**

Sampling Theorem: Sampling, Natural sampling, flat top sampling, Sampling Rate, Aliasing
Pulse Code Modulation: Block diagram of PCM system, Quantization, Delta Modulation, Continuously variable Slope Delta Modulator (CVSDM) or Adaptive Delta Modulation.

Unit-III — **12 hrs.**

Line Coding: Line Coding & its properties. NRZ & RZ types, signaling format for unipolar, Polar, bipolar (AMI) and Manchester coding.
Multiplexing Techniques: Fundamentals of time and frequency division multiplexing.
Multiple Access Techniques: Basics of TDMA, FDMA and CDMA.

Unit-IV	**10 hrs.**
Digital Carrier Modulation Techniques: Introduction, Amplitude Shift Keying (ASK), ASK Spectrum, ASK Modulator, Frequency Shift Keying (FSK), PSK. **Digital Carrier Demodulation Techniques**: Coherent ASK Detector, Non-coherent ASK Detector, Non-coherent FSK Detector, Coherent FSK Detector.	

RECOMMENDED BOOKS

Title	**Author**	**Publisher**
1 Principles Of Communication Systems	Taub and Schilling	Tata McGraw-Hill Education
2. Introduction to Communication Systems	Gary M. Miller	6th edition, Prentice-Hall, 1999
3. Modern Electronic Communication	D. Roy Choudhary	New Age International
4. Modulation and Coding Techniques in Wireless Communications	Evgenii Krouk, Sergei Semenov	WILEY, 2011.
5. Digital Communication	E.A. Lee and D.G. Messerschmitt	Kluwer Academic Publishers,1994

<table>
<tr><th colspan="13">Digital Communication Lab</th></tr>
<tr><td colspan="2">Course Objectives:</td><td colspan="11">This lab aims to understand the building blocks of digital communication system and to prepare mathematical background for communication signal analysis. To understand and analyses the signal flow in a digital communication system.</td></tr>
<tr><td colspan="2">Course Outcomes:</td><td colspan="11">1. Analyze the performance of a baseband and pass band digital communication system.
2. Understand and analyze the various data formats used in digital communication.</td></tr>
<tr><th colspan="13">Mapping of course outcomes with program outcomes</th></tr>
<tr><th></th><th>PO1</th><th>PO2</th><th>PO3</th><th>PO4</th><th>PO5</th><th>PO6</th><th>PO7</th><th>PO8</th><th>PO9</th><th>PO10</th><th>PO11</th><th>PO12</th></tr>
<tr><td>CO1</td><td></td><td></td><td>√</td><td>√</td><td></td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td>√</td><td></td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2"></td><td colspan="11">List of Experiments:
1. Study of Sampling and reconstruction techniques.
2. Study of Pulse code modulation and demodulation.
3. Study of Delta modulation and demodulation.
4. Study of different data formats/line codes.
5. Study of data coding techniques.
6. Study of ASK modulation and demodulation.
7. Study of FSK modulation and demodulation.
8. Study of PSK modulation and demodulation.
9. Study of TDM PCM receiver and transmitter.
10. Study of Adaptive Delta modulation and demodulation.</td></tr>
</table>

EC-315
Principles of Microwave Engineering

	L	T	P	Credits
	2	1	0	3
	Sessional Marks			**50**
	End Semester Examination Marks			**50**

Course Objectives	The objective of this course is to provide students with opportunities to learn different types of Microwave devices, components, their characteristics, their working, and their applications.
Course Outcome:	**1.** Acknowledge about the microwave frequencies and the waveguides that are used to carry them. **2.** Acknowledge about isolator, circulator, coupler, microwave solid state devices and microwave strip line. **3.** Study the comparative performance analysis of Microwave Tubes and Circuits.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√		√								
CO2		√	√	√		√						
CO3		√	√	√	√							

Unit-I — **12 hrs.**

Introduction: Microwave frequency spectrum, familiarization with bands and wavelength. Effects of microwave and RF radiation on animals and plants, Microwave heating effect.

Microwave Components: Wave guides and its parameters, isolators, and circulators.

Unit-II — **12hrs.**

Microwave Couplers and Tubes: Directional couplers, introduction to S parameters. Problem with conventional tubes, lumped elements at microwave frequencies, velocity modulations, two cavity klystrons and its parameters, Travelling wave Tube.

Unit-III — **12 hrs.**

Semiconductor Microwave Devices: Transistors, integrated circuits, advantages of Microwave Integrated Circuits, varactor diodes, step recovery diode, frequency multipliers.

Unit-IV — **12 hrs.**

Semiconductor Microwave Diodes: Gunn diode application, avalanche effect, IMPATT diode, TRAPATT diode, characteristics and application of avalanche diode, principle of pin diodes & its application, Schottky barrier diode.

RECOMMENDED BOOKS

Title	Author	Publisher
1.Microwaves	K C Gupta	New Age International
2.Microwave and Radar Engg.	M Kulkarni	Umesh Publications, Delhi
3.Microwave Devices and Circuits	Liao S Y	Prentice Hall of India
4. Foundation of Microwave Engg.	R. E. Collin	McGraw-Hill

TP-301E **Industrial Training**	
Course Objectives:	To provide hands-on experience in various domains such as hardware, software, maintenance and testing in Industry / Training Centre's/ Corporate Offices so that they become aware of the practical application of theoretical concepts studied in the classrooms and to expose students to the 'real' working environment and get acquainted with the organization structure, business operations and administrative functions.
Course Outcomes:	**1.** Generate a report based on the experiences and projects carried out with the ability to apply knowledge of Mathematics, Science, and Engineering Fundamentals. **2.** Demonstrate competency in relevant engineering fields through problem identification, formulation and solution. **3.** Effectively implement skills in communication, in writing and using multimedia tools. **4.** Develop the ability to work as an individual and in group with the capacity to be a leader or manager as well as an effective team member. **5.** Master the professional and ethical responsibilities of an engineer.

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1		√										
CO2	√	√		√	√	√						
CO3		√						√				
CO4		√								√		√
CO5		√									√	

EC-321
Industrial Electronics

	L	T	P	Credits
	3	1	4	6
	Sessional Marks			50
	End Semester Examination Marks			50

Course Objectives: The objective of this course is to provide in-depth knowledge of the basics of various power semiconductor devices, analyses and design of various power converter circuits using power semiconductor devices and their applications in commercial and industrial areas.

Course Outcomes:
1. Acquire knowledge about fundamental concepts and techniques used in power electronics.
2. Analyses various single phase and three phase power converter circuits and understand their applications.
3. Develop skills to build and troubleshoot power electronics circuits.
4. Foster ability to understand the use of power converters in commercial and industrial applications.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√	√		√							
CO2		√	√	√		√						
CO3		√		√		√						
CO4		√		√		√						

Unit-I — **12 hrs.**

Power Devices: Symbols, specifications, and testing of SCRs, DIACS, TRIACS, UJT, Characteristics of the above devices.
Introduction to Thyristors: Thyristor ratings, thyristor construction, principle of operation of an SCR, working of SCR using transistor analogy. Turn on methods-DC gate, AC gate and Pulse gate triggering and R-C trigger circuits. Turn off methods- natural and forced turn off methods. thyristor protection, Circuit for over voltage and over current protection.

Unit-II — **12hrs.**

Phase Controlled Rectifiers: Explanation of the working of single-phase uncontrolled half wave and full wave rectifier (resistive and inductive loads) with the help of wave forms, Explanation of working of controlled rectifier using SCR (resistive and inductive loads) with help of wave forms and appropriate mathematical expression (no derivations): three-phase controlled half wave, full wave and bridge rectifier, Principle of dual converters & their applications.

Unit-III — **12 hrs.**

Choppers: Introduction, types of choppers, step-up and step-down choppers. voltage and current commutated type chopper.
Cycloconverters: Introduction and principle of operation of converter, up and down Cycloconverters.
Inverters: Principle of operation of basic inverters circuit, basic series and parallel commutated inverters.

Unit-IV	**12 hrs.**
Thyristor Applications: Advantages of electronic control of devices, basics of DC motor speed control, speed control of DC and small AC motors using thyristor technology, principal of operation and working of the following switching circuits using SCRs: Automatic battery charger, Voltage regulator, Time delay relay circuit, Emergency, light, Burglar alarm circuit, Light operated alarm, AC phase control circuit using **TRIAC and its applications** : Illumination control, Fan speed control, Temperature control.	

RECOMMENDED BOOKS

Title	**Author**	**Publisher**
1. Industrial Electronics and Control	S K Bhattacharya and S Chatterji	Tata McGraw Hill
2. Power electronics	P S Bimbhra	Khanna Publishers, New Delhi
3. Power electronic	M Rama Murthi	New age

Industrial Electronics Lab	
Course Objectives:	The objective is to analyses V-I characteristics various power semiconductor devices like SCR, DIAC and TRIAC and to study various basic power control circuit using power semiconductor devices.
Course Outcomes:	**1.** Analyse the V-I characteristics of various industrial electronic devices like SCR, DIAC, TRIAC and UJT. **2.** Analyse the waveforms of half-wave, full-wave controlled rectifier, relaxation oscillator, chopper circuit etc.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			√	√		√						
CO2			√	√	√	√						

List of Experiments:

1. To test and draw the characteristics of SCR and find its latching and holding currents.
2. To test and draw the characteristics of DIAC and find its break over voltages.
3. To test and draw the characteristics of TRIAC and find its latching and holding currents.
4. To test and draw the characteristics of UJT and find its intrinsic standoff ratio.
5. To draw the different waveforms of half-wave controlled rectifier and find its average.
6. To draw the different waveforms of full wave mid-point controlled rectifier and find its average.
7. To draw the different waveforms of full-wave bridge configuration controlled rectifier and find its average.
8. To study the different waveforms of relaxation oscillator using UJT and find its time-period.
9. To trigger the SCR using relaxation oscillator.
10. To draw the different waveforms of half wave voltage controller and find its average.
11. To control speed of a universal motor using SCR and draw necessary waveforms.
12. To draw the different waveforms of voltage commutated and current commuted Chopper circuits and find their duty cycle.
13. To draw the different waveforms of Series and Parallel Inverter circuits.

EC-322
WIRELESS AND MOBILE COMMUNICATION

	L	T	P	Credits
	3	0	0	3
	Sessional Marks			50
	End Semester Examination Marks			50

Course Objectives: Aim of the course is to study the basics of cellular system. It also gives a deep insight in to the various types of fading effects. It discusses the different types of modulation techniques used for mobile communication. Finally, it introduces the CDMA and GSM techniques used for mobile communication.

Course Outcomes:

1. Understand the basics terms related to wireless communication system.
2. Understand the basics of cellular communication system.
3. Understand the modulation techniques used in mobile communication.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√	√	√								
CO2		√		√								
CO3		√	√	√								

Unit-I **12hrs.**

Introduction to Wireless Communication Systems: Concept of cellular communication system, basics of wireless cellular system, mobile unit, base station, mobile switching center, performance criteria, voice quality, service quality, coverage and required grade of service, co-channel interference, frequency reuse, determining the frequency reuse distance, channel assignment strategies, hand-off strategies, interference, and system capacity.

Unit-II **12 hrs.**

Mobile Radio Propagation: Introduction to radio wave propagation, free space propagation model, basic propagation mechanisms, reflection, diffraction, scattering, types of small-scale fading, fading effects due to Doppler spread and delay spread.

Unit-III **12 hrs.**

Modulation Techniques: Introduction to linear modulation techniques, minimum shift keying, gaussian minimum shift keying, spread spectrum modulation techniques.

Unit-IV **12 hrs.**

Advanced Transceiver Schemes: Cellular code division multiple access systems, GSM, IS–95, and introduction to fourth and fifth generation wireless communication standards.

RECOMMENDED BOOKS

Title	Author	Publisher
1. Wireless communications	T.S Rappaport	Pearson Education, 2003.
2. Principles of Mobile Communication	Gordon L. Stuber	Springer International Ltd., 2001.
3. Wireless Communications	Andrea Goldsmith	Cambridge University Press, 2007

EC-323

Microprocessor & Microcontroller Applications

	L	T	P	Credits
	3	1	2	5
	Sessional Marks			**50**
	End Semester Examination Marks			**50**

Course Objectives:	This course is aimed to provide knowledge about the interfacing of microprocessor and microcontroller with different peripherals viz., keyboard, LCD, memory etc.
Course Outcome:	**1.** Understand the interfacing of different peripherals with microprocessor. **2.** Write the programs and interfacing of peripherals with microcontroller. **3.** Design the circuit for interfacing.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√	√		√	√						
CO2		√	√		√	√						
CO3		√	√			√						

Unit-I — **12 hrs.**

Memory Interfacing: Details of interfacing of PIC8259, Interfacing of memory chips ROM (2732, 2764) and RAM (6116).
General Purpose Programmable Peripherals Interfacing Chips: Block concepts control function modes and application peripheral chips -8255.

Unit-II — **12hrs.**

Line drivers: MC 1488, 1489, 8250, 8251(in detail)
Interfacing Data Converters: DAC 0800.

Unit-III — **12 hrs.**

Interfacing of Microcontroller with Memory: Interfacing of external memory RAM & EPROM,
Interfacing of Microcontroller with External Devices: Interfacing of sensors, stepper motor, and keyboard.

Unit-IV — **12 hrs.**

Interfacing: Interfacing of Microcontroller Data Converters**,** Interfacing to enhance 8051 capabilities with 8255 & Timer chips.
Microcontroller Ports: connection to RS 232.

RECOMMENDED BOOKS

Title	Author	Publisher
1. Microprocessor Architecture, programming, and application with 8080/8085	Ramesh s Gaonker,	Willey eastern ltd New Delhi
2. The 8051 Microcontroller and Embedded Systems	Ali Mazidi	Pearson Education

Microprocessor & Microcontroller Applications Lab												
Course Objectives:	This lab aims to design various applications based on microprocessor and microcontroller. It includes the interfacing of microcontroller with dc stepper motor, ADC, LED, LCD display, relays *etc.*											
Course Outcomes:	**1.** Design various real time applications based on microprocessor and microcontroller such as traffic light, temperature control *etc.* **2.** Control the speed as well as step size of DC stepper motor. **3.** Interface various peripheral devices to microprocessor and microcontroller.											
Mapping of course outcomes with program outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1		√	√	√	√	√	√					
CO2			√	√	√	√						
CO3					√	√	√					

List of Experiments:

1. Write a program to control the operation of stepper motor using 8085/8086 microprocessors and 8255 PPI.
2. Write a program for finding square of a number using look-up table and verify.
3. Write a program to control the temperature using 8085/8086 microprocessors and 8255 PPI.
4. Write a program to control the traffic light system using 8085/8086 microprocessors and 8255 PPI.
5. Write a program to control speed of DC motor using 8085/8086 microprocessors and 8255 PPI.
6. Write a program of Flashing LED connected to port 1 of the Micro Controller
7. Write a program to generate a Ramp waveform using DAC with micro controller.
8. Write a program to interface the ADC.
9. Write a program to control a stepper motor in direction, speed and number of steps.
10. Write a program to control the speed of DC motor.
11. Interfacing of high power devices to Micro-controller port-lines, LED, relays, and LCD display.

EC-324
Antenna Wave Propagation

	L	T	P	Credits
	3	0	0	3
	Sessional Marks			50
	End Semester Examination Marks			50

Course Objectives:	The objective of this course is to provide students with opportunities to learn different types of antenna. This course provides an introduction to the basic antenna parameters, antenna arrays, aperture type antennas and wave propagation.
Course Outcomes:	**1.** Understand fundamental terms related to antenna parameters. **2.** Understanding of different types of antenna structure for different applications. **3.** Understand fundamentals of wave propagation.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2												
CO3												

Unit-I — **12 hrs.**

Basic Antenna Parameters: Introduction, radiation mechanism, radiation patterns, antenna beam area, antenna beam width, radiation intensity, gain, directive gain, power gain, directivity (D), antenna bandwidth, effective aperture and height, antenna impedance, radiation resistance, front to back ratio, radiation power density, isotropic radiators, near field and far field concept.

Unit-II — **12hrs.**

Wire Radiators: Voltage and current distribution, hertz dipole antenna, radiation from a half wavelength dipole and its radiation resistance. monopole radiator, loop antenna.

Antenna Arrays: Introduction, linear uniform array isotropic sources, principles of pattern multiplication, broadside arrays, end fire arrays, antenna for receiving and transmitting TV signals e.g., Yagi-Uda and log periodic antenna.

Unit-III — **12 hrs.**

Aperture Type Antennas: Aperture antennas, E & H -plane horns, pyramidal horn, reflector antennas, antenna measurements, microstrip antennas & their advantages.

Unit-IV — **12 hrs.**

Propagation of Radio Waves: Different modes of propagation, ground waves propagation, space wave propagation over flat and curved earth, optical and radio horizons, surface waves and troposphere waves, path loss calculation, sky wave propagation - introduction, Structure of ionosphere, critical frequency, maximum usable frequency (MUF), skip distance and virtual height, effect of earth's curvature.

RECOMMENDED BOOKS

Title	Author	Publisher
1. Antennas	Kraus	Mc Graw Hill
2. Antenna and Wave Propagation	K D Parsad	Parkash Publications

EC-325
Microelectronics

	L	T	P	Credits
	3	0	2	4
	Sessional Marks			**50**
	End Semester Examination Marks			**50**

Course Objectives: The objective of the subject microelectronics is to discuss the design and fabrication process of thick film, thin film and hybrid IC's. It also aims at understanding each and every step of fabrication from crystal growth to photolithography to manufacturing and to have a brief knowledge of fabrication process flow and learning design and fabrication of BJT, diode, FET, MOS *etc.*

Course Outcomes:

1. Understand the physical and electrical properties of semiconductor materials and their use in microelectronic circuits.
2. Develop an understanding about key aspects of the microelectronics industry, from device design, to processing, to photolithography, to manufacturing and packaging.
3. Learn in brief many of the core problems involved with MOSFET technology.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√	√	√		√						
CO2		√		√								
CO3		√		√								

Unit-I — **12 hrs.**

Introduction: Advantages of IC's, General classification of IC's(Linear/Digital IC's, Monolithic/ Hybrid IC's), Basic IC fabrication steps

Classification of integrated circuits: Classification of integrated circuits (IC's), thick film, thin film & hybrid IC's.

Unit-II — **12hrs.**

Fabrication of Components: Fabrication and component design, resistor, capacitors and inductors, design and fabrication.

Monolithic Techniques: Process on silicon crystals, line growth, refining, substrate slicing, polishing, chemical vapour deposition, thermal oxidation, photolithography, diffusion, impurities, diffusion system, ion implantation, metallization, isolation.

Unit-III — **12 hrs.**

Thermal oxidation: Thermal oxidation process (kinetics of growth, thin oxide growth), effect of impurities on the oxidation rate.

Photolithography: Pattern generation/Mask making, Contact and Proximity printing, photo resist, photolithography, process (lift off technology, fine line photolithography).

Unit-IV — **12 hrs.**

Diffusion: Basic diffusion process (diffusion equation, diffusion profiles), extrinsic diffusion, lateral diffusion,

Ion Implantation: Ion implantation process (ion distribution, ion stopping), implant damage and annealing process (furnace and rta)

RECOMMENDED BOOKS

Title	Author	Publisher
1. Integrated Circuits	Millman and Halkias	Mc Graw Hill
2. Integrated Circuits	K R Botkar	TMH

Microelectronics Lab												
Course Objectives:	The objective of micro-electronics lab is to make the students familiar with PCB designing processes. It also includes layout designing using different software followed by etching and mounting the components on final prepared PCB.											
Course Outcomes:	**1.** Understand the working of PCB making CNC Mill-15. **2.** Design the layout of electronic circuit with the help of various software. **3.** Perform various steps involved in the design of PCB.											
Mapping of course outcomes with program outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1							√					
CO2					√	√	√					
CO3					√	√	√					

List of Experiments:

1. To Study and observe the PCB making Machine CNC Mill- 15.
2. To Study and observe the Mach Mill 3 Software.
3. To Study and observe the Sprint Layout Software.
4. To Study and observe the Copper CAM Software.
5. To design and Implement the PCB using PCB making Machine.
6. To prepare Negative of a given artwork using Vertical process Camera.
7. To perform Dip Coating Operation on Copper Clad Board by using dip Coating machine.
8. To perform etching operation on given Printed Copper Clad Board.
9. To mount the Components on prepared PCB.
10. To test or Inspect the PCB.

EC-327 Project				
	L	**T**	**P**	**Credits**
	0	**0**	**4**	**2**
Course Objectives:	Project Work aims at developing innovative skills in the students whereby they apply in totality the knowledge and skills gained through the course work in the solution of particular problem or by undertaking a project. In addition, the project work is intended to place students for project oriented practical training in actual work situation for the stipulated period with a view to: 1. Develop understanding of subject based knowledge given in the classroom in the context of its application at workplaces and first-hand experience and confidence amongst the students to enable them to use and apply polytechnic/institute based knowledge and skills to solve practical problems related to the world of work. 2. Develop abilities like interpersonal skills, communication skills, positive attitudes and values etc. 3. Develop understanding regarding nature of fieldwork in which students are going to play their role after completing the courses of study.			
Course Outcomes:	**1.** Refine and complete the selected project making use of the technical and engineering knowledge which meets the expected outcome. **2.** Work with the modern tools required for the implementation of the project. **3.** Achieve the results within in the stipulated time. **4.** Acquire problem solving, system integration, project management, documentation, interpersonal and communication skills.			

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√	√	√	√	√	√						
CO2	√	√					√					
CO3											√	
CO4		√		√	√			√			√	√