INTEGRATED CERTIFICATE CUM DIPLOMA PROGRAMME (ICD)

DIPLOMA (ICD) IN ELECTRONICS AND COMMUNICATION ENGINEERING &

CERTIFICATE IN TELEVISION MECHANIC(CTV)

Proposed to be

CERTIFICATE IN TELECOMMUNICATION TECHNICIAN (CTC)

Study Scheme

Department of Electronics & Communication Engineering

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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 a center of excellence in thrust areas to nurture the spirit of innovation and creativity among faculty and students.

Kuldip Singh P. K. Das Dilip Kumar J. S. Ubhi Ajay Pal Singh

Programme Educational Objectives (PEOs)

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

1. Technically competent in maintenance, servicing and repairing of telecommunication equipment's.
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-CSME) program, student will be able to:

1. Apply technical skill to troubleshoot, repair, service & maintenance of telecommunication equipment's.
2. Use 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 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.

Study Scheme of Integrated Certificate Diploma Programme (CTC)

Semester-I							
S. No	**Code No.**	**Course Title**	**Hours per week**			**Hours**	**Credits**
			L	**T**	**P**		
1.	BSMA101	Mathematics-I	3	1	0	4	4
2.	BSPH103	Applied Physics-I	2	1	0	3	3
3.	BSCY105	Applied Chemistry	2	1	0	3	3
4.	HSMH101	Communication Skills in English	2	0	0	2	2
5.	BSPH107	Applied Physics-I Lab	0	0	2	2	1
6.	BSCY109	Applied Chemistry Lab	0	0	2	2	1
7.	HSMH105	Communication Skills in English Lab	0	0	2	2	1
8.	ESME101	Engineering Graphics	0	0	2	2	1
9.	ESWS103	Engineering Workshop Practice	0	0	4	4	2
10.	HSSP103	Sports and Yoga	0	0	2	2	1
		Total	**9**	**3**	**14**	**26**	**19**
11.	**QPEC101**	**Computing and Peripherals Technician**	**0**	**0**	**8**	**8**	**01**

Semester-II							
S. No	**Code No.**	**Course Title**	**Hours per week**			**Hours**	**Credits**
			L	**T**	**P**		
1.	BSMA102	Mathematics-II	3	1	0	4	4
2.	BSPH104	Applied Physics-II	2	1	0	3	3
3.	ESCS102	Introduction to IT Systems	2	0	0	2	2
4.	ESEE104	Fundamentals of Electrical Engineering	2	0	0	2	2
5.	ESEC108	Fundamentals of Electronics Engineering	2	0	0	2	2
6.	ESME106	Engineering Mechanics	2	1	0	3	3
7.	BSPH106	Applied Physics-II Lab	0	0	2	2	1
8.	ESCS110	Introduction to IT Systems Lab	0	0	2	2	1
9.	ESEE112	Fundamentals of Electrical Engineering Lab	0	0	2	2	1
10.	ESEC114	Fundamentals of Electronics Engineering Lab	0	0	2	2	1
11.	ESME116	Engineering Mechanics Lab	0	0	2	2	1
		Total	**13**	**3**	**10**	**26**	**21**

12.	**QPEC102**	**Electronic Workshop Practices**	**0**	**0**	**8**	**8**	**1**
13.	EAA 102	Fractional credit course/Extra Academic Activity	-	-	-	-	**1 (S/US)**

Summer-I							
S. No	**Code No.**	**Course Title**	**Hours per week**			**Hours**	**Credits**
			L	**T**	**P**		
1.	**QPEC103**	OJT/Qualification Pack (6 Weeks) in **PCB Design and Fabrication Technician**	**0**	**0**	**24**	**24**	**03**

Semester-III							
S. No	**Code No.**	**Course Title**	**Hours per week**			**Hours**	**Credits**
			L	**T**	**P**		
1.	PCEC201	Analog Electronics	3	1	0	4	4
2.	PCEC203	Digital Electronics	2	1	0	3	3
3.	PCEC207	Network Theory	3	1	0	4	4
4.	PCEC209	Analog Communication Systems	2	1	0	3	3
5.	PCEC211	Analog Electronics Lab	0	0	2	2	1
6.	PCEC213	Digital Electronics Lab	0	0	2	2	1
7.	PCEC215	Analog Communication System Lab	0	0	2	2	1
8	PCEC-217	Modern Television Engineering	2	0	0	2	1
9.	AUCH201	Environmental Science	2	0	0	2	**0(S/US)**
		Total	**14**	**4**	**6**	**24**	**20**
10.	**QPEC203**	**TV Repair Technician**	**0**	**0**	**8**	**8**	**1**
11.	EAA 201	Fractional credit course/ Extra Academic Activity	-	-	-	-	**1(S/US)**

Semester-IV							
S. No	**Code No.**	**Course Title**	**Hours per week**			**Hours**	**Credits**
			L	**T**	**P**		
1.	PCEC202	Fundamental of Microprocessors	2	1	0	3	3
2.	PCEC204	Electromagnetic Field and Antenna Systems	2	1	0	3	3
3.	PCEC206	Industrial Electronics	2	1	0	3	3
4.	PCEC208	Linear Integrated Circuits	2	1	0	2	2
5.	PEEC202	PE-I	3	1	0	4	4
6.	OEEC202	OE-I	3	0	0	3	3
7.	PCEC210	Industrial Electronics Lab	0	0	2	2	1
8.	AUMH202	Essence of Indian Knowledge and Tradition	2	0	0	2	0**(S/US)**
		Total	**16**	**5**	**2**	**23**	**20**
9.	**QPEC202**	**Troubleshooting & Maintenance of Electronics Equipment's**	**0**	**0**	**08**	**08**	**01**
10	EAA-202	Fractional credit course/Extra Academic Activity	-	-	-	-	**1 (S/US)**

Summer-II							
S. No	**Code No.**	**Course Title**	**Hours per week**			**Hours**	**Credits**
			L	**T**	**P**		
1.	**TPID-202**	**Summer Internship with OJT (4-6 weeks)**	**0**	**0**	**24**	**24**	**03**

Semester-V							
S. No	**Code No.**	**Course Title**	**Hours per week**			**Hours**	**Credits**
			L	**T**	**P**		
1.	HSMH301	Entrepreneurship and Start-ups	3	1	0	4	4
2.	PCEC301	Fundamentals of Microcontrollers	3	0	0	3	3
3.	PCEC303	Modern Communication Systems	2	1	0	3	3
4.	PEEC301	PE-II	3	1	0	4	4
5.	OEEC301	OE-II	3	0	0	3	3
6.	PCEC305	Modern Communication Systems Lab	0	0	2	2	1

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7.	PREC301	Minor Project	0	0	4	4	2
		Total	**14**	**3**	**6**	**23**	**20**
8.	**QPEC301**	**Electronic Hardware Design Technician**	**0**	**0**	**8**	**8**	**01**

Semester-VI							
S. No	**Code No.**	**Course Title**	**Hours per week**			**Hours**	**Credits**
			L	**T**	**P**		
1.	AUMH02	Indian Constitution	2	0	0	2	0
2.	PCEC302	Introduction to Python Programming	3	0	0	3	3
3.	PEEC302	PE-III	3	1	0	4	4
4.	PEEC304	PE-IV	3	1	0	4	4
5.	OEEC302	OE-III	3	0	0	3	3
6.	PCEC304	Python Programming Lab	0	0	2	2	1
7.	PREC302	Major Project	0	0	8	8	4
8.	SEEC302	Seminar	1	0	0	1	1
		Total	**15**	**2**	**10**	**27**	**20**
9.	**QPEC302**	**Mobile Phone Hardware Repair Technician**	**0**	**0**	**8**	**8**	**01**

List of Professional Electives

Professional Elective-I			
Sr.No	**Sub. Code**	**Subject Name**	
1	PEEC-202A	Audio Video System	
2	PEEC-202B	Electronic Equipment Maintenance	
3	PEEC-202C	Computer Programming & Application	
Professional Elective-II			
Sr.No	**Sub. Code**	**Subject Name**	
1	PEEC-301A	Wireless Communication	
2	PEEC-301B	Service and Maintenance of Computers	
3	PEEC-301C	Signals and Control System	
Professional Elective-III			
Sr.No	**Sub. Code**	**Subject Name**	
1	PEEC-302A	Electronic Measurements and Instrumentation	
2	PEEC-302B	Computer Networks	
3	PEEC-302C	Fundamentals of Internet of Things	
Professional Elective-IV			
Sr.No	**Sub. Code**	**Subject Name**	
1	PEEC-304A	Microwave and Radar Engineering	
2	PEEC-304B	Optical Electronics	
3	PEEC-304C	Programming of Arduino and Interfacing	

List of Open Electives

Open Elective-I			
Sr.No	**Sub. Code**	**Subject Name**	
1	OEEC-202A	Microprocessor and Applications	
2	OEEC-202B	Digital Logic Design	
3	OEEC-202C	Electronic Measurements & Instrumentation	
Open Elective-II			
Sr.No	**Sub. Code**	**Subject Name**	
1	OEEC-301A	Principle of Communication Engineering	
2	OEEC-301B	Introduction to Python Programming	
3	OEEC-301C	Wireless Communication	
Open Elective-III			
Sr.No	**Sub. Code**	**Subject Name**	
1	OEEC-302A	Optical Electronics	
2	OEEC-302B	Programming of Arduino and Interfacing	
3	OEEC-302C	Internet of Things and Applications	

Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
HS	Humanities & Social Sciences Courses
BS	Basic Science Courses
ES	Engineering Science Courses
PC	Program Core Courses
PE	Program Elective Courses
OE	Open Elective Courses
AU	Audit Courses
SI	Summer Internship
PR	Project
SE	Seminar

XX	EE (Electrical engineering)
	IE (Instrumentation Engineering)
	EC (Electronics & Communication Engineering)
	CS (Computer Science & Engineering)
	CH (Chemical Engineering)
	ME (Mechanical Engineering)
	FT (Food Technology)
	PH (Physics)
	CY (Chemistry)
	MA (Mathematics)
	MH (Management & Humanities)
	SP (Sports)

PCXX- YZZ
Y-stands for year code 1, 2 or 3
ZZ- odd for odd semester subject e.g. 101, 103, 201, 305 etc.
ZZ-Even for even semester subject e.g. 102, 112, 202, 306 etc

SUMMARY

Table 1: Working weeks, days and hours in a semester				
Semester	Working Weeks / Semester	Working days/ Week	Working Hours/ Day	Hours/ semester
Odd	15	5	8	600
Even	15	5	8	600

Table 2: Relation of credits and hours in a week		
Description	Credits	Hours/ week
Theory/ Tutorial	1	1
Laboratory (Practical)	1(2)	2(3/4)
Qualification Pack	1	8

Odd Semester		Even Semester		
Semester	Credit	Semester	Credit	
1	20	2	22	42
3	21	4	21	42
5	21	6	21	42
				126
		Summer-I	03	03
		Summer-II	03	03
				132

ESEC-108
Fundamentals of Electronics Engineering

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

Course Objectives: The course intends to provide the basic concepts 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. Able to understand working of various semiconductor devices.
3. Acquired knowledge about active and passive electronic components, voltage and current sources.
4. Able to understand the working principles of basic electronic circuits.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1	1	3	1	1	0	0	2	1
CO2	3	3	3	3	3	2	1	1	0	0	3	2
CO3	3	3	1	3	1	1	0	1	0	0	0	0
CO4	3	3	3	2	1	3	0	1	0	0	0	0

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, mass action law, diffusion, and drift currents.

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 of transistor configurations, amplifying action of a transistor, comparison of different configurations, JFET and 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

ESEC-114 Fundamentals of Electronics Engineering Lab				
	L	**T**	**P**	**Credits**
	0	**0**	**2**	**1**
	Sessional Marks			**50**
	End Semester Examination Marks			**50**
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 semiconductor devices 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	3	0	3	3	2	2	0	1	3	2	1	2
CO2	3	3	3	3	2	2	0	1	3	2	1	0
CO3	3	3	0	3	2	2	0	1	3	2	1	2

List of Experiments:

1. Identifications of different passive electronic components.
2. To measure values of different resistors by using the color-coding chart.
3. To calculate the value of various passive components using multimeter.
4. To observe the front panel of signal generator and CRO.
5. To study the VI characteristics of semiconductor diode in forward bias.
6. To study the VI characteristics of Zener diode in reverse bias.
7. To study the half-wave rectifier with and without filter and calculate its ripple factor.
8. To study the center tap type full-wave rectifier with and without filter and calculate its ripple factor.
9. To study the bridge type full-wave rectifier with and without filter and calculate its ripple factor.
10. To study the input and output VI characteristics of NPN/PNP transistor in CB configuration.
11. To study the application of Zener diode as voltage regulator and measurement of percentage regulation by varying load resistor.

PCEC-201
Analog Electronics

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

Course Objectives:	This subject intends to teach operating principles and application of electronic circuits and devices like different types of amplifiers, and oscillators and their applications.
Course Outcome:	1. Understand the concept and applications of BJT and FET. 2. Understand the concept of amplification, operating point, DC load line, and amplifier. 3. Understanding the concept of multistage amplifiers and various coupling techniques. 4. Knowing the concept of feedback circuits, oscillators, and tuned amplifiers.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	3	3	1	2	1	1	2	3	1	1
CO2	2	3	3	1	1	1	3	2	3	3	1	1
CO3	2	3	3	3	3	3	3	1	1	1	2	2
CO4	1	3	3	3	3	2	3	1	1	2	3	1

Unit-I **12 hrs.**

BJT characteristics and Biasing: Principle of transistor as switch and amplifier, Current equations of BJT, relationship among α, β, and γ. need for biasing, operating point, DC load line, stability factor, biasing techniques – fixed bias, collector to base bias, voltage divider or self-bias for BJT, bias compensation, thermal runaway.

Unit-II **12hrs.**

Single stage amplifiers: Graphical demonstration of Single stage amplifier, phase reversal, DC & AC equivalent circuit, Load line, Analysis, Classification of amplifier, Concept of gain and bandwidth, Transistor amplifier circuit as two-port network, hybrid parameter model for transistor amplifier.

FET amplifier: JFET and its types, characteristics of JFET, small signal model of JFET, biasing for JFET, JFET as an amplifier

Unit-III **12hrs.**

Multistage amplifiers: Characteristics of Cascaded Amplifier, Gain in Decibels, Selection of an Amplifier Configuration for Cascade Connection, Methods of Coupling in Multistage Amplifiers, RC Coupled Amplifiers, Transformer Coupled Amplifier, Direct Coupled Amplifiers, Comparison of Different Coupling Techniques.

Feedback Amplifier: Feedback principle, positive, negative feedback, and their features, advantages of negative feedback, topologies of feedback- voltage series, voltage shunt, current series, and current shunt

Unit-IV	**12hrs.**
Oscillator: Introduction and types of an oscillator, Barkhausen Criterion, RC oscillators – RC phase shift and Wein bridge, LC oscillator- Hartley and Colpitts, Crystal oscillator. **Power and tuned amplifier:** Introduction to large signal amplifier, Difference Between Voltage Amplifier and Power Amplifier, Power Amplifiers, Power Amplifier types, Comparison of Amplifier Classes, Class-A, Class-B, Class-C, and Class-D Power Amplifier, Concept of tuned amplifier.	

RECOMMENDED BOOKS

Title	**Author**	**Publisher**
1. Principle of Electronics	V K Mehta, Rohit Mehta	S Chand
2. Electronic Principles	A.P. Malvino	Tata McGraw Hill
3. Electronic Devices and Circuits	S. Salivahanan , N. Sereshkumar	Tata McGraw Hill

PCEC-203 Digital Electronics				
	L	**T**	**P**	**Credits**
	2	**1**	**0**	**3**
	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	3	3	3	1	2	1	1	1	1	0	2	2
CO2	3	3	2	1	1	1	2	1	1	0	3	2
CO3	3	3	3	3	2	2	2	1	1	0	3	2
CO4	3	3	3	1	3	2	2	1	1	0	3	2

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
3. Digital Logic Designs	Morris Mano	PHI 5th Edition
4. Digital Systems: Principles and Applications	R J Tocci	PHI 10th Edition

Unit-IV	**12 hrs.**
Application: Basic block diagram, working principles and application of Digital watch /clock, Calculator, Washing machine, Microwave ovens, Mobile handset, Digital camera, DTH, Electronic ignition system for automobiles.	

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

PCEC-207
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 analyze any given network with the help of fundamental techniques such as Kirchoff's laws, mesh and node analysis, network theorems, etc. Also, aims to provide the necessary background for understanding various circuits and networks.
Course Outcomes:	**1.** Understanding of the basic concept of network analysis. **2.** Analyze the circuit using Kirchhoff's laws, node analysis, mesh analysis, and network 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. **5.** Understand filters and attenuators.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	3	2	0	1	1	0	0	2
CO2	2	2	2	2	2	2	0	1	1	0	1	2
CO3	1	3	1	3	3	2	0	1	2	0	1	2
CO4	3	3	2	3	2	2	0	1	1	0	0	2
CO5												

Unit-I **12 hrs.**

Introduction: Resistor, Capacitor, Inductor, Series and Parallel Connection, star-delta conversion, Voltage and current sources, relation between current, voltage, power, and energy of DC sources, Source transformation, formation of branch, node, and loop.

Unit-II **14 hrs.**

Network Analysis: Kirchoff's Current Law (KCL), Kirchhoff's Voltage Law (KVL), mesh analysis, node analysis for solving network problems. Superposition theorem, Thevenin's theorem, Norton's theorem, and maximum power transfer 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, Series and parallel magnetically coupled circuits, Dot convention.

Unit-IV **10 hrs.**

Standard Test Signals: Unit step, ramp, impulse, gate and shifted functions and their Laplace transforms, **Filters and Attenuators:** Introduction to low pass, high pass, band pass, and band elimination filters, prototype LC and RC filters, basic concept of the attenuator and its types.

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

PCEC-209 Analog Communication				
	L	**T**	**P**	**Credits**
	2	**1**	**0**	**3**
	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	3	2	1	1	2	2	2	1	0	0	2	2
CO2	3	3	3	3	2	2	2	1	0	0	2	2
CO3	3	3	1	1	2	2	2	1	0	0	0	2
CO4	3	3	3	3	2	2	2	1	0	0	0	2

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.

Unit-II — **14 hrs.**

Amplitude/Linear Modulation: Definition, Expression of AM wave, modulation index, frequency, spectrum, bandwidth, power contents of sidebands and carrier. DSB-SC, DSB-FC, SSB-SC, their comparison and areas of applications, Basic principle of AM generation, Generation of DSB and SSB signals, AM diode detection, envelope detector.

Unit-III — **12 hrs.**

Angle/Exponential Modulation: Modulation index, frequency deviation, frequency spectrum and bandwidth of FM wave, Power contents in FM, Phase modulation. Basic principle of FM generation, Varactor diode modulator, FM detection, basic principle of slope detection, balanced slope detector

Unit-IV — **10 hrs.**

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

Pulse Modulation: Sampling process, Sampling theorem, Basic idea about PAM, PWM and PPM and typical applications, Reconstruction of message.

RECOMMENDED BOOKS		
Title	**Author**	**Publisher**
1. Electronic communication systems	Kennedy	Tata McGraw Hill
2. Electronic Communications System: Fundamentals Through Advanced	Wayne Tomasi	Pearson Education
3. Principles of communication systems	Taub and Schilling	Tata McGraw Hill
4. Communication system (Analog and Digital)	Sanjay Sharma	Katson Books
5. Communication System	Simon Haykin and Michaek Mohar	Wiley Publisher

PCEC-211
Analog Electronics Lab

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

Course Objectives: The objective of this lab is to give students hands-on practice in obtaining parameters of different amplifiers, finding their frequency response; designing & analyzing oscillators, and also study the characteristics of JFET. With this knowledge, students will be able to do mini-projects with the help of amplifiers and Oscillators.

Course Outcomes:

1. Understand the basic characteristics of BJT in different configurations.
2. Design amplifier circuits using BJTs in different configurations and determine frequency response.
3. Analyse and design feedback amplifiers and oscillators.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	3	1	2	3	1	1	1	2	2	2
CO2	1	2	3	3	3	3	1	1	2	2	1	1
CO3	1	3	3	2	3	3	1	2	2	1	2	1

List of Experiments:

1. Working of transistor as a switch,
2. Working of transistor as an amplifier.
3. Determine the input and output characteristics of the CB transistor configuration.
4. Determine the input and output characteristics of CE transistor configuration.
5. Determine drain and transfer characteristics of JFET.
6. Construct different types of biasing circuits and analyze the waveform using fixed bias and voltage divider bias.
7. Study the single-stage CE amplifier & find the gain.
8. Study multistage R-C coupled amplifier & to determine frequency response and gain.
9. To determine the frequency of oscillations of the Hartley and Colpitts oscillator.
10. Frequency response of a BJT amplifier with and without feedback amplifier.

PCEC-213 Digital Electronics Lab				
	L	**T**	**P**	**Credits**
	0	**0**	**2**	**1**
	Sessional Marks			**50**
	End Semester Examination Marks			**50**
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	**2**	**3**	**3**	**3**	**2**	**1**	**0**	**1**	**3**	**2**	**1**	**2**
CO2	**2**	**3**	**3**	**3**	**2**	**1**	**2**	**1**	**3**	**2**	**1**	**2**
CO3	**2**	**3**	**3**	**3**	**2**	**3**	**0**	**1**	**3**	**2**	**1**	**2**

	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

PCEC-215 Analog Communication Lab				
	L	**T**	**P**	**Credits**
	0	**0**	**2**	**1**
	Sessional Marks			**50**
	End Semester Examination Marks			**50**
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	3	3	3	3	3	2	0	1	3	2	1	3
CO2	3	3	3	3	3	2	2	1	3	2	1	3
CO3	3	3	3	3	3	2	0	1	3	2	1	3

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.

PCEC–214
Modern Television Engineering

	L	T	P	Credits
	2	0	0	2
	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:	**After successful completion of the course, the students will able to** 1. Acquire knowledge in Fundamentals of Television, Monochrome TV transmitter and receiver, Camera tubes and colour TV display tubes, 2. Identify the elements of Television, Monochrome TV transmitter and receiver, Camera tubes and color TV display tubes, advanced colour TV systems. 3. Interpret the essentials of colour TV and various colour TV systems. 4. Compare different display tubes and various colour TV systems.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	1	1	2	2	1	0	0	2	2
CO2	3	3	1	3	1	2	2	1	0	0	2	2
CO3	3	1	3	1	1	2	2	1	0	0	0	2
CO4	3	3	1	3	3	2	2	1	0	0	0	2

Unit-I **10 hrs.**

Fundamentals Of Television : TV transmitter and receivers, synchronization, Basic factors of TV system: aspect ratio, image continuity, interlaced scanning, flicker, picture resolution, Composite video signal, Horizontal and vertical sync details, no of scanning lines, scanning sequence details. Monochromatic Picture tube, Electrostatic focusing, Beam deflection, picture tube characteristics and specifications, monochrome TV camera

Unit-II **10 hrs**

Monochrome Tv Transmitter : TV transmitter - picture signal transmission, sound signal transmission, vestigial side band transmission, TV signal propagation - TV transmission Antennas.
Monochrome Tv Receiver : RF tuner, IF subsystem, video amplifier, sound section, sync separation and processing, deflection circuits, scanning circuits.
Camera Tubes : Basic Principles, Types: Image Orthicon, Vidicon, Plumbicon, Block diagram of broad cast TV transmitter, Block diagram of broadcast TV receiver.

Unit-III **10 hrs.**

Essentials of Colour Television : Compatibility & colour perception- Three colour theory-luminance, hue and saturation-colour television cameras- values of luminance and colour difference signals-formation of chrominance signal.

Colour TV display tubes : delta gun, precision in-line and Trinitron colour picture tubes, purity and convergence, purity and static and dynamic convergence adjustments, automatic degaussing circuit, grey scale tracking.

Unit-IV	**10 Hrs.**

Colour television systems : NTSC colour TV system, limitations of NTSC system, PAL colour TV system, merits and demerits of the PAL system - SECAM colour TV system, merits and demerits of SECAM system.

Extended Definition television (EDTV), HDTV, LCD Television : LCD technology, LCD matrix types & operation, **Plasma Television :** conduction of charge, signal processing in plasma TV receivers.

RECOMMENDED BOOKS

1. R.R. Gulati-Modern Television Practice - Principles, Technology and Service - New Age International Publication, 2009.
2. R.R. Gulati-Monochrome and Colour TV - New Age International Publication, 2002.

PCEC–202 Fundamentals of Microprocessor				
	L	**T**	**P**	**Credits**
	2	**1**	**0**	**3**
	Sessional Marks			**50**
	End Semester Examination Marks			**50**
Course Objectives:	The objective of the course is to expose 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 microcomputers. **2.** Understand the architecture of the 8085 microprocessor and its various applications. **3.** Apply 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	3	3	3	1	2	2	1	1	0	0	2	2
CO2	3	3	2	1	1	2	2	1	0	0	3	2
CO3	3	3	3	3	2	2	2	1	0	0	3	2
CO4	3	3	3	2	3	2	2	1	0	0	3	1

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.**
Introduction to 8086 microprocessor: Register organization of 8086,Architecture,signal description of 8086, 8086 microprocessor programming, 8086 Instruction Set, Addressing modes, Assembly Language Programming with Intel 8086 microprocessor		
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.

PCEC-204 Electromagnetic Field and Antenna Systems				
	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 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 and antenna. **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	3	3	2	3	2	2	1	1	0	0	0	2
CO2	3	3	2	1	2	2	2	1	0	2	0	1
CO3	3	1	1	0	2	1	1	1	0	3	2	2
CO4	3	3	2	2	2	2	2	1	1	1	2	2

Unit-I **14 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.

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-II **12hrs.**

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-III	**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.	
Unit-IV	**14 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. **Antenna Arrays:** Introduction, linear uniform array isotropic sources, principles of pattern multiplication, broadside arrays, end fire arrays.	

RECOMMENDED BOOKS

Title	**Author**	**Publisher**
1. Electromagnetic Engineering	Hayt	McGraw Hill
2. Electromagnetic	Karus	McGraw Hill
3. Electromagnetic Fields and Waves	K.D. Prasad	Satya Prakashan
4. Principles of Electromagnetics	Matthew N. O. Sadiku	Oxford Publication

PCEC-206 Industrial Electronics				
	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 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	1	**3**	**3**	2	**3**	1	1	2	2	1	1	1
CO2	2	**3**	**3**	**3**	1	**3**	1	2	2	1	3	2
CO3	**3**	**3**	1	**3**	2	**3**	3	3	1	1	1	1
CO4	1	**3**	2	**3**	1	**3**	2	1	2	2	1	1

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

PCEC-208
Linear Integrated Circuits

	L	T	P	Credits
	2	1	0	3
	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.** Understand various applications using 555 timers.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	2	1	0	1	2	0	2	3
CO2	3	3	3	3	2	1	0	1	1	0	0	3
CO3	2	2	3	3	1	1	0	1	1	1	2	3
CO4	3	3	3	3	3	1	0	1	0	0	0	3

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

PCEC-210
Industrial Electronics Lab

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

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 and 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	1	1	3	3	1	3	1	2	2	1	1	2
CO2	1	1	3	3	3	3	2	2	1	1	1	2

List of Experiments:

1. To test and draw the characteristics of SCR and find it's 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 it's 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.

PEEC–202A Audio Video Systems				
	L	**T**	**P**	**Credits**
	3	**1**	**0**	**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	3	3	3	0	0	0	0	0	0	0	0	0
CO2	0	3	3	0	0	0	0	0	0	0	0	0
CO3	0	3	3	3	0	0	0	0	0	0	0	0
CO4	3	3	3	0	0	0	0	0	0	0	0	0

Unit-I **12 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 **12 hrs**

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 **12 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	**12 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

PEEC–202B Electronic Equipment Maintenance				
	L	**T**	**P**	**Credits**
	3	**1**	**0**	**4**
	Sessional Marks			**50**
	End Semester Examination Marks			**50**
Course Objectives:	This course will enable the students to develop skills to maintain the basic electronic circuitry used in this equipment, which are employed in Industry and in consumer goods segments. This course will also enable them to fulfil the basic prerequisite for the advance maintenance issues which they will face in the industry.			
Course Outcome:	1. To understand the concept of troubleshooting. 2. Identify and test various active and passive components. 3. To understand the troubleshooting procedures 4. Diagnose faults in electronics equipment's.			

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	0	0	0	0	0	0	0	0	0
CO2	0	3	3	0	0	0	0	0	0	0	0	0
CO3	0	3	3	3	0	0	0	0	0	0	0	0
CO4	3	3	3	0	0	0	0	0	0	0	0	0

Unit-I **12 hrs.**

Fundamental Troubleshooting Procedures Inside an Electronic Equipment - Reading Drawings And Diagrams – Block Diagram, Circuit Diagram, Wiring Diagram; Dis-assembly and re-assembly of equipment, Equipment Failures and causes such as poor design, production deficiencies, careless storage and transport, inappropriate operating conditions, Nature of faults, Fault location procedure, Fault finding aids – Service and maintenance manuals and instruction manuals, Test and Measuring instruments, special tools Troubleshooting techniques, approaching components for tests, Ground- ing systems in Electronic Equipment, Temperature sensitive Intermittent problems Corrective actions, Situations where repairs should not be attempted.

Unit-II **12 hrs**

Passive Components and Their Testing Passive Components- Resistors, Capacitors, Inductors Failures in fixed resistors, testing of resistors, variable resistors, variable resistors as potentiometers, failures in potentiometers, testing of potentiometers, servicing potentiometers, LDRs and Thermistor Types of capacitors and their performance, Failures in capacitors, testing of capacitors and precautions therein, variable capacitor types, Testing of inductors and inductance measurement

Unit-III	**12 hrs.**
Testing of Semiconductor Devices - Types of semiconductor devices, Causes of failure in Semiconductor Devices, Types of failure Test procedures for Diodes, special types of Diodes, Bipolar Junction Transistors, Field Effect Transistors, Thyristors Operational Amplifiers, Fault diagnosis in op-amp circuits**.**	
Unit-IV	**12 hrs.**
Logic IC families, Packages in Digital ICs, IC identification, IC pin-outs, Handling ICs, Digital troubleshooting methods – typical faults, testing digital ICs with pulse generators Logic clip, Logic Probe, Logic Pulser, Logic Current Tracer, Logic Comparator Special consideration for fault diagnosis in digital circuits Handling precautions for ICs sensitive to static electricity Testing flip-flops, counters, registers, multiplexers and de-multiplexers, encoders and decoders; Tri-state logic.	

RECOMMENDED BOOKS

Title	**Author**	**Publisher**
1. Modern Electronic Equipment: Troubleshooting, Repair and Maintenance	Khandpur	Tata McGraw Hill Edition 2006
2. Electronic Instruments and Systems: Principles, Maintenance and Troubleshooting	R. G. Gupta	Tata McGraw Hill Edition 2001
3. Student Reference Manual for Electronic Instrumentation Laboratories	David L Terrell	Butterworth-Heinemann
4. Electronic Testing and Fault Diagnosis	G. C. Loveday, A. H	Wheeler Publishing

PEEC-202C
Computer Programming & Application

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

Course Objectives: This course is useful as it develops the ability to write computer programs, compare values, and perform alternative operations based on the comparison results. Students will also learn how to identify the proper structure of loops, the use of arrays, and the use of pointers and functions.

Course Outcome:

1. To understand the basic terminology used in computer programming and be able to write, compile, and debug programs in C language.
2. Describe the concepts of constants, variables, data types, and operators.
3. Understand the structure and usage of different looping and branching statements.
4. To understand array, pointer, and functions.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	**3**	**3**	**3**	1	2	1	1	2	3	1	1
CO2	2	**3**	**3**	1	1	1	3	2	3	3	1	1
CO3	2	**3**	**3**	**3**	**3**	3	3	1	1	1	2	2
CO4	1	**3**	**3**	**3**	**3**	2	3	1	1	2	3	1

Unit-I **12 hrs.**

Program Development: Program development cycle, Programming language levels & features. Properties & Classification of Algorithm, flowchart symbols, importance & advantage of flow chart.

Introduction to C: - History of C, features of C, structure of C program, Program execution process, Compile, link & run a program, Writing simple C programs.

Unit-II **12hrs.**

Variables, Constants & Data types: C character set, Tokens Constants, Keywords, identifiers and Variables, Data types and storage, Data type Qualifiers, Declaration of Variables, assigning values to variables, declaring variables as constants, Declaring variables as volatile - Overflow & underflow of data.

Operators and expressions: Operators in C, Arithmetic, Logical, Assignment, Relational, Increment and Decrement, Conditional, Bitwise, Operator precedence and Associativity. Arithmetic C expressions, Evaluation of expressions.

Unit-III **12hrs.**

Decision Control Structure: Introduction to Branch control statements, Simple if statement, if-else statement, else-if statement, nested if-else, Switch statement – go statement.

Loop Control Structure: Introduction to looping statements, while loop, do-while loop, for loop, break and continue statement.

Unit-IV	**12hrs.**
Array: Introduction to array and its types, declaration, initialization of array, accessing elements of an array, adding, deleting, sorting, and searching of array **Functions and Pointers:** Built-in functions, Math functions, Console I/O functions, Standard I/O functions, Character Oriented functions, Concept of pointer and pointer variable, initialization of pointer, call by reference.	

RECOMMENDED BOOKS

Title	**Author**	**Publisher**
1. Let us C	Y. P. Kanetkar	BPB Publications
2. Programming with C	E. Balagurusamy	Tata McGraw Hill
3. Programming in C	Reema Theraja	Oxford University Press

TPID-202 Four Weeks Summer Internship Training				
	L	**T**	**P**	**Credits**
	0	**0**	**24**	**3**

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	3	2	2	2	2	2	2	3	3	3	1	3
CO2	3	2	3	3	3	3	3	2	2	3	1	3
CO3	3	3	2	3	2	2	2	2	1	3	1	3
CO4	1	1	1	1	1	1	1	1	3	3	1	3
CO5	3	2	3	3	3	3	3	2	2	3	1	3

PCEC-301 Fundamentals of Microcontrollers												
	L			T		P					Credits	
	3			0		0					3	
	Sessional Marks										50	
	End Semester Examination Marks										50	
Course Objectives :	This course provides the knowledge about microcontrollers and embedded systems and emphasizes on the basic working of a microcontroller system and its programming language.											
Course Outcomes:	**1.** Understand Architecture of Microcontroller. **2.** Learn programming instructions and addressing modes. **3.** Acquire programming skills of microcontroller. **4.** Develop application programs using assembly and C Languages.											
Mapping of course outcomes with program outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	3	3	1	2	2	1	1	0	0	2	2
CO 2	3	3	2	1	1	2	2	1	0	0	3	2
CO 3	3	3	3	3	2	2	2	1	0	0	3	2
CO 4	3	3	3	2	3	2	2	1	0	0	3	1
Unit-I												**14 hrs.**
8051 Microcontroller: 8051 Architecture- Registers, Pin diagram, I/O ports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing.												
Unit-II												**8hrs.**
8051 Instruction Set: Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Bit manipulation instructions. Simple Assembly language program examples (without loops) to use these instructions.												
Unit-III												**12hrs.**
8051 Stack, I/O Port Interfacing and Programming: 8051 Stack, Stack and Subroutine instructions. Assembly language program examples on subroutine and involving loops. Interfacing simple switch and LED to I/O ports to switch on/off LED with respect to switch status.												
Unit-IV												**14hrs.**
8051 Timers and Serial Port: 8051 Timers and Counters – Operation and Assembly language programming to generate a pulse using Mode-1 and a square wave using Mode2 on a port pin. 8051 Serial Communication- Basics of Serial Data Communication, RS232 standard, 9 pin RS232 signals, Simple Serial Port programming in Assembly and C to transmit a message and to receive data serially.												

8051 Interrupts and Interfacing Applications: 8051 Interrupts. 8051 Assembly language programming to generate an external interrupt using a switch, 8051 C programming to generate a square waveform on a port pin using a Timer interrupt. Interfacing 8051 to ADC-0804, DAC, LCD and Stepper motor and their 8051 Assembly language interfacing programming.

Recommended Books

Textbook:

1. "The 8051 Microcontroller and Embedded Systems – using assembly and C", Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; PHI, 2006 / Pearson, 2006.
2. "The 8051 Microcontroller", Kenneth J. Ayala, 3rd Edition, Thomson/Cengage Learning.

Reference Books:

1. "The 8051 Microcontroller Based Embedded Systems", Manish K Patel, McGraw Hill, 2014, ISBN: 978-93-329-0125-4.
2. "Microcontrollers: Architecture, Programming, Interfacing and System Design", Raj Kamal, Pearson Education, 2005.

PCEC-303
Modern Communication Systems

	L	T	P	Credits
	2	1	0	3
	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. Acquire knowledge about digital modulations schemes.
4. Able to understand the fundamentals of optical fiber communication system.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	3	2	0	1	0	0	0	2
CO2	3	2	2	3	3	2	1	1	1	0	1	2
CO3	1	2	1	2	1	2	1	1	0	1	1	1
CO4	3	3	2	2	3	2	1	1	1	0	1	2

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
Sampling Theorem: Sampling, Natural sampling, flat top sampling, Sampling Rate, Aliasing

Unit-II — **14 hrs.**

Pulse Modulation Techniques: Block diagram of PCM system, Quantization, Delta Modulation, continuously variable Slope Delta Modulator (CVSDM) or Adaptive Delta Modulation.
Line Coding: Line Coding & its properties. NRZ & RZ types, signaling format for unipolar, Polar, bipolar (AMI) and Manchester coding.
Concept of amount of Information and entropy: Rate of information, Shannon Fano Source Coding, Huffman source coding

Unit-III — **12 hrs.**

Multiplexing Techniques: Fundamentals of time and frequency division multiplexing.
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.

Unit-IV — **10 hrs.**

Optical Fiber Communication: Benefits and disadvantages of fiber optics, transmission windows, point to point communication link, transmission of light through optical fiber, numerical aperture (NA), types of fiber, attenuation in optical fibers, bending loses, absorption, scattering.		
RECOMMENDED BOOKS		
Title	**Title**	**Title**
1. Electronic Communications System: Fundamentals Through Advanced	Wayne Tomasi	Pearson Education
2. Communication System	Simon Haykin and Michaek Mohar	Wiley Publisher
3. Fiber Optic Communication	Vivekanand Mishra and Sunita P. Ugale	Wiley Publisher

PCEC-305 Modern Communication Systems Lab				
	L	**T**	**P**	**Credits**
	0	**0**	**2**	**1**
	Sessional Marks			**50**
	End Semester Examination Marks			**50**

Course Objectives:	This lab aims to understand the building blocks of digital communication system.
Course Outcomes:	**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.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	0	1	3	2	1	3
CO2	3	3	3	3	3	2	2	1	3	2	1	3

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.

PEEC-301A
Wireless Communication

	L	T	P	Credits
	3	1	0	4
	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	2	2	0	0	1	2	0	1	0	0	3	2
CO2	1	2	3	3	1	2	0	1	1	2	2	2
CO3	3	2	1	2	2	2	1	1	1	1	2	3

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

PEEC-301B
Service and Maintenance of Computers

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

Course Objectives:	This course is useful as it equips participants with basic knowledge about personal computers. Participants will also learn about PC hardware and software, maintenance of PC systems and troubleshooting of common problems.
Course Outcomes:	**1.** Gain basic knowledge about personal computers **2.** Learn about PC hardware and software **3.** Understanding the architecture of computer systems **4.** Understanding the functions of peripheral devices in microcomputer systems **5.** Troubleshooting of common problems in personal computers and Simple home-networking

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	0	0	0	0	0	0	0	0	0
CO2	3	3	3	3	0	0	0	0	0	0	0	0
CO3	3	3	0	3	0	0	0	0	0	0	0	0
CO4	3	3	0	3	0	0	0	0	0	0	0	0
CO5	3	3	0	0	3	0	0	0	0	0	0	0

Unit-I **12 hrs.**

Repair, Servicing and Maintenance Concepts: Repair, Servicing and Maintenance Concepts Introduction to servicing and maintenance concepts. Meantime between failure (NTBF) meantime the repair maintenance policy, potential problems preventive maintenance and corrective maintenance. Circuit tracing techniques. Concept of shielding grounding and power supply requirements and considerations of computers and its peripherals.

Fundamental troubleshooting procedure & installation of OS: Fault location, Fault finding aids, Service Manuals - Test and measuring instruments, Special tools for troubleshooting, Installation of operating System

Unit-II **12 Hrs.**

Hardware and Software Faults: Trouble shooting techniques. Different trouble shooting techniques and methods, Functional area approach, Split half method, Divergent, convergent and feedback path circuits, analysis measured techniques.

Troubleshooting of computer components and Peripherals: Mother Board, FDD, HDD, CD ROM/DBD, Printers, Modems, Monitors, SMPs.

Unit-III	**12 Hrs.**
Maintenance and repair of peripherals: Specification, Maintenance and Repair of CVTs and UPS, Sight preparation and design of computer rooms. Testing specifications and installation of computer systems and peripherals. **CD Drive and its troubleshooting:** Working Principle and its types. CD-ROM drive: - CD drives mechanism installation of CD drive. Drive technologies: - CD-ROM: SCSI\CD-R, CD-RW, DVD-ROM. Working Principals, IDE controller card.	
Unit-IV	**12 Hrs.**
Modem: Fault Finding, Repairing, modem Circuit Diagram, Repairing MODEM. **Network Components:** Introduction of Network Cable like UTP, STP, Fiber Optics, Hub, Unmanageable Switch, Manageable Switch, Router, Wi-Fi, Access Point, PCI Wireless Card, USB Wireless Device, Print Server, USB Network Sharer, Backup Device, Server Hardware etc. Installation and troubleshooting of Routers.	

RECOMMENDED BOOKS

Title	**Author**	**Publisher**
1.Electronic test equipment	RS Khandpur	McGraw Hill
2. Maintenance and Troubleshooting Guide	SK Chauhan	SK Kataria and Sons, New Delhi
3. Trouble shooting computer system	Robert C Benner	

PEEC-301C
Signals and Control System

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

Course Objectives: This course aims to provide detailed description of continuous signals and systems, their properties, representations, and methods that are necessary for the analysis of continuous signals and systems. Knowledge of time-domain and frequency-domain representation and analysis using Transforms, Laplace-transform, to understand principles of random signals and random processes.

Course Outcomes:
1. Identify and classify different types of signals and systems that are commonly used in engineering.
2. Apply transform techniques to analyse continuous-time signals and systems.
3. Understand basics of control system theory and its role in engineering design.
4. Analyze time domain behavior of systems.

Mapping of Course Outcomes with Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	1	1	1	1	0	0	2
CO2	3	2	2	2	3	1	1	1	1	0	0	2
CO3	3	2	2	2	3	1	1	1	1	0	0	2
CO4	3	3	2	2	2	1	1	1	1	0	0	2

Unit-I — **12 hrs**

Introduction to signals and systems: Definition of signals and systems, elementary signals, classification of signals and systems, properties of systems.
LTI systems: Continuous-time and Discrete-time LTI systems, their properties.

Unit-II — **12hrs**

Fourier transform: Continuous-time Fourier transform of periodic and aperiodic signals, properties of continuous-time Fourier transform, discrete-time Fourier transform of periodic and aperiodic signals, convolution.

Unit-III — **12 hrs**

Laplace transform (LT): One-sided Laplace transform (LT) of common signals, important theorems, and properties of LT, Inverse LT, region of convergence (ROC).
Introduction to control system: Introduction, open loop control system, closed loop control system with block diagrams and illustrative examples, formulation of equations for linear electrical systems, signal flow graphs, block diagram simplification for linear systems.

Unit-IV — **12 hrs**

System response: Time domain and frequency domain response of the first and second order systems. time domain specifications, steady state error and coefficients, type and order of system with P, PI, PD and PID controller, relation between time and frequency response for second order systems.

RECOMMENDED BOOKS		
Title	**Author**	**Publisher**
1. Signals and Systems	T. Rawat	Oxford University Press, (2010)
2. Modern Control Systems Engineering,	Nagrath I J and Gopal M	New age international, 3rd Edition, 2014.
3. Linear Control System	B S Manke	Khanna Publishers, 12th edition

PREC-301 Minor Project				
	L	**T**	**P**	**Credits**
	0	**0**	**4**	**2**
Course Objectives	To guide the students in such a way so that they carry out a work on a topic as a forerunner to the full-fledged project work to be taken subsequently in IV semester.			
Course Outcomes	Upon completion of the course, the students will be able to 1. Select a suitable project making use of the technical and engineering knowledge gained from previous courses with the awareness of impact of technology on the society and their ethical responsibilities. 2. Collect and disseminate information related to selected project. 3. Form a team and distribute the work among themselves. 4. Communicate technical and general information by means of oral as well as written presentation skills with professionalism.			

Mapping of Course Outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**3**	**3**	**3**	**3**	**1**	**2**	**2**	**2**	**3**	**2**
CO2	**1**	**3**	**2**	**2**	**3**	**0**	**0**	**3**	**3**	**2**	**2**	**0**
CO3	**2**	**1**	**0**	**2**	**3**	**3**	**0**	**1**	**3**	**3**	**2**	**3**
CO4	**1**	**1**	**2**	**3**	**2**	**0**	**0**	**3**	**3**	**3**	**2**	**0**

PEEC-302A
Electronic Measurements and Instrumentations

	L	T	P	Credits
	3	1	0	4
	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	1	2	0	1	2	2	0	1	0	0	0	2
CO2	0	3	2	1	2	2	2	1	0	0	0	2
CO3	0	3	2	1	2	2	0	1	0	0	1	2

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 multi-meter, 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

PEEC-302B
Computer Networks

	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 computer networks, transmission media and network topologies. Emphasis will be laid on covering the basic layers used in TCP/IP model.
Course Outcomes	1. Understand the basics of TCP/IP models and different types of network. 2. Identify the issues and challenges in the architecture of a computer network. 3. Realize protocols at different layers of a network hierarchy. 4. Gain expertise in some specific areas of networking.

Mapping of Course Outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	0	3	3	2	1	1	0	1	2	0	1	2	2	2
CO2	3	2	3	3	2	2	2	1	0	0	2	2	1	2
CO3	1	3	3	2	0	1	1	1	1	0	2	2	1	2
CO4	3	3	3	3	0	1	1	1	2	0	2	3	2	2

Unit-I **12hrs**

Introduction to computer networks: Basics of computer networks, need and evolution of computer networks, introduction to network topology, difference between wired networks and wireless networks, classification of computer networks- LAN, MAN, PAN, WAN. internet, intranet and extranet, OSI and TCP/IP models, comparison of OSI and TCP/IP.

Unit-II **12 hrs**

Physical layer: Data and signals, digital and analog transmission, bandwidth utilization, transmission media and switching.

Unit-III **14 hrs**

Data link layer and network layer: Introduction to data link layer, error detection and correction, data link control, medium access control, ethernet, and other networks, network layer protocols, unicast and multicast routing.

Unit-IV **10 hrs**

Transport layer and application layer: Process to process delivery: TCP and UDP, application layer protocols, FTP, HTTP.

RECOMMENDED BOOKS

Title	Author	Publisher
1. Data Communication and Networking	B.A. Forouzan	4th Ed., Tata McGraw-Hill.
2. Computer Networks	A.S Tanenbaum	4th Ed., Pearson Education.
3. Data and Computer Communication	W. Stallings	8th Ed., Prentice-Hall

PEEC-302C Fundamental of Internet of Things				
	L	**T**	**P**	**Credits**
	3	**1**	**0**	**4**
	Sessional Marks			**50**
	End Semester Examination Marks			**50**
Course Objectives:	Aim of the course is to understand the basic concepts of Internet of Things and able to build IoT applications, Learn programming and use of Arduino and Raspberry Pi boards.			
Course Outcomes:	CO1. Known basic protocols in sensor networks. CO2. Program and configure Arduino boards for various designs. CO3. Python programming and interfacing for Raspberry Pi. CO4. Design IoT applications in different domains			

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	3	3	2	1	1	1	1	1
CO2	3	3	3	2	3	2	2	2	1	1	1	1
CO3	3	3	3	3	2	1	1	2	1	1	1	2
CO4	3	3	3	2	3	1	2	3	1	1	1	2

Unit-I — **12 hrs**

Introduction of IoT: Definition and characteristics of IoT, Physical design of IoT, Things in IoT, IoT Protocols, Logical Design of IoT, IoT functional blocks, IoT communication Models, IoT communication API's, IoT enabling Technologies Wireless sensor networks, Cloud Computing, Big Data Analytics, Communication protocols, embedded systems. IoT Levels and Deployment templates – IoT Level-1, IoT Level-2, IoT Level-3, IoT Level-4, IoT Level-5, IoT Level-6

Unit-II — **12 hrs**

Domain specific IoT: Introduction, Home automation- Smart lighting, smart appliances, intrusion detection, smoke for gas detectors; Cities- Smart Parking, Smart lighting, Smart Roads, Structural Health Monitoring, surveillance, Emergency Response; Environment- Weather monitoring, air pollution monitoring, noise pollution monitoring, forest fire detection, river flood's detection Energy- Smart grids, renewable energy systems, prognostics; Retail- Inventory management, smart payments, smart vending machines; Logistics- Route generation and scheduling, Fleet tracking, Shipment monitoring, Remote vehicle diagnostics; Agriculture- Smart Irrigation, Green house control; Industry- Machine diagnosis and prognosis, indoor air Quality monitoring; Health and Life Style- Health and fitness monitoring, Wearable electronics.

Unit-III — **12 hrs**

Introduction of Arduino Programming language: Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino.

Unit-IV	**12 hrs**
Introduction to Python Prog language: Introduction to Python programming, Introduction to Raspberry Pi, Interfacing Raspberry Pi with basic peripherals, Implementation of IoT with Raspberry Pi.	

RECOMMENDED BOOKS

Title	**Author**	**Publisher**
1. "Internet of Things: A Hands-on Approach"	Arshdeep Bahga and Vijay Madisetti	Universities Press
2. "Programming Arduino" Getting started with sketches	Simon Monk	McGraw-Hill

PEEC-304A Microwave and Radar Engineering				
	L	**T**	**P**	**Credits**
	3	**1**	**0**	**3**
	Sessional Marks			**50**
	End Semester Examination Marks			**50**
Course Objectives	The aim of this course is to understand the basic concepts and application areas of microwave and radar.			
Course Outcome:	1. Understand fundamentals of microwave and radar systems. 2. Acquire knowledge of microwave and radar devices and their characteristics. 3. Analyze the performance characteristics of microwave and radar systems. 4. Describe various detecting techniques used in radar.			

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	1	3	2	1	2	0	1	3
CO2	3	3	3	3	2	3	2	1	1	0	1	3
CO3	3	3	2	3	3	3	2	1	2	0	2	3
CO4	3	3	3	3	3	3	2	1	2	2	1	3

Unit-I — **12 hrs.**

Microwave Components: Microwave frequency spectrum, familiarization with bands and wavelength, Wave guides and its parameters, introduction to S parameters, isolators, and circulators, Directional couplers,

Unit-II — **12hrs.**

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

Unit-III — **12 hrs.**

Introduction to radar systems: Basic principle, block diagram, operation and applications of radar, radar range equation, CFARs pulse repetition frequency and range ambiguities.

Unit-IV — **12 hrs.**

Doppler radar: Doppler effect, moving target indicator (MTI) radar, delay line cancellers, blind speeds, pulse doppler radar, basic CW radar, FMCW radar

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

Kuldip Singh P. K. Das Dilip Kumar J. S. Ubhi Ajay Pal Singh

OEEC-302B Optical Electronics				
	L	**T**	**P**	**Credits**
	3	**1**	**0**	**4**
	Sessional Marks			**50**
	End Semester Examination Marks			**50**
Course Objectives	To familiarize the design concept of optoelectronics devices and circuits by using different design technologies used for design of optoelectronics devices. Implementation approach of optoelectronics devices in modern communication system. To study the design and evaluation of modern optoelectronics integrated systems.			
Course Outcomes	1. To gain knowledge about the fundamental concepts of various optoelectronics devices. 2. Ability to utilized optoelectronics devices in high speed optic communication systems. 3. Ability to analyze, model and implement advanced techniques in optoelectronics fabrication.			

Mapping of Course Outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	M	M	S	S	S	N	M	M	N	M	S	N	M
CO2	S	S	S	S	S	M	N	S	M	M	S	N	M
CO3	S	S	M	M	S	N	W	S	M	M	S	N	M

Unit-I — **8 hrs**

Elements of light and solid-state physics: Wave nature of light, polarization, interference, diffraction, light source, review of quantum mechanical concept, review of solid state physics, generic optical systems and fundamental building blocks, basics of semiconductor optoelectronics, elemental and compound semiconductor, electronic properties and optical processes in semiconductors.

Unit-II — **14 hrs**

Optical sources Emission and absorption of radiation, absorption of radiation, population inversion, optical feedback, threshold conditions-laser losses, line shape function, population inversion and pumping threshold conditions, laser modes, classes of laser, single mode operation, frequency stabilization.

Unit-III — **14 hrs**

Photo detectors: Principle of optical detection, detector performance parameters, thermal detectors, photon devices, solar cell.

Display devices: Luminescence, photoluminescence, cathode luminescence, cathode ray tube, electro luminescence, injection luminescence and light emitting diodes, plasma displays, display brightness, LCD, numeric displays.

Unit-IV — **12 hrs**

Optoelectronic integrated circuits: Introduction, hybrid and monolithic integration, application of optoelectronic integrated circuits, integrated transmitters and receivers.		
RECOMMENDED BOOKs		
Title	**Author**	**Publisher**
1. Semiconductor Optoelectronic Devices	Pallab Bhattacharya	Pearson Education Inc
2. Photonics - Optical Electronics in Modern Communications	A. Yariv and P. Yeh,	Oxford University Press
3. Opto Electronics – As Introduction to materials and devices	Jasprit Singh	McGraw-Hill International
4. Opto Electronics – An Introduction	J. Wilson and J. Haukes	Prentice Hall, 1995

PEEC-302C
Programming of Arduino and Interfacing

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

Course Objectives: Aim of the course is to understand the components of an Arduino i.e. hardware and software components and understand the basic concepts of programming Arduino IDE

Course Outcomes:
CO1: Understand the basic concepts of programming.
CO2: Learn how to prototype circuits with a breadboard .
CO3: Program basic Arduino examples.
CO4: Prototype circuits and connect them to the Arduino.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	3	3	2	1	1	1	1	1
CO2	3	3	3	2	3	2	2	2	1	1	1	1
CO3	3	3	3	3	2	1	1	2	1	1	1	2
CO4	3	3	3	2	3	1	2	3	1	1	1	2

Unit-I — **12 hrs**

Introduction of Arduino: Overview, Board description, Installation, Pin configuration and architecture, Device and platform features., Concept of digital and analog ports, Familiarizing with Arduino Interfacing Board, Introduction to Arduino platform.

Unit-II — **12 hrs**

Programming Basics: Arduino data types, Variables and constants, Operators, Control Statements, Loops, Arrays, Pointer, String, functions.
Arduino Functions: Pins Configured as INPUT, Pull-up Resistors, Pins Configured as OUTPUT, pinMode() Function, digitalWrite() Function, analogRead() function, Arduino Interrupts
Arduino Time: Incorporating Arduino time, delay () function, delayMicroseconds () function, millis () function, micros() function.

Unit-III — **12 hrs**

Arduino Displays: Working with Serial Monitor, Line graph via serial monitor, Interfacing a 8 bit LCD to Arduino, Fixed one line static message display, Running message display, Using the LCD Library of Arduino.
Arduino Sensors: Arduino – Humidity Sensor, Arduino – Temperature Sensor, Arduino – Water Detector / Sensor, Arduino – PIR Sensor, Arduino – Ultrasonic Sensor, Arduino – Connecting Switch (Magnetic relay switches)

Unit-IV — **12 hrs**

Giving Input to the Controller: Using serial input, Controlling LEDs with keys, Keys as toggle switch, interfacing a piezo Buzzer, Using a buzzer as an alarm unit.

Arduino Communications: Parallel Communication, Serial Communication Modules, Types of Serial Communications, Arduino UART, GSM/GPRS Arduino Interfacing.
RECOMMENDED BOOKS 1. Arduino Projects For Engineers ,BPB Publications ,Neerparaj Rai 2. Beginning C for Arduino, Apress,Jack purdum

PREC-302 Major Project				
	L	**T**	**P**	**Credits**
	0	**0**	**8**	**4**
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	**3**	**3**	**3**	**3**	**3**	**3**	**1**	**2**	**2**	**2**	**3**	**2**
CO2	**1**	**3**	**2**	**2**	**3**	**0**	**0**	**3**	**3**	**2**	**2**	**0**
CO3	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**0**
CO4	**2**	**1**	**0**	**2**	**3**	**3**	**0**	**1**	**3**	**3**	**2**	**3**

SEEC-302 Seminar				
	L	**T**	**P**	**Credits**
	0	**0**	**2**	**1**
Course Objectives	To carry out a presentation in one of the specializations of the program with substantial multidisciplinary component			
Course Outcomes	1. An ability to write technical documents and give oral presentations related to the work completed and improve personality development and communication skills. 2. Identify and apply appropriate well-rehearsed note-taking interactive and time management strategies to their academic studies. 3. Develop audience-cantered presentations meeting concrete professional objectives and integrating ethical and legal visual aids. 4. Identify and critically evaluate the quality of claims, explanation, support, and delivery in public and professional discourse, and understand the factors influencing a speaker's credibility.			

Mapping of Course Outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**2**	**3**	**3**	**3**	**0**	**0**	**2**	**2**	**3**	**2**	**2**
CO2	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**2**	**1**	**3**	**3**	**0**
CO3	**2**	**1**	**0**	**1**	**1**	**0**	**0**	**2**	**3**	**3**	**1**	**3**
CO4	**0**	**0**	**0**	**0**	**3**	**3**	**0**	**2**	**3**	**3**	**2**	**2**

OEEC–202A Microprocessor and Applications				
	L	**T**	**P**	**Credits**
	3	**0**	**0**	**3**
	Sessional Marks			**50**
	End Semester Examination Marks			**50**
Course Objectives :	The objective of the course is to expose 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 microcomputers. **2.** Understand the architecture of the 8085 microprocessor and its various applications. **3.** Apply 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
CO 1	3	3	3	1	2	2	1	1	0	0	2	2
CO 2	3	3	2	1	1	2	2	1	0	0	3	2
CO 3	3	3	3	3	2	2	2	1	0	0	3	2
CO 4	3	3	3	2	3	2	2	1	0	0	3	1

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.**
Introduction to 8086 microprocessor: Register organization of 8086,Architecture,signal description of 8086, 8086 microprocessor programming, 8086 Instruction Set, Addressing modes, Assembly Language Programming with Intel 8086 microprocessor	

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.

OEEC-202B Digital Logic Design				
	L	**T**	**P**	**Credits**
	3	**0**	**0**	**3**
	Sessional Marks			**50**
	End Semester Examination Marks			**50**
Course Objectives	This course provides a modern introduction to logic design and the basic building blocks used in digital system. The course deals with sequential circuits, random access memories, and modern logic devices such as field programmable logic gates.			
Course Outcomes	1. An ability to analyze and design combinational systems composed of standard combinational modules, such as multiplexers and decoders. 2. An ability to demonstrate knowledge of simple synchronous and asynchronous sequential systems. 3. An ability to analyze and design simple systems composed of programmable logic, such as ROMs PLDs, FPGAs and CPLDs.			

Mapping of Course Outcomes with Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	S	S	S	W	M	N	N	N	N	N	M	N	S
CO2	S	S	M	W	W	N	M	N	N	N	S	N	N
CO3	S	S	S	S	M	N	M	N	N	N	S	N	S

Unit-I	**12 hrs**
Design of combinational circuits and implementation using multiplexers, decoders, ROM, PLA and PAL.	

Unit-II	**12 hrs**
Synchronous sequential circuits: The finite state machine, design of single multimode and ring counters, Mealy state diagram, Moore state diagram, state transition tables, state reduction techniques, state assignments, synthesis of sequential circuits.	

Unit-III	**12 hrs**
ASM modules: The algorithm state m/c, ASM charts, ASM tables, linking of ASM modules. **Programmable logic devices**: Introduction to CPLDs and FPGAs	

Unit-IV	**12 hrs**
Asynchronous sequential circuits: Races, hazards, asynchronous, state diagrams, primitive flow tables, state reductions and row merging, design of asynchronous state.	

RECOMMENDED BOOKS

Title	Author	Publisher
1. An Engineering Approach to Digital Design	Fletcher William, I	3rd Indian reprint, PHI, (1994).
2. Digital Design	Morris Mano M	3rd Edition, Pearson Education (2002).

OEEC-202C
Electronic Measurements and Instrumentations

	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 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	1	2	0	1	2	2	0	1	0	0	0	2
CO2	0	3	2	1	2	2	2	1	0	0	0	2
CO3	0	3	2	1	2	2	0	1	0	0	1	2

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 multi-meter, 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

OEEC-301A
Principle of Communication Engineering

	L	T	P	Credits
	3	0	0	3
	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 and digital communication system. The students will understand the various analog communication techniques and 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. Gain knowledge about the fundamental concepts of digital communication systems.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	2	2	2	1	0	0	2	2
CO2	3	3	3	3	2	2	2	1	0	0	2	2
CO3	3	3	1	1	2	2	2	1	0	0	0	2
CO4	3	3	3	3	2	2	2	1	0	0	0	2

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.

Unit-II — **14 hrs.**

Amplitude/Linear Modulation: Definition, Expression of AM wave, modulation index, frequency, spectrum, bandwidth, power contents of sidebands and carrier. DSB-SC, DSB-FC, SSB-SC, their comparison and areas of applications, Basic principle of AM generation, Generation of DSB and SSB signals, AM diode detection, envelope detector.

Unit-III — **12 hrs.**

Angle/Exponential Modulation: Modulation index, frequency deviation, frequency spectrum and bandwidth of FM wave, Power contents in FM, Phase modulation. Basic principle of FM generation, Varactor diode modulator, FM detection, basic principle of slope detection, balanced slope detector

Unit-IV — **10 hrs.**

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

Sampling Theorem and Pulse code modulation: Sampling, Natural sampling, flat top sampling, Sampling Rate, Aliasing, Pulse code modulation.		
RECOMMENDED BOOKS		
Title	**Author**	**Publisher**
1. Electronic communication systems	Kennedy	Tata McGraw Hill
2. Electronic Communications System: Fundamentals Through Advanced	Wayne Tomasi	Pearson Education
3. Principles of communication systems	Taub and Schilling	Tata McGraw Hill
4. Communication system (Analog and Digital)	Sanjay Sharma	Katson Books
5. Communication System	Simon Haykin and Michaek Mohar	Wiley Publisher

OCEC–301B Introduction to Python Programming				
	L	**T**	**P**	**Credits**
	3	**0**	**0**	**3**
	Sessional Marks			**50**
	End Semester Examination Marks			**50**
Course Objectives :	The objective of the course is to expose the students to basics of Python Programming, and algorithmic problem solving. The students will gain hands-on experience to solve problems using Python conditionals and loops. Python functions and use function calls to solve problems. To use Python data structures - lists, tuples, dictionaries to represent complex data.			
Course Outcomes:	**1.** Develop algorithmic solutions to simple computational problems. **2.** Develop and execute simple Python programs. **3.** Write simple Python programs using conditionals and looping for solving problems. **4.** Represent compound data using Python lists, tuples, dictionaries etc.			

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	3	3	1	2	2	1	1	0	0	2	2
CO 2	3	3	2	1	1	2	2	1	0	0	3	2
CO 3	3	3	3	3	2	2	2	1	0	0	3	2
CO 4	3	3	3	2	3	2	2	1	0	0	3	1

Unit-I **14 hrs.**

Data Types, Expressions, Statements: Python interpreter and interactive mode, debugging; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

Unit-II **8hrs.**

Control Flow, Functions, Strings: Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays.

Unit-III **12hrs.**

Lists, Tuples, Dictionaries: Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries:

operations and methods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.

Unit-IV	**14hrs.**

Files and Miscellaneous: Files: File Objects, File Built-in Function [open()], File Built-in Methods, File Built-in Attributes, Standard Files, Regular Expressions.

RECOMMENDED BOOKS

Text book:

1. Core Python Programming, Wesley J. Chun, Second Edition, Pearson.

Reference Books:

1. Think Python, Allen Downey, Green Tea Press.
2. Introduction to Python, Kenneth A. Lambert, Cengage.
3. Python Programming: A Modern Approach, Vamsi Kurama, Pearson. 4. Learning Python, Mark Lutz, O'Reilly.

OEEC-301C
Wireless 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	2	2	0	0	1	2	0	1	0	0	3	2
CO2	1	2	3	3	1	2	0	1	1	2	2	2
CO3	3	2	1	2	2	2	1	1	1	1	2	3

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

OEEC-302A Optical Electronics				
	L	**T**	**P**	**Credits**
	3	**0**	**0**	**3**
	Sessional Marks			**50**
	End Semester Examination Marks			**50**
Course Objectives	To familiarize the design concept of optoelectronics devices and circuits by using different design technologies used for design of optoelectronics devices. Implementation approach of optoelectronics devices in modern communication system. To study the design and evaluation of modern optoelectronics integrated systems.			
Course Outcomes	4. To gain knowledge about the fundamental concepts of various optoelectronics devices. 5. Ability to utilized optoelectronics devices in high speed optic communication systems. 6. Ability to analyze, model and implement advanced techniques in optoelectronics fabrication.			

Mapping of Course Outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	M	M	S	S	S	N	M	M	N	M	S	N	M
CO2	S	S	S	S	S	M	N	S	M	M	S	N	M
CO3	S	S	M	M	S	N	W	S	M	M	S	N	M

Unit-I — **8 hrs**

Elements of light and solid-state physics: Wave nature of light, polarization, interference, diffraction, light source, review of quantum mechanical concept, review of solid state physics, generic optical systems and fundamental building blocks, basics of semiconductor optoelectronics, elemental and compound semiconductor, electronic properties and optical processes in semiconductors.

Unit-II — **14 hrs**

Optical sources Emission and absorption of radiation, absorption of radiation, population inversion, optical feedback, threshold conditions-laser losses, line shape function, population inversion and pumping threshold conditions, laser modes, classes of laser, single mode operation, frequency stabilization.

Unit-III — **14 hrs**

Photo detectors: Principle of optical detection, detector performance parameters, thermal detectors, photon devices, solar cell.

Display devices: Luminescence, photoluminescence, cathode luminescence, cathode ray tube, electro luminescence, injection luminescence and light emitting diodes, plasma displays, display brightness, LCD, numeric displays.

Unit-IV — **12 hrs**

Optoelectronic integrated circuits: Introduction, hybrid and monolithic integration, application of optoelectronic integrated circuits, integrated transmitters and receivers.		
RECOMMENDED BOOKs		
Title	**Author**	**Publisher**
1. Semiconductor Optoelectronic Devices	Pallab Bhattacharya	Pearson Education Inc
2. Photonics - Optical Electronics in Modern Communications	A. Yariv and P. Yeh,	Oxford University Press
3. Opto Electronics – As Introduction to materials and devices	Jasprit Singh	McGraw-Hill International
4. Opto Electronics – An Introduction	J. Wilson and J. Haukes	Prentice Hall, 1995

OEEC-302B
Programming of Arduino and Interfacing

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

Course Objectives: Aim of the course is to understand the components of an Arduino i.e. hardware and software components and understand the basic concepts of programming Arduino IDE

Course Outcomes:
CO1: Understand the basic concepts of programming.
CO2: Learn how to prototype circuits with a breadboard .
CO3: Program basic Arduino examples.
CO4: Prototype circuits and connect them to the Arduino.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	3	3	2	1	1	1	1	1
CO2	3	3	3	2	3	2	2	2	1	1	1	1
CO3	3	3	3	3	2	1	1	2	1	1	1	2
CO4	3	3	3	2	3	1	2	3	1	1	1	2

Unit-I — **12 hrs**

Introduction of Arduino: Overview, Board description, Installation, Pin configuration and architecture, Device and platform features., Concept of digital and analog ports, Familiarizing with Arduino Interfacing Board, Introduction to Arduino platform.

Unit-II — **12 hrs**

Programming Basics: Arduino data types, Variables and constants, Operators, Control Statements, Loops, Arrays, Pointer, String, functions.
Arduino Functions: Pins Configured as INPUT, Pull-up Resistors, Pins Configured as OUTPUT, pinMode() Function, digitalWrite() Function, analogRead() function, Arduino Interrupts
Arduino Time: Incorporating Arduino time, delay () function, delayMicroseconds () function, millis () function, micros() function.

Unit-III — **12 hrs**

Arduino Displays: Working with Serial Monitor, Line graph via serial monitor, Interfacing a 8 bit LCD to Arduino, Fixed one line static message display, Running message display, Using the LCD Library of Arduino.
Arduino Sensors: Arduino – Humidity Sensor, Arduino – Temperature Sensor, Arduino – Water Detector / Sensor, Arduino – PIR Sensor, Arduino – Ultrasonic Sensor, Arduino – Connecting Switch (Magnetic relay switches)

Unit-IV — **12 hrs**

Giving Input to the Controller: Using serial input, Controlling LEDs with keys, Keys as toggle switch, interfacing a piezo Buzzer, Using a buzzer as an alarm unit.

Arduino Communications: Parallel Communication, Serial Communication Modules, Types of Serial Communications, Arduino UART, GSM/GPRS Arduino Interfacing.
RECOMMENDED BOOKS 1. Arduino Projects For Engineers ,BPB Publications ,Neerparaj Rai 2. Beginning C for Arduino, Apress,Jack purdum

OEEC-302C Internet of Things and Applications				
	L	**T**	**P**	**Credits**
	3	**0**	**0**	**3**
	Sessional Marks			**50**
	End Semester Examination Marks			**50**
Course Objectives:	Aim of the course is to understand the basic concepts of Internet of Things and able to build IoT applications, Learn programming and use of Arduino and Raspberry Pi boards.			
Course Outcomes:	CO1. Known basic protocols in sensor networks. CO2. Program and configure Arduino boards for various designs. CO3. Python programming and interfacing for Raspberry Pi. CO4. Design IoT applications in different domains			

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	3	3	2	1	1	1	1	1
CO2	3	3	3	2	3	2	2	2	1	1	1	1
CO3	3	3	3	3	2	1	1	2	1	1	1	2
CO4	3	3	3	2	3	1	2	3	1	1	1	2

Unit-I	**12 hrs**
Introduction of IoT: Definition and characteristics of IoT, Physical design of IoT, Things in IoT, IoT Protocols, Logical Design of IoT, IoT functional blocks, IoT communication Models, IoT communication API's, IoT enabling Technologies Wireless sensor networks, Cloud Computing, Big Data Analytics, Communication protocols, embedded systems. IoT Levels and Deployment templates – IoT Level-1, IoT Level-2, IoT Level-3, IoT Level-4, IoT Level-5, IoT Level-6	
Unit-II	**12 hrs**
Domain specific IoT: Introduction, Home automation- Smart lighting, smart appliances, intrusion detection, smoke for gas detectors; Cities- Smart Parking, Smart lighting, Smart Roads, Structural Health Monitoring, surveillance, Emergency Response; Environment- Weather monitoring, air pollution monitoring, noise pollution monitoring, forest fire detection, river flood's detection Energy- Smart grids, renewable energy systems, prognostics; Retail- Inventory management, smart payments, smart vending machines; Logistics- Route generation and scheduling, Fleet tracking, Shipment monitoring, Remote vehicle diagnostics; Agriculture- Smart Irrigation, Green house control; Industry- Machine diagnosis and prognosis, indoor air Quality monitoring; Health and Life Style- Health and fitness monitoring, Wearable electronics.	
Unit-III	**12 hrs**
Introduction of Arduino Programming language: Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino.	
Unit-IV	**12 hrs**

Introduction to Python Prog language: Introduction to Python programming, Introduction to Raspberry Pi, Interfacing Raspberry Pi with basic peripherals, Implementation of IoT with Raspberry Pi.		
RECOMMENDED BOOKS		
Title	**Author**	**Publisher**
1. "Internet of Things: A Hands-on Approach"	Arshdeep Bahga and Vijay Madisetti	Universities Press
2. "Programming Arduino" Getting started with sketches	Simon Monk	McGraw-Hill

QPEC-102
Computing and Peripherals Technician

	L	T	P	Credits
	0	0	8	1

Course Objectives:

The course aims to equip students with the knowledge and practical skills required to effectively assemble, configure, maintain, and troubleshoot computer hardware and peripheral devices. Students will learn to install and manage operating systems, set up and secure networks, and utilize diagnostic tools to resolve hardware and software issues, ensuring optimal system performance and customer satisfaction. The course will also emphasize the importance of preventive maintenance, data security, and professional communication in technical support scenarios.

Course Outcomes:

1. Demonstrate proficiency in assembling, configuring, and maintaining computer hardware and peripherals.
2. Install, configure, and troubleshoot operating systems, networks, and storage solutions to ensure optimal system performance and reliability.
3. Utilize diagnostic tools and software to identify and resolve hardware and software issues, ensuring system security and customer satisfaction.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	0	1	3	2	1	3
CO2	3	3	3	3	3	2	2	1	3	2	1	3
CO3	3	3	3	3	3	2	0	1	3	2	1	3

List of Experiments:

1. Assemble a computer from individual components and verify its functionality.
2. Install Windows and Linux operating systems on a PC and configure dual boot.
3. Access and configure BIOS/UEFI settings for optimal performance.
4. Install different types of RAM and configure them in the BIOS.
5. Install and configure HDD and SSD storage devices in a desktop PC.
6. Install and test a power supply unit in a desktop case.
7. Install and configure a printer and scanner.
8. Connect and calibrate a monitor for optimal display performance.
9. Install and configure external USB and network-attached storage devices.
10. Set up a basic wired and wireless network and configure network settings.
11. Diagnose and fix common network issues using diagnostic tools.
12. Identify and resolve common printer issues, including connectivity and print quality problems.
13. Demonstrate proper handling and installation techniques to prevent ESD damage.
14. Use software tools to diagnose and fix hardware and software issues.
15. Perform preventive maintenance tasks on a desktop computer, including cleaning and software updates.
16. Install and configure a Network Interface Card and verify network connectivity.

	17. Set up a computer with dual-boot configuration for Windows and Linux operating systems. 18. Perform data recovery on a failed storage device using recovery software. 19. Set up and configure a router and switch for a small network. 20. Use antivirus and anti-malware tools to detect and remove malicious software. 21. Configure and use cloud storage services for data backup and synchronization. 22. Install and configure virtual machines using virtualization software like VirtualBox or VMware. 23. Set up and configure a RAID array for improved performance and redundancy. 24. Perform system backup and restore operations using different methods and tools. 25. Simulate a customer support scenario, including problem diagnosis, resolution, and customer communication.

QPEC-102 Electronics workshop Practices				
	L	**T**	**P**	**Credits**
	0	**0**	**8**	**1**
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	3	2	2	2	2	2	2	3	3	3	1	3
CO2	3	2	3	3	3	3	3	2	2	3	1	3
CO3	3	3	2	3	2	2	2	2	1	3	1	3

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 find the Q point for common emitter configuration.
8. To study the input and output V-I characteristics of common emitter configuration.
9. To study the input and output V-I characteristics of common collector configuration.
10. To study the amplifying characteristics of NPN and PNP transistor.

	11. **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.

QPEC-103 PCB Design Technician				
	L	**T**	**P**	**Credits**
	0	**0**	**24**	**3**
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. Understanding of type of PCB like single layer, double layer and multi-layer 2. Familiarization with the PCB Assembly procedures 3. Knowledge of SMT Machines			

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	2	2	3	3	3	1	3
CO2	3	2	3	3	3	3	3	2	2	3	1	3
CO3	3	3	2	3	2	2	2	2	1	3	1	3

List of Experiments:

1. To study the basics of Printed Circuit Board and its fabrication methods.
2. Learn the assembly processes such as thru-hole technology (THT), surface mount technology (SMT), and mixed technology.
3. Study of various types of active and passive components based on their ratings.
4. Identification of various types of Printed Circuit Boards (PCB) and soldering techniques.
5. Learn the use hand tools such as lead forming tools, cutter, cutting machine, soldering station, etc.
6. Learn the basics of soldering such as handling the soldering iron, iron temperature, etc. and types of soldering such as dry and cold solder.
7. Learn the tools/software and process of PCB layout design.
8. Select the appropriate process to assemble the PCB.
9. Insert components into designated plated through-holes (PTH) as per the design.
10. Solder the components onto circuit board using the soldering station as per standard operating procedures (SOP).
11. Conduct functional test of PCB assembly to identify soldering related errors.
12. Learn the different types of errors that occur during functional test and methods to rectify the same.

	13. Create PCB layout for 5V regulated power supply. 14. Schematic and PCB Layout Design of Half wave rectifier 15. Schematic and PCB Layout Design of Full wave rectifier 16. Schematic and PCB Layout Design of Half & Full wave rectifier with fixed voltage regulator circuit design.

QPEC-203 TV Repair Technician				
	L	**T**	**P**	**Credits**
	0	**0**	**8**	**1**
Course Objectives:	This QP aims to explore practically about components used in Televisions (BW and Color) and audio -video system 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 and troubleshoot faults in audio-video system.			

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	3	3	2	2	1	0	0	0	2
CO2	3	3	1	3	1	2	2	1	0	0	2	2
CO3	3	3	1	3	3	2	2	1	0	0	0	2

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.
11. To measure the AC/DC voltage at different points in Different sections of LED TV Trainer.
12. To study the block diagram and working of Public address system.
13. To measure the AC/DC voltage and waveform at different points in different sections of PA system.
14. Fault Finding in Public address system.
15. To understand the recording and playback process of an audio tape recorder.
16. To study the block diagram and working of a CD/DVD player trainer.

17. To measure the AC/DC voltage and waveform at different points in different sections CD/DVD player trainer
18. To find out fault in different sections of CD/DVD player trainer.
19. To study the block diagram and working of a VCD player trainer.
20. To measure the AC/DC voltage and waveform at different points in different sections of VCD player trainer.
21. To find out fault in different sections of VCD player trainer

QPEC-202
Troubleshooting & Maintenance of Electronic Equipment's

	L	T	P	Credits
	0	0	8	1

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's and testing of components.

Course Outcomes:

1. Find faults as well as repair various electronic instruments like C.R.O, function generator, power supplies, digital multi-meter.
2. Analyse the detailed functioning, fault finding and repair of UPS and home inverter system.
3. Understand the frequency response of loudspeaker, microphone, and audio-amplifiers.
4. Understand the working principle and fault diagnosis of various consumer equipment/gadgets.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	3	3	2	2	1	2	1	1	2
CO2	3	3	2	3	3	1	2	2	2	1	1	2
CO3	3	3	3	3	3	3	1	0	2	1	1	3
CO4	3	3	3	3	3	2	2	3	1	1	2	3

List of Experiments:

1. To study the block diagram and working of a VCR trainer.
2. To measure the AC/DC voltage at different point in Different section of VCR trainer.
3. To measure the waveform at different point in Different section of VCR trainer.
4. To find out fault in different sections of VCR trainer.
5. To measure the AC/DC voltage and waveform at different point in Different section of mobile trainer.
6. Demonstration and practice of fault finding and repair of C.R.O.
7. Demonstration and practice of fault finding and repair of Function Generator.
8. Demonstration and practice of fault finding and repair of Power supplies.
9. Demonstration and practice of fault finding and repair of Digital multimeter.
10. To study the block diagram and working principle of UPS system trainer.

	11. To measure the AC/DC voltage and waveform at different point in Different section of UPS system trainer. 12. To study the block diagram and working principle of home inverter system trainer. 13. To measure the AC/DC voltage and waveform at different point in Different section of home inverter system trainer. 14. Demonstration, practice of fault finding and repair of UPS system. 15. Demonstration, practice of fault finding and repair of home inverter system. 16. Testing of Integrated Circuits (ICs) 17. Use of digital tools for troubleshooting digital equipment.

QPEC–301 Electronic Hardware Design Technician				
	L	**T**	**P**	**Credits**
	0	**0**	**8**	**1**
Course Objectives:	This course aims to equip the students will the knowledge of microprocessor and microcontroller related programming and interfacing with other hardware chips. Also students will be able to design IC based circuits as timer, waveform generator and other circuits.			
Course Outcomes:	1. To learn the programming of 8085 hardware kit. 2. To interface various hardware interfacing chips with 8085 microprocessor. 3. To interface various hardware interfacing chips with 8051 microcontroller. 4. Analyse and deign basic op-amp circuits, particularly various linear and non-linear circuits, active filters, signal generators, and data converters.			

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	3	3	2	2	1	0	0	0	2
CO2	3	3	1	3	1	2	2	1	0	0	2	2
CO3	3	3	1	3	3	2	2	1	0	0	0	2
CO4	3	3	1	3	3	2	2	1	0	0	0	2

List of Experiments:

1. To familiarize with entering various steps of a program in 8085 kit.
2. Steps to enter, modify data/program and to execute a programme on 8085 kit.
3. Writing and execution of program for addition of two 8-bit numbers.
4. Writing and execution of program for subtraction of two 8-bit numbers.
5. Writing and execution of program for multiplication of two 8-bit numbers.
6. Writing and execution of program for division of two 8-bit numbers.
7. Write an assembly language program to perform subtraction between two 16 bit numbers on 8085.
8. Write an assembly language program for addition of two four-digit decimal numbers and the result is stored in BC register.
9. Write an assembly language program for the below stated function. 5 bytes of data are stored in memory location at 2050H to 2054H. Transfer the entire block of data to new memory location starting at 2060.
10. Write an assembly language program in 8085 to display a COUNT of 0 or 9 at the seven segment LED display with the delay of 0.5 sec between each COUNT.
11. Write an assembly language program to use Port A and B of 8255 PPI as output ports.
12. Write a program of Flashing LED connected to port 1 of the Micro Controller
13. Write a program to generate a Ramp waveform using DAC with micro controller.

14. Write a program to interface the ADC.
15. To study comparator using op amp.
16. To measure the performance parameters of an Op-amp.
17. Application of Op amp as Inverting amplifier.
18. Application of Op-amp as Non Inverting amplifier.
19. To use the Op-Amp as summing, scaling & averaging amplifier.
20. To Design differentiator and Integrator using Op-Amp.
21. Application of Op-amp as Low-pass and High-pass filter.
22. Application of Op Amp as square wave generator.
23. To Design a delay circuit using555.
24. To Design a +5V unregulated power supply.
25. To Design +5V regulated power supply.

QPEC-302 Mobile Phone Hardware Repair Technician				
	L	**T**	**P**	**Credits**
	0	**0**	**8**	**1**
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 mobile phone.			
Course Outcomes:	1. Understanding the Tools and Parts Required to Repair the Faulty Mobile Phone. 2. Understanding the Repairing Techniques of the Faulty Mobile Phone using tools and equipment's. 3. Understanding the procedure to test the Repaired Mobile Phone.			

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**1**	**3**	**3**	**2**	**2**	**1**	**2**	**1**	**1**	**2**
CO2	**3**	**3**	**2**	**3**	**3**	**1**	**2**	**2**	**2**	**1**	**1**	**2**
CO3	**3**	**3**	**3**	**3**	**3**	**3**	**1**	**0**	**2**	**1**	**1**	**3**

List of Experiments:

Following standard repair procedure

1. Follow the standard procedure as documented by the Mobile Phone brand for each model.

2. Take anti-static precautions before work and wear ESD wrist straps or aprons.

3. Follow standard operating procedure while handling hardware modules such as handling KLOB with ESD standards.

4. Use recommended tools for specific operation suggested by the brand.

5. Maintain zero-material defect during material handling by following standard operating procedure

Assembling and disassembling the Mobile Phone

6. Open the outer panel of the Mobile Phone using metal / plastic case opening tools

7. Use the brand recommended screwdrivers to remove the screws to open the inner casing

8. locate the connectors and release them to remove the motherboard from the device

	9. Use hot air gun and other devices to remove the LCD screen from the panel **5.** Follow similar process and use appropriate tools to assemble the Mobile Phone **Diagnosing the problem** **11.** Take preventive measures and identify if there are any other issues in the Mobile Phone and follow the standard diagnostic procedure as documented by the Mobile Phone brand for each model. **12.** Use the self-diagnostic tools (like power on self-test (POST) card) to perform standard diagnosis process and ensure functionality of different parts of the device. **Repairing the component or module** **16.** Understand the scope of component level of repair estimate the cost of repair and verify if it is within Beyond Economic Repair (BER). **17.** Heat the singled-out component using hot air gun to melt the solder joints and remove from KLOB **18.** Clean the board by melting the old solder and removing and place the new component precisely on the board at specified location. **19.** Solder the component on the KLOB using soldering stations and ensure the soldering is proper and the component is fixed as per the specification. **20.** Operate automated BGA (ball grid array) workstation to precisely remove the chip from the board and repair them. **21.** Perform reballing function by dismantling, heating the chip to be removed from the board, remove the solder remains, put new solder balls, place the chip and solder them with the KLOB **22.** Check for functioning of the hardware after repairing and ensure that there is no damage of KLOB while removal and fixing of SMD components **23.** Ensure other components are not damaged while using hot air gun for removal of a component which could cause damage. **Replacing faulty component**

	24. Identify and decide on replacing the module or component as the appropriate solution **25.** Take adequate measures and follow procedures when replacing expensive or delicate components such as LCD **26.** Ensure that replaced module or component is working and no further rework is required. **27.** Identify and use appropriate tools and manuals for repairing the specific issue and prevent any accidents while handling hazardous tools.