Final

REVISED DIPLOMA CURRICULUM OF ELECTRONICS AND COMMUNICATION ENGINEERING (ECE)
PART II

For the State of Meghalaya
(October, 2023)

National Institute of Technical Teachers' Training & Research
Block – FC, Sector – III, Salt Lake City, Kolkata – 700 106

Prog. Name: Electronics & Communication Engineering

Semester-III

SL. No	Category of Course	Code No	Course Title	Study Scheme				Evaluation Scheme							Total Marks	Credits
				Pre-requisite	Contact Hours/ week			Theory				Practical				
					L	T	P	End Exam	Progressive Assessment			End Exam	Progressive Assessment			
									Class Test	Assignment	Attendance		Sessional	Viva voce		
1	Program Core	ECPC201	Principles of Electronic Communication		3	0	0	60	20	15	5	0	0	0	100	3
2	Program Core	ECPC203	Electronic Devices and Circuits		3	0	0	60	20	15	5	0	0	0	100	3
3	Program Core	ECPC205	Digital Electronics		3	0	0	60	20	15	5	0	0	0	100	3
4	Program Core	ECPC207	Electronic Measurements and Instrumentation		3	0	0	60	20	15	5	0	0	0	100	3
5	Program Core	ECPC209	Electric Circuits and Network		2	1	0	60	20	15	5	0	0	0	100	3
6	Program Core	ECPC211	Principles of Electronic Communication Lab		0	0	2	0	0	0	0	40	40	20	100	1
7	Program Core	ECPC213	Electronic Devices and Circuits Lab		0	0	2	0	0	0	0	40	40	20	100	1
8	Program Core	ECPC215	Digital Electronics Lab		0	0	2	0	0	0	0	40	40	20	100	1
9	Program Core	ECPC217	Electronic Measurements and Instrumentation Lab		0	0	2	0	0	0	0	40	40	20	100	1
10	Summer Internship (4 weeks) after Semester II	SI201	Summer Internship-I		0	0	0	-	-	-	-	40	40	20	100	2
TOTAL					14	1	8	300	100	75	25	200	200	100	1000	21

Prog. Name: Electronics & Communication Engineering

Semester-IV

SL. No	Category of Course	Code No	Course Title	Study Scheme				Evaluation Scheme							Total Marks	Credits
				Pre-requisite	Contact Hours/ week			Theory				Practical				
					L	T	P	End Exam	Progressive Assessment			End Exam	Progressive Assessment			
									Class Test	Assignment	Attendance		Sessional	Viva voce		
1	Program Core Course	ECPC202	Microcontroller And Applications		3	0	0	60	20	15	5	-	-	-	100	3
2		ECPC204	Consumer Electronics		3	0	0	60	20	15	5	-	-	-	100	3
3		ECPE206	Digital Communication Systems		3	0	0	60	20	15	5	-	-	-	100	3
4		ECPC208	Microcontroller And Applications Lab		0	0	2	-	-	-	-	40	40	20	100	1
5		ECPC210	Digital Communication Systems Lab		0	0	2	-	-	-	-	40	40	20	100	1
6	Program Elective Course	ECPE202 (Any one)	A. Electronic Equipment Maintenance B. Simulation Software		3	0	0	60	20	15	5	-	-	-	100	3
7		ECPE204 (Any one)	A. Linear Integrated Circuits B. Industrial Instrumentation and Condition Monitoring		3	0	0	60	20	15	5	-	-	-	100	3
8		ECPE206 (Any one)	A. Linear Integrated Circuits Lab B. Industrial Instrumentation and Condition Monitoring Lab		0	0	2	-	-	-	-	40	40	20	100	1
9	Minor Project	PR202	Minor Project		0	0	4	-	-	-	-	40	40	20	100	2
10	Mandatory Course	AU202	Essence of Indian Knowledge and Tradition		2	0	0	0	0	0	0	0	0	0	0	0
TOTAL					17	0	10	300	100	75	25	160	160	80	900	20

Prog. Name: Electronics & Communication Engineering

Semester- V

SL. No	Category of Course	Code No	Course Title	Study Scheme				Evaluation Scheme							Total Marks	Credits
				Pre-requisite	Contact Hours/ week			Theory				Practical				
					L	T	P	End Exam	Progressive Assessment			End Exam	Progressive Assessment			
									Class Test	Assignment	Attendance		Sessional	Viva voce		
1	Program Core Course	ECPC301	Embedded Systems		3	0	0	60	20	15	5	0	0	0	100	3
2		ECPC303	Mobile and Wireless Communication		3	0	0	60	20	15	5	0	0	0	100	3
3		ECPC305	Embedded Systems Lab		0	0	2	-	-	-	-	40	40	20	100	1
4		ECPC307	Mobile and Wireless Communication Lab		0	0	2	-	-	-	-	40	40	20	100	1
5	Program Elective Course	ECPE301 (Any one)	A. Industrial Automation B. Control System and PLC		3	0	0	60	20	15	5	-	-	-	100	3
6		ECPE303 (Any one)	A. Microwave and RADAR B. Optical Communication and Networking		3	0	0	60	20	15	5	-	-	-	100	3
7		ECPE305 (Any one)	A. Industrial Automation Lab B. Control System and PLC Lab		0	0	2	-	-	-	-	40	40	20	100	1
8		ECPE307	A. Microwave and RADAR Lab B. Optical Communication and Networking Lab		0	0	2	-	-	-	-	40	40	20	100	1
9	Open Elective	ECOE301 (Any one)	A. Renewable Energy Technologies B. Internet of Things C. Engineering Economics and Accountancy		3	0	0	60	20	15	5	-	-	-	100	3
10	Summer Internship (6 weeks) after Semester IV	SI301	Summer Internship-II		0	0	0	-	-	-	-	40	40	20	100	3
11	Major Project	PR301	Major Project		0	0	2	-	-	-	-	Assessment to be done, credit to be carried over				##
Total					15	0	10	300	100	75	25	200	200	100	1000	22

credit of Major Project to be carried over to VI sem.

Prog. Name: Electronics & Communication Engineering

Semester- VI

SL. No	Category of Course	Code No	Course Title	Study Scheme				Evaluation Scheme							Total Marks	Credits
				Pre-requisite	Contact Hours/ week			Theory				Practical				
					L	T	P	End Exam	Progressive Assessment			End Exam	Progressive Assessment			
									Class Test	Assignment	Attendance		Sessional	Viva voce		
1	Program Core Course	ECPC302	Computer Networking and Data Communication		3	0	0	60	20	15	5	0	0	0	100	3
2		ECPC304	Computer Networking and Data Communication Lab		0	0	2	-	-	-	-	40	40	20	100	1
3	Humanities and Social Science Course	HS302	Entrepreneurship and Start-ups		3	1	0	60	20	15	5	-	-	-	100	4
4	Open Elective Course	ECOE302 (Any one)	A. Robotics B. Mechatronics		3	0	0	60	20	15	5	-	-	-	100	3
5		ECOE304 (Any one)	A. Artificial Intelligence B. Product Design		3	0	0	60	20	15	5	-	-	-	100	3
6	Mandatory Course	AU302	Indian Constitution		2	0	0	0	0	0	0	0	0	0	0	0
7	Major Project	PR302	Major Project		0	0	6	-	-	-	-	100	50	50	200	4##
8	Seminar	SE302	Seminar		1	0	0	-	-	-	-	0	50	50	100	1
Total					15	1	8	240	60	60	40	140	140	120	800	19

COURSES OF SEMESTER - III

[For Electronics & Communication Engineering (ECE)]

PRINCIPLES OF ELECTRONIC COMMUNICATION

L	T	P	Total Marks: 100	Course Code No.: ECPC201	
3	0	0			
Total Contact Hours		**: 45Hrs**		**Theory**	
Theory and tutorial		: 45Hrs		End Term Exam	: 60
				Progressive Assessment	: 40
Pre Requisite		**: Nil**			
Credit		**: 3**			

RATIONALE:

This course concentrates on the field of analog communication and pulse code modulation. It also includes the advantages and disadvantages of digital and analog communications. . After completion of this course, the students will be able to get some idea about modern digital communication techniques like delta modulation, multiplexing, ASK, FSK, PSK etc.

COURSE OUTCOMES:

After completion of the course the students will be able to

- Explain the basic requirements of an analog communication system;
- Describe analog modulation including PAM, PWM and PPM;
- Mention the function of transmitter and receiver;
- Differentiate between digital and analog communication;
- Discuss the basic ideas of information theory.

DETAILED COURSE CONTENTS

Unit	Topic/Sub Topic	Hours
I	**ANALOG MODULATION:** 1.1.Concept of frequency translation. 1.2.Amplitude Modulation: Description of full AM, DSBSC, SSB and VSB in time and frequency domains, 1.3.Methods of generation & demodulation, 1.4.Descriptions of FM signal in time and frequency	**9**
II	**PULSE ANALOG MODULATION**: 2.1.Ideal sampling 2.2.Sampling theorem, 2.3.Aliasing, interpolation, natural and flat top sampling in time and frequency domains.	**8**
III	**PCM & DELTA MODULATION SYSTEMS**: 1.Uniform and Non-uniform quantization. 2.PCM and delta modulation, 3.Signal to quantization noise ratio in PCM and delta modulation.	**8**

IV	**DIGITAL MODULATION**: 1.Baseband transmission: Line coding (RZ, NRZ), 2.Inter symbol interference (ISI), pulse shaping 3.Nyquist criterion for distortion free base band transmission, raised cosine spectrum. 4. Pass band transmission: Geometric interpretation of signals, orthogonalization	**10**
V	**SPREAD-SPECTRUM MODULATION**: 1.Introduction, Pseudo-Noise sequences, direct sequence spread spectrum (DSSS) with coherent BPSK, 2. Processing gain, probability of error, frequency-hop spread spectrum (FHSS). 3.Application of spread spectrum: CDMA	**10**

REFERENCES:

1. Principles of communication systems By Taub Schilling, T.M.H.
2. Fundamentals of communication systems By Proakis & Salehi, Pearson education
3. Communication Systems by Simon Haykin, John Wiley
4. Communication Systems (Analog and Digital) By R.P. Singh, S.D. Sapre, T.M.H.
5. Modern Digital & Analog Communication By B.P. Lathi, Oxford Publications
6. Digital & Analog Communication Systems By K.S. Shanmugam, John

ELECTRONIC DEVICES & CIRCUITS

L	T	P	Total Marks: 100	Course Code No.: ECPC203	
3	0	0			
Total Contact Hours		**: 45 Hrs**		**Theory**	
Theory and tutorial		: 45 Hrs		End Term Exam	: 60
				Progressive Assessment	: 40
Pre Requisite		**: Nil**			
Credit		**: 3**			

RATIONALE:

Electronics Engineering cannot stand alone without the study of Electronic Devices & Circuits. The modern Electrical Equipments are mostly controlled by electronic circuits where the circuits are mostly designed on the basis of linear and binary operation of the solid state devices. This subject provides the facility for the study of basic knowledge of the solid state devices and their application. The part of this subject deals with the characteristics of basic devices like diode transistors and their circuits. The second part is dealing with the special devices e.g. UJT, FET, MOSFET, Care has been taken so that the study of the practical circuits are included in this subject rather than theoretical approach. Some problems on designing of simple electronic circuits have also been included here.

COURSE OUTCOMES:

After completion of the course the students will be able to

- Explain the characteristics of different type of diode and transistor
- Describe the working principle of transistor amplifiers
- Describe the effect of feedback on amplifier
- Develop different application circuit on diode and transistors
- Explain the application and working principle of (a) UJT, FET,MOSFET.

DETAILED COURSE CONTENTS

Unit	Topic/Sub Topic	Hours
I	**Semiconductor and Diodes** 1.1 Definition, Extrinsic/Intrinsic, N-type & p-type 1.2 PN Junction Diode – Forward and Reverse Bias Characteristics 1.3 Zener Diode – Principle, characteristics, construction, working 1.4 Diode Rectifiers – Half Wave and Full Wave 1.5 Filters – C, LC and PI Filters	**9**
II	**Bipolar Junction Transistor (BJT)** 2.1NPN and PNP Transistor – Operation and characteristics 2.2Common Base Configuration – characteristics and working 2.3Common Emitter Configuration – characteristics and working 2.4Common Collector Configuration – characteristics and working 2.5High frequency model of BJT 2.6Classification of amplifiers, negative feedback	**9**
III	**Field Effect Transistors**	**9**

	3.1 FET – Working Principle, Classification 3.2 MOSFET Small Signal model 3.3 N-Channel/ P-Channel MOSFETs – characteristics, enhancement and depletion mode, MOSFET as a Switch 3.4 Common Source Amplifiers 3.5 Uni-Junction Transistor – equivalent circuit and operation.	
IV	**SCR DIAC & TRIAC** 4.1 SCR – Construction, operation, working, characteristics 4.2 DIAC - Construction, operation, working, characteristics 4.3 TRIAC - Construction, operation, working, characteristics 4.4 SCR and MOSFET as a Switch, 4.5 DIAC as bidirectional switch 4.6 Comparison of SCR, DIAC, TRIAC, MOSFET	**9**
V	**Amplifiers and Oscillators** 5.1 Feedback Amplifiers – Properties of negative Feedback, impact of feedback on different parameters 5.2 Basic Feedback Amplifier Topologies: Voltage Series, Voltage Shunt, Current Series, Current Shunt 5.3 Oscillator – Basic Principles, Crystal Oscillator, Non-linear/ Pulse Oscillator	**9**

REFERENCES:

1. Analog Circuits; A.K. Maini Khanna Publishing House Ed. 2018 (ISBN: 978-93-86173-584) 2. Electronic Devices and Circuits; S. Salivahanan and N. Suresh Kumar McGraw Hill Education; Fourth edition (1 July 2017) ISBN: 978-9339219505
3. Electronics Devices and circuit theory; Boyestad & Nashelsky Pearson Education India; 11 edition (2015) ISBN: 978-9332542600
4. Electronic Principles; Albert Malvino & David Bates Tata McGraw Hill Publication 2010 ISBN: 978-0070634244
5. Electronics Devices & Circuits; Jacob Millman McGraw Hill Education; 4th edition (2015) ISBN: 978-9339219543

SUGGESTED SOFTWARE/LEARNING WEBSITES:

a. https://www.electronics-tutorials.ws/
b. https://www.youtube.com/watch?v=Rx43l-QpeWQ
c. https://electronicsforu.com/resources/electronic-devices-and-circuit-theory

DIGITAL ELECTRONICS

L	T	P	Total Marks: 100	Course Code. No.: ECPC205	
3	0	0			
Total Contact Hours		**: 45Hrs**		**Theory**	
Theory and tutorial		: 45 Hrs		End Term Exam	: 60
				Progressive Assessment	: 40
Pre Requisite		**: Nil**			
Credit		**: 3**			

RATIONALE:

A lot of MSI, LSI, VLSI have been developed and are being widely used in the Industrial Applications. To understand the functions of the above-mentioned techniques it is required to learn the basic principles. So different topics of digital electronics have been included in this subject. In this course the study of fundamental principles, combinational and sequential logic application of different IC chips have been included. The knowledge of digital to Analog and Analog to Digital converters are very essential for interfacing the analog to Digital System. So these topic have also been included.

COURSE OUTCOMES:

After completion of the course the students will be able to

- Explain the operation of basic building blocks e.g. AND, OR,NOT
- Develop the (a) combinational logic circuits and (b) Sequential logic circuits
- Explain the operation of DAC and ADC modules
- Develop application circuits by using available standard IC Chips

DETAILED COURSE CONTENTS

Unit	Topic/Sub Topic	Hours
I	**Number Systems & Boolean Algebra** 1.1 Introduction to different number systems – Binary, Octal, Decimal and Hexadecimal 1.2 Conversion from one number system to another. 1.3 Boolean variables – Rules and laws of Boolean Algebra 1.4 De-Morgan's Theorem 1.5 Karnaugh Maps and their use for simplification of Boolean expressions	**9**
II	**Logic Gates** 2.1 Logic Gates – AND, OR, NOT, NAND, NOR , XOR, XNOR: Symbolic representation and truth table 2.2 Implementation of Boolean expressions and Logic Functions using gates 2.3 Simplification of expression	**9**
III	**Combinational Logic Circuits** 3.1 Arithmetic Circuits – Addition, Subtraction, 1's 2's Complement, Half Adder, Full Adder, Half Subtractor, Full Subtractor, Parallel and Series Adders 3.3 Encoder, Decoder 3.4 Multiplexer – 2 to 1 MUX, 4 to 1 MUX, 8 to 1 MUX. Applications	**9**

	3.5 Demultiplexer – 1 to 2 DEMUX, 1- 4 DEMUX, 1- 8 DEMUX	
IV	**Sequential Logic Circuits** 4.1 Flip Flops – SR,JK, T, D, FF, JK-MS, Triggering 4.2Counters – 4 bit Up – Down Counters, Asynchronous/ Ripple Counter, Decad Counter- Mod 3, Mod 7 Counter, Johnson Counter, Ring Counter 4.3 Registers – 4bit Shift Register: Serial in Serial out, Serial in Parallel out, Parallel in Serial out, Parallel in Parallel out	**9**
V	**Memory Devices** 5.1 Classification of Memories – RAM Organization, Address Lines and Memory Size, 5.2 Static RAM, Bipolar RAM, cell Dynamic RAM, D RAM, DDR RAM 5.3 Read Only memory – ROM organization, Expanding memory, PROM, EPROM, EEPROM, Flash memory 5.4 Data Converters – Digital to Analog converters, Analog to Digital Converter	**9**

REFERENCES:

1. Digital principles & Applications; Albert Paul Malvino & Donald P. Leach; McGraw Hill Education; Eighth edition ISBN: 978-9339203405
2. Digital Electronics; Roger L. Tokheim; Macmillian McGraw-Hill Education (ISE Editions); International 2 Revised ed edition ISBN: 978-0071167963
3. Digital Electronics – an introduction to theory and practice; William H. Gothmann; Prentice Hall India Learning Private Limited; 2 edition ISBN: 978-8120303485
4. Fundamentals of Logic Design; Charles H. Roth; Jr. Jaico Publishing House; First edition ISBN: 978-8172247744
5. Digital Electronics; R. Anand Khanna Publications, New Delhi (Edition 2018) ISBN: 978-93-8260944

ELECTRONIC MEASUREMENT & INSTRUMENTATION

L	T	P	Total Marks: 100	Course Code No.: ECPC207	
3	0	0			
Total Contact Hours		**: 45Hrs**		**Theory**	
Theory and tutorial		: 45 Hrs		End Term Exam	: 60
				Progressive Assessment	: 40
Pre Requisite		**: Nil**			
Credit		**: 3**			

RATIONALE:

This subject deals with the technique of measuring voltage, current and wattage by the indicating & display type of instruments and CRO. The working principle, construction of all types of measuring instruments (indicating, integrating and recording type) digital instruments are also covered. The general principles of build and handling of electronic instrumentation are also there. The topic of instrumentation and control develops an understanding of sensors, transducers.

COURSE OUTCOMES:

After completion of the course the student will be able to

- Select similar instruments for the measurement of voltage,current and wattage.
- Apply techniques for connecting different type of signal generators.
- Explain the working principle of different type of signal analyzers
- Explain the working principle and construction of different type of Transducers

DETAILED COURSE CONTENTS

Unit	Topic/Sub Topic	Hours
I	**Basics of Measurements and Bridges** 1.1 Accuracy & precision, Resolution, reliability, repeatability, validity 1.2 Types of Errors; Standards of measurement 1.3 DC Bridges – Wheatstone and Kelvin Double Bridge 1.4 AC Bridges - Maxwell's Bridge, Hay's Bridge, Anderson Bridge, Schering and Wien bridges 1.5 Electronic Instruments for Measuring Basic Parameters: Amplified DC meter, AC Voltmeter, True- RMS responding Voltmeter	**9**
II	**Signal Generators**: 2.1 Sine wave generator, 2.2 Frequency – Synthesized Signal Generator, 2.3 Sweep frequency Generator. 2.4 Pulse and square wave generators. 2.5 Function Generators	**9**
III	**Signal Analysis**: 3.1 Wave Analyzer, 3.2 Spectrum Analyzer. 3.3 Frequency Counters: Simple Frequency Counter; Measurement of errors; extending frequency range of counters	**5**

IV	**Electronic Instruments** 4.1 Electronic voltmeter & digital voltmeter 4.2 Electronic Multimeters 4.3 Q meter 4.4 Vector Impedance meter	**7**
V	**Oscilloscopes** 5.1 Cathode ray tube: construction, operation, screens, graticules 5.2 Vertical deflection system, Horizontal deflection system, Delay line, 5.3 Measurement of frequency, time delay, phase angle and modulation index (trapezoidal method) 5.4 Oscilloscope probe: Structure of 1:1 and 10:1 probe 5.5: Special Oscilloscopes – Multiple Trace CRO Storage Oscilloscope, Sampling Oscilloscope. 5.6 Specification of an Oscilloscope	**5**
VI	**Transducers** 6.1 Classification, Selection Criteria, Characteristics, Construction, Working Principles and Application of following Transducers: 6.2 RTD, Thermocouple, Thermistor 6.3 LVDT, RVDT, Strain Gauge 6.4 Load Cell 6.5 Piezoelectric Transducer 6.6 Optical transducer: photo voltaic, photodiode, photo transistor, photo emissive, photo conductive	**5**

REFERENCES:

1. Electrical & Electronic Measurement & Instruments A.K. Sawhney Dhanpat Rai & Sons, India
2. Electronic Instrument and Measurement Technique W.D. Cooper Prentice Hall International, India.
3. Electronic Measurement & Instrumentation J.G. Joshi Khanna Publishing House, Delhi
4. Measurement systems application and design E.O. Doebelin and D. N. Manik The Mcgraw-Hill
5. Electronic Measurements and Instrumentation Oliver and Cage The Mcgraw-Hill
6. Basic Electrical Measurement M.B. Stout Prentice hall of India, India
7. Electronic Instrumentation H. S. Kalsi The Mcgraw-Hill
8. Electrical and Electronics Measurement and Instrumentation Prithwiraj Pukrait, Budhaditya Biswas, Santanu Das, Chiranjib Koley The Mcgraw-Hill

ELECTRIC CIRCUITS & NETWORKS

L	T	P	Total Marks: 100	Course Code No.: ECPC209	
2	1	0			
Total Contact Hours		**: 45Hrs**		**Theory**	
Theory and tutorial		: 45 Hrs		End Term Exam	: 60
				Progressive Assessment	: 40
Pre Requisite		**: Nil**			
Credit		**: 3**			

RATIONALE:

Study of Electric Circuits are essential in study of Electronic Engineering. Study of Circuits, Network and Filters constitutes the basic and fundamental aspect of deriving insight into the functioning and analysis of Electrical network, instruments and machineries.

COURSE OUTCOMES:

After completion of this course the student will be able to:

- Identify Electrical circuit parameters
- Solve problems on magnetic Circuit.
- Apply Network theorems in analyzing and solving electrical circuit problems
- Analyze R-L, R-C and R-L-C circuit in A.C
- Explain the behavior of circuit in transient condition.
- Design filters as per required circuit characteristics

DETAILED COURSE CONTENTS

Unit	Topic/Sub Topic	Hours
I	**Basics of Network and Network Theorem** 1.1 Node and Mesh Analysis 1.2 Superposition Theorem; Thevenin Theorem; Norton Theorem; Maximum Power transfer theorem; Reciprocity Theorem.	**9**
II	**Graph Theory** 2.1 Graph of network, tree, incidence matrix 2.2 F- Tie Set Analysis F-Cut Set Analysis 2.3 Analysis of resistive network using cut-set and tie-set 2.4 Duality	**9**
III	**Time Domain and Frequency Domain Analysis** 3.1 Solution of first and second order differential equations for Series and parallel R-L, R-C, R-L-C circuits 3.2 Initial and Final conditions in network elements 3.3 Forced and Free response, time constants 3.4 Steady State and Transient State Response 3.5 Analysis of electrical circuits using Laplace Transform for standard inputs	**9**

	(unit, Ramp, Step)	
IV	**Trigonometric and exponential Fourier series** 4.1 Discrete spectra and symmetry of waveform 4.2 Steady state response of a network to non-sinusoidal periodic inputs, power factor, effective values 4.3 Fourier transform and continuous spectra	**9**
V	**Two Port Network Two Port Network** 5.1 Open Circuit Impedance Parameters 5.2 Short Circuit Admittance Parameters, Transmission Parameters, Hybrid Parameters 5.3 Interrelationship of Two Port Network 5.4 Inter Connection of Two Port Network	**9**

REFERENCES:

1. Networks and Systems; Ashfaq Husain; Khanna Publishing House.
2. Network Analysis; M. E. Van Valkenburg; Prentice Hall of India.
3. Engineering Circuit Analysis W. H. Hayt, J. E. Kemmerly and S. M. Durbin; McGraw Hill.
4. Electrical Circuits; Joseph Edminister, Schaum's Outline, Tata McGraw Hill.
5. Basic Circuit Theory; Lawrence P. Huelsma; Prentice Hall of India.
6 .Network & Systems; D. Roy Choudhury; Wiley Eastern Ltd.
7. Linear Circuit Analysis; De Carlo and Lin Oxford Press.

PRINCIPLES OF ELECTRONIC COMMUNICATION LAB

L	T	P	Total Marks: 100	Course Code No.: ECPC211	
0	0	2			
Total Contact Hours		**: 30 Hrs**			
Practical		: 30 Hrs			
Pre Requisite		**: Nil**		**Practical**	
				End Term Exam	: 40
Credit		**: 1**		Progressive Assessment	: 60

RATIONALE:

This course concentrates on the application of analog communication including PAM, PWM and PPM and pulse code modulation techniques.

COURSE OUTCOMES:

After completion of the course the students will be able to

- Apply the different techniques of signal modulation and demodulation.
- Explain the variation in amplitude of controllers.
- Analyse transmitter and receiver circuits.
- Compare design issues, advantages, disadvantages and limitations of analog communication systems.

DETAILED COURSE CONTENTS

Unit	Topic/Sub Topic	Hours
I	Harmonic analysis of a square wave of modulated waveform: measures modulation index.	**4**
II	To modulate a high frequency carrier with sinusoidal signal to obtain FM signal.	**4**
III	To study and observe the operation of a super heterodyne receiver	**4**
IV	To modulate a pulse carrier with sinusoidal signal to obtain PWM signal and demo it.	**4**
V	To modulate a pulse carrier with sinusoidal signal to obtain PPM signal and demodulate it.	**4**
VI	To observe pulse amplitude modulated waveform and its demodulation.	**4**
VII	To observe the operation of a PCM encoder and decoder. To consider reason for using digital signal x-missions of analog signals.	**3**
VIII	To study & observe the amplitude response of automatic gain controller (AGC)	**3**

REFERENCES

Same as Theory Course.

ELECTRONIC DEVICES & CIRCUITS LAB

L	T	P	Total Marks: 100	Course Code No.: ECPC213	
0	0	2			
Total Contact Hours		**: 30 Hrs**			
Practical		: 30 Hrs			
Pre Requisite		**: Nil**		**Practical**	
				End Term Exam	: 40
Credit		**: 1**		Progressive Assessment	: 60

RATIONALE:

Electronics Engineering cannot stand alone without the study of Electronic Devices & Circuits. The modern Electrical Equipments are mostly controlled by electronic circuits where the circuits are mostly designed on the basis of linear and binary operation of the solid state devices. This subject provides the facility for the study of basic knowledge of the solid state devices and their application. The part of this subject deals with the characteristics of basic devices like diode transistors and their circuits. Care has been taken so that the study of the practical circuits are included in this subject rather than theoretical approach. Some problems on designing of simple electronic circuits have also been included here.

COURSE OUTCOMES:

After completion of the course the students will be able to

- Differentiate different types of diodes, operation and its characteristics
- Analyze the DC bias circuitry of DIAC and TRIAC
- Design biasing circuits using diodes and transistors.
- Analyze diode application circuits, amplifier circuits and oscillators employing BJT, FET devices.

DETAILED COURSE CONTENTS

Unit	Topic/Sub Topic	Hours
I	Construct the circuit and plot the VI characteristics of the PN Junction Diode , find the cut in voltage	**2**
II	Construct the circuit and plot the characteristics of a Zener Diode. Find the breakdown voltage.	**2**
III	Construct a Half Wave Rectifier and obtain regulation characteristics – Without Filters and with Filters Compare the results	**2**
IV	. Construct a Full Wave Rectifier and obtain regulation characteristics – Without Filters and with Filters Compare the results	**3**
V	Construct a Bridge Rectifier and obtain regulation characteristics – Without Filters and with filters	**3**
VI	Obtain the characteristics of DIAC and TRIAC.	**3**
VII	Simulate half wave, full wave and bridge rectifier using simulation tool like PSpice/ Orcad/ Multisim.	**3**
VIII	Develop a simulation model for Voltage Series and Voltage Shunt Feedback Amplifiers	**3**
IX	Develop circuits for Voltage Series and Voltage Shunt Feedback Amplifiers	**3**

	and obtain output plots. Compare the results with the simulation model.	
X	Develop a simulation model for Current Series and Current Shunt Feedback Amplifiers	**3**
XI	Develop circuits for Current Series and Current Shunt Feedback Amplifiers and obtain output plots. Compare the results with the simulation model.	**3**

REFERENCES:

1. Analog Circuits; A.K. Maini. Khanna Publishing House Ed. 2018 (ISBN: 978-93-86173-584) 2. Electronic Devices and Circuits; S. Salivahanan and N. Suresh Kumar, McGraw Hill Education; Fourth edition (1 July 2017) ISBN: 978-9339219505
3. Electronics Devices and circuit theory; Boyestad & Nashelsky,
Pearson Education India; 11 edition (2015) ISBN: 978-9332542600
4. Electronic Principles; Albert Malvino & David Bates, Tata McGraw Hill Publication 2010 ISBN: 978-0070634244
5. Electronics Devices & Circuits, Jacob Millman, McGraw Hill Education; 4 edition (2015) ISBN: 978-9339219543

DIGITAL ELECTRONICS LAB

L	T	P	Total Marks: 100	Course Code. No.: ECPC215	
0	0	2			
Total Contact Hours		**: 30 Hrs**			
Practical		: 30 Hrs			
Pre Requisite		**: Nil**		**Practical**	
				End Term Exam	: 40
Credit		**: 1**		Progressive Assessment	: 60

RATIONALE:

To understand the functions of the MSI, LSI, VLSI, it is required to learn the basic principles. So different topics of digital electronics have been included in this subject. In this course the application of combinational and sequential logic and application of different IC chips have been included. The application of Digital to Analog and Analog to Digital converters are very essential for interfacing the analog to Digital System.

COURSE OUTCOMES:

After completion of the course the students will be able to

- Convert from one code to other.
- Write the Boolean expression for a logic circuit.
- Design combinational and sequential digital circuit.
- Analyse A/D and D/A conversion circuits.

DETAILED COURSE CONTENTS

Unit	Topic/Sub Topic	Hours
I	To verify the truth tables for all logic fates – NOT OR AND NAND NOR XOR XNOR using CMOS Logic gates and TTL Logic Gates	**2**
II	Implement and realize Boolean Expressions with Logic Gates.	**2**
III	Implement Half Adder, Full Adder, Half Subtractor, Full subtractor using ICs	**2**
IV	Implement parallel and serial full-adder using ICs	**2**
V	Design and development of Multiplexer and De-multiplexer using multiplexer ICs	**2**
VI	Verification of the function of SR,D, JK and T Flip Flops	**2**
VII	Design controlled shift registers	**2**
VIII	Construct a Single digit Decade Counter (0-9) with 7 segment display	**3**
IX	To design a programmable Up-Down Counter with a 7 segment display.	**3**
X	Study of different memory ICs	**2**
XI	Study Digital- to – Analog and Analog to Digital Converters	**2**
XII	Simulate in Software (such as PSpice) an Analog to Digital Converter	**3**
XIII	Simulate in Software (such as PSpice) an Analog to Digital Converter	**3**

REFERENCES:

1. Digital principles & Applications; Albert Paul Malvino & Donald P. Leach; McGraw Hill Education; Eighth edition ISBN: 978-9339203405
2. Digital Electronics; Roger L. Tokheim; Macmillian; McGraw-Hill Education (ISE Editions); International; 2 Revised ed edition ISBN: 978-0071167963
3. Digital Electronics – an introduction to theory and practice; William H. Gothmann; Prentice Hall India Learning Private Limited; 2 edition ISBN: 978-8120303485
4. Fundamentals of Logic Design; Charles H. Roth Jr. Jaico Publishing House; First edition ISBN: 978-8172247744
5. Digital Electronics; R. Anand Khanna Publications, New Delhi (Edition 2018) ISBN: 978-93-8260944

ELECTRONIC MEASUREMENT & INSTRUMENTATION LAB

L	T	P	Total Marks: 100	Course Code No.: ECPC217	
0	0	2			
Total Contact Hours		**: 30 Hrs**			
Practical		: 30 Hrs			
Pre Requisite		**: Nil**		**Practical**	
				End Term Exam	: 40
Credit		**: 1**		Progressive Assessment	: 60

RATIONALE:

The subject Electronic Measurement & Instrumentation is an important subject in the field of Electronics Engineering. The course gives an overview of fundamentals of electronic measurement systems and elements of electronic instrumentation

COURSE OUTCOMES:

After completion of the course the students will be able to

- Measure unknown inductance using following bridges (a) Anderson Bridge (b) Maxwell bridge
- Study working and applications of (i) C.R.O. (ii) Digital Storage C.R.O. & (ii) C.R.O. Probes
- Draw the characteristics of the transducers
- Measure of Resistance using Wheatstone bridge
- Measure Low resistance by Kelvin's Double Bridge

DETAILED COURSE CONTENTS

Unit	Topic/Sub Topic	Hours
I	Measure unknown inductance using following bridges (a) Anderson Bridge (b) Maxwell bridge	**3**
II	Measure Low resistance by Kelvin's Double Bridge	**3**
III	Study working and applications of (i) C.R.O. (ii) Digital Storage C.R.O. & (ii) C.R.O. Probes	**3**
IV	Measurement of Resistance using Wheatstone bridge (3 methods)	**3**
V	Draw the characteristics of the photo electric transducers	**3**
VI	Draw the characteristics of the RVDT	**3**
VII	Measurement of displacement with the help of LVDT	**3**
VIII	Draw the characteristics of the RTD (Pt)	**3**
IX	Draw the characteristics of the thermistor	**3**
X	Measurement of strain/force with the help of strain gauge load cell	**3**

REFERENCES:

1. Electrical & Electronic Measurement & Instruments A.K. Sawhney Dhanpat Rai & Sons, India
2. Electronic Instrument and Measurement Technique W.D. Cooper Prentice Hall International, India.
3. Electronic Measurement & Instrumentation J.G. Joshi Khanna Publishing House, Delhi
4. Measurement systems application and design E.O. Doebelin and D. N. Manik The Mcgraw-Hill
5. Electronic Measurements and Instrumentation Oliver and Cage The Mcgraw-Hill
6. Basic Electrical Measurement M.B. Stout Prentice hall of India, India
7. Electronic Instrumentation H. S. Kalsi The Mcgraw-Hill
8. Electrical and Electronics Measurement and Instrumentation Prithwiraj Pukrait, Budhaditya Biswas, Santanu Das, Chiranjib Koley The Mcgraw-Hill

SUMMER INTERNSHIP – I

L	T	P		Course Code No.: SI201	
0	0	0			
Total Contact Hours			**Total Marks: 100**	**Practical**	
Internship (4 weeks) after Semester II				End Term Exam	: 40
				Progressive Assessment	: 60
Pre Requisite		**:**			
Credit		**: 2**			

RATIONALE

The rationale for a summer internship is to offer a structured and practical learning experience that prepares individuals for their future careers, helps them make informed career choices, and equips them with the skills and knowledge necessary to succeed in their chosen field. This course provides opportunities to students for hand on industry experience.

COURSE OUTCOME

After completing this course, student will be able to:

- Apply theoretical knowledge gained in their academic coursework to real-world situations.
- Develop and refine specific skills relevant to the field.
- Gains hands-on experience in a professional network by interacting with mentors and industry professionals.
- Learn to manage their time effectively.
- Clarify career goals.

COURSE CONTENT DETAILS

1. Orientation:

• Introduction to the organization's mission, values, and culture.
• Familiarization with workplace policies, procedures, and safety guidelines.
• Orientation to the team and organizational structure.

2. Project-Based Learning:

• Description of the main project or tasks the intern will be working on during the internship.
• Detailed project goals and objectives.
• Training and guidance on project-specific tools, technologies, or methodologies.

3. Technical and Skill Development:

• Training sessions or workshops to enhance technical skills relevant to the internship role (e.g., programming languages, software tools, laboratory techniques).
• Soft skills development, including communication, teamwork, problem-solving, and time management.

4. Mentorship and Supervision:

• Regular meetings with a designated mentor or supervisor for guidance, feedback, and support.

• Mentorship objectives and expectations.

5. Professional Development:

• Sessions on professional etiquette, networking, and building a personal brand
• Resume writing and interview preparation workshops.

6. Industry and Field-Specific Knowledge:

• Lectures, seminars, or presentations on industry trends, best practices, and emerging technologies.
• Guest speakers from the field to share insights and experiences.

7. Reporting and Documentation:

• Training on how to document project progress, results, and findings.
• Practice in creating reports, presentations, or other deliverables.

9. Ethics and Professionalism:

• Discussions on ethical considerations within the field.
• Scenarios and case studies related to ethical decision-making.

10. Feedback and Evaluation:

• Regular performance evaluations and feedback sessions.
• Self-assessment and goal-setting exercises.

11. Networking and Industry Exposure:

• Opportunities to attend industry conferences, webinars, or networking events.
• Encouragement to connect with professionals in the field.

COURSES OF SEMESTER - IV
[For Electronics & Communication Engineering (ECE)]

MICROCONTROLLER & APPLICATIONS

L	T	P		Course Code No.: ECPC202	
3	0	0			
Total Contact Hours		**: 45 Hrs**	**Total Marks: 100**	**Theory**	
Theory		: 45Hrs		End Term Exam	: 60
				Progressive Assessment	: 40
Pre Requisite		**: ECPC205**			
Credit		**: 3**			

RATIONALE:

The technology of microprocessor has led to a single chip Microcontroller technology MCS51 family architecture, details of 8051 Microcontroller and its programming is covered in this subject. Use of assembler and stimulator for programming of Microcontroller will make the students equipped for the development of embedded systems.

COURSE OUTCOMES:

After completion of this course students will be able to

- Describe the fundamental concepts of microcontroller.
- Explain the architecture and features of 8051 microcontroller.
- Develop skill in simple program writing for 8051 microcontroller.
- Implement C programming in 8051
- Do interfacing of various peripheral devices with 8051 microcontroller

DETAILED COURSE CONTENTS

Unit	Topic/Sub Topic	Hours
I	**Introduction** 1.1 Introduction to Microprocessors and Microcontrollers, 1.2 Architectures [8085,8086] 1.3 Intel MCS51 family features – 8051 -organization and architecture.	**9**
II	**Programming with 8051** 2.1 10 8051 instruction set, addressing modes, conditional instructions, I/O Programming, 2.2 Arithmetic logic instructions, single bit instructions, interrupt handling, programming counters, timers and Stack	**9**
III	**MCS51** 3.1 MCS51 and external Interfaces 3.2 8 User interface – keyboard, 3.3 LCD, LED, 3.5 Real world interface - ADC, DAC, SENSORS Communication interface.	**9**
IV	**C programming with 8051** 4.1 8 I/O Programming, 4.2 Timers/counters, 4.3 Serial Communication, 4.4 Interrupt, User Interfaces	**9**

	4.5 LCD, Keypad, LED and communication	
V	**ARM processor core based microcontrollers** 5.1 14 Need for RISC Processor- 5.2 ARM processor fundamentals, 5.3 ARM core based controller [LPC214X], IO ports, ADC/DAC	**9**

REFERENCES:

1. The 8051 Micro Controller and Embedded Systems, Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D.Kinely, PHI Pearson Education, 5th Indian reprint.
2. Microprocessor and Microcontrollers, Krishna Kant, Eastern Company Edition, Prentice Hall of India, New Delhi
3. Microprocessor & Microcontroller Architecture: Programming & Interfacing using 8085,8086,8,05,1 Soumitra Kumar Mandal, McGraw Hill Edu,
4. Microcontrollers: Architecture implementation and Programming, Tabak Daniel, Hintz Kenneth j Tata McGraw Hill, 2007
5. ARM Developer's Guide.UM10139 LPC214X User manual – Rev.4 Andrew N.Sloss, Dominic Symes, Chris Wright User manual – Rev.4
6. Microprocessors and interfacing: programming and hardware, Douglas V. Hall, Tata McGraw Hill.
7. "Microcontroller – Fundamentals and Applications with Pic, Valder – Perez Yeesdee Publishers, Tayler & Francis.

CONSUMER ELECTRONICS

L	T	P	Total Marks: 100	Course Code No.: ECPC204	
3	0	0		**Theory**	
Total Contact Hours		**: 45 Hrs**		End Term Exam	: 60
Theory		: 45 Hrs		Progressive Assessment	: 40
Pre Requisite		**: NIL**			
Credit		**: 3**			

RATIONALE:

Revolution in electronics technology has brought radical changes in Audio & Video system in the recent years and the state of art will enable the students to comprehend the fact, concept, working principle and its application. The knowledge so gathered by the students will help them to be familiar with designing concepts and repairing of audio& video system.

COURSE OUTCOMES:

After completion of this course students will be able to

- Explain the construction and working principle of different types of microphone and loud speakers.
- Analyze the working and construction of Audio systems
- Discuss the block diagram, functions and various types of TV receiver
- Draw the circuit and applications of Advanced Television Systems.
- Describe the working principle and block diagram of CD players.
- Analyze the construction and working of different home and office appliances.

DETAILED COURSE CONTENTS

Unit	Topic/Sub Topic	Hours
I	**Audio Fundamentals and Devices** 1.1 Basic characteristics of sound signal, Audio level metering, decibel level in acoustic measurement, 1.2 Microphone & Types, speaker types & working principle, 1.3 Sound recording principle & types.	**9**
II	**Audio Systems** 2.1 CD player, home theatre sound system, surround sound, 2.2 Digital console block diagram, working principle, applications, 2.3 FM tuner, PA address system.	**9**
III	**Television Systems** 3.1 Monochrome TV standards, scanning process, aspect ratio, persistence of vision and flicker, interlace scanning, picture resolution, Composite video signal, 3.2 Colour TV standards, colour theory, hue, brightness, saturation, luminance and chrominance, 3.3 Different types of TV camera, Transmission standard.	**9**

IV	**Television Receivers and Video Systems** 4.1 PAL-D colour TV receiver, 4.2 Digital TVs:- LCD, LED , PLASMA, HDTV, 3-D TV, projection TV, 4.3 DTH receiver, Video interface, Digital Video, SDI, HDMI Multimedia Interface , Digital Video Interface, 4.4 CD and DVD player	**9**
V	**Home / Office Appliances** 5.1 Diagrams, operating principles and controller for FAX and Photocopier, 5.2 Microwave Oven, Washing Machine, Air conditioner and Refrigerators, Digital camera and cam coder.	**9**

REFERENCES:

1. Consumer Electronics, Bali S.P. Pearson Education India, 2010, latest edition.
2. Audio video systems: principle practices & troubleshooting, Bali R and Bali S.P, Khanna Book Publishing Co. (P) Ltd., 2010 Delhi , India, latest edition.
3. Modern Television practices, Gulati R.R. New Age International Publication (P) Ltd. New Delhi, latest edition
4. Audio video systems, Gupta R.G., Tata Mc graw Hill, New Delhi, India 2010, latest edition
5. Mastering Digital Television, Whitaker Jerry & Benson Blair, McGraw-Hill Professional, 2010, latest edition.
6. Standard handbook of Audio engineering, Whitaker Jerry & Benson Blair, McGraw-Hill Professional, 2010, latest edition.

DIGITAL COMMUNICATION SYSTEMS

L	T	P	Total Marks: 100	Course Code No.: ECPC206	
3	0	0			
Total Contact Hours		**: 45 Hrs**		**Theory**	
Theory		: 45Hrs		End Term Exam	: 60
				Progressive Assessment	: 40
Pre Requisite		**: ECPC201**			
Credit		**: 3**			

RATIONALE:

Digital communication system is backbone of modern communication system which rules rocket science to telecommunication everything. Present-day scenario, modern applications like Internet of things (IOT), Robotics, and Embedded Systems are highly dependent on the knowledge of communication system. In this course students will learn the advanced communication techniques used in the practical communication systems. Also the recent trends in communication fields are included.

COURSE OUTCOMES:

After completion of this course students will be able to

- Discuss the elements of a digital communication system.
- Write the characteristics of data transmitter circuits.
- Explain the various types of pulse modulation with suitable waveforms.
- Draw the block diagram of PCM transmitter and receiver and also give its application.
- Write short notes on ASK, FSK and PSK.
- Explain FDM and TDM systems and give their advantages.

DETAILED COURSE CONTENTS

Unit	Topic/Sub Topic	Hours
I	1.1 Block diagram and sub-system description of a digital communication system 1.2 Sampling of low-pass and band-pass signals, 1.3 PAM, PCM, signal to quantization noise ratio analysis of linear and nonlinear quantizers, 1.4 Line codes and bandwidth considerations; 1.5 PCM TDM hierarchies, frame structures, frame synchronization and bit stuffing.	**9**
II	2.1 Quantization noise analysis of DM and ADM; DPCM and ADPCM; 2.2 Low bit rate coding of speech and video signals. 2.3 Baseband transmission, matched filter, performance in additive Gaussian noise; 2.4 Intersymbol interference (ISI), Nyquist criterion for zero ISI, sinusoidal roll-off filtering, correlative coding, equalizers and adaptive equalizers; 2.5 Digital subscriber lines	**11**

III	3.1 Geometric representation of signals, maximum likelihood decoding; 3.2 Correlation receiver, equivalence with matched filter. 3.3 Generation, detection and probability of error analysis of OOK, BPSK, coherent and non-coherent FSK, QPSK and DPSK; 3.4 QAM, MSK and multicarrier modulation; 3.5 Comparison of bandwidth and bit rate of digital modulation schemes.	**12**
IV	4.1 Introduction to Information Theories: 4.1.1 Information measures, Shannon entropy, differential entropy, mutual information, 4.1.2 Capacity theorem for point-to-point channels with discrete and continuous alphabets. 4.2 Coding Theory: 4.2.1 Linear block codes – definitions, properties, bounds on minimum distance (singleton, Hamming, GV, MRRW), 4.2.2 Soft versus hard decision decoding, some specific codes (Hamming, RS, Concatenated); 4.2.3 Convolutional codes – structure, decoding (the Viterbi and BCJR algorithms); Turbo codes, LDPC codes.	**13**

REFERENCES:

1. Communication Systems, Haykin, S 4th Ed., John Wiley & Sons.
2. Modern Digital and Analog Communication Systems, Lathi, B.P. and Ding, Z Intl. 4th Ed., Oxford University Press.
3. Digital Communications, Proakis, J.G. and Saheli, M 5th Ed., McGraw-Hill.
4. Digital Communication: Fundamentals and Applications. Sklar, B., and Ray, P.K. 2nd Ed., Dorling Kindersley.
5. Elements of Information Theory, T. Cover and J. Thomas 2/e, Wiley.
6. Principles of Digital Communication, R. G. Gallager, Cambridge Univ. Press.
7. A Foundation in Digital Communication, A. Lapidoth, Cambridge Univ. Press.
8. Error Control Coding, S. Lin and D. Costello 2/e, Prentice Hall.

MICROCONTROLLER & APPLICATIONS LAB

L	T	P	Total Marks: 100	Course Code No.: ECPC208	
0	0	2			
Total Contact Hours		**: Hrs**			
Practical		: 30 Hrs			
Pre Requisite		**: ECPC215**		**Practical**	
				End Term Exam	: 40
Credit		**: 1**		Progressive Assessment	: 60

RATIONALE:

The technology of microprocessor has led to a single chip Microcontroller technology. Details of 8051 Microcontroller programming is covered in this subject, Use of assembler and stimulator for programming of Microcontroller will make the students equipped for the development of embedded systems. This course provides a platform for hands on practice.

COURSE OUTCOMES:

After completion of this course students will be able to

- Write programming in Assembly language using microcontroller.
- Develop skill to interface different external devices with 8051 microcontroller.
- Implement timers using 8051 microcontroller.
- Implement C programming in 8051

DETAILED COURSE CONTENTS

Unit	Topic/Sub Topic	Hours
I	Programming 8051 Micro controller using ASM and C, and implementation in flash 8051 microcontroller.	**2**
II	Programming with Arithmetic logic instructions [Assembly]	**1**
III	Program using constructs (Sorting an array) [Assembly]	**1**
IV	Programming using Ports [Assembly and C]	**2**
V	Delay generation using Timer [Assembly and C]	**2**
VI	Programming Interrupts [Assembly and C]	**2**
VII	Implementation of standard UART communication (using hyper terminal) [Asser and C].	**2**
VIII	Interfacing LCD Display. [Assembly and C]	**2**
IX	Interfacing with Keypad [Assembly and C]	**2**
X	Programming ADC/DAC [Assembly and C]	**2**
XI	Interfacing with stepper motor. [Assembly and C]	**3**
XII	Programming ARM Micro controller using ASM and C using simulator.	**3**
XIII	GPIO programming in ARM microcontroller. [C Programming].	**3**
XIV	Timers programming in ARM Microcontroller. [C Programming].	**3**

REFERENCES:

1. The 8051 Micro Controller and Embedded Systems, Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D.Kinely, PHI Pearson Education, 5th Indian reprint.
2. Microprocessor and Microcontrollers, Krishna Kant, Eastern Company Edition, Prentice Hall of India, New Delhi.
3. Microprocessor & Microcontroller Architecture: Programming & Interfacing using 8085, 8086, 8051, Soumitra Kumar Mandal, McGraw Hill Edu,
4. Microcontrollers: Architecture implementation and Programming, Tabak Daniel, Hintz Kenneth j, Tata McGraw Hill, 2007.
5. ARM Developer's Guide.UM10139 LPC214X User manual – Rev.4 Andrew N. Sloss, Dominic Symes, Chris Wright User manual – Rev.4.
6. Microprocessors and interfacing: programming and hardware, Douglas V. Hall Tata McGraw Hill, 2editon, 2007.
7. "Microcontroller – Fundamentals and Applications with Pic Valder – Perez Yeesdee, Publishers, Tayler & Francis.

DIGITAL COMMUNICATION SYSTEMS LAB

L	T	P		Course Code No.: ECPC210	
0	0	2			
Total Contact Hours		**: Hrs**			
			Total Marks: 100		
Practical		: 30 Hrs			
Pre Requisite		**: ECPC211**		**Practical**	
				End Term Exam	: 40
Credit		**: 1**		Progressive Assessment	: 60

RATIONALE:

In this course students will learn the practical aspects of Digital communication techniques used in the practical communication systems. Also, the recent trends in communication in the real fields are also included.

COURSE OUTCOMES:

After completion of this course students will be able to

- Identify the elements of a digital communication system.
- Simulate data transmitter circuits.
- Analyze modulated waveforms.
- Implement Time Division Multiplexing
- Implement ASK, FSK and PSK.

DETAILED COURSE CONTENTS

Unit	Topic/Sub Topic	Hours
I	Pulse Code Modulation and Differential Pulse Code Modulation	**3**
II	Delta Modulation and Adaptive Delta modulation	**3**
III	Simulation of Band Pass Signal Transmission and Reception • Amplitude Shift Keying • Frequency Shift Keying • Phase S	**4**
IV	Performance Analysis of Band Pass Signal Transmission and Reception • Amplitude Shift Keying • Frequency Shift Keying • Phase Shift Keying	**4**
V	Implementation of Amplitude Shift Keying	**4**
VI	Implementation of Frequency Shift Keying	**4**
VII	Implementation of Phase Shift Keying.	**4**
VIII	Time Division Multiplexing: PLL (CD 4046) based synch, clock and data extraction	**4**

REFERENCES:

1. Communication Systems Haykin, S 4th Ed., John Wiley & Sons.
2. Modern Digital and Analog Communication Systems, Lathi, B.P. and Ding, Z Intl. 4th Ed., Oxford University Press.
3. Digital Communications, Proakis, J.G. and Saheli, M 5th Ed., McGraw-Hill.
4. Digital Communication: Fundamentals and Applications, Sklar, B., and Ray, P.K 2nd Ed., Dorling Kindersley.
5. Elements of Information Theory, T. Cover and J. Thomas 2/e, Wiley.
6. Principles of Digital Communication, R. G. Gallager, Cambridge Univ. Press.
7. A Foundation in Digital Communication, A. Lapidoth, Cambridge Univ. Press.
8. Error Control Coding, S. Lin and D. Costello 2/e, Prentice Hall.

Program Elective – I (Any one)

ELECTRONICS EQUIPMENT MAINTENANCE

L	T	P	Total Marks: 100	Course Code No.: ECPE202A	
3	0	0			
Total Contact Hours		**: 45 Hrs**		**Theory**	
Theory and tutorial		: 45 Hrs		End Term Exam	: 60
				Progressive Assessment	: 40
Pre Requisite		**: NIL**			
Credit		**: 3**			

RATIONALE:

Equipment with electronic circuitry are increasingly being used in all the industries and the maintenance of them is the essential work for the proper functioning of the complete system. This course will enable the students to develop skills to maintain the basic electronic circuitry used in electronic equipment. This course will also enable them to fulfill the basic prerequisite for the advanced maintenance issues which they will face in the industries.

COURSE OUTCOMES:

After completion of this course students will be able to

- Identify fundamental Troubleshooting Procedures
- Select maintenance policy for specified equipment/appliance/gadget.
- Select troubleshooting tools for specified work
- Maintain the electronic home appliance/consumer electronic products.

DETAILED COURSE CONTENTS

Unit	Topic/Sub Topic	Hours
I	**Fundamental Troubleshooting Procedures Inside An Electronic Equipment:** 1.1 Reading Drawings And Diagrams – Block Diagram, Circuit Diagram, Wiring Diagram; 1.2 Dis-assembly and re-assembly of equipment, Equipment Failures and causes such as poor design, production deficiencies, careless storage and transport, inappropriate operating conditions, 1.3 Nature of faults, Fault location procedure, Fault finding aids – Service and maintenance manuals and instruction manuals, 1.4 Test and Measuring instruments, special tools Troubleshooting techniques, Approaching components for tests, Grounding systems in Electronic Equipment, 1.5 Temperature sensitive Intermittent problems Corrective actions, Situations where repairs should not be attempted.	**9**
II	**Passive Components and Their Testing**:	**9**

	2.1 Passive Components- Resistors, Capacitors, Inductors Failures in fixed resistors, testing of resistors, variable resistors, variable resistors as potentiometers, 2.2 Failures in potentiometers, testing of potentiometers, servicing potentiometers, LDRs and Thermistors 2.3 Types of capacitors and their performance, Failures in capacitors, testing of capacitors and precautions therein, variable capacitor types, Testing of inductors and inductance measurement	
III	**Testing of Semiconductor Devices:** 3.1 Types of semiconductor devices, Causes of failure in Semiconductor Devices, Types of failure Test procedures for Diodes, special types of Diodes, 3.2 Bipolar Junction Transistors, Field Effect Transistors, Thyristors, 3.3 Operational Amplifiers, Fault diagnosis in op-amp circuits	**9**
IV	**Logic IC families:** 4.1 Packages in Digital ICs, IC identification, IC pin-outs, Handling ICs, 4.2 Digital troubleshooting methods – typical faults, testing digital ICs with pulse generators Logic clip, Logic Probe, Logic Pulser, Logic Current Tracer, Logic Comparator 4.3 Special consideration for fault diagnosis in digital circuits 4.4 Handling precautions for ICs sensitive to static electricity 4.5 Testing flip-flops, counters, registers, multiplexers and de-multiplexers, encoders and decoders; Tri-state logic.	**9**
V	**Rework and Repair of Surface Mount Assemblies**: 5.1 Surface Mount Technology and surface mount devices 5.2 Surface Mount Semiconductor packages – SOIC, SOT, LCCC, LGA, BGA, CC Flatpacks and Quad Packs, 5.3 Cylindrical Diode Packages, Packaging of Passive Components as SMDs 5.4 Repairing Surface Mount PCBs, Rework Stations.	**9**

REFERENCES:

1. Modern Electronic Equipment: Troubleshooting, Repair and Maintenance, Khandpur TMH 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
5. Standard handbook of Audio engineering, Whitaker Jerry & Benson Blair, McGraw-Hill Professional, 2010, latest edition.

SIMULATION SOFTWARE

L	T	P		Course Code No.: ECPE202B	
3	0	0			
Total Contact Hours		**: 45 Hrs**		**Theory**	
Theory and tutorial		: 45 Hrs	**Total Marks: 100**	End Term Exam	: 60
				Progressive Assessment	: 40
Pre Requisite		**: NIL**			
Credit		**: 3**			

RATIONALE:

Simulation software allows engineers to evaluate, optimize, and compare product designs by modeling real world events in a computer generated environment. It is a facet of computer-aided engineering (CAE) software. Simulation allows to explore 'what if' questions and scenarios without having to experiment on the system itself. It helps to identify bottlenecks in material, information and product flows. It helps also to gain insight into which variables are most important to system performance.

COURSE OUTCOMES:

After completion of this course students will be able to

- Do various matrix manipulations, plotting of functions and data
- Test various circuit and control applications through simulation
- Develop skill in simulating various analog and digital logic circuits.
- Simulate digital and analog modulation, demodulation, phase locked loops
- Compile the source code and execute it step by step

DETAILED COURSE CONTENTS

Unit	Topic/Sub Topic	Hours
I	**MATLAB (matrix laboratory)** Use MATLAB for matrix manipulations, plotting of functions and data, implementation of algorithms, creation of user interfaces, and interfacing with programs written in other languages, including C, C++, Java, and Fortran.	**7**
II	**LabVIEW** Use this a system engineering software for test, measurement, and control applications. It can quickly access hardware and data information.	**6**
III	**Xilinx ISE (Integrated Software Environment)** Use Xilinx for synthesis and analysis of HDL designs, to perform timing analysis, examine RTL diagrams, simulate a design's reaction to different stimuli, and configure the target device with the programmer. (The Web Edition is a free	**6**

	version of Xilinx ISE that can be downloaded at no charge).	
IV	**Altera Quartus** Use this software for implementation of VHDL and Verilog for hardware description, visual edition of logic circuits and vector waveform simulation. The Web Edition is a free version of Quartus It that can be downloaded or delivered by mail for free. *(License registration is required to use the Web Edition of Quartus II, which is free and can be renewed an unlimited number of times.)*	**6**
V	**Emu8086** Use it to combine an advanced source editor, assembler, disassembler, software emulator (Virtual PC) with debugger, and step by step tutorials. Use it to compile the source code and to execute it on emulator step by step. Use Visual interface to watch registers, flags and memory while the program executes. Arithmetic & Logical Unit (ALU) shows the internal work of the central processor unit (CPU). The emulator runs programs on a Virtual PC.	**7**
VI	**PSpice** Use this to simulate analog circuit and digital logic simulation program for Microsoft Windows. Promote the understanding of the simulation process, emphasis to be given on user written circuit files rather than a graphical entry of the circuit diagrams.	**7**
VII	**Commsim** Use this for designing and simulating analog and digital end-to-end communication links. Use the Commsim library to get digital and analog modulation, channel models, demodulation, phase locked loops, error correcting codes, and bit error rate analysis.	**6**

REFERENCES:

1. Matlab and Its Applications in Engineering, Raj Kumar Bansal, Ashok Kumar Goel, Manoj Kumar Sharma. Pearson Education. .
2. Virtual Instrumentaion Using LABVIEW, Sanjay Gupta, Joseph John, McGraw Hill Edition 2001.
3. Xilinx ISE Manual (https://www.scribd.com/document/58805816/Xilinx-ISE-Manual)
4.Altera Quartus Manual (https://openlab.citytech.cuny.edu/emtlabs/1250-exercises/quartus-ii-tutorial-and-practice/)
5. Commsim manual (https://www.scribd.com/document/364851856/Comm-Lab-Manual-22-1-1)

Program Elective – II (Any one)

LINEAR INTEGRATED CIRCUITS

L	T	P	Total Marks: 100	Course Code No.: ECPE204A	
3	0	0			
Total Contact Hours		**: 45 Hrs**		**Theory**	
Theory		: 45Hrs		End Term Exam	: 60
				Progressive Assessment	: 40
Pre Requisite		**: ECPC203**			
Credit		**: 3**			

RATIONALE:

Linear integrated circuits are widely used in the automotive controls, computers, microwaves, play stations, MP3, aeroplanes, ship equipment, space crafts, cellular phones, cameras and laptops of modern times. They are also ideal for data processing and telephone circuit switching.

COURSE OUTCOMES:

After completion of this course students will be able to

- Explain the basic concepts of Differential Amplifier circuits
- Analyze filter circuits for specific applications.
- Describe the basic principle of analog to digital converters (ADC), and digital to analog converters (DAC) and Gain knowledge in designing a stable voltage regulators
- Apply PLL and special ICs

DETAILED COURSE CONTENTS

Unit	Topic/Sub Topic	Hours
I	**IC Fabrication and Circuit Configuration for Linear IC:** 1.1 Advantages of ICs over discrete components – Manufacturing process of monolithic ICs. 1.2 Construction of monolithic bipolar transistor – Monolithic diodes – Integrated Resistors Monolithic Capacitors – Inductors. Current mirror and current sources, 1.3 Current sources as active loads, Voltage sources, Voltage References, 1.4 BJT, Differential amplifier with active loads, 1.5 General operational amplifier stages -and internal circuit diagrams of IC 741, DC and AC performance characteristics, slew rate, Open and closed loop configurations	**9**
II	**Applications of Operational Amplifiers:** 2.1 Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V converters, adder, subtractor, 2.2 Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Schmitt trigger, 2.3 Precision rectifier, peak detector, clipper and clamper, 2.4 Low-pass, high-pass and band-pass Butterworth filters.	**9**

III	**Analog Multiplier and PLL:** 3.1 Analog Multiplier using Emitter Coupled Transistor Pair - Gilbert Multiplier cell – Variable transconductance technique, analog multiplier ICs and their applications, 3.2 Operation of the basic PLL, Closed loop analysis, Voltage controlled oscillator, Monolithic PLL IC 565, 3.3 Application of PLL for AM detection, FM detection, FSK modulation and demodulation and Frequency synthesizing	**9**
IV	**Analog to digital and digital to analog converters:** 4.1 Analog and Digital Data Conversions, 4.2 D/A converter – specifications - weighted resistor type, R-2R Ladder type, Voltage Mode and Current-Mode R2R Ladder types switches for D/A converters, 4.3 High speed sample-and-hold circuits, A/D Converters specifications - Flash type - Successive Approximation type - Single Slope type – Dual Slope type - A/D Converter using Voltage-to-Time Conversion - Over-sampling A/D Converters.	**9**
V	**Waveform generators and special function ICs**: 5.1 Sine-wave generators, Multivibrators and Triangular wave generator, Saw-tooth wave generator, ICL8038 function generator, Timer IC 555, 5.2 IC Voltage regulators – Three terminal fixed and adjustable voltage regulators - IC 723 general purpose regulator Monolithic switching regulator, 5.3 Switched capacitor filter IC MF10, Frequency to Voltage and Voltage to Frequency converters, 5.4 Audio Power amplifier, Video Amplifier, Isolation Amplifier, Opto-couplers and fiber optic IC.	**9**

REFERENCES:

1. Design with operational amplifiers and analog integrated circuits, 3rd Edition Sergio Franco, Tata McGraw-Hill, 2007.
2. Linear Integrated Circuits, D.Roy Choudhry, Shail Jain, New Age International Pvt. Ltd. 3. System design using Integrated Circuits . B.S.Sonde New Age Pub, 2nd Edition, 2001.
4. Analysis and Design of Analog Integrated Circuits, Gray and Meyer, Wiley International, 2005.
5. OP-AMP and Linear ICs, Ramakant A.Gayakwad, Prentice Hall / Pearson Education, 4th Edition, 2001
6. Operational Amplifier and Linear Integrated Circuits, K Lal Kishore , Pearson Education, 2006.

INDUSTRIAL INSTRUMENTATION AND CONDITIONING MONITORING

L	T	P		Course Code No.: ECPC204B	
3	0	0			
Total Contact Hours		**: 45 Hrs**		**Theory**	
Theory		: 45Hrs	**Total Marks: 100**	End Term Exam	: 60
				Progressive Assessment	: 40
Pre Requisite		**: ECPC207**			
Credit		**: 3**			

RATIONALE:

Condition monitoring (CM) is the process of monitoring a particular condition in instruments or machinery to identify changes that could indicate a developing fault. I industry, monitoring based on condition in maintenance focuses on the prevention of downtime, asset failures, and unneeded practices by monitoring the health of the asset to determine which maintenance tasks need to be carried out and at what time.

COURSE OUTCOMES:

After completion of this course students will be able to

- Explain the basic concept of instrumentation
- Distinguish various transducers.
- Design signal conditioning circuits
- Build data acquisition system
- Apply condition monitoring and diagnostic analysis

DETAILED COURSE CONTENTS

Unit	Topic/Sub Topic	Hours
I	**Fundamentals of instrumentation** Basic purpose of instrumentation. Basic block diagram (transduction, signal conditioning, signal presentation) and their function. Construction, working and application of switching devices- Push button, limit switch, float switch, pressure switch, thermostat, electromagnetic relay.	**6**
II	**Transducers** Distinguish between Primary and Secondary, Electrical and Mechanical, Analog and Digital, Active and Passive. Mechanical devices Pry and Sec. transducers Advantages of electric transducers Required characteristics of transducers. Factors affecting the choice of transducers Construction and principle of resistive Transducer-Potentiometer –variac and strain gauges -No derivation. Only definition and formula for gauge factor Types of strain gauges like unbonded, bonded and semiconductor.	**8**

	Construction and principle of Inductive transducers-L.V.D.T. and R.V.D.T, their applications. Construction, principle and applications of transducers – Piezo-Electric transducer, photo-conductive cells, photo voltaic cells.	
III	**Measurement of Non-Electrical Quantities** Temperature measurement - Construction and Working of RTD, Thermistor and Thermocouple, radiation pyrometer, technical specifications and ranges. Pressure measurement – Construction and working of bourdon tube, bellow diaphragm and strain gauge, Combination of diaphragm and inductive transducer, Bourdon tube and LVDT, bellow and LVDT, diaphragm capacitance and bridge Circuit. Construction and Working of Speed Measurement by contacting and non-Contact Type- DC tachometer, photo- electric tachometer, toothed rotor tachometer Generator - magnetic pick-up and Stroboscope. Construction and Working of Vibration measurement by accelerometer-LVDT accelerometer, Piezo electric type. Construction and Working of Flow measurement by electromagnetic and Turbine Flow meter. Construction and Working of Liquid level measurement by resistive, inductive, Capacitive gamma rays and Ultrasonic methods. Construction and Working of Thickness measurement by resistive, inductive, capacitive, ultrasonic and Nuclear methods.	**10**
IV	**Signal Conditioning** Basic Concept of signal conditioning System. Draw pin configuration of IC 741. Differential input resistance, CMMR, SVRR, voltage gain, output voltage, slew rate, gain bandwidth. Output, short circuit current. Filters: Types of RC filters and frequency response -no derivation. Sample and hold circuits - operation and its application	**5**
V	**Data Acquisition System** Generalized DAS- Block diagram and description of Transducer, signal conditione multiplexer, converter and recorder Draw Single Channel and Multi-channel DAS- Block diagram only. Difference be Signal Channel and Multi-Channel DAS. Data conversion- Construction and Working of Analog to digital conversion- succe approximation method, ramp type method. Digital to Analog conversion- Construction and Working of binary weighted resist method. Concept and methods of data transmission of electrical and electronic transmission Construction and principle of telemetry system and its type - Electrical telemeterin system	**8**

	Digital display device- operation and its application of seven segment display, dot display and concept of 3½, 4½ digits, LED and LCD applications.	
VI	**Condition Monitoring and Diagnostic Analysis** Definition of condition monitoring Insulation deterioration Mechanism- factors affecting occurrence and rate of deteri types of stresses responsible for deterioration Different tests on transformer, their purpose, and the necessary condition of machi Tests on Circuit breaker, purpose and required condition of machine Tests on CT, purpose, item to be tested and required condition of machine. Power factor, capacitance /tan delta test Insulation and Polarization index, DC winding resistance test, Turns Ratio test Tools and equipment used in Condition monitoring	**8**

References:

1. Sawhney, A.K. Electric and Electronic Measurement and instrumentation, Dhanpat Rai and Co. Author, Nineteenth revised edition 2011 reprint, 2014, ISBN:10: 8177001000
2. Rangan, C.S. G.R.Sharma. andV.S.V.Mani, Instrumentation devices and system, Pen ram International Publishing India Pvt. Ltd. Fifth edition, ISBN:10: 0074633503
3. Mehta, V.K. Electronics and instrumentation, Third edition-S.Chand and company Pvt Ltd Reprint, 2010, ISBN:81-219-2729-3
4. Singh, S.K. Industrial instrumentation and control, Tata McGraw-Hill, 1987. ISBN: 007451914X, 9780074519141.
5. J.G. Joshi, Electronic Measurement and Instrumentation, Khanna Publishing House, New Delhi (ISBN: 978-93-86173-621)

Program Elective – III (Any one)

LINEAR INTEGRATED CIRCUITS LAB

L	T	P	Total Marks: 100	Course Code No.: ECPE206A	
0	0	2			
Total Contact Hours		**: Hrs**			
Practical		: 30 Hrs			
Pre Requisite		**: ECPC213**		**Practical**	
				End Term Exam	: 40
Credit		**: 1**		Progressive Assessment	: 60

RATIONALE:

Linear integrated circuits are widely used in the automotive controls, computers, microwaves, play stations, MP3, aeroplanes, ship equipment, space crafts, cellular phones, cameras and laptops of modern times. They are also ideal for data processing and telephone circuit switching. This course provides a way for Hands on Practice in various applications of linear integrated circuits.

COURSE OUTCOMES:

After completion of this course students will be able to

- Implement different Amplifier circuits.
- Do experimentation on filter circuits for specific applications.
- Apply analog to digital converters (ADC), and digital to analog converters (DAC) and Gain knowledge in designing a stable voltage regulator.
- Apply PLL and special ICs.

DETAILED COURSE CONTENTS

Unit	Topic/Sub Topic	Hours
I	Operational Amplifiers (IC741)-Characteristics and Application	**2**
II	Waveform Generation using Op-Amp (IC741).	**2**
III	Applications of Timer IC555.	**2**
IV	Design of Active filters.	**3**
V	Study and application of PLL IC's	**3**
VI	Design of binary adder and subtractor	**3**
VII	Design of counters.	**3**
VIII	Study of multiplexer and demultiplexer /decoders.	**3**
IX	Implementation of combinational logic circuits.	**3**
X	Study of DAC and ADC	**3**
XI	Op-Amp voltage Regulator- IC 723	**3**

REFERENCES:

1. Design with operational amplifiers and analog integrated circuits, 3rd Edition Sergio Franco Tata McGraw-Hill, 2007.
2. Linear Integrated Circuits, D.Roy Choudhry, Shail Jain New Age International Pvt. Ltd. 3. System design using Integrated Circuits. B.S.Sonde New Age Pub, 2nd Edition, 2001
4. Analysis and Design of Analog Integrated Circuits, Gray and Meyer Wiley International, 2005.
5. OP-AMP and Linear ICs, Ramakant A. Gayakwad, Prentice Hall / Pearson Education, 4th Edition, 2001
6. Operational Amplifier and Linear Integrated Circuits K Lal Kishore , Pearson Education, 2006.

INDUSTRIAL INSTRUMENTATION AND CONDITIONING MONITORING LAB

L	T	P		Course Code No.: ECPE206B	
0	0	2			
Total Contact Hours		**: 30 Hrs**	**Total Marks: 100**	**Theory**	
Theory		: 30Hrs		End Term Exam	: 40
				Progressive Assessment	: 60
Pre Requisite		**:**			
Credit		**: 1**			

RATIONALE:

There are two broad techniques in condition monitoring—condition checking and monitoring changes in performance over time. Condition checking assesses the state of a machine at a specific moment in time and takes a performance snapshot, from which to derive its current operational health. So for condition monitoring applications of various instruments, transducers and data acquisition system are needed.

COURSE OUTCOMES:

After completion of this course students will be able to

- Select relevant instruments used for measuring electrical and non-electrical quantities.
- Select relevant transducers/sensors for various applications.
- Use relevant instruments for measuring non-electrical quantities.
- Check the signal conditioning and telemetry system for their proper functioning.
- Use data acquisition systems in various applications.
- Undertake condition monitoring for diagnostic analysis of electrical equipment.

DETAILED COURSE CONTENTS

Unit	Topic/Sub Topic	Hours
I	Identify different switches used in instrumentation system.	**2**
II	Measure linear displacement by L.V.D.T.	**2**
III	Measure the strain with the help of strain gauge	**2**
IV	Measure temperature by PT-100, thermistor, thermocouple along with simple resistance bridge.	**3**
V	Use Thermocouple to control the temperature of a furnace/machine.	**3**
VI	Measure pressure using pressure sensor kit.	**3**
VII	Measure angular speed using stroboscope and tachometer.	**3**
VIII	Measure the flow using flow meter.	**3**
IX	Convert digital data into analog data by using analog to digital converters and analog data into digital data by digital to analog converter.	**3**
X	Prepare a Report on various tools and equipment used for condition monitoring electrical Machines.	**3**
XI	Visit to testing center of electrical testing lab for tan delta and diagnostic tests a determine polarization index	**3**

References:

1. D. Patranabis; Principal Of Industrial Instrumentation; TMH.
2. Sawhney, A.K. Electric and Electronic Measurement and instrumentation, Dhanpat Rai and Co. Author, Nineteenth revised edition 2011 reprint, 2014, ISBN:10: 8177001000
3. Rangan, C.S. G.R.Sharma. andV.S.V.Mani, Instrumentation devices and system, Pen ram International Publishing India Pvt. Ltd. Fifth edition, ISBN:10: 0074633503
4. Mehta, V.K. Electronics and instrumentation, Third edition-S.Chand and company Pvt Ltd Reprint, 2010, ISBN:81-219-2729-3
5. Singh, S.K. Industrial instrumentation and control, Tata McGraw-Hill, 1987. ISBN: 007451914X, 9780074519141.
6. J.G. Joshi, Electronic Measurement and Instrumentation, Khanna Publishing House, New Delhi (ISBN: 978-93-86173-621)

MINOR PROJECT

L	T	P		Course Code No.: ECPR202	
0	0	4			
Total Contact Hours		**: 60 Hrs**	**Total Marks: 100**	**Practical**	
Theory and tutorial		: 0 Hrs		End Term Exam	: 40
Practical: 60 Hrs				Progressive Assessment	: 60
Pre Requisite		**:**			
Credit		**: 2**			

RATIONALE

Minor Project offers students an opportunity to apply theoretical knowledge in a practical setting, thereby enhancing their technical skill and problem solving skill. This course has been designed for students to understand the basics of carrying out any engineering project which includes Literature survey, methodology, setting up objective and scope of the project work.

COURSE OUTCOME:

After completing this course, student will be able to:

- Identify the objective and scope of work
- Undertake interdisciplinary literature survey.
- Prepare methodology of the project work.
- Learn the necessary field and laboratory experiments.
- Learn handling of necessary equipment.

COURSE CONTENT DETAILS

UNIT NO.	CONTENT	TIME ALLOTTED (HOURS)
UNIT –I	**Objective and Scope of work** • Introduction to the project. • Clear statement of project objectives. • Explanation of the scope and limitations of the project. • Justification for why the project is important or relevant.	**08**
UNIT –II	**Literature Survey** • Review of existing literature and research related to the project. • Identification of gaps in current knowledge. • Discussion of relevant theories, models, and previous work in the field. • Proper citations and references to sources.	**10**
UNIT –III	**Methodology** • Detailed explanation of the research methods and approaches to be used. • Description of data collection techniques (if applicable). • Explanation of any experiments or simulations to be conducted.	**10**

	• Ethical considerations and research ethics, if applicable.	
UNIT –IV	**Handling of Instruments and Experiments** • Description of the tools, equipment, or software to be used. • Details on how experiments or simulations will be conducted. • Safety precautions and protocols, if relevant. • Data collection and analysis methods.	**07**
UNIT –V	**Comprehensive Progress Presentation** • Regular progress reports or presentations to track the development of the project. • Presentation of findings, data, and results obtained so far. • Discussion of any challenges encountered and how they were addressed. • Feedback received from mentors or advisors and any adjustments made to the project plan.	**10**

AUDIT COURSE - ESSENCE OF INDIAN KNOWLEDGE AND TRADITION

L	T	P		Course Code No.: AU202
2	0	0		
Total Contact hrs.: Lecture: 30 Tutorial:0 Practical: 0 **Credit: 0**			Max. Marks: 100	Min. Passing Marks:40

RATIONALE:

To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system, this course is very much required. The knowledge gained in this course makes the students understand the traditional knowledge and analyze and apply it in their day-to-day life**.**

COURSE OUTCOMES:

At the end of the course, the student will be able to:

- Identify the concept of Traditional knowledge and its importance.
- Explain the need for and importance of protecting traditional knowledge.
- Illustrate the various enactments related to the protection of traditional knowledge.
- Interpret the concepts of Intellectual property to protect the traditional knowledge.
- Explain the importance of Traditional knowledge in Agriculture and Medicine.

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COURSE CONTENT DETAILS

UNIT	TOPIC/SUB-TOPIC	HRS.
1	Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge (Unani / Siddha/ Ayurveda), Indigenous Knowledge (IK), characteristics, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge of Meghalaya	07
2	Protection of traditional knowledge (TK): The need for protecting traditional knowledge, Significance of TK Protection, value of TK in global economy, Role of Governmentto harness TK.	07
3	Legal framework and TK: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act); The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016.	06
4	Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and traditional knowledge, Strategies to increase protection	04

	of traditional knowledge, Geographical Indications (GI).	
5	Traditional Knowledge in Different Sectors: Traditional knowledge and engineering, Traditional medicine system, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK	06

REFERENCE BOOKS:

1. Traditional Knowledge System in India, by Amit Jha, 2009.
2. "Knowledge Traditions and Practices of India" Kapil Kapoor.
3. Madhya Himalayi Sanskriti mein Gyan, Vigyan evam Paravigyan by Prof PC Pandey.

Suggested Online Link:

Web Links:
1.https://www.youtube.com/watch?v=LZP1StpYEPM
2.http://nptel.ac.in/courses/12110600/