CURRICULUM

FOR

DIPLOMA PROGRAMME

IN

ELECTRONICS & COMMUNICATION ENGINEERING

2nd Year (3rd& 4th Semester)

FOR THE STATE OF HIMACHAL PRADESH

N-2022

Implemented w.e.f. Session 2022-23

Prepared by: -

Composite Curriculum Development Centre

Directorate of Technical Education,

Vocational & Industrial Training, Sundernagar (H.P.)

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THREE YEAR DIPLOMA

IN

ELECTRONICS & COMMUNICATION ENGINEERING

SALIENT FEATURES

Programme	Diploma in Electronics & Communication Engineering
Duration	Three years (Six Semesters)
Entry Qualification	As prescribed by H.P. Takniki Shiksha Board /AICTE
Intake	As approved by H.P. Takniki Shiksha Board
Pattern	Semester System

PROGRAMME OUTCOMES (POs)

PO1	**Basic and Discipline Specific Knowledge:** Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.
PO2	**Problem Analysis:** Identify and analyze well-defined engineering problems using codified standard methods.
PO3	**Design/ Development of Solutions:** Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.
PO4	**Engineering Tools, Experimentation and Testing:** Apply modern engineering tools and appropriate technique to conduct standard tests and measurement.
PO5	**Engineering Practices for Society, Sustainability and Environment:** Apply appropriate technology in context of society, sustainability, environment and ethical practices.
PO6	**Project Management:** Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities.
PO7	**Life-long Learning:** Ability to analyse individual needs and engage in updating in the context of technological changes.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO 1	Use the fundamentals of the electronic components & devices in the industries.
PSO 2	Able to identify various electrical and electronic components and apply hands on skill in the areas of circuit design, circuit tracing, troubleshooting and rectification.
PSO 3	Develop the ability to organize test set up & operate the equipment.
PSO 4	Inculcate the knowledge of Engineering and Management principles as an individual or as a team member to plan, prepare and execute various types of works effectively.

Programme: Programme means Diploma Programme i.e Diploma in Electronics & Communications Engineering, which is of three years duration.

Course code and Abbreviation

Course code	Definitions
L	Lecture
DCS	Doubt Clearing Session
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

HORIZONTAL AND VERTICAL ORGANISATION OF THE SUBJECTS

Sr. No	Subjects	Distribution in Hours per week in Various Semesters	
		III	IV
1	Principles of Electronic Communication	7	
2	Electronic Devices and Circuits	7	
3	Digital Electronics	7	
4	Electronic Measurement and Instrumentation	7	
5	Electric Circuits and Network	4	
6	Student Centered Activities	4	
7	Internship-I (4 weeks) after III Semester	-	
8	Microcontroller and Applications		7
9	Consumer Electronics		4
10	Digital Communication Systems		7
11	Electronic Equipment Maintenance		4
12	Linear Integrated Circuits		7
13	Minor Project Work		4
14	Essence of Indian Knowledge and Tradition		2
15	Internship-II (6 weeks) after IV Semester		-
16	Student Centered Activities		2
	Total	**36**	**37**

STUDY AND EVALUATION SCHEME

THIRD SEMESTER

Sr. No.	Subject Code	Subjects	Study Scheme Hours/Week			Total Study Hrs	Credits	Evaluation Scheme								Total Marks
								Internal Assessment			External Assessment					
			Th	Pr	DCS			Th	Pr	Total	Th	Hrs	Pr	Hrs	Total	
1	ECPC201	Principles of Electronic Communication	3		1	4	3	40		80	60	3			120	**200**
2	ECPC203	Principles of Electronic Communication Lab		2	1	3	1		40				60	3		
3	ECPC205	#Electronic Devices and Circuits	3		1	4	3	40		80	60	3			120	**200**
4	ECPC207	Electronic Devices and Circuits Lab		2	1	3	1		40				60	3		
5	ECPC209	# # Digital Electronics	3		1	4	3	40		80	60	3			120	**200**
6	ECPC211	Digital Electronics Lab		2	1	3	1		40				60	3		
7	ECPC213	# # # Electronic Measurement and Instrumentation	3		1	4	3	40		80	60	3			120	**200**
8	ECPC215	Electronic Measurement and Instrumentation Lab		2	1	3	1		40				60	3		
9	ECPC217	# # # #Electric Circuits and Network	3		1	4	3	40		40	60	3			60	**100**
Student Centered Activities			-	4	-	4	0	-	25	25	-	-	-	-	-	**25**
Total			**15**	**12**	**9**	**36**	**19**	**200**	**185**	**385**	**300**	**15**	**240**	**12**	**540**	**925**

\# Common with Diploma in Electrical Engineering, Electrical & Electronics Engineering, Mechatronics

\# # Common with Diploma in Electrical & Electronics Engineering, Mechatronics

\# # # Common with Diploma in Electrical & Electronics Engineering

\# # # # Common with Diploma in Mechatronics

NOTE: The students shall undergo Internship-I at the end of 3rd semester (During semester break after board examinations of duration 04 weeks) which willbe evaluated and reflected in study and evaluation scheme of 4th semester.

STUDY AND EVALUATION SCHEME
FOURTH SEMESTER

Sr. No	Subject Code	Subjects	Study Scheme Hours/Week			Total Study Hrs	Credits	Evaluation Scheme								Total Marks
								Internal Assessment			External Assessment					
			Th	Pr	DCS			Th	Pr	Total	Th	Hrs	Pr	Hrs	Total	
1	ECPC202	Microcontroller and Applications	3	-	1	4	3	40	-	80	60	3	-	-	120	200
2	ECPC204	Microcontroller and Applications Lab	-	**2**	1	3	1	-	40		-	-	60	3		
3	ECPC206	Consumer Electronics	3	-	1	4	3	40	-	40	60	3	-	-	60	100
4	ECPC208	Digital Communication Systems	3	-	1	4	3	40	-	80	60	3	-	-	120	200
5	ECPC210	Digital Communication Systems Lab	-	**2**	1	3	1	-	40		-	-	60	3		
6	ECPE202	ECPE 202(I): Electronic Equipment MaintenanceOR ECPE 202(II): Bio-Medical Instrumentation	3	-	1	4	3	40	-	40	60	3	-	-	60	100
7	ECPE204	# ECPE204(I): Linear Integrated Circuits OR## ECPE204(II): Industrial Electronics	4	-	-	4	4	40	-	80	60	3	-	-	120	200
8	ECPE206	ECPE206(I): Linear Integrated Circuits Lab OR ECPE206(II): Industrial Electronics	-	**2**	1	3	1	-	40		-	-	60	3		
9	PR202	Minor Project Work	-	**4**	-	4	2	-	40	40	-	-	60	3	60	100
10	AU202	Essence of Indian Knowledge and Tradition	2	-	-	2	0	40	-	40	60	3	-	-	60	100
11	SI - I	Internship-I (after III Semester)	-	-	-	-	2	-	40	40	-	-	60	3	60	100
Student Centered Activities			-	**2**	-	2	0	-	25	25	-	-	-	-	-	25
Total			**18**	**12**	**7**	**37**	**23**	**240**	**225**	**465**	**360**	**18**	**300**	**15**	**660**	**1125**

\# Common with Diploma in Electrical & Electronics Engineering

\# \# Common with Diploma in Mechatronics

NOTE: The students shall undergo Internship-II at the end of 4th semester (During semester break after board examinations of duration 06 weeks) which will be evaluated and reflected in study and evaluation scheme of 5th semester.

DETAILED CONTENTS

Semester III

Course Code: ECPC201

Course Title: Principles of Electronic Communication

Number of Credits: 03 (L:3, T:0, P:0, DCS:1)

Course Category: PC

Course Objectives:

1	To Introduce the students to modulation and various analog and digital modulation Schemes.
2	Make students to have a broad understanding of satellite, optical, cellular, mobile, wireless and telecom concepts.

Course Content:

1. **ANALOG MODULATION:** Concept of frequency translation, Amplitude Modulation: Description of full AM, DCSBSC, SSB and VSB in time and frequency domains, methoDCS of generation & demodulation, descriptions of FM signal in time and frequency domains.

2. **PULSE ANALOG MODULATION**: Ideal sampling, Sampling theorem, aliasing, interpolation, natural and flat top sampling in time and frequency domains.

3. **PCM & DELTA MODULATION SYSTEMS**: Uniform and Non-uniform quantization. PCM and delta modulation, Signal to quantization noise ratio in PCM and delta modulation.

4. **DIGITAL MODULATION**: Baseband transmission: Line coding (RZ, NRZ), inter symbol interference (ISI), pulse shaping, Nyquist criterion for distortion free base band transmission, raised cosine spectrum. Pass band transmission: Geometric interpretation of signals, orthogonalization.

5. **SPREAD-SPECTRUM MODULATION**: Introduction, Pseudo-Noise sequences, direct sequence spread spectrum (DCSSS) with coherent BPSK, processing gain, probability of error, frequency-hop spread spectrum (FHSS). Application of spread spectrum: CDMA.

SUGGESTED LEARNING RESOURCES:

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 Wiley

Course Outcomes (COs)

CO 1	Ability to define various modulation and demodulation techniques.
CO 2	Identify and solve basic communication problems.
CO 3	Generalization of AM, FM & spread spectrum techniques
CO 4	Compare and contrast design issues, advantages, disadvantages and limitations of analog communication systems.
CO 5	Analysis of analog and pulse modulation.

Suggested Distribution of Marks (For Paper Setters and Students)

Topic /Unit	Time (In Hrs.)	Marks Allotted
1	12	12
2	14	12
3	12	12
4	14	12
5	12	12
Total	**64**	**60**

Course Code: ECPC203
Course Title: Principles of Electronic Communications Lab
Number of Credits: 01 (L: 0, P: 02, DCS:01)
Course Category: PC

Course Content:

1. Harmonic analysis of a square wave of modulated waveform: measures modulation index.
2. To modulate a high frequency carrier with sinusoidal signal to obtain FM signal.
3. To study and observe the operation of a super heterodyne receiver
4. To modulate a pulse carrier with sinusoidal signal to obtain PWM signal and demodulate it.
5. To modulate a pulse carrier with sinusoidal signal to obtain PPM signal and demodulate it.
6. To observe pulse amplitude modulated waveform and its demodulation.
7. To observe the operation of a PCM encoder and decoder. To consider reason for using digital signal x-missions of analog signals. 8.To study & observe the amplitude response of automatic gain controller (AGC).

Practical outcomes (PrOs):

1. Understanding different techniques of signal modulation and demodulation.
2. Understanding the variation in amplitude of controllers.

Course Code: ECPC205
Course Title: Electronics Devices and Circuits
Number of Credits: 03 (L:03, T:0, P:0, DCS:1)
Course Category: PC

Course Objective:

1	To introduce semiconductor devices BJT, FET, MOSFET and their characteristics, operations, circuits and applications.
2	To introduce concepts of rectifier, oscillator, amplifier and various amplifier configuration.
3	Description of SCR and family devices, their characteristics and applications.

Course Content:

1. **Semiconductor and Diodes:** Definition, Extrinsic/Intrinsic, N-type & P-type. PN Junction Diode – Forward and Reverse Bias Characteristics. Zener Diode – Principle, characteristics, construction, and working. Diode Rectifiers – Half Wave and Full Wave. Filters – C, LC, and PI Filters**.**

2. **Bipolar Junction Transistor (BJT):** NPN and PNP Transistor – Operation and characteristics. Common Base Configuration – characteristics and working. Common Emitter Configuration – characteristics and working. Common Collector Configuration – characteristics and working. High frequency model of BJT. Classification of amplifiers, negative feedback.

3. **Field Effect Transistors:** FET – Working Principle, Classification. MOSFET Small Signal model. N-Channel/ P-Channel MOSFETs – characteristics, enhancement, and depletion mode, MOS- FET as a Switch. Common Source Amplifiers. Uni-Junction Transistor – equivalent circuit and operation.

4. **SCR DIAC &TRIAC :**SCR – Construction, operation, working, characteristics. DIAC - Construction, operation, working, characteristics. TRIAC - Construction, operation, working, characteristics. SCR and MOSFET as a Switch, DIAC as bidirectional switch. Comparison of SCR, DIAC, TRIAC, MOSFET.

5. **Amplifiers and Oscillators:** Feedback Amplifiers – Properties of negative Feedback, impact of feedback on different parameters. Basic Feedback Amplifier Topologies: Voltage Series, Voltage Shunt, Current Series, Current Shunt. Oscillator – Basic Principles, Crystal Oscillator, Non-linear/ Pulse Oscillator .

Course Outcomes (COs)

CO 1	To understand various diodes and transistors used in analog electronics.
CO 2	Recognition of amplifier configuration and cascading of amplifiers.
CO 3	Analyze small signal model of FET and MOSFET
CO 4	Demonstration of rectifier, Feedback and oscillators.

SUGGESTED LEARNING RESOURCES:

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: 9780070634244.
5. Electronics Devices & Circuits Jacob Millman McGraw Hill Education; 4 edition (2015) ISBN: 978-9339219543.

Suggested Distribution of Marks (For Paper Setters and Students)

Topic /Unit	Time (In Hrs.)	Marks Allotted
1	12	12
2	14	12
3	12	12
4	14	12
5	12	12
Total	**64**	**60**

 # Common with Diploma in Electrical Engineering, Electrical & Electronics Engineering, Mechatronics

Course Code: ECPC207
Course Title: Electronic Devices and Circuits Lab
Number of Credits: 01 (L: 0, P: 02, DCS:01)
Prerequisites : NIL
Course Category: PC

Course Content:

1. Construct the circuit and plot the VI characteristics of the PN Junction Diode , find the cut in voltage
2. Construct the circuit and plot the characteristics of a Zener Diode. Find the breakdown voltage
3. Construct a Half Wave Rectifier and obtain regulation characteristics – Without Filters and with Filters Compare the results
4. Construct a Full Wave center tap Rectifier and obtain regulation characteristics – Without Filters and with Filters Compare the results
5. Construct a Bridge Rectifier and obtain regulation characteristics – Without Filters and with Filters
6. Obtain the characteristics of DIAC and TRIAC
7. Simulate half wave, full wave and bridge rectifier using simulation tool like PSpice/ ORCAD/ Multisim.
8. Develop a simulation model for Voltage Series and Voltage Shunt Feedback Amplifiers Or Develop circuits for Voltage Series and Voltage Shunt Feedback Amplifiers and obtain output plots. Compare the results with the simulation model.
9. Develop a simulation model for Current Series and Current Shunt Feedback Amplifiers
10. Develop circuits for Current Series and Current Shunt Feedback Amplifiers and obtain output plots. Compare the results with the simulation model.

Practical Outcomes (PrOs):

1.To understand the characteristics of diode, Zener diode, DIAC & TRIAC.
2.Verification of output waveforms of half wave and full wave bridge rectifier circuits.
3.Simulate half wave and full wave bridge circuits using suitable software.
4. Develop the circuit for all types of feedback amplifier.

Course Code: ECPC209
Course Title: Digital Electronics
Number of Credits: 03(L:3, T:0, P:0, DCS:1)
Course Category: PC Course

Course Objective:

1	To acquire the basic knowledge of digital logic gates and understanding, application of digital electronics circuits.
2	It covers the building blocks of embedded systems used in today in smart devices.

Course Content:

1. **Number Systems & Boolean Algebra:** Introduction to different number systems – Binary, Octal, decimal, Hexadecimal. Conversion from one number system to another. Boolean variables – Rules and laws of Boolean algebra. De-Morgan's Theorem. Karnaugh Maps and their use for simplification of Boolean expressions

2. **Logic Gates:** Logic Gates – AND, OR, NOT, NAND, NOR, XOR, XNOR: Symbolic representation and truth table. Implementation of Boolean expressions and Logic Functions using gates. Simplification of expressions.

3. **Combinational Logic Circuits:** Arithmetic Circuits – Addition, Subtraction, 1's &2's Complement, Half Adder, Full Adder, Half Subtractor, Full Subtractor, Parallel and Series Adders Encoder, Decoder. Multiplexer – 2 to 1 MUX, 4 to 1 MUX, 8 to 1 MUX and their Applications, Demultiplexer – 1-2 DEMUX, 1-4 DEMUX, 1- 8 DEMUX.

4. **Sequential Logic Circuits:** Flip Flops – SR, JK, T, D, JK-MS, Triggering. Counters – 4bit Up – Down Counters, Asynchronous/ Ripple Counter, Decade Counter- Mod 3, Mod 7 Counter, Johnson Counter, Ring Counter. Registers – 4bit Shift Register: Serial In Serial Out, Serial In Parallel Out, Parallel In Serial Out, Parallel In Parallel Out.

5. **Memory Devices:** Classification of Memories – RAM Organization, Address Lines and Memory Size, Static RAM, Bipolar RAM, Cell Dynamic RAM, D RAM, DDR RAM. Read only memory – ROM organization, Expanding memory, PROM, EPROM, EEPROM, Flash memory. Data Converters – Digital to Analog converters, Analog to Digital Converters.

Course Outcomes (COs)

CO1	Recall and order the logic gates and their circuits.
CO2	Design combinational and sequential circuits.
CO3	Design and implement hardware circuit to test performance and application.
CO4	Recognition of various memory devices.

SUGGESTED LEARNING RESOURCES:

1. Digital principles & Applications Albert Paul Malvino& Donald P. Leach McGraw Hill Education; Eighth edition ISBN: 978-9339203405.
2. Digital Electronics Roger L. TokheimMacmillian McGraw-Hill Education (ISE Editions); International 2nd Revised edition ISBN: 978-0071167963.
3. Digital Electronics – an introduction to theory and practice William H. Gothmann Prentice Hall India.
4. Learning Private Limited; 2 edition ISBN: 978-8120303485.
5. Fundamentals of Logic Design Charles H. Roth Jr. Jaico Publishing House; First edition ISBN: 9788172247744.
6. Digital Electronics R. Anand Khanna Publications, New Delhi (Edition 2018) ISBN: 978-93-82609445.

Suggested Distribution of Marks (For Paper Setters and Students)

Topic /Unit	Time (In Hrs.)	Marks Allotted
1	12	12
2	14	14
3	12	10
4	14	14
5	12	10
Total	**64**	**60**

 # Common with Diploma in Electrical & Electronics Engineering, Mechatronics

Course Code: ECPC211
Course Title: Digital Electronics Lab
Number of Credits: 01 (L: 0, P: 02, DCS:01)
Category: PC

Course Content:

1. 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. Implement and realize Boolean Expressions with Logic Gates.
3. Implement Half Adder, Full Adder, Half Subtractor, Full subtractor using ICs.
4. Implement parallel and serial full-adder using ICs.
5. Design and development of Multiplexer and De-multiplexer using multiplexer ICs.
6. Verification of the function of SR,D, JK and T Flip Flops.
7. Design controlled shift registers.
8. Construct a Single digit Decade Counter (0-9) with 7 segment display 9.To design a programmable Up-Down Counter with a 7-segment display.
10. Study of different memory ICs .
11. Study Digital- to – Analog and Analog to Digital Converters.
12. Simulate in Software (such as PSpice) an Analog to Digital Converter.

Practical Outcomes (PrOs).

The practical in this section are PrOs (i.e.sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

Course Code: ECPC213
Course Title: Electronic Measurement and Instrumentation
Number of Credits: 03 (L:3, T:0, P:0, DCS:1)
Category: PC Course

Objective:

1	To know the necessity of different measuring instruments and their design principle.
2	To understand the working principle of different measuring instruments and technical solutions to handle different errors.
3	To learn the architecture and working principle of advanced measuring instrument and their applications.

Course Content:

1. **Basics of Measurements and Bridges:** Accuracy& precision, Resolution. Types of Errors. DC Bridges – Wheatstone and Kelvin Double Bridge. AC Bridges - Maxwell's Bridge, Hay's Bridge, Anderson Bridge, De-Sauty's Bridge.

2. **Potentiometer:** Basic DC slide wire Potentiometer. Crompton's DC Potentiometer, Applications of DC Potentiometer. AC Potentiometers, Applications of AC Potentiometers.

3. **Measuring Instruments:** Permanent Magnet Moving Coil Instruments (PMMC). Moving Iron type Instruments (MI). Electro Dynamo Type Instruments. Single Phase Energy Meter.

4. **Electronic Instruments:** Electronic Voltmeter and Digital Voltmeter. Electronic Multimeters. Q – Meter. Vector Impedance Meter.

5. **Oscilloscopes:** Cathode ray tube: construction, operation, screens, graticules. Vertical deflection system, Horizontal deflection system, Delay line, Measurement of frequency, time delay, phase angle and modulation index (trapezoidal method). Oscilloscope probe: Structure of 1:1 and 10:1 probe. Multiple Trace CRO.

6. **Transducers:** Classification, Selection Criteria, Characteristics, Construction, Working Principles and Application of following Transducers: RTD, Thermocouple, Thermistor, LVDT, Strain Gauge Load Cell, Piezoelectric Transducers.

Program Specific Outcomes (COs):

CO1	Understand fundamental of various electrical measurements.
CO2	Describe the measurement bridges, potentiometer and transducer.
CO3	Formulation of bridges and transducers.
CO4	Learning of measurement using various instruments under different setups.
CO5	Understanding of Oscilloscope and transducer.

SUGGESTED LEARNING RESOURCES:

1. Electrical & Electronic Measurement & Instruments A.K. SawhneyDhanpat 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 PrithwirajPukrait, Budhaditya Biswas, Santanu Das, ChiranjibKoleyTheMcgraw-Hill

Suggested Distribution of Marks (For Paper Setters and Students)

Topic /Unit	Time (In Hrs.)	Marks Allotted
1	10	9
2	10	9
3	10	9
4	10	9
5	12	12
6	12	12
Total	**64**	**60**

 # Common with Diploma in Electrical & Electronics Engineering

Course Code: ECPC215
Course Title: Electronic Measurements and Instrumentation Lab
Number of Credits: 01 (L: 0, P: 02, DCS:01)
Course Category: PC

Course Content:

1. Measure unknown inductance using following bridges (a) Anderson Bridge (b) Maxwell Bridge
2. Measure Low resistance by Kelvin's Double Bridge
3. Calibrate an ammeter using DC slide wire potentiometer
4. Calibrate a voltmeter using Crompton potentiometer
5. Measure low resistance by Crompton potentiometer
6. Calibrate a single-phase energy meter by phantom loading
7. Study the working of Q-meter and measure Q of coils
8. Study working and applications of (i) C.R.O. (ii) Digital Storage C.R.O. & (iii) C.R.O. Probes
9. Measurement of displacement with the help of LVDT.
10. Draw the characteristics of the following temperature transducers (a) RTD (Pt-100) (b) Thermistor
11. Measurement of strain/force with the help of strain gauge load cell

Practical Outcomes (PrOs).

The practical in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

Course Code: ECPC217
Course Title: Electric Circuits & Network
Number of Credits: 03 (L:3, T:0, P:0, DCS:1)

Category: PC

Course Objective:

1	To learn a number of powerful engineering circuit analysis techniques such as nodal analysis, mesh analysis, theorems, source transformation and several methoDCS of simplifying networks.
2	To understand frequency response in electrical circuits
3	Different types of two-port network analysis using network parameters, with different types of connections

Course Content:

1. **Basics of Network and Network Theorem:** Node and Mesh Analysis, Superposition Theorem, Thevenin Theorem, Norton Theorem, Maximum Power transfer theorem, Reciprocity Theorem

2. **Graph Theory:** Concept of Graph, Node Tree of network, and incidence matrix and Analysis of resistive network using cut-set and tie-set, Duality Theorem and their application in the electrical circuits.

3. **Time Domain and Frequency Domain Analysis:** Solution of first and second order differential equations for Series and parallel R-L, R-C, R-L-C circuits. Initial and Final conditions in network elements. Forced and Free response, time constants. Steady State and Transient State Response. Analysis of electrical circuits using Laplace Transform for standard inputs (unit, Ramp, Step).

4. **Trigonometric and exponential Fourier series:** Discrete spectra and symmetry of waveform. Steady state response of a network to non-sinusoidal periodic inputs, power factor, effective values. Fourier transform and continuous spectra.

5. **Two Port Network:** Introduction of the Two Port Network and the various network parameters i.e., Open Circuit Impedance Parameters. Short Circuit Admittance Parameters. Transmission Parameters, Introduction of Hybrid Parameters.

Course Outcomes (COs)

CO 1	Demonstration of network theorems and network graph
CO2	Describe the response and state of 1st order & 2nd order circuit.
CO3	Define the time domain & frequency domain analysis.

SUGGESTED LEARNING RESOURCES:

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 EdministerSchaum'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.

Suggested Distribution of Marks (For Paper Setters and Students)

Topic /Unit	Time (In Hrs.)	Marks Allotted
1	12	12
2	14	12
3	12	12
4	14	12
5	12	12
Total	64	60

 # Common with Diploma in Mechatronics

Course Code	:	**SI-I**
Course Title	:	**Internship-I**
Number of Credits (Teaching Load)	:	2 (L: 0; T:0; P:0)
Prerequisites	:	-
Course Category	:	SI (Internship)

Guidelines

An internship of four weeks after 3rd semester during vacations should be undertaken in an industry/ Govt. or Pvt. Certified Agencies which are in social sector/ Govt. Skill Centres/ Institutes/ Schemes. The assessment of internship will be carried out in 4thsemester. The faculty members must visit the internship site during the course of internship to monitor the progress of the students.

Evaluation Criteria

The internal assessment of internship is to be carried out by the Industry/ Organization where the students have undergone the internship. The internal assessment done by the industry/ organization may be rationalized by the Department, if needed. The external assessment is to be done at the Institute. The department shall finalize external assessment within a month of the beginning of the 4th semester. The studentshave to prepare a daily diary of their internship period and the same has to be submitted at the institute after completion of the internship. The students have also to present the experience gained during internship in a seminar for the purpose of external evaluation.

(a) The assessment criteria (Internal Assessment) by the industry/ organization where the students have undergone the internship is asfollows:

- Attendance and general behavior : 20%
- Daily diary maintenance : 20%
- Initiative and participative attitude during internship : 20%
- Performance in the assigned activities by the industrial supervisor :40%

(b) The assessment criteria (External Assessment) by the institute is asfollows:

- Presentation : 60%
- Report : 20%
- Viva : 20%

Semester IV

Course Code: ECPC202
Course Title: Microcontroller and Applications
Number of Credits: 03 (L:3, T:0, P:0, DCS:1)
Course Category: PC

Course Objective:

1	To introduce students with the architecture and operation of typical microcontrollers.
2	To familiarize the students with the programming and interfacing of microcontrollers.
3	To provide strong foundation for designing real world applications using microcontrollers.

Course Content:

1. **Introduction**: Introduction to Microprocessors and Microcontrollers, Architectures [8085, 8086] Intel MCS- 51 family features – 8051 -organization and architecture.

2. **Programming with 8051**: 8051 instruction set, addressing modes, conditional instructions, I/O Programming, Arithmetic logic instructions, single bit instructions, interrupt handling, programming counters, timers and Stack.

3. **MCS51 and external Interfaces:** User interface – keyboard, LCD, LED, Real world interface - ADC, DAC, SENSORS Communication interface.

4. **C programming with 8051**: I/O Programming, Timers/counters, Serial Communication, Interrupt, User Interfaces- LCD, Keypad, LED and communication interfaces [RS232].

5. **ARM processor core based microcontrollers:** Need for RISC Processor-ARM processor fundamentals, ARM core based controller [LPC214X], IO ports, ADC/DAC, Timers.

Course Outcomes (COs)

CO1	Generalization of organization and architecture of microprocessor and microcontroller.
CO2	Practicing the programing of MC51.
CO 3	Develop interfacing to real world devices.
CO 4	Define the ARM based processor.

SUGGESTED LEARNING RESOURCES:

1. The 8051 Micro Controller and Embedded Systems Muhammad Ali Mazidi& Janice GilliMazidi, 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, 8051Soumitra 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

Suggested Distribution of Marks (For Paper Setters and Students)

Topic /Unit	Time (In Hrs.)	Marks Allotted
1	12	12
2	12	12
3	12	12
4	14	12
5	14	12
Total	**64**	**60**

Course Code: ECPC204
Course Title: Microcontroller and Applications Lab
Number of Credits: 01 (L: 0, P: 02, DCS:01)
Course Category: PC

Course Content:

1. Programming 8051 Micro controller using ASM and C, and implementation in flash 8051 microcontroller.
2. Programming with Arithmetic logic instructions [Assembly].
3. Program using constructs (Sorting an array) [Assembly].
4. Programming using Ports [Assembly and C].
5. Delay generation using Timer [Assembly and C].
6. Programming Interrupts [Assembly and C].
7. Implementation of standard UART communication (using hyper terminal) [Assembly and C].
8. Interfacing LCD Display. [Assembly and C].
9. Interfacing with Keypad [Assembly and C].
10. Programming ADC/DAC [Assembly and C].
11. Interfacing with stepper motor. [Assembly and C].
12. Pulse Width Modulation. [Assembly and C] Programming ARM Micro controller using ASM and C using simulator.
13. GPIO programming in ARM microcontroller. [C Programming].
14. Timers programming in ARM Microcontroller. [C Programming].

Practical Outcomes(PrOs).

The practical in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

Course Code: ECPC206
Course Title: Consumer Electronics
Number of Credits: 03(L:3, T:0, P:0, DCS:1)
Courses Category: PC

Course Objective:

1	To sketch and describe operating principles of different types of microphones.
2	To learn various components of composite video signal and differentiate between hue, brightness, saturation, luminance and chrominance.
3	To describe working of Washing machine, Digital Camera system, Microwave ovens with sketches of block diagram.

Course Content:

1. **Audio Fundamentals and Devices**: Basic characteristics of sound signal, Audio level metering, decibel level in acoustic measurement, Microphone & Types, speaker types & working principle, Sound recording principle & types.

2. **Audio Systems**: CD player, home theatre sound system, surround sound, Digital console block diagram, working principle, applications, FM tuner , ICs used in FM tuner TDA 7021T , PA address system.

3. **Television Systems**: Monochrome TV standarDCS, scanning process, aspect ratio, persistence of vision and flicker, interlace scanning, picture resolution, Composite video signal, Color TV standarDCS, color theory, hue, brightness, saturation, luminance and chrominance, Different types of TV camera, Transmission standarDCS.

4. **Television Receivers and Video Systems**: PAL-D colour TV receiver, Digital TVs:- LCD, LED,PLASMA, HDTV, 3-D TV, projection TV, DTH receiver, Video interface, Digital Video, SDI, HDMI Multimedia Interface, Digital Video Interface, CD and DVD player.

5. **Home / Office Appliances**: Diagrams, operating principles and controller for FAX and Photocopier, Microwave Oven, Washing Machine, Air conditioner and Refrigerators, Digital camera and cam coder.

Course Outcomes (COs)

CO1	Describe the Audio & Video fundamentals.
CO2	Define the various Colour Television systems with a greater emphasis on television standarDCS
CO3	To study the advanced topics in Digital Television and High-Definition Television.

SUGGESTED LEARNING RESOURCES:

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., 2010Delhi, India, latest edition
3. Modern Television practices Gulati R.R. New Age International Publication (P) Ltd. New Delhi Year 2011, 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.

Suggested Distribution of Marks (For Paper Setters)

Topic /Unit	Time (In Hrs.)	Marks Allotted
1	12	12
2	12	12
3	12	12
4	14	12
5	14	12`
Total	64	60

Course Code: ECPC208
Course Title: Digital Communication Systems
Number of Credits: 03 (L:3, T:0, P:0, DCS:1)
Course Category: PC

Course Objective:

1	Design digital communication systems (e.g., choose modulation scheme, coherent vs. non-coherent), given constraints on data rate, bandwidth, power, and bit error rate
2	Compute the power and bandwidth requirements of modern communication systems, including those employing Amplitude-Shift Keying (ASK), Phase-Shift Keying (PSK), Frequency-Shift Keying (FSK), and Quadrature-Amplitude Modulation (QAM) modulation formats
3	Determine the power spectral density of band pass digital modulation formats.

Course Content:

1. Block diagram and sub-system description of a digital communication system. Sampling of low pass and band-pass signals, PAM, PCM, signal to quantization noise ratio analysis of linear and nonlinear quantizes, Line codes and bandwidth considerations; PCM TDM hierarchies, frame structures, frame synchronization and bit stuffing.

2. Quantization noise analysis of Delta Modulation and Adaptive Delta Modulation, Low bit rate coding of speech and video signals. Baseband transmission, matched filter, performance in additive Gaussian noise; Inter symbol interference (ISI), Nyquist criterion for zero ISI, sinusoidal roll-off filtering, correlative coding, equalizers and adaptive equalizers; Digital subscriber lines.

3. Geometric representation of signals, maximum likelihood decoding; Correlation receiver, equivalence with matched filter. Generation, detection, and probability of error analysis of BPSK, coherent and non-coherent FSK, QPSK and DPSK; QAM, MSK and multicarrier modulation; Comparison of bandwidth and bit rate of digital modulation schemes.

4. Introduction to Information and Coding Theories: Information Theory: information measures, the concept of entropy, Shannon entropy, differential entropy, mutual information, capacity theorem for point-to-point channels with discrete and continuous alphabets. Coding Theory: linear block codes – definitions, properties, bounDCS on minimum distance (singleton, Hamming).

Course Outcomes (COs)

CO1	Understanding of basic theories of Digital communication system Communication and Signal Processing Lab for practical applications.
CO2	Able to design and implement various digital modulation and demodulation techniques.
CO3	Identification and description of different techniques in modern digital communications, in particular in source coding using MATLAB or similar tools
CO4	Able to understand and verify sampling theorem for practical applications.

SUGGESTED LEARNING RESOURCES:

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, M5th Ed., McGraw-Hill
4. Digital Communication: Fundamentals and ApplicationsSklar, 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. Press8. Error Control Coding S. Lin and D. Costello 2/e, Prentice Hall.

Suggested Distribution of Marks (For Paper Setters)

Topic /Unit	Time (In Hrs.)	Marks Allotted
1	16	15
2	16	15
3	16	15
4	16	15
Total	**64**	**60**

Course Code: ECPC210
Course Title: Digital Communication Systems Lab
Number of Credits: 01 (L: 0, P: 02,
DCS:01) Course Category: PC

Course Content:

1. Pulse Code Modulation and Differential Pulse Code Modulation.
2. Delta Modulation and Adaptive Delta modulation.
3. Simulation of Band Pass Signal Transmission and Reception • Amplitude Shift Keying •Frequency Shift Keying • Phase Shift Keying.
4. Performance Analysis of Band Pass Signal Transmission and Reception • Amplitude Shift Keying • Frequency Shift Keying • Phase Shift Keying.
5. Implementation of Amplitude Shift Keying
6. Implementation of Frequency Shift Keying
7. Implementation of Phase Shift Keying.
8. Time Division Multiplexing: PLL (CD 4046) based synch, clock and data extraction.

Practical Outcomes (PrOs).

The practical in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

Course Code: ECPE202(I)
Course Title: Electronic Equipment Maintenance
Number of Credits: 03 (L:3, T:0, P:0, DCS:1)
Course Category: PE

Course Objective:

1	To understand the concept of troubleshooting.
2	To study basic preparatory topics of components and their testing
3	To understand the troubleshooting procedures.

Course Content:

1. **Fundamental Troubleshooting Procedures Inside an Electronic Equipment**: Reading Drawings and Diagrams – Block Diagram, Circuit Diagram, Wiring Diagram; Disassembly 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 aiDCS – Service and maintenance manuals and instruction manuals, Test and Measuring instruments, special tools Troubleshooting techniques, Approaching components for tests, Grounding systems in Electronic Equipment, Temperature sensitive Intermittent problems Corrective actions, Situations where repairs should not be attempted.

2. **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 Thermistors Types of capacitors and their performance, Failures in capacitors, testing of capacitors and precautions therein, variable capacitor types, Testing of inductors and inductance measurement.

3. **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.

4. **Logic IC families**: Packages in Digital ICs, IC identification, IC pin-outs, Handling ICs, Digital troubleshooting methoDCS – 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.

5. **Rework and Repair**: Rework and repair of Surface Mount Assemblies, Surface Mount Technology and surface mount devices, Surface Mount Semiconductor packages – SOIC, SOT, LCCC, LGA, BGA, COB, Flat packs and Quad Packs, Cylindrical Diode Packages, Packaging of Passive Components as SMDCS, Repairing Surface Mount PCBs, Rework Stations.

Course Outcomes (COs)

CO1	Classification and generalization of testing procedure for semiconductor components.
CO2	Acquires skill of troubleshooting analog and digital circuits
CO3	Gets acquainted with fault diagnosis procedure
CO4	Familiarization of various IC Packages and logic families.

SUGGESTED LEARNING RESOURCES:

1. Modern Electronic Equipment: Trouble- shooting, 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.

Suggested Distribution of Marks (For Paper Setters and students)

Topic /Unit	Time (In Hrs.)	Marks Allotted
1	16	15
2	14	12
3	12	12
4	12	12
5	10	9
Total	**64**	**60**

Course Code: ECPE202(II)
Course Title: Bio-Medical Instrumentation
Number of Credits: 03 (L:3, T:0, P:0, DCS:1)
Course Category: PE

Course Description:
A large number of electronic equipment s are being used in hospitals for patient care anddiagnosis or carry out advanced surgeries. This subject will enable the students to learn the basic principles of different instruments used in medical science.

Course Objectives:
1 To familiarize students with the fundamental principles and technologies used in medical electronics and devices.
2 To develop an understanding about the working mechanism of various devices used in health care institutions.
3. To develop awareness of safety protocols and standarDCS in the design, operation, and maintenance of medical devices.

COURSE CONTENT:-

1. Overview of Medical Electronics Equipment: Classification, application and specificationsof diagnostic, therapeutic and clinical laboratory equipment, method of operation of these instruments.

2. Electrodes
Bioelectric signals, Bio electrodes, Electrode tissue interface, contact impedance, Types of Electrodes, Electrodes used for ECG,EEG.

3. Transducers
Typical signals from physiological parameters, pressure transducer, flow transducer, temperature transducer, pulse sensor, respiration sensor,

4. Bio Medical Recorders
Block diagram description and application of following instruments:

- ECG Machine
- EEG Machine
- EMG Machine

5. Patient Monitoring Systems

- Heart rate measurement
- Pulse rate measurement
- Respiration rate measurement
- Blood pressure measurement
- Principle of defibrillator and pace maker

6 Safety Aspects of Medical Instruments

- Gross current shock
- Micro current shock
- Special design from safety consideration
- Safety standards.

Course Outcomes (COs)

CO 1	Understand the fundamental principles of bio-medical devices, their classification and significance in healthcare.
CO 2	Understand the generation of bio-electric signal and conversion into electric signals using appropriate transducers
CO 3	Understanding of interpreting physiological measurements, such as heart rate, blood pressure, temperature, and respiration, and understand the principles and operation of medical imaging systems

SUGGESTED LEARNING RESOURCES

1. Handbook of biomedical Instrumentation by RS Khandpur
2. Biomedical Instrumentation by Cromwell,
3. Modern Electronics Equipment by RS Khandpur, TMMH, New Delhi
4. Introduction to Bio-Medical Electronics by Edward J. Perkstein; Howard Bj, USA.

Suggested Distribution of Marks (For Paper Setters and students)

Topic /Unit	Time (In Hrs.)	Marks Allotted
1	12	12
2	10	09
3	12	09
4	08	06
5	14	18
6	08	06
Total	**64**	**60**

Course Code: ECPE204(I)
Course Title: Linear Integrated Circuits
Number of Credits: 04 (L:04, T:0, P:0)
Category: PE

Course Objective:

1	To introduce the basic building blocks of linear integrated circuits
2	Illustration of Linear integrated circuit in the modern electronic devices.
3	Recognize and make use of the DC & AC limitations of OP-AMPS.
4	To introduce the theory and applications of analog multipliers and PLL.
5	To introduce the concepts of waveform generation and introduce some special function ICs.

Course Contents:

1. **IC Fabrication and Circuit Configuration for Linear IC**: Advantages of ICs over discrete components – Manufacturing process of monolithic IC's, Construction of monolithic bipolar transistor – Monolithic diodes – Integrated Resistors, Monolithic Capacitors – Inductors. Current mirror and current sources, Current sources as active loaDCS, Voltage sources, Voltage References, BJT Differential amplifier with active loaDCS, General operational amplifier stages -and internal circuit diagrams of IC 741, DC and AC performance characteristics, slew rate, Open and closed loop configurations.

2. **Applications of Operational Amplifiers**: Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V converters, adder, subtractor, Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Schmitt trigger, Precision rectifier, peak detector, clipper and clamper, Low-pass, high-pass and band-pass Butterworth filters.

3. **Analog Multiplier and PLL**: Analog Multiplier using Emitter Coupled Transistor Pair - Gilbert Multiplier cell – Variable transconductance technique, analog multiplier ICs and their applications, Operation of the basic PLL, Closed loop analysis, Voltage controlled oscillator, Monolithic PLL IC 565, application of PLL for AM detection, FM detection, FSK modulation and demodulation and Frequency synthesizing.

4. **Analog to digital and digital to analog converters**: Analog and Digital Data Conversions, D/A converter – specifications - weighted resistor type, R-2R Ladder type, Voltage Mode and Current-Mode R2R Ladder types switches for D/A converters, 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.

5. **Waveform generators and special function ICs:** Sine-wave generators, Multivibrators and Triangular wave generator, Saw-tooth wave generator, ICL8038 function generator, Timer IC 555, IC Voltage regulators – Three terminal fixed and adjust- able voltage regulators - IC 723 general purpose regulator Monolithic switching regulator, Switched capacitor filter IC MF10, Frequency to Voltage and Voltage to Frequency converters, Audio Power amplifier, Video Amplifier, Isolation Amplifier, Opto-couplers and fibre optic IC.

Course Outcomes (COs)

CO1	Description and Understanding of IC Fabrication and Circuit Configuration for Linear IC.
CO2	Design and analysis of operation amplifier application
CO3	Generalizations of the ADC and DAC operation and parameters.
CO4	Understanding of Waveform generators and special function ICs

SUGGESTED TEXT/REFERENCE BOOKS:

1. Design with operational amplifiers and analog integrated circuits, 3rd Edition Sergio Franco Tata McGraw-Hill, 2007
2. Linear Integrated Circuits, D.Roy Choudhry, ShailJainNew 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 .

Suggested Distribution of Marks (For Paper Setters and Students)

Topic /Unit	Time (In Hrs.)	Marks Allotted
1	12	12
2	12	12
3	12	12
4	14	12
5	14	12
Total	64	60

 # Common with Diploma in Electrical & Electronics Engineering

Course Code: ECPE206(I)
Course Title: Linear Integrated Circuits Lab
Number of Credits: 01 (L: 0, P: 02, DCS:01)
Course Category: PE

Course Content:

1. Operational Amplifiers (IC741)-Characteristics and Application.
2. Waveform Generation using Op-Amp (IC741).
3. Applications of Timer IC555.
4. Design of Active filters.
5. Study and application of PLL IC's.
6. Design of binary adder and subtractor.
7. Design of counters.
8. Study of multiplexer and demultiplexer /decoders. 9.Implementation of combinational logic circuits
10. Study of DAC and ADC.
11. Op-Amp voltage Regulator- IC 723

Practical Outcomes (PrOs).

The practical in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

Course Code: ECPE204(II)
Course Title: Industrial Electronics
Number of Credits: 04 (L: 4, P: 0)
Category: PE

Course Objective:

1	To introduce the various thyristor family devices
2	Understand the working of controlled rectifiers, invertor and choppers.
3	Application of power devices for AC and DC power conversion.
4	Familiarisation of DC electric drives.

Course Contents:

1. **Introduction to thyristor family:**
   - Overview of SCR, DIAC and TRIAC.
   - Different methoDCS of SCR triggering.
   - Different commutation circuits for SCR.
   - Series &parallel operation of SCR.
   - Construction, working principle of UJT, V-I characteristics of UJT, UJT as relaxation oscillator.
   - Briefintroduction to Gate Turnoff thyristor (GTO).

2. **Controlled Rectifiers**
   - Single phase half wave controlled rectifier with R & R-L load.
   - Single phase fully controlled full wave bridge rectifier R &R-L Load.
   - Single phase fully controlled full wave center tap rectifier R&R-L Load.
   - Single phase half controlled full wave rectifier with R & R-L Load.

3. **Inverters, Choppers, Dual Converters and Cyclo converters:**
   - Principle of operation of basic inverter circuits, concepts of duty cycle, series &parallel inverters & their applications.
   - Choppers: Introduction, types of choppers (Class A, Class B, ClassC and Class D). Step up and step down choppers.
   - Dual Converter sand cyclo-converters: Introduction, types & basic workingprinciple of dual converters and cyclo converters & their applications.

4. **Thyristorised Control of DC drives:**
   - DC drive control mechanism (Basic working principle)
     i) Half wave drives.
     ii) Full wave drives
     iii) Chopper drives (Speed control of DC motor using choppers)

5. **Application of Power Electronic Devices:**
   - UPS system, its block diagram and operation.Types of UPS systems: on-line, offline, line-interactive& their applications
   - Light intensity control of lamp using TRIAC
   - Speed control of universal motors
   - fan regulator
   - Automatic battery charger circuit.

Course Outcomes (COs)

CO 1	Understanding the working mechanisms of various power devices.
CO 2	Understanding the controlled power conversion concepts AC to DC, DC to AC, AC to AC and DC to DC conversion.
CO 3	Understanding of working mechanism of DC electric drives
CO 4	Use of power devices in different areas.

SUGGESTED TEXT/REFERENCE BOOKS:

1. Power Electronics by P. C. Sen Tata McGraw Hill. New Delhi
2. Power Electronics by P. S. Bhimbhra, Khanna Publishers, New Delhi
3. Power Electronics by M. S. Berde, Khanna Publishers, New Delhi.
4. Power Electronics by M. D. Singh and K. B. Khanchandani, Tata Mc-Graw Hill, New Delhi.
5. Industrial Electronics and Control by S. K. Bhattacharya and S. Chatterji, New AgePublications, New Delhi
6. Power Electronics by S Rama Reddy, Narosa Publishing House Pvt. Ltd., New Delhi

Suggested Distribution of Marks (For Paper Setters and Students)

Topic /Unit	Time (In Hrs.)	Marks Allotted
1	18	15
2	12	12
3	18	15
4	08	8
5	08	10
Total	**64**	**60**

 # Common with Diploma in Mechatronics

Course Code: ECPE206(II)
Course Title: Industrial Electronics Lab
Number of Credits: 01 (L: 0, P: 02, DCS:01)
Course Category: PE

Course Content:

1. To plot VI characteristic of an SCR and measure latching current and holding current.
2. To plot VI characteristics of DIAC and measure its break over voltage.
3. To plot VI characteristics of TRIAC for various firing angles.
4. To plot VI characteristics of UJT and its use as relaxation oscillator.
5. To observe the wave shape of voltage at relevant point of single-phase half wavecontrolled rectifier and effect of change of firing angle.
6. To observe the wave shapes of voltage at relevant point of single phase fullwave controlled rectifier and effect of change of firing angle.
7. To observe the wave shapes and measurement of voltage at relevant points inTRIAC based AC phase control circuit for varying lamp intensity.
8. To control the speedof universal motor using SCR.

Practical Outcomes (PrOs).

The practical in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

Course Code: PR202
Course Title: Minor Project Work
Number of Credits: 02(L: 0, T: 0, P: 4)
Prerequisites: NIL
Course Category: PR

Course Content: List of Suggested Minor Project

1. Regulated power supply.
2. Timers using 555 and other oscillators.
3. Touch plate switches– transistorized or 555 based.
4. Doorbell/cordless bell.
5. Clapping switch and IR switch.
6. Blinkers.
7. Sirens and hooters.
8. Single hand AM or FM.
9. Electronic toy gun, walker, blinkers.
10. Electronic dice.
11. Cell charger, battery charger, mobile charger.
12. Fire/smoke/intruder alarm.
13. Liquid level controller.
14. Counters.
15. Combination locks.
16. Electronics musical instruments.
17. Telephone hanDCSet.
18. Electronic Ballasts.
19. Audio amplifiers.
20. Tape recorders.
21. Automatic stabilizer/CVT.
22. Emergency light.
23. Design and manufacture of transformer.
24. Fan regulator.
25. Dish Antenna.
26. Any other innovative idea student wishes to make as minor project.

Course Outcomes The project should include those components which students have studied in earlier classes, with a clear idea of signal processing. It would enable them first-hand experience of components, their purchase, assembly, testing and trouble shooting. It would boost up confidence of the students to repair and prepare Electronic gadgets. There should not be more than 2 to 3 students for each project. A report must be prepared in the form of hard copy. Some of the projects are listed above which is just a guide line for selecting the minor project. Students can select other than these also with the consultation of teacher.

Course Code	:	**AU202**
Course Title	:	**Essence of Indian Knowledge & Tradition**
Number of Credits (Teaching Load)	:	0 (L: 2, DCS:0; P:0)
Prerequisites	:	-
Course Category	:	AU (Audit Course)

Course Learning Objectives

The objective of this course is to expose the students with the concepts of Indian traditional knowledge and to make them appreciate the importance of the roots of indigenous knowledge system.

Course Outcomes

After completing this course the students will be able to:

CO-1.Identify the concept of Indian Knowledge System (IKS).

CO-2.Understand the need and importance of protecting traditional knowledge.

CO-3.Compare the Indian traditional knowledge and modern science.

CO-4.Understand the use of Yoga in stress management, mental health, mindfulness, healthy eating, weight loss and quality sleep.

CO-5.Aware of the general knowledge of Himachal Pradesh.

Course Content

Unit 1 Indian Knowledge System (IKS):----------25%

- Introduction and Function of Indian Knowledge System(IKS).
- The Basic Structure of Indian Knowledge System(IKS) (only Introduction)

1. The 4 Vedas, Namly ऋग्वेद (Rigveda) ,यजुर्वेद (Yajurveda),सामवेद (Samaveda) ,अथर्ववेद (Atharvaveda) .
2. The 4 UpVedas, Namely आयुर्वेद (Ayurveda (health-care)), धनुर्वेद (Dhanurveda (archery)), गंधर्ववेद (Gandharva-veda (dance, music etc.)) and स्थापत्यवेद (Sthapatyaveda (architecture)).
3. The 6 Vedagangs ,namely Shiksha (शिक्षा), Kalpa (कल्प), Vykaraṇa (व्याकरण), Chhandas छंदस्), Nirukta (निरुक्त), and Jyotisha(ज्योतिष).
4. Itihasa (इतिहास) (Ramayana रामायण and Mahabharata महाभारत) and Purana पुराण (Vishnupurana विष्णुपुराण , Bhagavata Purana (भागवत पुराण) etc.)
5. Dharmashatraधर्मशास्त्र (Manusmriti मनुस्मृति, Yajnavalkya-smriti याज्ञवल्क्य स्मृति, etc.).

6. Darshan दर्शन (आस्तिक तथा नास्तिक).
7. Nyaya न्याय (Logic तर्कशास्त्र and Epistemology ज्ञानमीमांसा).

Unit 2 : Modern Science **20% Marks**

- Modern science: Introduction, Characteristics, importance and Example
- Difference between modern Science and Indian knowledge system
- Role of IKS in modern science

Unit 3 : Traditional knowledge **15% Marks**

- Traditional knowledge: Definition, nature, characteristics, scope and importance
- Indigenous Knowledge (IK): characteristics
- Traditional knowledge vis-a-vis Indigenous knowledge
- Traditional knowledge Vs western knowledge
- The need for protecting traditional knowledge

Unit 4 : Yoga and Holistic Health Care **25% Marks**

- Yoga: Meaning and Importance of Yoga
- Yoga and physical health, Yoga and psychological health, Yoga and intellectual health, Yoga and spiritual health, Yoga and social approach.
- Introduction to Ashtanga Yoga, Yogic Kriyas (Shat Karma)
- Pranayama and its types; Active lifestyle and stress management through Yoga
- Physical Fitness, Health and wellness: Meaning and Importance of Wellness,
- Components of Wellness, Health and physical Fitness;
- Traditional sports & Regional Games for promoting wellness:
- Leadership through Physical Activity and Sports; Introduction to First Aid.

Unit 5 : Himachal Pradesh: A Basic Information **15% Marks**

- History, Culture, Heritage/ Tradition, Customs & Manners,
- Regional Knowledge, Geographical Features, Constitutional History
- Tourism Place & Scope
- Festivals and Fairs

Suggested Text/ Reference Books

1. Cultural Heritage of India-Course Material by V. SivaramakrishnaBharatiya, VidyaBhavan, Mumbai, 5th Edition, 2014
2. Modern Physics and Vedant by Swami JitatmanandBharatiya, VidyaBhavan
3. The wave of Life by Fritz of Capra
4. Tao of Physics Fritz of Capra
5. Tarkasangraha of Annam Bhatta, International by V N Jha, Chinmay Foundation, Velliarnad, Ernakulam
6. Science of Consciousness Psychotherapy and Yoga Practices by RN Jha, VidyanidhiPrakashan, Delhi, 2016
7. Himachal Pradesh History, Culture & Economy by MianGoverdhan Singh & Prof. Dr. C.L. Gupta.

SUGGESTED DISTRIBUTION OF MARKS (Internal Assessment)		
Project Component	**Time Allotted (Hrs)**	**Marks Allotted (%)**
Unit 1 : Indian Knowledge System (IKS)	8	25%
Unit 2 : Modern Science	6	20%
Unit 3 : Traditional knowledge	5	15%
Unit 4 : Yoga and Holistic Health Care	8	25%
Unit 5 : Himachal Pradesh: A Basic Information	5	15%
Total	32	100%

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Course Code	:	**SI-II**
Course Title	:	**Internship-II**
Number of Credits (Teaching Load)	:	3 (L: 0; T:0; P:0)
Prerequisites	:	-
Course Category	:	SI (Internship)

Guidelines

An internship of Six weeks after 4th semester during vacations should be undertaken by the students in relevant Industry. The objective of this mandatory internship is to expose the students to the real world of work and get experience with the latest tools, best practices, work & culture, etiquettes and ethics followed in modern industries. The assessment of internship will be carried out in 5th semester. The faculty members must visit the internship site during the course of internship to monitor the progress of the students.

Evaluation Criteria

The internal assessment of internship is to be carried out by the Industry/ Organization where the students have undergone the internship. The internal assessment done by the industry/ organization may be rationalized by the Department, if needed. The external assessment is to be done at the Institute. The department shall finalize external assessment within a month of the beginning of the 5th semester. The studentshave to prepare a daily diary of their internship period and the same has to be submitted at the institute after completion of the internship. The students have also to present the experience gained during internship in a seminar for the purpose of external evaluation.

(a) The assessment criteria (Internal Assessment) by the industry/ organization where the students have undergone the internship is asfollows:

- Attendance and general behavior : 20%
- Daily diary maintenance : 20%
- Initiative and participative attitude during internship : 20%
- Performance in the assigned activities by the industrial supervisor :40%

(b) The assessment criteria (External Assessment) by the institute is asfollows:

- Presentation : 60%
- Report : 20%
- Viva : 20%