GOVERNMENT OF NAGALAND

DIRECTORATE OF TECHNICAL EDUCATION
NAGALAND: KOHIMA

DIPLOMA CURRICULUM STRUCTURE FOR ELECTRONICS AND COMMUNICATION ENGINERING (ECE) 3 (THREE) YEARS COURSE

APPROVED
BY
STATE COUNCIL FOR TECHNICAL EDUCATION
(SCTE)
NAGALAND

DESIGNED IN COLLABORATION WITH

- STRUCTURE BY NITTTR, KOLKATA
- AICTE MODEL CURRICULUM
- BASED ON NEP2020
- COA GUIDELINES AND NORMS

FOR THE STATE OF NAGALAND
(*July 2025*)

1.1 STUDY AND EVALUATION SCHEME FOR DIPLOMA IN ELECTRONICS AND COMMUNICATION ENGINEERING

FIRST SEMESTER

SL. No	Category of Course	Code No	Course Title	Study Scheme				Evaluation Scheme							Total Marks	Credits
				Prerequisite	Contact Hours/ week			Theory				Practical				
					L	T	P	End Exam	Progressive Assessment			End Exam	Progressive Assessment			
									Class Test	Assignment	Attendance		Sessional	Viva voce		
1	BASIC SCIENCE	BS101	Mathematics -I		2	1	0	60	20	15	5	-	-	-	100	3
2		BS103	Applied Physics -I		2	1	0	60	20	15	5	-	-	-	100	3
3		BS 105	Applied Chemistry		2	1	0	60	20	15	5	-	-	-	100	3
4		BS107	Applied Physics –I Lab		0	0	2	0	-	-	-	40	40	20	100	1
5		BS109	Applied Chemistry Lab		0	0	2	0	-	-	-	40	40	20	100	1
6	HUMANITIES & SOCIAL SCIENCE	HS101	Communication skills in English		2	0	0	60	20	15	5	-	-	-	100	2
7		HS 103	Sports & Yoga/ NCC/NSS		0	0	2	-	-	-	-	40	40	20	100	1
8		HS 105	Communication skills in English Lab -I		0	0	2	-	-	-	-	40	40	20	100	1
9	ENGINEERING SCIENCE	ES101	Engineering Graphics		0	0	3	-	-	-	-	-	60	40	100	1.5
10		ES103	Engineering Workshop Practice		0	0	3	-	-	-	-	-	60	40	100	1.5
TOTAL					8	3	14	240	80	60	20	160	280	160	1000	18

1.2 STUDY AND EVALUATION SCHEME FOR DIPLOMA IN ELECTRONICS AND COMMUNICATION ENGINEERING

SECOND SEMESTER

SL. No	Category of Course	Code No	Course Title	Study Scheme				Evaluation Scheme							Total Marks	Credits
				Prerequisite	Contact Hours/ week			Theory				Practical				
					L	T	P	End Exam	Progressive Assessment			End Exam	Progressive Assessment			
									Class Test	Assignment	Attendance		Sessional	Viva voce		
1	BASIC SCIENCE	BS102	Mathematics - II	BS101	3	1	0	60	20	15	5	-	-	-	100	4
2		BS104	Applied Physics - II	BS103	2	1	0	60	20	15	5	-	-	-	100	3
3		BS106	Applied Physics – II Lab	BS107	0	0	2	-	-	-	-	40	40	20	100	1
4	ENGINEERING SCIENCE	ES102	Introduction to IT Systems		2	0	0	60	20	15	5	-	-	-	100	2
5		ES104	Fundamentals of Electrical & Electronics Engineering		2	1	0	60	20	15	5	-	-	-	100	3
6		ES106	Engineering Mechanics		2	1	0	60	20	15	5	-	-	-	100	3
7		ES108	Introduction to IT Systems Lab		0	0	4	-	-	-	-	40	40	20	100	2
8		ES110	Fundamentals of Electrical & Electronics Engineering Lab		0	0	2	-	-	-	-	40	40	20	100	1
9		ES112	Engineering Mechanics Lab		0	0	2	-	-	-	-	40	40	20	100	1
10	MANDATORY AUDIT COURSE	AU102	Environmental Science		2	0	0	0	0	0	0	0	0	0	0	0
`TOTAL					13	4	10	300	100	75	25	160	160	80	900	20

1.3 STUDY AND EVALUATION SCHEME FOR DIPLOMA IN ELECTRONICS AND COMMUNICATION ENGINEERING THIRD SEMESTER

SL. No	Category of Course	Code No	Course Title	Study Scheme				Evaluation Scheme							Total Marks	Credits
				Prerequisite	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	Communication Electronics	ES104	2	1	0	60	20	15	5	0	0	0	100	3
2		ECPC202	Semiconductor Devices & Electronic Circuits	ES104	3	0	0	60	20	15	5	0	0	0	100	3
3		ECPC203	Digital Electronics	ES104	3	0	0	60	20	15	5	0	0	0	100	3
4		ECPC204	Electronic Instrumentation and Measurements	ES104	3	0	0	60	20	15	5	0	0	0	100	3
5		ECPC205	Electric Circuits	ES104	2	1	0	60	20	15	5	0	0	0	100	3
6		ECPC211	Communication Electronics Lab	ES 104	0	0	2	0	0	0	0	40	40	20	100	1
7		ECPC212	Semiconductor Devices & Electronic Circuits Lab	ES110	0	0	2	0	0	0	0	40	40	20	100	1
8		ECPC213	Digital Electronics Lab	ES110	0	0	2	0	0	0	0	40	40	20	100	1
9		ECPC214	Electronic Instrumentation and Measurements Lab	ES104	0	0	2	0	0	0	0	40	40	20	100	1
10		ECPC215	Electric Circuits Lab	ES110	0	0	2	0	0	0	0	40	40	20	100	1
11	SUMMER INTERNSHIP (10 Days) after Semester II	SI201	Summer Internship-I		0	0	0	-	-	-	-	40	40	20	100	2
TOTAL					13	2	10	300	100	75	25	240	240	120	1100	22

1.4 STUDY AND EVALUATION SCHEME FOR DIPLOMA IN ELECTRONICS AND COMMUNICATION ENGINEERING

FOURTH SEMESTER

SL. No	Category of Course	Code No	Course Title	Study Scheme				Evaluation Scheme							Total Marks	Credits
				Prerequisite	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	ECPC206	Microprocessor and Microcontroller	ECPC203	3	0	0	60	20	15	5	-	-	-	100	3
2		ECPC207	Power Electronics	ECPC202	3	0	0	60	20	15	5	-	-	-	100	3
3		ECPE208	Digital Communication	ECPC201	2	1	0	60	20	15	5	-	-	-	100	3
4		ECPC216	Microprocessor and Microcontroller Lab	ECPC203	0	0	2	-	-	-	-	40	40	20	100	1
5		ECPC217	Digital Communication Lab	ECPC201	0	0	2	-	-	-	-	40	40	20	100	1
6	PROGRAM ELECTIVE COURSE	ECPE201 (Any one)	A. Microwave and RADAR Engineering B. Control System		3	0	0	60	20	15	5	-	-	-	100	3
7		ECPE202 (Any one)	A. Linear Integrated Circuits B. Basics of VLSI Design		3	0	0	60	20	15	5	-	-	-	100	3
8		ECPE211 (Any one)	A. Linear Integrated Circuits Lab B. Basics of VLSI Design 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					16	1	10	300	100	75	25	160	160	80	900	20

1.5 STUDY AND EVALUATION SCHEME FOR DIPLOMA IN ELECTRONICS AND COMMUNICATION ENGINEERING FIFTH SEMESTER

SL. No	Category of Course	Code No	Course Title	Study Scheme				Evaluation Scheme							Total Marks	Credits
				Prerequisite	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	ECPC206	3	0	0	60	20	15	5	0	0	0	100	3
2		ECPC302	Mobile and Wireless Communication	ECPC208	2	1	0	60	20	15	5	0	0	0	100	3
3		ECPC311	Embedded Systems Lab	ECPC206	0	0	2	-	-	-	-	40	40	20	100	1
5	Program Elective Course	ECPE301 (Any one)	A. Simulation Software B. Consumer Electronics		3	0	0	60	20	15	5	-	-	-	100	3
6		ECPE302 (Any one)	A. Digital Signal Processing B. Optical Fiber Communications		3	0	0	60	20	15	5	-	-	-	100	3
7		ECPE311 (Any one)	A. Simulation Software Lab B. Consumer Electronics Lab		0	0	2	-	-	-	-	40	40	20	100	1
8		ECPE312	A. Digital Signal Processing Lab B. Optical Fiber Communications 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 (21Days) 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					14	1	8	300	100	75	25	160	160	80	900	21

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

1.6 STUDY AND EVALUATION SCHEME FOR DIPLOMA IN ELECTRONICS AND COMMUNICATION ENGINEERING

SIXTH SEMESTER

SL. No	Category of Course	Code No	Course Title	Study Scheme				Evaluation Scheme							Total Marks	Credits
				Prerequisite	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	ECPC303	Computer Networks		**3**	**0**	**0**	**60**	**20**	**15**	**5**	**0**	**0**	**0**	**100**	**3**
2		ECPC312	Computer Networks 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		**0**	**0**	**2**	**-**	**-**	**-**	**-**	**0**	**50**	**50**	**100**	**1**
Total					**14**	**1**	**10**	**240**	**80**	**60**	**20**	**140**	**140**	**120**	**800**	**19**

2. LIST OF PROGRAM CORE COURSES (PC) FOR DIPLOMA IN ELECTRONICS AND COMMUNICATION ENGINEERING

Sl. No.	Code No.	Course Title	Hours per Week			Semester	Credits
			L	T	P		
1	ECPC 201	Communication Electronics	2	1	0	3	3
2	ECPC 211	Communication Electronics Lab	0	0	2	3	1
3	ECPC 202	Semiconductor Devices & Electronic Circuits	3	0	0	3	3
4	ECPC 212	Semiconductor Devices & Electronic Circuits Lab	0	0	2	3	1
5	ECPC 203	Digital Electronics	3	0	0	3	3
6	ECPC 213	Digital Electronics Lab	0	0	2	3	1
7	ECPC 204	Electronic Instrumentation and Measurements	3	0	0	3	3
8	ECPC 214	Electronic Instrumentation and Measurements Lab	0	0	2	3	1
9	ECPC 205	Electric Circuits	2	1	0	3	3
10	ECPC 215	Electric Circuits Lab	0	0	2	3	1
11	ECPC 206	Microprocessor and Microcontroller	3	0	0	4	3
12	ECPC 216	Microprocessor and Microcontroller Lab	0	0	2	4	1
13	ECPC 207	Power Electronics	3	0	0	4	3
14	ECPC 208	Digital Communication	2	1	0	4	3
15	ECPC 217	Digital Communication Lab	0	0	2	4	1
16	ECPC 301	Embedded Systems	3	0	0	5	3
17	ECPC 311	Embedded Systems Lab	0	0	2	5	1
18	ECPC 302	Mobile and Wireless Communication	2	1	0	5	3
19	ECPC 303	Computer Networks	3	0	0	6	3
20	ECPC 312	Computer Networks Lab	0	0	2	6	1
Total Credits							**42**

		Semester III
Course Code	:	ECPC 201
Course Title	:	Communication Electronics
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites	:	ES 104
Course Category	:	PC

RATIONALE

The study of principles of communication systems leads to further specialized study of audio and video systems, line communications and microwave communication systems. Thus the diploma-holder in Electronics and Communication Engineering shall find employment in areas of R and D, production, servicing and maintenance of various communication systems. The students should understand the advantage and limitations of various analog and digital modulation systems on a comparative a scale and relate to them while studying practical communication systems.

DETAILED CONTENTS

Unit	Topics	No. of Lectures
I	**AM GENERATION & TRANSMISSION**: Need for modulation-Amplitude Modulation- Frequency spectrum of the AM wave- Modulation index- Power relation in the AM wave- AM generation- AM transmitter- Forms of Amplitude Modulation- Evolution of SSB- Balance Modulator- Methods of SSB generation- VSB transmission	**14**
II	**FM GENERATION & TRANSMISSION:** Frequency Modulation- Frequency spectrum of the FM wave- Modulation index- Effect of noise- Adjacent & Co-channel Interference- Wide band & Narrow band FM- FM generation	**06**
III	**AM & FM RECEPTION:** AM receiver- TRF receiver- Super Heterodyne receiver- Image frequency rejection- Frequency changing & tracking- Choice of IF- AM detection- AGC- SSB detection- FM receiver- Amplitude limiter- De-emphasis- FM detection- Balance slope detector- Phase discriminator- Ratio detector- Direct & In direct methods- FM transmission- Pre-emphasis	**12**

IV	**PULSE MODULATION:** PAM modulation & detection- PWM modulation & detection- PPM modulation & detection- Sampling theorem- Quantization & quantization error- PCM modulation & detection- Companding- ASK- FSK- BPSK- QPSK- DPSK	**08**
V	**CELLULAR COMMUNICATION:** Concept of cellular mobile communication- Frequency bands used in cellular communication- Frequency reuse- Roaming & handoff- Architecture of cellular	**08**
	mobile communication network- CDMA overview- Comparative study of GSM and CDMA- 2G, 3G & 4G concepts	

Instructional Strategy:

The subject requires both theory and practical emphasis simultaneously, so that the student can understand the practical significance of the various areas. Visits to instrumentation and communications industries must be carried out, so as to make the students can understand where and how the various instruments are used in the industry.

Suggested Books:

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:

1. Use of different modulation and demodulation techniques used in analog communication.
2. Identify and solve basic communication problem's.
3. Analyze transmitter and receiver circuits.
4. Compare and contrast design issues, advantages, disadvantages and limitations of analog communication systems.

Suggestive Distribution of Marks

Unit	Topic	Time Allotted (Hrs)	Distribution (Theory Marks)			
			R Level	U Level	A Level	Total
I	AM Generation & Transmission	14	04	08	06	18
II	FM Generation & Transmission	06	02	05	-	07
III	AM & FM Reception	12	04	05	06	15

IV	Pulse Modulation	08	02	04	04	10
V	Cellular Communication	08	02	04	04	10
	Total	**48**	**14**	**26**	**20**	**60**

Legends: *R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)*

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		Semester III
Course Code	:	ECPC 211
Course Title	:	Communication Electronics Lab
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	ES 104
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 the different techniques of signal modulation and demodulation.
2. Understanding the variation in amplitude of controllers.

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		Semester III
Course Code	:	ECPC 202
Course Title	:	Semiconductor Devices & Electronic Circuits
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	ES 104
Course Category	:	PC

RATIONALE

In unit I to II, the students will attain the basic knowledge of electronic devices like diodes, transistors, and elementary circuits. In later units, the course will enable the students to learn about the use of transistors in analog circuits like voltage amplifier, power amplifier, multistage amplifier, tuned amplifiers, oscillators, etc. It also gives information about FET, MOSFETs, C-MOS and their applications for effective functioning in the field of electronic service industry.

DETAILED CONTENTS

Unit	Topics	No. of Lectures
I	**Semiconductor Basics:** Introduction to semiconductor materials, Intrinsic & extrinsic semiconductors, N type semiconductors, P type semiconductors with reference to energy levels, Donors, Acceptors, concept of fermi level.	04
II	**PN Junction Diode:** Symbols, pins, unbiased diode, depletion layer, barrier potential, working in forward bias & reverse bias, concept of breakdown, I-V characteristic, knee voltage, break down voltage, bulk resistance, zener diode, light emitting diode, photo diode, solar cell.	04
III	**Bipolar Junction Transistor (BJT):** Symbols, pins, basic types- PNP and NPN, unbiased transistors, biased transistors, transistor currents, concept of current gain, $\propto$, β of BJT, configurations CE, CB and CC, with respect to CE configuration I-V characteristics- base curve and collector curve, load line, operating point, biasing techniques- voltage divider bias, emitter bias, collector feedback bias and base bias.	12

IV	**UJT, JFET and MOSFET:** Symbols, types, construction, working principles, I-V characteristics, specification parameter of UJT, JFET and MOSFET, comparison of UJT, JFET and MOSFET.	**08**
V	**Diode Circuits:** Half wave rectifier, transformer, full wave rectifier, bridge rectifier, choke input filter, capacitor input filter, peak inverse voltage and surge current, block diagram of power supply, zener regulator, clippers and limiters, clampers and voltage multipliers.	**10**
VI	**Transistor Circuits:** Transistor as a switch, transistor as an amplifier, class A operation, class B operation, Emitter follower, class B push pull emitter follower, class C operation, single staged RC coupled CE amplifier, voltage gain, concept of frequency response and bandwidth, JFET biasing in ohmic/active region, MOSFET in digital switching.	**10**

Suggested Software/ Learning Website: 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

Suggested Books:

S. No.	Title of Book	Author	Publication
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 & Nash-elsky	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

Course Outcome:

1. Understand the basic material and properties of semiconductors
2. Explore the constructional features of basic semiconductor devices
3. Describe the biasing principles of semiconductor devices like diode and transistor.
4. Explain the I-V characteristics of semiconductor devices like diode, UJT, JFET and MOSFET
5. The learner will be able to apply basic concepts of P-N junction in developing simple application circuits.
6. Understand the power supply at block level
7. Attain knowledge of various amplifiers and their comparison.
8. Identify the application of JFET and MOSFET
9. Familiarization with basics of Thyristor families.

Suggestive Distribution of Marks

Unit	Topic	Time Allotted (Hrs)	Distribution (Theory Marks)			
			R Level	U Level	A Level	Total
I	Semiconductor Basics	04	03	02	-	05
II	PN Junction Diode	04	02	02	02	06
III	Bipolar Junction Transistor (BJT)	12	02	07	06	15
IV	UJT, JFET and MOSFET	08	02	04	04	10
V	Diode Circuits	10	03	03	06	12
VI	Transistor Circuits	10	02	05	05	12
	Total	**48**	**14**	**23**	**23**	**60**

Legends: *R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)*

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		Semester III
Course Code	:	ECPC 212
Course Title	:	Semiconductor Devices & Electronic Circuits Lab
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	ES 110
Course Category	:	PC

Course Content:

1. Study of the I-V characteristic of Diode – Ordinary and Zener Diode.
2. Study of the I-V characteristic of the CE configuration of BJT and obtain ri, ro, β
3. Study of the I-V characteristic of the CB configuration of BJT and obtain ri, ro, β
4. Study of the I-V characteristic of the CC configuration of BJT and obtain ri, ro, β
5. Study of the I-V characteristic of UJT and SCR
6. Study of the I-V characteristic of JFET and MOSFET
7. Study of characteristics of solar cell
8. Study of Hall effect
9. Construct a Half Wave Rectifier and obtain regulation characteristics – Without Filters and with Filters Compare the results
10. Construct a Full Wave Rectifier and obtain regulation characteristics – Without Filters and with Filters Compare the results
11. Construct a Bridge Rectifier and obtain regulation characteristics – Without Filters and with Filters
12. Study of clipping and clamping circuit.
13. Designing of single stage CE amplifier.
14. Study of class A, B and C power amplifiers.
15. Designing and testing of 5V/9V DC regulated power supply and find its load regulation.
16. Simulate half wave, full wave and bridge rectifier using simulation tool like PSpice/ Orcad/ Multisim.
17. Develop a simulation model for Voltage Series and Voltage Shunt Feedback Amplifiers.
18. Develop a simulation model for Current Series and Current Shunt Feedback Amplifiers.

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.

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		Semester III
Course Code	:	ECPC 203
Course Title	:	Digital Electronics
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	ES 104
Course Category	:	PC

Rationale:

To study different logic families. To introduce different logic gates, their Boolean algebra and combinational logic design using those gates. To learn how to design sequential logic using flip flop. After this course the student will be able to design simple logic circuits, assemble logic circuits, test the logic circuits, observe outputs of logic circuits and troubleshoot digital circuits

DETAILED CONTENTS

Unit	Topics	No. of Lectures
I	**Number Systems and Codes:** Binary number system, Binary to Decimal conversion, Decimal to binary conversion, Octal numbers, Hexadecimal numbers, ASCII codes, Excess-3 code, Gray code, Error detection and correction.	04
II	**Digital Principles and Logic:** Digital signal definition, Digital waveform, Digital logic, Digital computers, Digital Integrated Circuits, Digital IC signal levels, Digital logic, Basic gates-NOT, OR, AND, universal logic gates-NOR, NAND, AND-OR- Invert gates, Positive and Negative logic.	08
III	**Combination Logic Circuits:** Boolean laws and theorems, Sum of Products method, Truth table to Karnaugh map, pairs, quads and octets, Karnaugh simplification, Don't care condition, Product of Sum simplification, simplification by Quine Mc Clusky method.	06
IV	**Arithmetic Circuits:** Binary addition, Binary subtraction, Unsigned binary numbers, Sign- magnitude numbers, 2's compliment representation, 2's compliment arithmetic, arithmetic building block, Adder-Subtractor, Fast-adder, Arithmetic Logic Unit, Binary multiplication and division.	08

V	**Latches:** Latches, Flip flops- SR, JK, D, T and master slave edge triggering, Level triggering asynchronous ripple and serial counter, Asynchronous Up/Down counter, Synchronous counter, Synchronous Up/Down counter, programmable counter, Modulo-n counter, Registers- shift register, universal shift register.	**10**

Suggested Books:

1. Digital System Design- Morris Mano, Pearson Education (2014)
2. Digital Principles- Schaum's outline series, Tata Mcgraw Hill (2006)
3. Digital Fundamentals- T.L.Floyld, Pearson Education (2013)
4. Electronic principles- A.P.Malvino, Tata Mcgraw Hill (2003)

Course Outcome:

1. Convert different types of codes and number systems in computer and communication.
2. Describe switch model used to illustrate building blocks of digital circuits.
3. Use Boolean algebra and Karnaugh maps for reduction of logic expression and circuits.
4. Perform arithmetic operation on binary numbers and design simple arithmetic logic circuits.

Suggestive Distribution of Marks

Unit	Topic	Time Allotted (Hrs)	Distribution (Theory Marks)			
			R Level	U Level	A Level	Total
I	Number Systems and Codes	04	02	02	-	04
II	Digital Principles and Logic	08	02	08	04	14
III	Combination Logic Circuits	06	02	05	05	12
IV	Arithmetic Circuits	08	02	05	07	14
V	Latches	10	03	08	05	16
Total		**36**	**11**	**28**	**21**	**60**

Legends: *R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)*

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		Semester III
Course Code	:	ECPC 213
Course Title	:	Digital Electronics Lab
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	ES 110
Course Category	:	PC

Course Content:

S. No.	Practical Outcomes (PrOs)	Approx. Hrs. Required
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	02
2.	Implement and realize Boolean Expressions with Logic Gates	02
3.	Implement Half Adder, Full Adder, Half Subtractor, Full subtractor using ICs	02
4.	Implement parallel and serial full-adder using ICs	02
5.	Design and development of Multiplexer and De-multiplexer using multiplexer ICs	02
6.	Verification of Demorgan's Theorem	02
7.	Verification of the function of SR,D, JK and T Flip Flops	02
8.	Design controlled shift registers	03
9.	Construct a Single digit Decade Counter (0-9) with 7 segment display	03
10.	To design a programmable Up-Down Counter with a 7 segment display.	02
11.	Study of different memory ICs	02
12.	Study Digital- to – Analog and Analog to Digital Converters	03
13.	Simulate in Software (such as PSpice) an Analog to Digital Converter	03
	Total	**30**

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.

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		Semester III
Course Code	:	ECPC 204
Course Title	:	Electronic Instrumentation and Measurements
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	ES 104
Course Category	:	PC

RATIONALE

In the real world of work, the technician is required to handle wide variety of instruments while testing, trouble shooting, calibration etc. the study of this subject will help students to gain the knowledge of working principles and operation of different instruments. During practical sessions, he will acquire the requisite skills.

DETAILED CONTENTS

Unit	Topics	No. of Lectures
I	**Generalized Measurement system:** Accuracy, Precision, Fidelity, speed of response, static & dynamic performance characteristics, dynamic- step response, ramp response of first and second order instruments. Classifications of errors, error analysis of measurement.	08
II	**Analog and Digital instruments:** PMMC Galvanometer, Analog multimeter, range extension of voltmeter and ammeter, Series and shunt ohmmeter. Digital multimeter, Signal generator and Function generator. Cathode Ray Oscilloscope, basic of CRO circuit and components. Uses of CRO for different measurement. Lissajous pattern.	14
III	**AC and DC Bridges:** Introduction to DC and AC bridges for measurement of voltage / current / resistance /capacitance and inductance.	10
IV	**Transducer:** Classification, Selection Criteria, Characteristics, Construction, Working Principles and Application of following Transducers: RTD, Thermocouple, Thermistor LVDT, Strain Gauge, Load Cell, piezoelectric transducer.	08

Instructional Strategy:

The subject requires both theory and practical emphasis simultaneously, so that the student can understand the practical significance of the various areas. Visits to instrumentation and communications industries must be carried out, so as to make the students can understand where and how the various instruments are used in the industry

Suggested Books:

1. Principles of Electronics instrumentation and measurements. Berlyn and Getz (McMillan Pub. Co.)
2. A Course in Electrical Electronics Measurements and instrumentation. A.K. Sawhney (Dhanpat Roy & Co.).
3. Modern Electronics Instrumentation and Measurement Techniques Albert D. Heltrick, W. D. Cooper. (PHI).
4. Murthy DVS – Transducers & Instrumentation, PHI, ND, 1995.
5. Elements of Electronic Instrumentation and Measurement. Joseph J. Carr. Pearson Education
6. PC-Based Instrumentation Concept and Practice N. Mathivanan PHI

Course Outcome:

1. Study of different measurement terminology and dynamic response of measuring instruments.
2. Understand the concepts of popular instruments like analog, digital and cathode ray oscilloscope
3. Acquire the concept and use of different types of bridges
4. Study of different types of transducers and their application

Suggestive Distribution of Marks

Unit	Topic	Time Allotted (Hrs)	Distribution (Theory Marks)			
			R Level	U Level	A Level	Total
I	Generalized Measurement system	08	03	05	04	12
II	Analog and Digital instruments	14	04	05	11	20
III	AC and DC Bridges	10	03	04	09	16
IV	Transducer	08	02	04	06	12
	Total	**40**	**12**	**18**	**30**	**60**

Legends: *R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)*

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		Semester III
Course Code	:	ECPC 214
Course Title	:	Electronic Instrumentation and Measurements Lab
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	ES 104
Course Category	:	PC

Course Content:

S. No.	Practical Outcomes (PrOs)	Approx Hrs. Required
1.	Measure unknown inductance using following bridges (a) Anderson Bridge (b) Maxwell Bridge	4
2.	Measure Low resistance by Kelvin's Double Bridge	2
3.	Calibrate an ammeter using DC slide wire potentiometer	2
4.	Calibrate a voltmeter using Crompton potentiometer	2
5.	Measure low resistance by Crompton potentiometer	2
6.	Calibrate a single-phase energy meter by phantom loading	2
7.	Study the working of Q-meter and measure Q of coils	2
8.	Study working and applications of (i) C.R.O. (ii) Digital Storage C.R.O. & (ii) C.R.O. Probes	2
9.	Measurement of displacement with the help of LVDT	2
10.	Draw the characteristics of the following temperature transducers (a) RTD (Pt-100) (b) Thermistor	2
11.	Measurement of strain/force with the help of strain gauge load cell	2

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.

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		Semester III
Course Code	:	ECPC 205
Course Title	:	Electric Circuits
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites	:	ES 104
Course Category	:	PC

RATIONALE:

The concept of electrical Circuit is very essential for the study of the other subjects in Electrical Engineering. This subject covers the basic electrical principles both on D.C and A.C circuits. Analysis of series and parallel circuits have also been covered.

DETAILED CONTENTS

Unit	Topics	No. of Lectures
I	**Single Phase A.C Series Circuits:** Generation of alternating voltage, Phasor representation of sinusoidal quantities R, L, C circuit elements its voltage and current response ,R-L, R-C, R-L-C combination of A.C series circuit, impedance, reactance, impedance triangle, Power factor, active power, reactive power, apparent power, power triangle and vector diagram Resonance, Bandwidth, Quality factor and voltage magnification in series R-L, R-C, R-L-C circuit.	08
II	**Single Phase A.C Parallel Circuits:** R-L, R-C and R-L-C parallel combination of A.C. circuits. Impedance, reactance, phasor diagram, Impedance triangle R-L, R-C, R-L-C parallel A.C. circuit's power factor, active power, apparent power, reactive power, Power triangle Resonance in parallel R-L, R-C, R-L-C circuit, Bandwidth, Quality factor and voltage magnification	09
III	**Three Phase Circuits:** Phasor and complex representation of three phase supply, Phase sequence and polarity, Types of three-phase connections, Phase and line quantities in three phase star and Delta system, Balanced and unbalanced load, neutral shift in unbalanced load Three phase power, active, reactive and apparent power in star and delta system.	09
IV	**Network Reduction and Principles of Circuit Analysis:** Source transformation Star/delta and delta/star transformation, Mesh Analysis, Node Analysis.	09

V	**Network Theorems:** Superposition theorem, Thevenin's theorem. Norton's theorem Maximum power transfer theorem Reciprocity theorem Duality in electric circuits	**10**

Suggested Books:

1. Ashfaq Husain, Networks & Systems, Khanna Book Publishing, New Delhi.
2. Gupta, B.R; Singhal, Vandana;, Fundamentals of Electrical Network, S.Chand and Co., New Delhi, ISBN : 978-81-219-2318-7
3. Saxena, S.B Lal; Dasgupta, K; Fundamentals of Electrical Engineering, Cambridge University
   Press Pvt. Ltd., New Delhi, ISBN : 978-11-0746-435-3
4. Theraja, B. L. : Theraja, A. K;, A Text Book of Electrical Technology Vol-I, S. Chand & Co. Ram- nagar, New Delhi, ISBN : 9788121924405
5. Sudhakar, A. ; Shyammohan, S. Palli; Circuit and network, McGraw Hill Education, New Delhi, ISBN : 978-93-3921-960-4
6. Bell, David A., Electric Circuits, Oxford University Press New Delhi, ISBN : 978-01-9542524-6
7. Boylested, R.L., Introductory circuit Analysis, Wheeler, New Delhi,ISBN: 978-00-2313161-5
8. Mittle, V.N. ;Mittle, Arvind; Basic Electrical Engineering, McGraw Hill Education, Noida, ISBN: 978-00-705-9357-2
9. Sivanandam, S.N, Electric Circuit Analysis, Vikas Publishing House Pvt. Ltd, Noida, ISBN:978- 81259-1364-1
10. Salivahanan, S.; Pravinkumar, S; Circuit theory, Vikas Publishing House Pvt. Ltd, Noida; ISBN:978-93259-7418-0

Course Outcome:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

a) Troubleshoot problems related to single phase A.C series circuits.
b) Troubleshoot problems related to single phase A.C parallel circuits.
c) Troubleshoot problems related to three phase circuits.
d) Use principles of circuit analysis to troubleshoot electric circuits.
e) Apply network theorems to troubleshoot electric circuits

Suggestive Distribution of Marks

Unit	Topic	Time Allotted (Hrs)	Distribution (Theory Marks)			
			R Level	U Level	A Level	Total
I	Single Phase A.C Series Circuits	08	4	4	2	10
II	Single Phase A.C Parallel Circuits	09	3	5	4	12
III	Three Phase Circuits	09	2	4	4	10
IV	Network Reduction and Principles of Circuit Analysis	09	2	4	8	14
V	Network Theorems	10	2	4	8	14
Total		**45**	**13**	**21**	**26**	**60**

Legends: *R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)*

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		Semester III
Course Code	:	ECPC 215
Course Title	:	Electric Circuits Lab
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	ES 110
Course Category	:	PC

Course Content:

1. Use dual trace oscilloscope to determine A.C voltage and current response in given R, L, C circuit.
2. Use voltmeter, ammeter, wattmeter to determine active, reactive and apparent power consumed in given R-L series circuit. Draw phasor diagram.
3. Use voltmeter, ammeter to determine active, reactive and apparent power consumed in given R-C series circuit. Draw phasor diagram.
4. Use voltmeter, ammeter, wattmeter to determine active, reactive and apparent power consumed in given R-L-C series circuit. Draw phasor diagram.
5. Use variable frequency supply to create resonance in given series R-L-C circuit or by using variable inductor or variable capacitor.
6. Use voltmeter, ammeter, wattmeter to determine current, p.f , active, reactive and apparent power in R-C parallel A.C. circuit.
7. Use voltmeter, ammeter, wattmeter, p.f meter to determine current, p.f., active, reactive and apparent power for given R-L-C parallel circuit with series connection of resistor and inductor in parallel with capacitor.
8. Use variable frequency supply create resonance in given parallel R-L-C circuit or by using variable inductor or capacitor.
9. Use voltmeter, ammeter, wattmeter, p.f meter to determine line and phase quantities of volt- age and current for balanced three phase star and delta connected load and calculate active, reactive, and apparent power. Draw phasor diagram.
10. Use voltmeter, ammeter, wattmeter, p.f meter to determine line and phase quantities of volt- age and current for unbalanced three phase star and delta connected load and calculate active, reactive, and apparent power. Draw phasor diagram.
11. Use voltmeter, ammeter to determine current through the given branch of a electric network by applying mesh analysis.

12. Use voltmeter, ammeter to determine current through the given branch of a electric network by applying node analysis.
13. Use voltmeter, ammeter to determine current through the given branch and voltage across the given element of circuit by applying superposition theorem.
14. Use voltmeter, ammeter to determine equivalent circuit parameter in a given circuit by applying Thevenin's theorem
15. Use voltmeter, ammeter to determine equivalent circuit parameter in a given circuit by applying Norton's theorem
16. Use voltmeter, ammeter to determine load resistance for maximum power transfer for a given circuit by applying maximum power transfer theorem.

Practical Outcomes (PrOs):

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

a) Troubleshoot problems related to single phase A.C series circuits.
b) Troubleshoot problems related to single phase A.C parallel circuits.
c) Troubleshoot problems related to three phase circuits.
d) Use principles of circuit analysis to troubleshoot electric circuits.
e) Apply network theorems to troubleshoot electric circuits.

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Semester IV		
Course Code	:	ECPC 206
Course Title	:	Microprocessor and Microcontroller
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	ECPC 203
Course Category	:	PC

RATIONALE

The course provides the student with the opportunity to study Architecture and memory management of 8-bit microprocessor (i.e., 8085) and 8051 microcontrollers, to study the assembly language programming and to implement different system interfacing.

DETAILED CONTENTS

Unit	Topics	No. of Lectures
I	**Introduction to Microprocessor:** Introduction, application, basic block diagram, speed, word size, memory capacity, classification of microprocessors (mention different microprocessors being used).	**03**
II	**8085 Microprocessor:** Main features, architecture, block diagram, CPU, ALU, registers, flags, stack pointer, program counter, data and address buses, control signals, pin out diagram and pin description.	**04**
III	**8085 Instructions and Programming:** Operation Code, Operand and Mnemonics, instruction classification, addressing modes, instruction format, instruction sets, data transfer, arithmetic, increment, decrement, logical, branch and machine control instructions, assembly language programming examples, stack operations, subroutines and delay loop calls, return operation, use of counters, timing and control circuitry, timing diagram, instruction cycle, machine cycle, T-states, time delay.	**14**
IV	**Interrupts:** Structure, hardware and software interrupts, vectored and non-vectored interrupts, latency time and response time	**05**
V	**Interfacing:** Basic interfacing concepts, memory mapped I/O and I/O mapped I/O and isolated I/O structure, partial/ full memory decoding, interfacing of programmable peripheral interface (PPI) chip 8255, address allocation technique and decoding, interfacing of I/O devices (LEDs and Toggle switch as example)	**12**
VI	**8051 I/O Port Programming:** Introduction of I/O Port Programming, Pin out diagram of 8051 microcontroller, I/O ports pin description and their function, I/O port programming in 8051 (using assembly language), I/O Programming: Bit manipulation.	**10**

Suggested Books:

1. Gaonkar- Microprocessor Architecture, Programming and Applications with 8085 Penram
2. B. Ram- Fundamentals of Microprocessors and Microcomputers, Dhanpat Rai
3. Krishna Kant- Microprocessors and Microcontrollers: Architecture, programming and system design, PHI
4. Mathur and Panda- Microprocessors and Microcontrollers, PHI
5. Shah- 8051 Microcontrollers: MCS 51 Family and its Variant, Oxford.
6. Ayala and Gadre- The 8051 Microcontroller and Embedded System using Assembly and C, Cengage.
7. Mazidi, Mazidi and Mckinlay- The 8051 Microcontroller and Embedded System using Assembly and C, Pearson.

Course Outcomes:

1. Discuss the architecture of 8085 processors, instruction sets and timing diagram
2. Have the concept of micro and macro programming
3. Understand various interrupts and the concept of interfacing
4. Understand the basics of 16-bit processor
5. Discuss the architecture of 8051 microcontrollers and its CPU, Memory, and interfacing ports.
6. Apply knowledge and demonstrate proficiency of designing hardware interface for memory as well as I/O and write assembly language program for target microprocessor and microcontrollers.

Suggestive Distribution of Marks

Unit	Topic	Time Allotted (Hrs)	Distribution (Theory Marks)			
			R Level	U Level	A Level	Total
I	Introduction to Microprocessor	03	01	03	-	04
II	8085 Microprocessor	04	02	03	-	05
III	8085 Instructions and Programming	14	02	07	11	20
IV	Interrupts	05	02	04	-	06
V	Interfacing	12	02	04	07	13
VI	8051 I/O Port Programming	10	02	06	04	12
	Total	**40**	**11**	**27**	**22**	**60**

Legends: *R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)*

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		Semester IV
Course Code	:	ECPC 216
Course Title	:	Microprocessor and Microcontroller Lab
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	ECPC 203
Course Category	:	PC

Course Content:

1. Program for 8-bit addition and subtraction
2. Program for 16-bit addition and subtraction
3. Program for 8-bit multiplication and division
4. Program for 16-bit multiplication and division
5. Program for square and square root of a number
6. Program for sorting and searching
7. Program for smallest and largest number in array
8. Program for reversing a string
9. Program for Fibonacci series
10. Program for BCD to Binary, Binary to BCD, ASCII to Binary
11. Interfacing traffic light controller
12. Interfacing stepper motor control
13. Interfacing ADC, DAC
14. Study of 8255 chip and generation of square wave, saw tooth wave, triangular wave.
15. Programming using Ports for 8051
16. Study the 8051 micro controller based DC motor/ Stepper motor speed control system

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.

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		Semester IV
Course Code	:	ECPC 207
Course Title	:	Power Electronics
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	ECPC 202
Course Category	:	PC

RATIONALE

Diploma holders in Electronics and related fields are required to handle a wide variety of power electronic equipment used in process control Industry. This subject will provide the student basic understanding of the principles of their working. The practical training will further re-inforce the knowledge and skill of the students

DETAILED CONTENTS

Unit	Topics	No. of Lectures
I	**Introduction to Thyristors and other Power Electronics Devices:** Construction, Working principles of SCR, two transistor analogy of SCR, V-I characteristics of SCR, SCR specifications & ratings. Different methods of SCR triggering. Different commutation circuits for SCR. Series & parallel operation of SCR. Construction & working principle of DIAC, TRIAC & their V-I characteristics. Construction, working principle of UJT, V-I characteristics of UJT. UJT as relaxation oscillator. Brief introduction to Gate Turn off thyristor (GTO), Programmable uni-junction transistor (PUT). Basic idea about the selection of Heat sink for thyristors. Applications such as light intensity control, speed control of universal motors, fan regulator, battery charger.	**13**
II	**Controlled Rectifiers:** Single phase half wave fully controlled rectifier with R & R-L load. Single phase half controlled full wave rectifier with R & R-L Load. Single face fully controlled full wave bridge rectifier R & R-L Load. Single phase fully controlled full wave centre tap rectifier R & R-L Load.	**07**
III	**Inverters, Choppers, Dual Converters and Cyclo converters:** Principle of operation of basic inverter circuits, concepts of duty cycle, series & paralle inverters & their applications. Choppers: Introduction, types of choppers (Class A, Class B, Class C and Class D). Step up and step down choppers. Dual Converters and cyclo converters: Introduction, types & basic working principle of dual converters and cyclo converters & their applications	**12**
IV	**Thyristorised Control of Electric drives:** DC drive control: Half wave drives. Full wave drives. Chopper drives (Speed control of DC motor using choppers) AC drive control: Phase control, Constant V/F operation, Cycloconverter/Inverter drives	**10**

V	**Uninterrupted Power supplies:** UPS, on-line, off line & their specifications. Concept of high voltage DC transmission. Idea of SMPS	**06**

Instructional Strategy:

Power Electronics being very important for industrial controls requires a thorough know how about industrial devices. Teacher should take to the class various SCRs and other semiconductor devices to demonstrate these to the students. The teacher may encourage students to perform practical simultaneously for better understanding of the subject and verification of theoretical concepts. So industrial visit in between the course is a must.

Suggested Books:

1. Power Electronics by P.C. Sen Tata Mc Graw 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 MH Rashid
5. Industrial Electronics and Control by SK Bhattacharya and S. Chatterji, New Age Publications. New Delhi
6. Power Electronics by S Rama Reddy, Narosa Publishing House Pvt. Ltd., New Delhi
7. Power Electronics by Sugandhi and Sugandhi
8. Power Electronics – Principles and Applications by J Michael Jacob, Vikas Publishing House, New Delhi

Course Outcomes:

1. Will be able to classify various Thyristor families.
2. Understand the working of SCR, IGBT, GTO, DIAC and TRIAC.
3. Study and analyze rectifiers with R and RL load.
4. Understand basic working principles of converters, inverters.

Suggestive Distribution of Marks

Unit	Topic	Time Allotted (Hrs)	Distribution (Theory Marks)			
			R Level	U Level	A Level	Total
I	Introduction to Thyristors and other Power Electronics Devices	13	06	06	06	18
II	Controlled Rectifiers	07	02	03	04	09
III	Inverters, Choppers, Dual Converters and Cyclo converters	12	02	08	04	14
IV	Thyristorised Control of Electric drives	10	01	05	06	12
V	Uninterrupted Power supplies	06	02	05	-	07
	Total	**48**	**13**	**27**	**20**	**60**

Legends: *R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)*

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		Semester IV
Course Code	:	ECPC 208
Course Title	:	Digital Communication
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites	:	ECPC 201
Course Category	:	PC

RATIONALE

Communication technologies have undergone radical changes, especially due to convergence of computers and communication. No industry is untouched by the digital communication. This course will enable the diploma engineers to apply facts, concepts and working principles of digital communication for troubleshooting and maintenance of digital communication system. This course is intended to develop the skills to diagnose and rectify the errors occurring in digital communication system. The concepts and principles of digital communication will also lay the foundation to understand the various modern communication system.

DETAILED CONTENTS

Unit	Topics	No. of Lectures
I	**Review of Sampling theorem**: Pulse-Amplitude Modulation, Channel bandwidth. Natural and Flat top sampling. Quantization of signals, Quantization error, Pulse-code modulation (PCM), Electrical representation of binary digits, PCM system, Companding, Multiplexing. Differential PCM, Delta modulation, Adaptive delta modulation, Vocoders, Channel Vocoder, Linear Predictive coder	**12**
II	**Digital Modulation Techniques:** Binary Phase-Shift Keying (BPSK), Differential Phase-Shift Keying, Differentially Encoded PSK (DEPSK), Quadrature Phase- Shift Keying (QPSK), Quadrature Amplitude Shift Keying (QASK), Binary Frequency-Shift Keying (BFSK), Similarity of BPSK and BFSK, M-ary FSK, Minimum Shift Keying (MSK)	**12**
III	**Data Transmission**: Baseband signal receiver, Probability of error. Matched Filter, Probability of error in Matched filter, Coherent reception of PSK and FSK, Non-Coherent reception of FSK, PSK and QPSK. Error probability of BPSK, BFSK and QPSK. Bit-by-bit encoding versus Symbol-by-Symbol encoding, Relationship between Bit error rate and Symbol Error rate, comparison of modulation systems	**06**
IV	**Information Theory and Coding**: Discrete messages, information, Entropy, Information rate, coding to increase average information per bit. Shannon's theorem, Capacity of Gaussian channel, Bandwidth-S/N trade off, use of orthogonal signals to attain Shannon's limit, Efficiency of orthogonal signal transmission, Coding: Parity check bit coding, error detection and error correction coding, Block codes, Convolution codes, Comparison of error rates in coded and uncoded transmission.	**10**

Suggested Books:

1. Electronic Communications Systems, Wayne Tomasi, Pearson Education 2. Principles of Communication Systems, Taub and Schilling TMH
3. Digital Communication, S. Haykin, Wiley.
4. Analog and Digital Communication, S. Haykin, Wiley

Course Outcome:

1. Understand data conversion techniques
2. Understand digital modulations
3. Familiarize with digital data transmission techniques
4. Familiarize with information theory and coding schemes

Suggestive Distribution of Marks

Unit	Topic	Time Allotted (Hrs)	Distribution (Theory Marks)			
			R Level	U Level	A Level	Total
I	Review of Sampling theorem	12	04	06	08	18
II	Digital Modulation Techniques	12	04	08	06	18
III	Data Transmission	10	02	03	05	10
IV	Information Theory and Coding	06	02	06	06	14
	Total	**40**	**12**	**23**	**25**	**60**

Legends: *R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)*

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		Semester IV
Course Code	:	ECPC 217
Course Title	:	Digital Communication Lab
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	ECPC 201
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.

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		Semester V
Course Code	:	ECPC 301
Course Title	:	Embedded Systems
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	ECPC 206
Course Category	:	PC

RATIONALE

In the rapidly growing digital world, role of embedded system is increasingly vital in various domains such as industrial and home automation, entertainment systems, medical equipment's and many more. The core of all such system is powered by electronic hardware and associated software. It is therefore evident to impart the knowledge of the related technology and hands on skills to develop and maintain electronics hardware based embedded system.

DETAILED CONTENTS

Unit	Topics	No. of Lectures
I	**Embedded C basics operators for Arduino**: Familiarizing with the Arduino IDE. Sketch designing for Arduino Communication interface using serial port. Basic understanding of the code with Boolean operations, pointer access operations, bitwise operations, compounded operations.	**10**
II	**Embedded C control**: Structure blocks Looping mechanism – for, do and while. The branching operations based on conditions expression.	**10**
III	**Introduction to Arduino Mega:** Arduino Mega specifications including power ratings, digital and analog peripherals. Difference between the C language and Embedded C language Arduino Mega Ports, Pins, Digital and Analog Peripherals.	**12**
IV	**Communication with Arduino:** Different communication modules available with their real-life application Communication interface**.**	**08**

Suggested Books:

S. No.	Title of Book	Author	Publication

1.	Arduino Projects For Dummies (For Dummies Series)	Kennedy George; Davis Bernard; Prasanna SRM	Wiley (5 July 2013) ISBN : 978-1118551479
2.	Make: Getting Started With Arduino - The Open Source Electronics Prototyping Platform	Massimo Banzi and Michael Shi- loh	Shroff/Maker Media; Third edition (27 December 2014) ISBN : 978-9351109075

SUGGESTED SOFTWARE/LEARNING WEBSITES:

a. https://www.arduino.cc/reference/en/
b. https://learn.adafruit.com/category/learn-arduino

Course Outcome:

1. Able to familiarize the Arduino kit and assemble it.
2. Understand the coding and programming of Arduino kit using C.
3. Will be able to specify the requirements of Arduino and its basic architecture.
4. Be able to implement real time projects using Arduino kit.

Suggestive Distribution of Marks

Unit	Topic	Time Allotted (Hrs)	Distribution (Theory Marks)			
			R Level	U Level	A Level	Total
I	Embedded C basics operators for Arduino	10	05	07	03	15
II	Embedded C control	10	02	07	06	15
III	Introduction to Arduino Mega	12	04	08	08	20
IV	Communication with Arduino	08	-	05	05	10
	Total	**40**	**11**	**27**	**22**	**60**

Legends: *R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)*

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		Semester V
Course Code	:	ECPC 311
Course Title	:	Embedded Systems Lab
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	ECPC 206
Course Category	:	PC

Course Content:

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1.	Built-in LED state control by push button sketch implementation	I	02
2.	Built-in LED blinking sketch implementation	I	02
3.	Built-in LED blinking by toggling states based on binary operation	I	02
4.	Built-in LED state control by user interface through serial port	I	02
5.	User interface for boolean operation and bit wise operation through serial port	I	02
6.	User interface for compounded operation through serial port	I	02
7.	Looping mechanism to check the state of pin and if change print its status on serial port	II	02
8.	Controlling multiple LEDs with a loop and an array	II	02
9.	Use a potentiometer to control the blinking of an LED	III	02
10.	Uses an analog output (PWM pin) to fade an LED.	III	02
11.	Servo Motor Control using PWM	III	02
12.	Temperature sensor interfacing and sending its reading over serial port	IV	04
13.	I2C light sensor interfacing and sending its reading over serial port	IV	04
	Total		**30**

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.

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		Semester V
Course Code	:	ECPC 302
Course Title	:	Mobile and Wireless Communication
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites	:	ECPC 208
Course Category	:	PC

RATIONALE

In this world of connectivity and collaborative work environment, it is necessary to connect to the network from anywhere, with anybody, at anytime. Wireless communication provides connectivity with mobility, flexibility and convenience. Wireless devices are used across the various industries like Healthcare, education, Automation, Renewable energy sector, Automobile etc. effective use of social networking has become possible due to high end wireless devices. This course will help the students to develop skills to handle wireless and mobile communication systems.

DETAILED CONTENTS

Unit	Topics	No. of Lectures
I	**Wireless Communication**: Basics- Advantage of wireless communication- Electromagnetic waves- Frequency spectrum used- Paging system- Cordless telephone system- Cellular telephone system- comparison of above wireless communication systems- Propagation consideration: Range, Atmospheric effect, Geographic effect, Fading, Doppler effect.	**08**
II	**Cellular Concept:** Cell area- Capacity of cell- Frequency response- Co-channel interference- Adjacent channel interference- Power control for reducing interference- Improving coverage and capacity in cellular system: Cell splitting, Sectoring, Repeater for range extension.	**14**
III	**Multiple Access Techniques for Wireless Communication**: Introduction to multiple Access- Frequency Division Multiple Access (FDMA)- Time Division Multiple Access (TDMA)- Code Division Multiple Access (CDMA)- Spread Spectrum Multiple Access (SSMA)- Frequency Hopping Spread Spectrum (FHSS)- Comparison of FDMA/TDMA/CDMA	**14**
IV	**Mobile Communication Systems**: Advance Mobile Phone System (AMPS): Operation of AMPS, Working of AMPS phone system- Introduction of Global System for Mobile Communication (GSM) and its architecture- Introduction of CDMA system, comparison of CDMA and GSM systems- Introduction of GPRS and GPS system- Introduction to 3G/4G mobile technology	**12**

Suggested Books:

1. Wireless Communication- Thedore S Rappapoirt

2. Introduction to Wireless and Mobile Systems- Dharma Prakash Agarwal, Qing-An Zeng
3. Wireless Communications and Networking- William Stallings
4. Mobile and Personal Communication Systems and Services- Raj Pandya, Prentice Hall of India, New Delhi
5. Mobile Communication- John Schiller, Prentice Hall of India, New Delhi
6. Wireless Communications- Pahalwan, Pearson Publishers

Course Outcome:

1. To expose the students to the fundamentals of wireless communication technologies.
2. Explain basic principles of cellular communication system.
3. Explain basic principles, characteristics and applications of mobile communication system.
4. Understand basic principles, characteristics and applications of CDMA and GSM system.

Suggestive Distribution of Marks

Unit	Topic	Time Allotted (Hrs)	Distribution (Theory Marks)			
			R Level	U Level	A Level	Total
I	Wireless Communication	08	02	04	04	10
II	Cellular Concept	14	05	05	08	18
III	Multiple Access Techniques for Wireless Communication	14	04	07	07	18
IV	Mobile Communication Systems	12	04	06	04	14
	Total	**48**	**15**	**22**	**23**	**60**

Legends: *R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)*

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Semester VI		
Course Code	:	ECPC 303
Course Title	:	Computer Networks
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	NIL
Course Category	:	PC

RATIONALE

A computer networks has been growing with rapid technological progress. Computer communication through networking becomes an essential part of our life. By considering importance of networking in day today life, it is essential for students to know the basic concept of networks like network classification, network topologies, network devices. This course deals with the important concepts and techniques related to computer communication network and enable students to have an insight in to technology involved to make the network communication possible.

DETAILED CONTENTS

Unit	Topics	No. of Lectures
I	**Networks Basics:** What is network. Peer-to –peer Network. Server Client Network. LAN, MAN and WAN. Network Services. Network Topologies. Switching Techniques	06
II	**OSI Model:** Standards. OSI Reference Model. OSI Physical layer concepts and application. OSI Data-link layer concepts and application. OSI Networks layer concepts and application. OSI Transport layer concepts and application. OSI Session layer concepts and application. OSI presentation layer concepts and application. OSI Application layer concepts and application	09
III	**Introduction to TCP/IP:** Concept of physical and logical addressing. Different classes of IP addressing, special IP address. Sub netting and super netting. Loop back concept. IPV4 and IPV6 packet Format. Configuring IPV4 and IPV6.	07
IV	**Cables and Connectors:** Types of Cables (Coaxial, Twisted Pair), Shielded and Unshielded Pair of Cables, fiber optic cable. (Straight through Cable, Cross Over Cables) with colour coding. Ethernet Specification and Standardization: 10 Mbps (Traditional Ethernet), 100 Mbps (Fast Ethernet) and 1000 Mbps (Gigabit Ethernet), Leased lines. Use of RJ45, RJ11, BNC,SCST.	07
V	**Network Connectivity:** Network connectivity Devices, NICs, Hubs, Bridges, Repeaters, Switches, Routers and Routing Protocols, Routing Algorithm, Configuring of Routers.	08
VI	**Network Administration / Security**: Client/Server Technology. Server Management. RAID management and mirroring. Cryptography. Ethical Hacking	06

VII	**Wireless Networking**: Basics of Wireless: Wireless MAN, Networking, Wireless LAN, Wi-Fi, WiMax (Broad-band Wireless) and Li-Fi.	**05**

Suggested Books:

1. Computer Networks by Tanenbaum, Prentice Hall of India, New Delhi
2. Data Communications and Networking by Forouzan, (Edition 2nd and 4th), Tata McGraw Hill Education Pvt Ltd , New Delhi
3. Data and Computer Communication by William Stallings, Pearson Education, New Delhi
4. e-books/e-tools/relevant software to be used as recommended by AICTE/NITTTR

Course Outcome:

1. Recognize physical topology and cabling (coaxial, OFC, UTP, STP) of a network.
2. Recognize various types of connectors RJ-45, RJ-11, BNC and SCST.
3. Demonstrate various types of networking models and protocol suites.
4. Install and configure a network interface card in a workstation.
5. Identify the IP address of a workstation and the class of the address and configure the IP Address on a workstation.
6. Configure routers.
7. Demonstrate sub netting of IP address.
8. Identify connectivity troubleshooting using PING, IPCONFIG, IFCONFIG.
9. Explain concept of wireless networking.
10. Configure different Network devices.
11. Understand network security management and configuration

Suggestive Distribution of Marks

Unit	Topic	Time Allotted (Hrs)	Distribution (Theory Marks)			
			R Level	U Level	A Level	Total
I	Networks Basics	06	03	04	-	07
II	OSI Model	09	04	04	03	11
III	Introduction to TCP/IP	07	02	04	04	10
IV	Cables and Connectors	07	02	02	06	10
V	Network Connectivity	08	02	02	06	10
VI	Network Administration / Security	06	-	04	03	07
VII	Wireless Networking	05	02	03	-	05
	Total	**48**	**15**	**23**	**22**	**60**

Legends: *R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)*

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Semester VI		
Course Code	:	ECPC 312
Course Title	:	Computer Networks Lab
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	NIL
Course Category	:	PC

Course Content:

1. To study the different physical equipment used for networking 2.

Study the different internetworking devices in a computer network

3. Configure local area network using topologies.
4. Configure different network devices used in LAN- hub/switch/routers/bridges.
5. Create different types of cables for straight through and cross over cable
6. Configure Ethernet network
7. Install NIC and locate MAC address
8. Configure TCP/IP addressing
9. Install Network printer and sharing content
10. Study and configuration of modem of computer
11. Study of wireless communication

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

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3. LIST OF PROGRAM ELECTIVE COURSES (PE) FOR DIPLOMA IN ELECTRONICS AND COMMUNICATION ENGINEERING

Sl. No.	Code No.	Course Title	Hours per Week			Total Hours/ Week	Credits
			L	T	P		
1	ECPE 201	Control System Or Microwave and RADAR Engineering	3	0	0	3	3
2	ECPE 202	Basics of VLSI Design Or Linear Integrated Circuits	3	0	0	3	3
3	ECPE 211	Basics of VLSI Design Lab Or Linear Integrated Circuits Lab	0	0	2	2	1
4	ECPE 301	Simulation Software Or Consumer Electronics	3	0	0	3	3
5	ECPE 311	Simulation Software Lab Or Consumer Electronics Lab	0	0	2	2	1
6	ECPE 302	Digital Signal Processing Or Optical Fiber Communications	3	0	0	3	3
7	ECPE 312	Digital Signal Processing Lab Or Optical Fiber Communications Lab	0	0	2	2	1
Total Credits							**15**

		Control System
Course Code	:	ECPE 201
Course Title	:	Control System
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	NIL
Course Category	:	PE

RATIONALE

It is pre-requisite for the students to know the various total plants controls in the process industry. An automatic control system saves manpower, reduces cost of production, increases the accuracy of the finished product and helps in mass production so that the knowledge of this subject is required to have deeper grasp of the control environment/ techniques as needed to be studied in the subjects e.g., process control, process instrumentation.

DETAILED CONTENTS

Unit	Topics	No. of Lectures
I	**Elementary control concepts**: Open loop and close loop control system. Transfer function, impulse response, modeling of electrical and mechanical (translational and rotational) systems, DC motor block diagram simplification, and signal flow graphs.	08
II	**Transient response analysis of I and II order system**: Type of systems and its effect on error function, stability, steady state error.	06
III	**Stability concept**: Routh Hurwitz criterion of stability, Root locus techniques: Root-Loci and complementary root loci rules for root locus plots.	06
IV	**Frequency Response Analysis**: Nyquist plot and Bode plot. Gain and phase margins, compensation typical examples. Compensators and controllers: lead, lag and lag-lead compensators, proportional, PI and PID controllers.	10
V	**State Space Analysis**: State Variables and State Model, State Transition Matrix and its properties, Concept of Controllability and Observability. Digital Control System: Sampled Data Control System, Step Response (First & Second Order Systems), Introduction to Digital PID Controller, block schematic of PLC and addressing.	10

Suggested Books:

1. Control Systems Engineering, Nagaratha and Gopal
2. Discrete-Time Control Systems, K. Ogata, Pearson Education/PHI, 2 Edition
3. Modern Control Engg, K. Ogata, 2nd ed., PHI, 1995
4. Automatic Control Systems, B. C. Kuo, 9th ed., PHI, 1995.

Course Outcome:

1. Realize block diagrams, mathematical model and transfer functions of open and closed loop control systems.
2. Have an in-depth knowledge on transient, steady state and stability of a control system.
3. Specify control system performance in the frequency-domain in terms of gain and phase margins, design compensators to achieve the desired performance.
4. Model and analyze control systems using state-space analysis and knowledge on digital control System.

Suggestive Distribution of Marks

Unit	Topic	Time Allotted (Hrs)	Distribution (Theory Marks)			
			R Level	U Level	A Level	Total
I	Elementary control concepts	08	03	03	06	12
II	Transient response analysis of I and II order system	06	01	04	05	10
III	Stability concept	06	02	04	04	10
IV	Frequency Response Analysis	10	02	04	08	14
V	State Space Analysis	10	02	05	07	14
	Total	**40**	**10**	**20**	**30**	**60**

Legends: *R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)*

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		Microwave and RADAR Engineering
Course Code	:	ECPE 201
Course Title	:	Microwave and RADAR Engineering
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	ECPC 201
Course Category	:	PE

RATIONALE

Microwave communication is the back bone of terrestrial communication and also the sole of mobile communication. To provide communication at difficult geographical locations and for specific task microwave links and RADAR are the established telecommunication solution. This course has been designed to develop skills in the diploma engineers to maintain microwave and RADAR based telecommunication systems.

DETAILED CONTENTS

Unit	Topics	No. of Lectures
I	**Introduction to Microwaves:** Introduction to microwaves and its applications, Classification on the basis of its frequency bands (HF, VHF, UHF, L, S, C, X, Ku, Ka, Sub mm)	**05**
II	**Microwave Devices:** Characteristics, operating principles and typical applications of the following devices (No mathematical treatment)-Multi cavity klystron- Reflex klystron- Multi-cavity magnetron- Traveling wave tube- Gunn diode- IMPATT diode- TRAPATT diode- PIN diode	**08**
III	**Wave guides:** Rectangular and circular wave guides and their applications. Mode of wave guide; Propagation constant of a rectangular wave guide, cut off wavelength, guide wavelength and their relationship with free space wavelength (no mathematical derivation). Impossibility of TEM mode in a wave guide.	**10**

IV	**Antenna and Wave Propagation:** Physical concept of radiation electromagnetic energy from an antenna, relationship between the direction of electric and magnetic fields with direction of propagation; concept of polarization of EM waves. Electromagnetic spectrum and its various range VLF, LF, HF, VHF, UHF, Micro wave, Optical waves etc. Definition and physical concepts of the terms used with antennas like point source, gain, power gain, directivity aperture, effective area, radiation pattern, (field strength power and phase) beam angle, beam width and radiation resistance. Types of antennas- Brief description, characteristics and typical applications of medium wave antenna, shortwave antenna, HF antenna, VHF, UHF and Microwave antenna e.g., half wave dipole, ground plane, yagi and ferrit rod antenna in transistor receiver. Brief idea about rhombic antenna, dish antenna, Horn, Parabolic reflector and Lens antenna. Antenna arrays-Brief description of broad side and end fire arrays their radiation pattern and application (without analysis)- Basic idea about different modes of radio wave propagation- ground wave propagation, space wave propagation and	**12**
	sky wave propagation, their characteristics and typical areas of application. (e.g. medium wave, short wave, TC communication.) Explanation of the terms-critical frequency, maximum usable frequency (MUF) and skip distance.	
V	**Radar Systems:** Introduction to radar, its various applications, radar range equation (no derivation) and its applications.	**05**
VI	**Satellite Communication:** Basic idea passive and active satellites- Meaning of the terms Orbit, Apogee and Perigee- Geo- stationary satellite and its need- Block diagram and explanation of a satellite communication link- Differentiate between various types of satellites.	**06**

Suggested Books:

1. Microwave Devices and Components by Sylio; Prentice Hall of India, New Delhi
2. Electronics Communication by Roddy and Coolen; Pearson Publishers
3. Electronics Communication System by KS Jamwal; Dhanpat Rai and Sons, Delhi
4. Microwave Engineering by Das; Tata McGraw Hill Education Pvt Ltd , New Delhi
5. Microwave & Radar Engineering by Navneet Kaur; Ishan Publications, Ambala City
6. e-books/e-tools/relevant software to be used as recommended by AICTE/NITTTR, Chandigarh

Course Outcome:

1. Identify and demonstrate operating principles and typical applications of tubes and diode.
2. Understand the various types and propagation modes of wave guides
3. Describe the various types of antennas and wave propagation techniques
4. Know the basic principle of radar and interpret the various parameters used in radar Equation
5. Measure VSWR of a given load

6. Identify the block diagram and explain the operating principles of CW(Doppler), FMCW, MTI radar
7. Interpret radar display PPI
8. Describe the working principles of microwave communication link

Suggestive Distribution of Marks

Unit	Topic	Time Allotted (Hrs)	Distribution (Theory Marks)			
			R Level	U Level	A Level	Total
I	Introduction to Microwaves	05	02	04	-	06
II	Microwave Devices	08	02	04	06	12
III	Wave guides	10	02	06	06	14
IV	Antenna and Wave Propagation	12	03	04	08	15
V	Radar Systems	05	01	05	-	06
VI	Satellite Communication	06	02	05	-	07
Total		**46**	**12**	**28**	**20**	**60**

Legends: *R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)*

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		Basics of VLSI Design
Course Code	:	ECPE 202
Course Title	:	Basics of VLSI Design
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	ECPC 202, ECPC 203
Course Category	:	PE

RATIONALE

This course will provide an opportunity to the students to learn about various topics on VLSI such as MOSFET fabrication, its physics, and analysis as well as design of digital circuits using MOSFET device. In laboratory part of this course, students will be given exposure to hardware description language such as VHDL/ Verilog for automated design of digital circuits. This subject is very important for the students who will be in future would like to pursue their career in VLSI domain.

DETAILED CONTENTS

Unit	Topics	No. of Lectures
I	**VLSI design flow Design**: MOS Transistor; DC Transfer Characteristics: Static CMOS Inverter DC Characteristics	**08**
II	**CMOS Processing Technology**: Layout design rules, CMOS Process enhancements; Stick Diagrams; Technology-Related CAD Issues, Manufacturing Issues	**08**
III	**Delay**: Delay Models; Logical Efforts of Paths, Timing Analysis of Delay Models Power: Dynamic Power and Static Power	**06**
IV	**Combinational Circuit Design**: CMOS Logic Gates, The Compound Gates, Pass Transistors and Transmission Gates, Tristate buffer, Multiplexers. Circuit Families: Static CMOS, Ratioed Circuits, Cascade Voltage Switch Logic, Dynamic Circuits, Pass-Transistor Circuits. Subthreshold Circuit Design	**10**
V	**Sequential MOS logic circuitry**: Behavioral of Bi-stable element, Flip-Flop. Sequencing Static Circuits; Circuit Design of Latches and Flip-Flops; Memory: SRAM; DRAM; Semiconductor memories: Introduction, Read-Only Memory circuits, SRAM circuits, DRAM circuits	**08**

Suggested Books:

1. "CMOS VLSI Design", Pearson Education, Neil H.E. Weste, David Harris, Ayan Banerjee, 3rd Edition.

2. “CMOS digital Integrated Circuits, Analysis and Design”, Sung-Mo Kang and Yusuf Leblebici, Tata McGraw-Hill Publishing Company Limited, New Delhi.
3. “Basic VLSI Design”, Douglas. A. Pucknell, Kamaran Eshraghian, PHI,3rd Edition.
4. “Introduction to VLSI Circuits & Systems”, John P. Uyemura Wiley India Edition

Course Outcome:

1. Understand CMOS technology and be able to do DC and transient analysis of digital CMOS circuits.
2. Describe the techniques used for VLSI fabrication and ability to estimate timing characteristics, noise margins, power consumption of a digital VLSI circuit. Design static.
3. CMOS and dynamic clocked CMOS circuits.
4. Analyze working of SRAM cell and DRAM cell

Suggestive Distribution of Marks

Unit	Topic	Time Allotted (Hrs)	Distribution (Theory Marks)			
			R Level	U Level	A Level	Total
I	VLSI design flow Design	08	04	04	04	12
II	CMOS Processing Technology	08	02	02	08	12
III	Delay	06	02	02	04	08
IV	Combinational Circuit Design	10	03	05	08	16
V	Sequential MOS logic circuitry	08	02	04	06	12
	Total	**40**	**13**	**17**	**30**	**60**

Legends: *R = Remember; U = Understand; A = Apply and above levels (Bloom’s revised taxonomy)*

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VLSI Design Lab		
Course Code	:	ECPE 211
Course Title	:	Basics of VLSI Design Lab
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	ECPC 202, ECPC 203
Course Category	:	PE

Course Content:

1. Design an Adder (Min 8 Bit) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
2. Design a Multiplier (4 Bit Min) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
3. Design an ALU using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
4. Design a Universal Shift Register using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
5. Design Finite State Machine (Moore/Mealy) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
6. Design Memories using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA.

Compare pre synthesis and post synthesis simulation for experiments 1 to 6. Requirements: Xilinx ISE/Altera Quartus/ equivalent EDA Tools along with Xilinx/Altera/equivalent FPGA Boards.

7. Design and simulate a CMOS inverter using digital flow
8. Design and simulate a CMOS Basic Gates & Flip-Flops
9. Design and simulate a 4-bit synchronous counter using a Flip-Flops

Manual/Automatic Layout Generation and Post Layout Extraction for experiments 7 to 9

Practical Outcomes (PrOs):

1. To learn Hardware Descriptive Language(Verilog/VHDL)
2. To learn the fundamental principles of VLSI circuit design in digital and analog domain.
3. To familiarize fusing of logical modules on FPGAs. 4. To provide hands on design experience with professional design (EDA) platforms.

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Linear Integrated Circuits		
Course Code	:	ECPE 202
Course Title	:	Linear Integrated Circuits
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	ECPC 202
Course Category	:	PE

RATIONALE

Operational Amplifier (Op-Amp) is the most versatile Linear Integrated Circuit (IC) used to develop various application in electronic circuits and equipment's. Hence this course is intended to develop the skills to build, test, diagnose and rectify the Op-Amp based electronic circuits. This course deals with various aspects of Linear Integrated Circuits used in various industrial, consumer and domestic applications.

DETAILED CONTENTS

Unit	Topics	No. of Lectures
I	**Basic Operational Amplifier:** Concept of differential amplifiers (Dual input balanced and unbalanced output), constant current bias, current mirror, cascaded differential amplifier stages with concept of level translator, block diagram of an operational amplifier (IC 741)	**05**
II	**Op-Amp Parameters:** Input offset voltage, input offset current, input bias current, differential input resistance, input capacitance, offset voltage adjustment range, input voltage range, common mode rejection ratio, slew rate, supply voltage rejection ratio	**06**
III	**Op-Amp Circuits:** Open and closed loop configurations, frequency response of an Op-Amp in open loop and close loop configurations, inverting, non- inverting, summing and difference amplifier, integrator, differentiator, voltage to current converter, current to voltage converter. **Comparators**: Basic comparator, level detector, voltage limiters, Schmitt trigger. **Signal generators**: phase shift oscillators, wein bridge oscillator, square wave generator, triangular wave generator, saw tooth wave generator, voltage controller oscillator.	**15**
IV	**Signal Conditioning Circuits:** Sample and hold systems, active filters: first order low pass and high pass butterworth filter, second order filters, band pass filters, band rejection filter, all pass filters, log and antilog amplifiers.	**12**

V	**Multivibrators (IC 555):** Block diagram, Astable and monostable multivibrator circuit, applications of astable and monostable multivibrator, phase locked loop (PLL): block diagram, phase detectors, IC 565.	**10**

Suggested Books:

1. Op-Amps and Linear IC's – R.A Gayakwad, Pearson Education.
2. Operational Amplifiers and Linear Integrated Circuits - R.F.Coughlin and F.F.Driscoll, Pearson Education.
3. Integrated Electronics – J.Millman and C.C. Halkias, Tata Mcgraw Hill
4. Electronic Principles – A.P.Malvino, Tata Mcgraw Hill
5. Op-Amp and Linear Integrated Circuits, K.LKishore, Pearson **Course Outcome**:

1. Infer the DC and AC characteristics of operational amplifier and its effect on output and their compensation techniques.
2. Elucidate and design the linear and non linear applications of an op-amp and special application ICs
3. Explain and compare the working of multi vibrator using special application IC 555 and general purpose op-amp.

Suggestive Distribution of Marks

Unit	Topic	Time Allotted (Hrs)	Distribution (Theory Marks)			
			R Level	U Level	A Level	Total
I	Basic Operational Amplifier	05	03	03	-	06
II	Op-Amp Parameters	06	04	03	-	07
III	Op-Amp Circuits	15	03	07	10	20
IV	Signal Conditioning Circuits	12	-	07	08	15
V	Multivibrators (IC 555)	10	-	06	06	12
	Total	**48**	**10**	**26**	**24**	**60**

Legends: *R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)*

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Linear Integrated Circuits Lab		
Course Code	:	ECPE 211
Course Title	:	Linear Integrated Circuits Lab
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	ECPC 202
Course Category	:	PE

Course Content:

1. Study of Op-Amp characteristics
2. Designing of an amplifier of given gain for an inverting and non-inverting configuration using op-amp
3. Design of an analog adder and subtractor circuit
4. Designing of an integrator using op-amp for a given specification and study its frequency response.
5. Designing of a differentiator using op-amp for a given specification and study its frequency response.
6. Designing of a first order low pass filter using op-amp
7. Designing of a first order high pass filter using op-amp
8. Designing of a RC phase shift oscillator using op-amp
9. Study of 555 IC as an astable multivibrator
10. Study of 555 IC as a mono stable multivibrator

Practical Outcomes (PrOs):

1. Infer the DC and AC characteristics of operational amplifier and its effect on output and their compensation techniques.
2. Elucidate and design the linear and non linear applications of an op-amp and special application ICs.
3. Explain and compare the working of multi vibrator using special application IC 555 and general purpose op-amp

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		Simulation Software
Course Code	:	ECPE 301
Course Title	:	Simulation Software
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	NIL
Course Category	:	PE

RATIONALE

The course provides introduction to simulation and designing software's for electronics. Using simulation software the students can design and analyze various analog and digital circuits. The students can design PCB layout for the desired circuits using PCB design tools. Using PSpice/ PCB Design software/SCILAB various waveforms can be generated and various electronics systems can be implemented.

DETAILED CONTENTS

Unit	Topics	No. of Lectures
I	**Introduction to PSpice software**: General purpose circuit simulation using Schematic Editor, Introduction to netlist command based SPICE simulation, Basic netlist commands. Basic circuit analyses: DC, AC Transient	**10**
II	**Introduction to PCB Design software**: Schematic Entry, Netlist Creation, Working with component libraries, Design of Boards, Layout of Parts, Optimizing Parts Placements, Pads and Via, Manual and Auto Routing, Handling Multiple Layers	**10**
III	**Introduction to SCILAB**: Use SCILAB functions. Writing simple programs using SCILAB, handling arrays, files, plotting of functions etc. Writing SCI files for Creation of analog & discrete signals, plotting of signals etc. Simulation of electronic circuits using SCILAB	**12**

Suggested Books:

1. NGspice, LTSpice, MULTISIM, Orcad, Proteus or other open source PCB design tools, SCILAB
2. Website: http://www.scilab.org/ (To download SCILAB open source software)
3. http://www.linear.com/
4. http://www.expresspcb.com/

5. http://ngspice.sourceforge.net/

Course Outcome:

1. Basic outline of PSpice software, its commands and interface in analyzing the circuits.
2. Will be able to understand the schematic and creation of PCB using PCB design software.
3. Understand and apply various functions of SCILAB for creating SCI files for analyzing the signals.

Suggestive Distribution of Marks

Unit	Topic	Time Allotted (Hrs)	Distribution (Theory Marks)			
			R Level	U Level	A Level	Total
I	Introduction to PSpice software	10	04	06	08	18
II	Introduction to PCB Design software	10	04	06	08	18
III	Introduction to SCILAB	12	02	08	14	24
	Total	**32**	**10**	**20**	**30**	**60**

Legends: *R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)*

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		Simulation Software Lab
Course Code	:	ECPE 311
Course Title	:	Simulation Software Lab
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	NIL
Course Category	:	PE

Course Content:

1. Simulation of one rectifier circuit and one clipper/clamper circuit.
2. Simulation of any one transistor biasing circuit.
3. Simulation of CE single/double stage amplifier circuit.
4. Simulation of any one power amplifier circuit.
5. Simulation of any one JFET/MOSFET amplifier circuit.
6. Simulation of any one negative feedback circuit.
7. Simulation of encoder/multiplexer circuit.
8. Simulation of decoder/de multiplexer circuit.
9. Simulation of any one flip-flop circuit using gates.
10. Simulation of any one register/counter circuit.
11. Design of PCB for any one circuit from experiment 1 to 6.
12. Design of PCB for any one circuit from experiment 7 to 10.
13. Plot the sine, cosine, triangle and exponential waveform using SCILAB.
14. Plot sampled sine, cosine, triangle and exponential waveform using SCILAB.
15. Study of Simulink. (Only source and sink available in Simulink library).

Practical Outcomes (PrOs):

1. Design the electronics circuits using software tools like NGspice/LTSpice/Multisim.
2. Simulate various analog and digital circuits using NGspice/LTSpice/Multisim
3. Able to design PCB for given circuit using PCB Software like EAGLE, ExpressPCB, and OrCAD.
4. Use open source SCILAB tool and write simple programs
5. Plot various waveforms using SCILAB.
6. Simulate basic electronic system blocks using SCILAB

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		Consumer Electronics
Course Code	:	ECPE 301
Course Title	:	Consumer Electronics
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	NIL
Course Category	:	PE

RATIONALE

The objective of teaching this subject is to give students an in depth knowledge of various electronic audio and video devices and systems. Further this subject will introduce the students with working principles, block diagram, main features of consumer electronics gadgets/goods/devices. This in-turn will develop in them capabilities of assembling, fault diagnosis and rectification in a systematic way.

DETAILED CONTENTS

Unit	Topics	No. of Lectures
I	**Audio Systems**: Microphones and Loudspeakers: a) Carbon, moving coil, cordless microphone b) Direct radiating and horn loudspeaker c) Multi-speaker system d) Hi-Fi stereo and dolby system. Concept to fidelity, Noise and different types of distortion in audio system	**08**
II	**Digital Audio Fundamentals**: Audio as Data and Signal, Digital Audio Processes Outlined, Time Compression and Expansion.	**06**
III	**Television**: Basics of Television- Elements of TV communication system- Scanning and its need- Need of synchronizing and blanking pulses, VSB- Composite Video Signal Colour Television- Primary, secondary colours- Concept of Mixing, Colour Triangle- Camera tube- PAL TV Receiver- NTSC, PAL, SECAM (brief comparison)	**10**
IV	**Digital Transmission and Reception**: - Digital satellite television, Direct-To-Home (DTH) satellite television, Introduction to: Video on demand, CCTV, High Definition(HD)-TV. Introduction to Liquid Crystal and LED Screen Televisions Basic block diagram of LCD and LED Television and their comparison.	**08**
V	**Introduction to different type of domestic/commercial appliances**: - Operation of Micro-wave oven- Food Processors- Digital Electronic Lock- Vacuum cleaner- Xerox Machine- Scanner	**10**

Means of Assessment:

1. Assignments and quiz/class tests

2. Mid-term and end-term written tests
3. Model/prototype making

Suggested Books:

1. Modern Television Practice by R. R. Gulai; New Age International Publishers.
2. Audio Video Systems by R. G. Gupta; McGraw Hill Education System.
3. Audio Video Systems Principles Practices and Troubleshooting by Bali & Bali; Khanna Publishing Company
4. Consumer Electronics by S. P. Bali; Pearson Education, New Delhi
5. e-books/e-tools/relevant software to be used as recommended by AICTE/NITTTR, Chandigarh.

Course Outcome:

1. Understand the various type of microphones and loud speakers.
2. To identify the various digital and analog signal.
3. Describe the basis of television and composite video signal.
4. Describe the various kind of colour TV standards and system.
5. Compare the various types of digital TV system.
6. Understand the various type of consumer goods.

Suggestive Distribution of Marks

Unit	Topic	Time Allotted (Hrs)	Distribution (Theory Marks)			
			R Level	U Level	A Level	Total
I	Audio Systems	08	02	06	04	12
II	Digital Audio Fundamentals	06	02	03	03	08
III	Television	10	02	08	04	14
IV	Digital Transmission and Reception	08	03	04	05	12
V	Introduction to different type of domestic/commercial appliances	10	-	04	10	14
Total		**42**	**09**	**25**	**26**	**60**

Legends: *R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)*

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Consumer Electronics Lab		
Course Code	:	ECPE 311
Course Title	:	Consumer Electronics Lab
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	NIL
Course Category	:	PE

Course Content:

1. To plot the directional response of a Microphone.
2. To plot the directional response of a Loud Speaker.
3. To study public address system and its components.
4. To perform fault identification in TV.
5. Installation of Dish Antenna for best reception.
6. Installation of CCTV system.
7. To study the various parameters in the Smartphone and Tablet, PC

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.

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		Digital Signal Processing
Course Code	:	ECPE 302
Course Title	:	Digital Signal Processing
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	NIL
Course Category	:	PE

RATIONALE

Many Electrical and Power Electronics applications require complex control schemes and signal processing. Hence, for such application, embedded processor having very good control capacity and signal processing capacity both are required. So, special processors combining both these capacities are used in such applications. They are Digital Signal Controllers (DSC). They combine the best features of microcontroller (MCU) and powerful digital signal processor (DSP) capabilities in one single chip. Considering this, it becomes necessary for any electrical and power engineer involved in product development to understand the concepts of Digital Signal Processing (theoretical). Also, they should understand Digital Signal Controllers form practical implementation point of view. This subject includes both of these.

DETAILED CONTENTS

Unit	Topics	No. of Lectures
I	**Discrete Time Fourier Transform**: Review of Discrete-time Fourier Transform, Frequency response of discrete time systems, All pass inverse and minimum phase systems.	**05**
II	**The DFT and FFT**: DFT, Relationship of DFT to other transforms, FFT, DIT and DIF algorithms, Linear filtering using DFT and FFT.	**08**
III	**Design of Filters**: Frequency response of FIR filter, Design of FIR Digital filters, Window method, Park-McClellan's method, Frequency Sampling Method, Design of IIR Digital Filters, Butterworth, Chebyshev and Elliptic Approximations, Lowpass, Bandpass, Bandstop and High pass filters, Mapping formulas, Frequency transformations	**11**
IV	**Realization of FIR and IIR Filters**: Direct form realization of FIR and IIR systems, Lattice structure for FIR and IIR systems, Finite-word length effects. Limit cycle oscillations	**06**

V	**Multirate Signal Processing**: Multirate signal processing – Sampling rate conversion – applications of multirate signal processing. Parametric and non-parametric spectral estimation. Application of DSP.	**10**

Suggested Books:

1. Digital Signal Processing, Algorithms and Applications, Proakis and Manolakis, 3rd edition, Prentice Hall of India, New Delhi.
2. Discrete-time Signal processing, Alan V Oppenheim and Ronald W Schafer, 3rd edition, Pearson.
3. The Scientist & Engineer's Guide to Digital Signal Processing, Steven W Smith.
4. Understanding Digital Signal Processing, Richard G Lyons, Pearson.2017
5. Digital Signal Processing: A Practical approach, Emmanual C. Ifeachoret. Al., Pearson Education, 2nd edition

Course Outcome:

1. Understand signal processing systems using basic concepts.
2. Analyze signal using the discrete Fourier transform and its effective computation by FFT techniques.
3. Specify and design FIR and IIR type digital filters and identify the fundamentals of multi rate signal processing and its applications.
4. Understand advanced digital signal processing techniques

Suggestive Distribution of Marks

Unit	Topic	Time Allotted (Hrs)	Distribution (Theory Marks)			
			R Level	U Level	A Level	Total
I	Discrete Time Fourier Transform	05	02	05	-	07
II	The DFT and FFT	08	02	06	04	12
III	Design of Filters	11	03	05	08	16
IV	Realization of FIR and IIR Filters	06	-	06	04	10
V	Multirate Signal Processing	10	02	08	05	15
Total		**40**	**09**	**30**	**21**	**60**

Legends: *R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)*

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		Digital Signal Processing Lab
Course Code	:	ECPE 312
Course Title	:	Digital Signal Processing Lab
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	NIL
Course Category	:	PE

Course Content:

1. To represent basic signals like: Unit Impulse, Ramp, Unit Step, Exponential.
2. To generate discrete sine and cosine signals with given sampling frequency.
3. To determine impulse and step response of two vectors using MATLAB.
4. To perform convolution between two vectors using MATLAB.
5. To perform cross correlation between two vectors using MATLAB.
6. To compute DFT and IDFT of a given sequence using MATLAB.
7. To perform linear convolution of two sequence using DFT using MATLAB.
8. To determine z-transform from the given transfer function and its ROC using MATLAB.
9. To determine rational z-transform from the given poles and zeros using MATLAB.
10. To determine partial fraction expansion of rational z-transform using MATLAB.
11. To design a Type 1 Chebyshev IIR highpass filter using MATLAB.
12. To design an IIR Butterworth bandpass filter using MATLAB.
13. To design low pass filter using the Kaiser window using MATLAB.

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.

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		Optical Fiber Communications
Course Code	:	ECPE 302
Course Title	:	Optical Fiber Communications
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	PS 103, PS 104, ECPC 202
Course Category	:	PE

RATIONALE

Progressing from communication over copper wire to today's fiber optic communication, we have increased our ability to transmit more information, more quickly and over longer distances. This has expanded our boundaries and is finding a good slot in communication system. Optical fiber has replaced existing transmission media due to its advantages. As a result, the technicians are supposed to have knowledge of optical communication. This subject will provide basic concepts and requisite knowledge and skill required for optical fiber communication system.

DETAILED CONTENTS

Unit	Topics	No. of Lectures
I	**Introduction:** Advantage over other communication system. Optical wave guides-Ray theory of transmission, Total internal reflection, acceptance angle, Numerical aperture, skews rays	**06**
II	**EM theory of optical propagation**: Setup and graded index fibers, Modes and their coupling, single mode fiber, mode field diameter, spot size. Transmission characteristics of optical fiber-Intrinsic and Extrinsic absorption, Linear scattering, Fiber band loss, Material and waveguide dispersion, Intermodal dispersion, Modified single mode fiber	**08**
III	**Optical sources**: LASERS, Absorption and emission of radiation, Einstein relation, Population inversion, Optical feedback and threshold condition for laser oscillation, Optical emission from semiconductors- PN Junction, Spontaneous and stimulated emission and lasing. Heterojunctions, semiconductor injection laser, efficiency, Laser modes, Single mode operations, Injection Laser characteristics. LED structure- surface and edge emitters. LED characteristics -Optical output power, output spectrum, Modulation BW.	**10**

IV	**Optical detectors**: Principles, Direct and Indirect absorption, Group 3 to 5 alloy. Quantum efficiency, p-n-p-n, Avalanche and p-i-n photodiode. Receiver structure-Low and high impedance front end.	**08**
V	**Optical amplification**:	**08**
	Semiconductor Laser and fiber amplifier. Optical TDM, WDM. Transmission link analysis, Point to point links, System considerations, Link power budget, Rise time budget. Fiber attenuation measurements -Optical time domain reflectometer. Fiber fault location, Dispersion measurements.	

Instructional Strategy:

This subject gives the complete knowledge of optical fiber communication techniques. The teacher should make the students aware about the historical development, optical sources and optical fiber system in addition to applications of optical fiber in communication system. Since this subject deals with theory and practical, the theory should be reinforced by visit to sites and industries like BSNL having optical fiber installations in addition to practical work in the laboratory.

Suggested Books:

1. Optical Fiber Communication: Principles and Practice, 3rd Ed. John Senior, Prentice Hall of India, New Delhi., 1992
2. Optical Fiber Communication, 3rd Ed., G. Keiser, McGraw Hill International, New York, 2000
3. Optical fiber Communication by J. Gower, Prentice Hall of India, New Delhi

Course Outcome:

1. Quantitatively analyze individual components of Optical Fiber Communication link
2. Compute analog and digital optical fiber link design parameters
3. Analyze optical source, Fiber and Detector operational parameters
4. Understand, model and analyze the components of optical networking technology

Suggestive Distribution of Marks

Unit	Topic	Time Allotted (Hrs)	Distribution (Theory Marks)			
			R Level	U Level	A Level	Total
I	Introduction	06	02	04	03	09
II	EM theory of optical propagation	08	03	03	06	12
III	Optical sources	10	02	08	05	15
IV	Optical detectors	08	02	06	04	12
V	Optical amplification	08	02	05	05	12
	Total	**40**	**11**	**26**	**23**	**60**

Legends: *R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)*

Communications Lab		
Course Code	:	ECPE 312
Course Title	:	Optical Fiber Communications Lab
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	PS 103, PS 104, ECPC 202
Course Category	:	PE

Course Content:

1. To identify and use various components and tools used in optical fiber communication
2. To set up fiber analog link
3. To set up optic digital link
4. To measure bending losses in optical fibers
5. To observe and measure the splice or connector loss
6. To measure and calculate numerical aperture of optical fiber
7. To observe characteristics of optical source
8. To observe characteristics of optical detector
9. To splice the available optical fiber
10. To connect a fiber with connector at both ends

Practical Outcomes (PrOs):

1. Understand various components and light propagation methods in optical fiber communication.
2. Demonstrate various types of optical fibers
3. Identify and test losses in optical fibers
4. Explain and demonstrate characteristics of optical source and optical detector
5. Connect and provide joints in optical fibers
6. Components and tools used in optical fiber

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4. MINOR PROJECT

nor Project		
Course Code	:	PR 202
Course Title	:	Minor Project
Number of Credits	:	2 (L: 0, T: 0, P: 4)
Prerequisites	:	NIL
Course Category	:	Minor Project

Learning Outcomes:
After undergoing this subject, the student will be able to:

1. Use effectively oral, written and visual communication.
2. Demonstrate skill and knowledge of current information and technological tools and techniques specific to the professional field of study.
3. Identify, analyze and solve problems creatively through sustained critical investigation.
4. Develop co-worker and leadership abilities.
5. Apply fundamental and disciplinary concepts and methods in ways appropriate to their areas of study.

Minor project work aims at exposing the students to various industries dealing with computers. It is expected from them to get acquainted with computer environment. For this purpose, student during middle of the course are required to be sent for a period of two to four weeks at a stretch in different establishments. Depending upon the interest of students they are sent for exposure to:

1. Industrial practices in installation and maintenance of computers and computer networks
2. Fabrication of computers
3. Fault diagnosis and testing of computers
4. Industrial practices in respect of documentation and fabrication
5. A variety of computers and peripherals in assembly organizations
6. Software package development organizations
7. Maintenance of database
8. Write procedure or functions which can be attached as the library objects to the main projects.
9. Write a procedure function to convert number of words.
10. Write a procedure function to convert all data function (create your own) Database connectivity, (SQL server, Oracle, Access), Library classes in C++ (same application).,
11. Design web applications using PHP

Note: The teachers may guide /help students to identify their minor project work and check out their plan of action well in advance.

As a minor project activity each student is supposed to study the operations at site and prepare a detail project report of the observations/processes/activities by him/her. The students should be guided by the respective subject teachers. Each teacher may guide a group of 4 to 5 students. The teachers along with field supervisors/engineers will conduct performance assessment of students. Criteria for assessment will be as follows:

Criteria	Weightage
Attendance and Punctuality	15%
Initiative in performing tasks/creating new things	30%
Relation with people	15%
Report Writing	40%

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5. MAJOR PROJECT

ıjor Project		
Course Code	:	PR 301 & PR 302
Course Title	:	Major Project
Number of Credits	:	4 (L: 0, T: 0, P: 14)
Prerequisites	:	NIL
Course Category	:	Major Project

Rationale:

Project Work aims at developing innovative skills in the students whereby they apply in totality the knowledge and skills gained through the course work in the solution of particular problem or by undertaking a project. In addition, the project work is intended to place students for project oriented practical training in actual work situation for the stipulated period.

Learning Outcomes:

After undergoing the project work, the students will be able to:

1. Apply in totality the knowledge and skills gained through the course work in the solution of particular problem or by undertaking a project.
2. Develop understanding regarding the size and scale of operations and nature of fieldwork in which students are going to play their role after completing the courses of study.
3. Develop understanding of subject based knowledge given in the classroom in the context of its application at work places.
4. Develop firsthand experience and confidence amongst the students to enable them to use and apply polytechnic/institute based knowledge and skills to solve practical problems related to the world of work.
5. Develop abilities like interpersonal skills, communication skills, positive attitudes and values etc.
6. Assemble/fabricate and test an electronics gadget.

General Guidelines:

The individual students have different aptitudes and strengths. Project work, therefore, should match the strengths of students. For this purpose, students should be asked to identify the type of project work, they would like to execute. The activity of problem identification should begin well in advance (say at the end of second year). Students should be allotted a problem of interest to him/her as a major project work. It is also essential that the faculty of the respective department may have a brainstorming session to identify suitable project assignments for their students. The project assignment can be individual assignment or a group assignment. There should not be more than 3 students if the project work is given to a group. The project work identified in collaboration with industry should be preferred.

This practical training cum project work **should not be considered** as merely conventional industrial training in which students are sent at work places with either minimal

or no supervision. This experience is required to be planned in advance and supervised on regular basis by the polytechnic faculty. For the fulfillment of above objectives, polytechnics may establish close linkage with 8-10 relevant organization for providing such an experience to students. It is necessary that each organization is visited well in advance and activities to be performed by students are well defined. The chosen activities should be such that it matches with the curricular interest to students and of professional value to industrial/ field organizations. Each teacher is expected to supervise and guide 5-6 students.

Note:

A suggestive criterion for assessing student performance by the external (person from industry) and internal (teacher) examiner is given in table below:

Sr. No.	**Performance Criteria**	**Max.** Marks**	**Rating Scale**				
			Excellent	**Very Good**	**Good**	**Fair**	**Poor**
1	Selection of project assignment	10%	10	8	6	4	2
2	Planning and execution of considerations	10%	10	8	6	4	2
3	Quality of performance	20%	20	16	12	8	4
4	Providing solution of the problems or production of final product	20%	20	16	12	8	4
5	Sense of responsibility	10%	10	8	6	4	2
6	Self expression/ communication skills	5%	5	4	3	2	1
7	Interpersonal skills/human relations	5%	5	4	3	2	1
8	Report writing skills	10%	10	8	6	4	2
9	Viva voce	10%	10	8	6	4	2
Total marks		**100**	**100**	**80**	**60**	**40**	**20**

The overall grading of the practical training shall be made as per following table. In order to qualify for the diploma, students must get "Overall Good grade" failing which the students may be given one more chance to improve and re-evaluate before being disqualified and declared "not eligible to receive diploma". It is also important to note that the students must get more than six "goods" or above "good" grade in different performance criteria items in order to get "Overall Good" grade.

	Range of maximum marks	**Overall grade**
i)	More than 80	Excellent
ii)	79 <> 65	Very good
iii)	64 <> 50	Good
iv)	49 <> 40	Fair
v)	Less than 40	Poor

Important Notes:

1. These criteria must be followed by the internal and external examiner and they should see the daily, weekly and monthly reports while awarding marks as per the above criteria.
2. The criteria for evaluation of the students have been worked out for 200 maximum marks. The internal and external examiners will evaluate students separately and give marks as per the study and evaluation scheme of examination.
3. The external examiner, preferably, a person from industry/organization, who has been associated with the project-oriented professional training of the students, should evaluate the students performance as per the above criteria.
4. It is also proposed that two students or two projects which are rated best be given merit certificate at the time of annual day of the institute. It would be better if specific nearby industries are approached for instituting such awards.

The teachers are free to evolve other criteria of assessment, depending upon the type of project work.

It is proposed that the institute may organize an annual exhibition of the project work done by the students and invite leading Industrial organizations in such an exhibition.

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