SYLLABUS

DIPLOMA IN ELECTRONICS & COMMUNICATION ENGINEERING

(DAY COURSES)

w.e.f. - 2025

UNIVERSITY POLYTECHNIC
FACULTY OF ENGINEERING & TECHNOLOGY
JAMIA MILLIA ISLAMIA, NEW DELHI - 110 025

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Program Educational Objectives (PEOs):

The students of Diploma in Electronics and Communication Engineering will be able to:

PEO 1	Apply the principles of Mechanical Engineering in a variety of areas practically
PEO 2	Prepare the diploma students with employability skills
PEO 3	Motivate the students to pursue higher education Such as graduate education or other training programs in engineering science or other professional fields.
PEO 4	Inculcate the entrepreneurship skills among the students
PEO 5	Prepare the students with professional background and ethical behavior, social responsibility, and diversity, both as individuals and in team environments.

Program Outcomes (POs):

The students of Diploma in Electronics and Communication Engineering will be able to demonstrate the following:

PO 1	An ability to apply knowledge of mathematics, science, and engineering to design, conduct experiments, analyze and provide solution for engineering problems
PO 2	An ability to apply discipline - specific knowledge with an understanding of the limitations to solve core and/or applied engineering problems
PO 3	Demonstrate knowledge to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
PO 4	Understand and apply professional ethics and responsibilities and norms of the engineering practice.
PO 5	An ability to function as an individual, and as a member or leader in diverse/multidisciplinary teams.
PO 6	An ability to identify, formulate, and solve engineering problems
PO 7	An ability to communicate effectively
PO 8	A recognition of the need for, and an ability to engage in lifelong learning
PO 9	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
PO 10	Ability to engage in independent and life-long learning in the context of technological changes.

STRUCTURE OF DIPLOMA IN ELECTRONICS & COMMUNICATION ENGINEERING PROGRAM

S. No.	Category of Courses	Category Code of Courses	Breakup of Credits
1	Humanities & Social Science Courses	HS	8
2	Basic Science Courses	BS	14
3	Engineering Science Courses	ES	21
4	Program Core Courses (Branch specific)	PC	47
5	Program Elective Courses (Branch specific)	PE	13
6	Open Elective Courses (from other technical and/or emerging subjects)	OE	6
7	Project	PR	11
	Seminar	SE	
	Summer Internship (in industry or elsewhere)	SI	
8	Audit Courses	AU	Nil
		Total	**120**

EVALUATION SCHEME FOR THREE YEAR
DIPLOMA COURSE IN ELECTRONICS & COMMUNICATION ENGINEERING
SEMESTER - 1

First Semester

S .No	Code No	Subject	Course Type	Periods/Week			Credits	Distribution of Marks		
				L	T	P		IA	UE	Total
Theory Courses										
1	ECHS101	Communication Skills-I	HS	2	1	0	3	60	90	150
2	ECBS102	Applied Physics	BS	2	1	0	3	60	90	150
3	COES103	IT Systems and Computer Programming	ES	2	0	0	2	40	60	100
4	EEES104	Fundamentals of Electrical Engineering	ES	2	0	0	2	40	60	100
5	ECBS105	Applied Mathematics-I	BS	2	1	0	3	60	90	150
Practical Courses										
1	ECHS111	Communication Skills Lab	HS	0	0	2	1	30	20	50
2	ECBS112	Applied Physics Lab	BS	0	0	2	1	30	20	50
3	COES113	IT Systems and Computer Programming Lab	ES	0	0	4	2	60	40	100
4	EEES114	Fundamentals of Electrical Engineering Lab	ES	0	0	2	1	30	20	50
5	MEES116	Engineering Graphics	ES	0	0	4	2	60	40	100
						Total	**20**	**470**	**530**	**1000**

HS: Humanities & Social Science Courses
BS: Basic Science Courses
ES: Engineering Science Courses

EVALUATION SCHEME FOR THREE YEAR
DIPLOMA COURSE IN ELECTRONICS & COMMUNICATION ENGINEERING
SEMESTER - 2

Second Semester

S .No	Code No	Subject	Course Type	Periods/Week			Credits	Distribution of Marks		
				L	T	P		IA	UE	Total
Theory Courses										
1	CEES201	Engineering Mechanics	ES	2	1	0	3	60	90	150
2	ECBS202	Applied Chemistry	BS	2	1	0	3	60	90	150
3	MEES103	Fundamentals of Mechanical Engineering	ES	2	1	0	3	60	90	150
4	EEES204	Fundamentals of Electronics Engineering	ES	2	0	0	2	40	60	100
5	ECBS205	Applied Mathematics-II	BS	2	1	0	3	60	90	150
Practical Courses										
1	CEES211	Engineering Mechanics Lab	ES	0	0	2	1	30	20	50
2	ECBS212	Applied Chemistry Lab	BS	0	0	2	1	30	20	50
3	ECES214	Fundamentals of Electronics Engineering Lab	ES	0	0	2	1	30	20	50
4	MEES216	Engineering Workshop Practice	ES	0	0	4	2	60	40	100
5	ECHS217	Sports and Yoga	HS	0	0	2	1	30	20	50
Audit Courses										
1	ECAU200	Environmental Science	AU	2	0	0	0			
						Total	**20**	**460**	**540**	**1000**

HS: Humanities & Social Science Courses
BS: Basic Science Courses
ES: Engineering Science Courses
AU: Audit Courses
Note: Summer Internship-I of 4 weeks after 2nd semester

EVALUATION SCHEME FOR THREE YEAR
DIPLOMA COURSE IN ELECTRONICS & COMMUNICATION ENGINEERING
SEMESTER - 3

Third Semester

S .No	Code No	Subject	Course Type	Periods/Week			Credits	Distribution of Marks		
				L	T	P		IA	UE	Total
Theory Courses										
1	ECPC301	Electronics Devices and Circuits-I	PC	2	1	0	3	60	90	150
2	ECPC302	Digital Electronics	PC	2	1	0	3	60	90	150
3	ECPC303	Principles of Communication Engineering	PC	2	1	0	3	60	90	150
4	EEES304	Networks & Transmission Lines	PC	2	0	0	2	40	60	100
5	EEPC305	Electrical and Electronic Measurements	PC	2	0	0	2	40	60	100
Practical Courses										
1	ECPC311	Electronics Devices and Circuits-I Lab	PC	0	0	2	1	30	20	50
2	ECPC312	Digital Electronics Lab	PC	0	0	2	1	30	20	50
3	ECPC313	Principles of Communication Engineering Lab	PC	0	0	2	1	30	20	50
4	EEPC305	Electrical and Electronic Measurements Lab	PC	0	0	2	1	30	20	50
5	ECSI316	Summer Internship-I	SI	0	0	0	2	100		100
						Total	**20**	**500**	**500**	**1000**

PC: Program Core Courses
SI: Summer Internship Courses

EVALUATION SCHEME FOR THREE YEAR
DIPLOMA COURSE IN ELECTRONICS & COMMUNICATION ENGINEERING
SEMESTER - 4

Fourth Semester

S .No	Code No	Subject	Course Type	Periods/Week			Credits	Distribution of Marks		
				L	T	P		IA	UE	Total
Theory Courses										
1	ECPC401	Electronics Devices and Circuits-II	PC	2	1	0	3	60	90	150
2	ECPC402	Industrial Electronics	PC	2	1	0	3	60	90	150
3	ECPE403	Digital System Design	PE	2	0	0	2	40	60	100
4	ECPC404	Microwave and RADAR Engineering	PE	2	1	0	3	60	90	150
5	ECPC405	Computer System Architecture	PC	2	1	0	3	60	90	150
Practical Courses										
1	ECPC411	Electronics Devices and Circuits-II Lab	PC	0	0	2	1	30	20	50
2	ECPC412	Industrial Electronics Lab	PC	0	0	2	1	30	20	50
3	ECPE413	Digital System Design Lab	PE	0	0	2	1	30	20	50
4	ECPC414	Microwave and RADAR Engineering Lab	PE	0	0	2	1	30	20	50
5	ECPR416	Minor Project	PR	0	0	4	2	60	40	100
Audit Courses										
1	ECAU400	Indian Knowledge & Tradition	AU	2	0	0	0			
						Total	**20**	**460**	**540**	**1000**

PC: Program Core Courses
PE: Program Elective Courses
PR: Project Courses
AU: Audit Courses
Note: Summer Internship-II of 4 weeks after 4th semester

EVALUATION SCHEME FOR THREE YEAR
DIPLOMA COURSE IN ELECTRONICS & COMMUNICATION ENGINEERING
SEMESTER - 5

Fifth Semester

S .No	Code No	Subject	Course Type	Periods/Week			Credits	Distribution of Marks		
				L	T	P		IA	UE	Total
Theory Courses										
1	ECPC501	Advance Communication Systems	PC	2	1	0	3	60	90	150
2	ECPC502	Microprocessors and Applications	PC	2	0	0	2	40	60	100
3	ECPE503	Consumer Electronics	PE	2	1	0	3	60	90	150
4	COOE504	Cyber Security	OE	2	1	0	3	60	90	150
5	ECHS505	Entrepreneurship and Start-up	HS	2	1	0	3	60	90	150
Practical Courses										
1	ECPC511	Advance Communication Systems Lab	PC	0	0	2	1	30	20	50
2	ECPC512	Microprocessors and Applications Lab	PC	0	0	2	1	30	20	50
3	ECPE513	Consumer Electronics Lab	PE	0	0	2	1	30	20	50
4	ECSI516	Summer Internship-II	SI	0	0	0	2	60	40	100
5	ECPR517	Major Project-I	PR	0	0	2	1	50		50
						Total	**20**	**480**	**520**	**1000**

PC: Program Core Courses
PE: Program Elective Courses
OE: Open Elective Courses
HS: Humanities & Social Science Courses
SI: Summer Internship Courses
PR: Project Courses

EVALUATION SCHEME FOR THREE YEAR
DIPLOMA COURSE IN ELECTRONICS & COMMUNICATION ENGINEERING
SEMESTER - 6

Sixth Semester

S .No	Code No	Subject	Course Type	Periods/Week			Credits	Distribution of Marks		
				L	T	P		IA	UE	Total
Theory Courses										
1	ECPC601	Microcontrollers and Embedded Systems	PC	2	1	0	3	60	90	150
2	ECPC602	Data Communication and Networking	PC	2	1	0	3	60	90	150
3	ECPE603	VLSI Design and Technology	PE	2	1	0	3	60	90	150
4	COOE604	Artificial Intelligence	OE	2	1	0	3	60	90	150
Practical Courses										
1	ECPC611	Microcontrollers and Embedded Systems Lab	PC	0	0	4	2	60	40	100
2	ECPC612	Data Communication and Networking Lab	PC	0	0	4	2	60	40	100
3	ECSE616	Seminar	SE	0	0	1	1	50		50
4	ECPR617	Major Project-II	PR	0	0	6	3	90	60	150
Audit Courses										
1	ECAU600	Indian Constitution	AU	2	0	0	0			
						Total	**20**	**500**	**500**	**1000**

PC: Program Core Courses
PE: Program Elective Courses
OE: Open Elective Courses
SE: Seminar Courses
PR: Project Courses
AU: Audit Courses

Course Code	**:**	**ECHS101**
Course Title	**:**	**Communication Skills**
Number of Credits	**:**	**3 (L: 2, T: 1, P: 0)**
Prerequisites	**:**	**High School English Course**
Course Category	**:**	**HS**

Course Objectives:

- To develop confidence and proficiency in spoken English with correct pronunciation, while strengthening the four key communication skills
- To enhance public speaking, group discussions and presentation skills, enabling students to express their ideas effectively, and succeed academically, professionally and socially.
- To foster personality development by cultivating self-confidences, adaptability, emotional intelligence and resilience.
- To strengthen leadership and teamwork abilities through collaboration, efficient team management and proactive decision-making.
- To align communication and interpersonal skills with professional ethics and career aspirations and goals for long-term success.

Course Contents:

Unit-1
Basics of Communication Skills in English:

Introduction to Communication: Meaning, definition and process of communication, Types of Communication: Formal and informal; verbal, non-verbal and written, Barriers to Effective Communication: Physical, linguistic, psychological, cultural, organizational, semantic and technical barriers, 7 Cs of Effective Communication: Considerate, Concrete, Concise, Clear, Complete, Correct, Courteous, Art of Effective Communication: Choosing words, voice modulation, clarity, time management and simplification of words and Technical Communication.

Unit-II
Soft Skills and Life Skills for Personal Excellence:

Soft Skills: Personal attributes and interpersonal abilities that enhance job performance and career prospects and interpersonal interactions. Soft skills help build effective relationships, clear communication and adaptability in professional environments, Life Skills: Tools for managing personal and professional challenges, developing self-awareness and self-analysis, understanding one's strengths and weaknesses. Life skills also encompass adaptability with a positive attitude, resilience to overcome setbacks and stress; emotional intelligence to recognize, understand and manage one's emotions while responding to others, and empathy which promotes better relationships by understanding and sharing others' feelings.

Unit-III
Reading Comprehension:

Comprehension, Vocabulary Enrichment, Grammar Exercises based on reading of the following texts:

Section-1 (Stories)

1. Sparrows by K. A. Abbas
2. The Gift of the Magi by O. Henry
3. The Happy Prince by Oscar Wilde
4. Games at Twilight by Anita Desai

Section-2 (Poems)

1. Night of the Scorpion by Nissim Ezekiel
2. Stopping by Woods on a Snowy Evening by Robert Frost
3. Where the Mind is Without Fear by Rabindranath Tagore
4. My Mother at Sixty Six by Kamla Das

Unit-IV:
Professional Writing:

1. The Art of Paragraph Writing
2. Letters: Business and Personnel
3. Drafting notices, minutes of a meeting, etc.

Unit-V
Vocabulary and Grammar:

Commonly used words: Word Meaning and Usage, Synonyms and Antonyms, Dictionary skills, Contextual Vocabulary, Glossary of Official Correspondence, One-word substitution, Idioms and Phrases, Tenses and Verbs Usage (Through Translation between English and Hindi),Transformation of sentences: Interchange of Degrees of Comparison, Active and Passive Voice, Direct and Indirect Speech, Common errors: Grammatical errors, Pronunciation errors, Vocabulary errors, Wrong use of Idiomatic Expressions, etc.

References:

1. Anjana Tiwari, Communication Skills in English, Khanna Book Publishing Co. (P) Ltd. Delhi.
2. O'Connor, J. D. Better English Pronunciation, Cambridge University Press.
3. Murray, Lindley. An English Grammar: Comprehending Principles and Rules. Wilson and Sons.
4. Tiwari, Anjana, Communication Skills in English, Khanna Book Publishing Co. (P) Ltd., 2022.
5. Kumar, Kulbhushan, Effective Communication Skills, Khanna Publishing House, 2018.
6. Maison, Margaret M, Examine Your English, Orient Longman.
7. Rizvi, M. Ashraf, Effective Technical Communication, McGraw Hill.
8. Nielson, John, Effective Communication Skills, Xlibris.
9. Cambridge Advanced Learner's Dictionary, 4th ed., Cambridge University Press.

10. Roget, Peter Mark. Roget's Thesaurus of English Words and Phrases, Edited by George Davidson, Penguin Books.
11. Raman, Meenakshi, and Sangeeta Sharma, Technical Communication: Principles and Practice, Oxford University Press.
12. Swan, Michael, Practical English Usage, Oxford University Press.
13. Balasubramanian, T. A Textbook of English Phonetics for Indian Students. Macmillan.
14. Murphy, Raymond, Intermediate English Grammar, Cambridge University Press.

Course Outcomes:

At the completion of this course the students will be able to:

CO1	Develop conceptual clarity on communication and its components, identify and overcome barriers to effective communication, apply the 7 Cs for clarity and precision; refine verbal and non-verbal skills through word choice, voice modulation and master technical communication for professional excellence.
CO2	Acquire essential soft and life skills to enhance personal and professional effectiveness, foster strong interpersonal relationships, cultivate adaptability and resilience, apply and demonstrate emotional intelligence and empathy for meaningful interactions and career success.
CO3	Enhance reading comprehension through diverse literary texts, enrich vocabulary, strengthen grammar and develop critical thinking and analytical skills for deeper textual interpretation. Foster a lifelong learning mindset, develop and promote empathy, resilience, cultural awareness and values such as patriotism, familial bonds, scientific attitude and self-awareness, logic and rationality.
CO4	Attain proficiency in professional writing by mastering paragraph structuring, composing effective business and personal letters and drafting formal documents such as notices and meeting minutes with clarity and precision.
CO5	Strengthen vocabulary and grammar skills through word usage, synonyms, antonyms, and contextual vocabulary, master official correspondence terminology, enhance accuracy in sentence transformation, tense usage and translation and rectify common errors in grammar, pronunciation and idiomatic expressions for effective communication.

Course Code	**:**	**ECBS102**
Course Title	**:**	**Applied Physics**
Number of Credits	**:**	**3 (L: 2, T: 1, P: 0)**
Prerequisites	**:**	**High School Physics Course**
Course Category	**:**	**BS**

Course Objectives:

- To develop a foundational understanding of concepts of physics.
- To utilize theoretical concepts to solve real-world problems.
- To improve analytical, mathematical and problem-solving skills in physics.
- To analyze physical phenomena and interpret the results.
- To introduce practical applications of physics in engineering and technology.

Course Contents:

Unit-I
Physical World, Units, and Measurements:

Physical Quantities: Fundamental and derived units, Systems of units (FPS, CGS and SI), Dimensions: Dimensional formulae, principle of homogeneity, derivation of simple equations and correctness of physical equations, Measurements: Least count, significant figures, error analysis and measuring instruments.

Unit-II
Vectors and Mechanics:

Scalar and vector quantities: Addition and subtraction of vectors, scalar and vector product, resolution of vector, Conservation of momentum, Work and energy, kinetic and potential energy, work-energy theorem.

Unit-III
Electromagnetism:

Electric Field: Coulomb's law, electrostatic field, Gauss's law, and its applications (charged sheet, sphere etc.), electrostatic potential, Capacitance: parallel plate capacitor, series and parallel combinations, energy stored in capacitor, Electric Current: Resistance, Kirchhoff's laws and their applications, Generation of Magnetic Field: Biot-Savart law, magnetic field due to current carrying straight wire and circular loop, Permanent magnets, Effect of Magnetic Field: Force on current-carrying wires, torque on current-carrying loop, Devices: Moving coil galvanometer and its conversion to ammeter and voltmeter.

Unit-IV
Heat and Thermal properties:

Heat, modes of heat transfer, specific heat (C_p and C_v), Scales of temperature and thermometer, thermocouple and Seebeck effect, Thermal conductivity, thermal expansion, engineering applications.

Unit-V

Waves and Optics:

Simple Harmonic Motion: Time period, frequency, amplitude, transverse and longitudinal waves, superposition, Principle of interference, Reflection and Refraction: Total internal reflection and its application in fiber optics. Lens formula, magnification, optical instruments: simple microscope, compound microscope and astronomical telescope, LASER and applications.

References:

1. Physics Textbook for Class XI (Part 1 and Part 2) & XII (Part 1 and Part 2), NCERT.
2. David Halliday, Robert Resnick & Jearl Walker, Principles of Physics, John Wiley and Sons.
3. Vivek Talati & Vinod Kumar Yadav, Applied Physics-I (with Lab manual), Khanna Book Publishing Co. (P) Ltd.
4. Hussain Jeevakhan, Applied Physics-II (with lab manual), Khanna Book Publishing Co. (P) Ltd.
5. A Manual of Higher Secondary Physics Laboratory Kit, NCERT.
6. M. Mudassir Husain & M. Rafat, An Experience of Physics, Cadplan Publishers.
7. E-books/e-tools/learning physics software/YouTube videos/websites etc.

Course Outcomes:

At the end of the course the students will be able to:

CO1	Identify dimensions of physical quantities and correctness of physical equations, use accurate units and apply rules of error propagation and significant figures.
CO2	Perform vector operations and analyze vectors to apply them in the problem related to principles of mechanics.
CO3	State key concepts of electrostatics, current electricity and electromagnetism and derive standard results and solve problems based on these concepts.
CO4	Demonstrate understanding of the concepts of heat and thermal properties and identify their applications in real-world scenarios.
CO5	Recall the fundamental principles of simple harmonic motion and wave motion and describe the working of optical devices along with their applications.

Course Code:	**:**	**COES103**
Course Title	**:**	**IT Systems and Computer Programming**
Number of Credits	**:**	**2 (L: 2, T: 0, P: 0)**
Prerequisites	**:**	**Nil**
Course Category	**:**	**ES**

Course Objectives:

- To understand the fundamentals of computers, information technology and data representation.
- To analyze computer system based on hardware, software and different types of memories.
- To apply algorithms and flowchart for writing programs using C language.
- To understand C programming using array and functions.
- To apply structures and pointers for writing programs using C language.

Course Contents:

Unit-I

Information Technology System and Data Representation:

Digital computer systems, Characteristics, Digital vs. Analog computer systems, History, Computer generations, Types of computers and their classifications, Application of computer in various fields, Types of Personal Computers (PC),PC setup and Basic Input Output System; Working knowledge of PC software including Word Processor; Introduction to Information Technology (IT), Components of an IT system: Hardware, Software, Networks, Data, People, and Processes; Data representation: Number systems, radix, decimal, binary, octal, hexadecimal, conversion, and Complements: 1's complement, 2's complement, 9's complement, and 10's complement.

Unit-II

Computer Hardware, Software, and Memories:

Elements of computer hardware, CPU, I/O devices, storage and media used in PCs, Computer software: Types of software, System software, Application software, Introduction to Operating System (OS), Functions and types of OS, DOS commands, Memory system of a PC, Primary memory, Random access memory, Read only memory, Secondary memory, Types of secondary Storage, Access mechanism of storage devices.

Unit-III

Elements of Algorithms and Programming in C:

Computer languages, Generation of languages, Translators- Assemblers, Interpreters, Compilers, Algorithm, Pseudo-code, Flowchart rules and symbols, Structured programming concepts, Introduction to 'C', importance of C, basic structure of a C program, constants, variables and data types, Operators and expressions, managing I/O operations, Control statement: 'IF'

statement and its various forms, go to statement, for, while and do- while loops, Switch decision making statement.

Unit-IV

Array and Functions:

Introduction to array, Array notation, storage and representation, manipulating array elements, using multidimensional arrays, Functions: Built-in and user defined functions and their applications; Use of built-in graphics functions to draw 2D objects.

Unit-V

Structures and Pointers:

Introduction to structures, Purpose, and usage of structures, declaring structures, assigning of structures, Pointers: Introduction, Address operator, and Basic programs using pointers, File handling, sequential and random-access files, Memory allocation, Command line parameters.

References:

1. Thareja R., Computers Fundamentals and Programming in C, Oxford University Press 3rd Edition.
2. Kanetkar Y., Let Us C: Authentic Guide to C Programming Language, BPB Publications.
3. Ram B. and Kumar S., Computer Fundamentals: Architecture and Organization, New Age International Private Limited.
4. Balagurusamy E., Computing Fundamentals and C Programming, McGraw Hill Education.

Course Outcomes:

CO1	Explain about computer system, components of IT system and different ways of data representation.
CO2	Differentiate among computer hardware, computer software and memories.
CO3	Write C programs based on algorithm and flowchart.
CO4	Implement algorithms using array and functions of C programming language.
CO5	Demonstrate the use of structures and pointers in C programming language.

Course Code	**:**	**EEES104**
Course Title	**:**	**Fundamentals of Electrical Engineering**
Number of Credits	**:**	**2 (L: 2, T: 0, P: 0)**
Prerequisites	**:**	**Nil**
Course Category	**:**	**ES**

Course Objectives:

- To provide basic knowledge of electric and magnetic quantities and their units.
- To teach the basic concepts of electric and magnetic circuits as well as their inter-relations.
- To learn the various electrical rules/laws/theorems to help students deal with electrical engineering applications in industrial processes of different fields.
- To understand the concepts of alternating current and voltage, impedance, and phase angle.
- To learn the construction and principle of different types of transformers and rotating machines.

Course Contents:

Unit-I

Electric Circuits:

Basic concepts of charge, Electrical quantities and their units, Ohm's law; Resistance, Resistances in series; Resistances in parallel, Kirchhoff's laws & their applications, Network theorems, Laws of resistance, Temperature coefficient of resistance, Grouping of cells and Numerical problems.

Unit-II

Electromagnetism:

Introduction to electromagnetism; Magnetic field at the axis of a solenoid; Force on a current carrying conductor placed in the magnetic field; Force between two parallel current carrying conductors, Faraday's laws of electromagnetic induction; Lenz's law; Dynamically and statically induced emfs, Self and mutual inductances, Coefficient of coupling and Simple numerical problems.

Unit-III

Magnetic Circuits:

Magnetic flux & flux density, Magnetizing force, Magneto motive force (mmf); Absolute and relative permeability, Reluctance, Series and parallel magnetic circuits, Ampere-turn calculations, Leakage flux, Leakage factor, Analogy between electric and magnetic circuits and Numerical problems.

Unit-IV

A.C. Circuits:

Concept of alternating current and voltage, Cycle, Frequency, Periodic time, Amplitude, Angular velocity, Average value, RMS value, Form factor, Peak factor, Impedance, Phase angle, Mathematical and phasor representation of alternating emf and current, A.C. through pure resistance, pure inductance & pure capacitance, Concept of conductance, susceptance & admittance, Power factor, A.C. in R-L, R-C, R-L-C series and parallel circuits.

Unit-V

Transformer and Rotating Machines:

General construction and principle of different type of transformers; Emf equation and transformation ratio of transformers; Auto transformers; Construction and working principle of motors; Basic equations and characteristic of motors, B-H curve, Concept of eddy current and hysteresis; Hysteresis loop; Eddy current and hysteresis losses.

References:

1. Ritu Sahdev, Basic Electrical Engineering, Khanna Publishing House.
2. Mittal and Mittal, Basic Electrical Engineering, McGraw Education, New Delhi.
3. Saxena, S. B. Lal, Fundamentals of Electrical Engineering, Cambridge University Press.
4. Theraja, B. L., Electrical Technology Vol. - I, S. Chand Publications, New Delhi.
5. Theraja, B. L., Electrical Technology Vol. - II, S. Chand Publications, New Delhi.
6. Jegathesan, V., Basic Electrical and Electronics Engineering, Wiley India, New Delhi.

Course Outcomes:

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

CO1	Analyze electric circuits using Ohm's law, Kirchhoff's laws, and network theorems.
CO2	Understand the fundamental principles of electromagnetism, including electromagnetic induction and magnetic forces.
CO3	Design and analyze magnetic circuits, including magnetizing force, reluctance, and permeability.
CO4	Analyze and design AC circuits, including impedance, phase angle, and power factor.
CO5	Understand the construction, principle, and operation of transformers and rotating machines.

Course Code	**:**	**ECBS105**
Course Title	**:**	**Applied Mathematics-I**
Number of Credits	**:**	**3 (L: 2, T: 1, P: 0)**
Prerequisites	**:**	**High School Mathematics Course**
Course Category	**:**	**BS**

Course Objectives:

- To develop foundational knowledge of trigonometry.
- To strengthen understanding of algebraic concepts.
- To enhance combinatorial and theoretical skills.
- To introduce determinants and matrices
- To explore and apply complex numbers.

Course Contents:

Unit-I

Trigonometry: Grades, radians and their conversions, Trigonometric ratios of allied angles (without proof), sum, difference formulae and their applications (without proof), Product formulae (transformation of product to sum, differences and vice-versa), Trigonometric ratios of multiple and sub-multiple angles, Statement of cosine formula, sine formula, Napier's, half angle formula and Heron's formula.

Unit-II

Algebra: Sequences and series: Arithmetic progression, its nth term, sum to n terms. Geometric progression, its n^{th} term, sum to n terms and sum of infinite terms, Finite sum of squares and cubes of natural numbers, Partial fraction: Definition of polynomial fraction and partial fractions, proper and improper fraction. To resolve proper fraction into partial fraction with denominator containing non-repeated linear factors, repeated linear factor and irreducible non-repeated quadratic factors.

Unit-III

Combinatory and Binomial Theorem: Permutations and Combinations: Basic Counting techniques, Value of P (n, r) and C (n, r), and their applications, Binomial Theorem: Binomial theorem (without proof) for positive integral index (expansion, general term, and middle term), Binomial theorem (without proof) for any index (expansion and general term) and Binomial approximation of first and second-degree terms.

Unit-IV

Determinants and Matrices: Matrices : Definition and examples of matrices, types of matrices, Basic operations, Equality of matrices, addition, multiplication of two matrices, scalar multiplication of a matrix, Transpose of a matrix, symmetric, skew-symmetric matrices, singular and non-singular matrices, cofactor matrix, adjoint of a matrix, inverse of a matrix, Determinants: Determinants (up to 3^{rd} order only), minors, co-factors, Properties of

determinants, Solution of linear simultaneous equations in three variables by Cramer's rule and matrix inverse methods.

Unit-V

Complex Numbers: Modulus and amplitude of a complex number, Conjugate of a complex number, Polar and Cartesian representation of a complex number and its conversion from one form to other, Operations on complex numbers, De-Moivrer's theorem and its application, cube roots and n-th roots of unity.

References:

1. H.K. Das, Rama Verma & Rajneesh Verma, Mathematics for Polytechnics, CBS Publishers.
2. R. D. Sharma, Applied Mathematics, Dhanpat Rai Publications.
3. Deepak Singh, Mathematics-I, Khanna Book Publishing Co. Pvt. Ltd.
4. Garima Singh, Mathematics-II, Khanna Book Publishing Co. Pvt. Ltd.

Course Outcomes:

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

CO1	Apply trigonometric identities and formulas to solve problems involving angles, including those related to sum, difference, product, multiple, and sub-multiple angles.
CO2	Solve problems involving sequences and series, including arithmetic progression, geometric progression, and partial fractions, to analyze and simplify expressions.
CO3	Apply the principles of permutations and combinations to solve counting problems and use the binomial theorem for expansion and approximations.
CO4	Use matrices and determinants to solve systems of linear equations, perform matrix operations, and understand key properties and types of matrices.
CO5	Perform operations on complex numbers in both polar and Cartesian forms and apply De Moivrer's theorem to solve problems involving powers and roots of complex numbers.

Course Code	**:**	**ECHS111**
Course Title	**:**	**Communication Skills Lab**
Number of Credits	**:**	**1 (L: 0, T: 0, P: 2)**
Prerequisites	**:**	**Communication Skills Theory**
Course Category	**:**	**HS**

Course Objectives:

- To enhance listening, speaking and digital communication for professional and social interaction.
- To develop leadership, teamwork and public speaking for impactful presentations.
- To cultivate professional etiquette, cultural sensitivity and global awareness for diverse work environments.

Course Contents:

Listening Skills - Enhancing Comprehension and Interpretation:

1. Introduction to active listening strategies, focusing on listening for main ideas, details and inferences.
2. Practice with a variety of audio-visual materials such as recorded lectures, podcasts, interviews, TED talks, speeches and debates.
3. Listening tests based on different accents, dialects and speech patterns to improve listening comprehension in diverse settings.
4. Exercises to differentiate between tone, mood and intent in spoken language to strengthen interpretative skills.
5. Focus on active listening and emotional regulation during interactions.

Phonetics and Pronunciation - Mastering Sounds for Clarity:

1. Study of the International Phonetic Alphabet (IPA) for accurate word transcription and pronunciation.
2. Practice with consonants, vowels, diphthongs, stress patterns and weak forms to ensure precise and clear speech.
3. Syllable division and understanding of stress patterns to enhance fluency and speech rhythm.
4. Focus on intonation, voice modulation and pitch for effective communication and expressiveness.
5. Techniques to improve accent reduction and pronunciation for clearer, more confident speech.

Speaking Skills - Effective Expression and Interaction:

1. Focus on formal and standard speech practices in various contexts: academic, business and public communication, Exercises to enhance self-awareness, adaptability and resilience in challenging communication situations.
2. Development of oral presentation skills with emphasis on structure, clarity and audience engagement.

3. Training in group discussions, debates and impromptu speaking to build confidence and articulation.
4. Mock interviews and role-playing exercises to prepare students for real-world professional situations.
5. Techniques for effective communication in business settings, including business presentations and public speaking engagements.
6. Practice in conveying ideas clearly, assertively and persuasively in both individual and group settings.

Vocabulary Enhancement - Building Lexical Resource:

1. Construction of new words through affixes, prefixes and suffixes to enhance word formation skills.
2. Extensive practice with phrasal verbs, idioms and foreign phrases to build fluency in diverse communication settings.
3. Introduction to jargon and specialized vocabulary related to organizational structures, industries and professional settings.
4. Development of contextual vocabulary for accurate and appropriate word choices in different settings (formal vs. informal, professional vs. casual).

Digital and Virtual Communication - Handling Online Platforms:

1. Techniques for effective communication in virtual settings, including webinars, video conferencing and digital presentations.
2. Introduction to virtual communication etiquette: body language, tone and engagement in online meetings and webinars.
3. Practice with writing and responding to professional emails, creating formal online presentations and using digital tools for effective communication.
4. Developing skills to manage cross-cultural communication in global digital platforms.
5. Developing empathy and emotional intelligence in communication for effective relationship-building.

References:

1. Anjana Tiwari, Communication Skills in English, Khanna Book Publishing Co. (P) Ltd. Delhi.
2. Jones, Daniel, The Pronunciation of English, Cambridge University Press.
3. Hartman, James, English Pronouncing Dictionary, Cambridge University Press.
4. Kumar, Kulbhushan, Effective Communication Skills, Revised ed., Khanna Publishing House.
5. O'Connor, J. D. Better English Pronunciation, Cambridge University Press.
6. Murray, Lindley, An English Grammar: Comprehending Principles and Rules, Wilson and Sons.
7. Maison, Margaret M. Examine Your English, Orient Longman.
8. Sethi, J. A Practice Course in English Pronunciation, Prentice Hall, 2004.
9. Pfeiffer, William Sanborn, and T. V. S. Padmaja, Technical Communication: A Practical Approach, Pearson.

10. Bansal, R. K., and J. B. Harrison, Spoken English: A Manual of Speech and Phonetics, Orient Blackswan.

Course Outcome:

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

CO1	Apply active listening to understand key ideas, analyze speech patterns, interpret tone for effective communication, and master International Phonetic Alphabet, fine tune pronunciation and enhance fluency, intonation and accent for confident speech.
CO2	Strengthen formal speech proficiency, improve presentations and build confidence through discussions, debates and role-plays, and expand vocabulary, develop fluency in idioms and phrasal verbs and refine word choice for effective formal and informal communication.
CO3	Excel virtual and cross-cultural communication, enhance non-verbal skills and adapt to diverse accents with personalized feedback, and cultivate emotional intelligence, resilience and adaptability for success in academic and professional settings.

Course Code	**:**	**ECBS112**
Course Title	**:**	**Applied Physics Lab**
Number of Credits	**:**	**1 (L: 0, T: 0, P: 2)**
Prerequisites	**:**	**Applied Physics Theory**
Course Category	**:**	**BS**

Course Objectives:

- To value the importance of precise measurement and error analysis.
- To develop and enhance students' hands-on skills in measuring and recording of experiment data.
- To relate theoretical concepts of physics to real-world applications and engineering tasks.

List of Experiments:

1. To measure the volume of a cylinder using a Vernier caliper and calculate the associated uncertainty in the volume.
2. To measure the area of cross-section of a wire using a screw gauge and calculate the associated uncertainty in the area.
3. To determine radius of curvature of a spherical surface using spherometer.
4. To determine the spring constant of helical spring using dynamic method.
5. Verification of Ohm's law.
6. Conversion of galvanometer into Ammeter/Voltmeter of desired range.
7. To determine focal length of a convex lens.
8. To determine temperature of room and hot bath using thermometer and convert the value into different scales.

References:

1. M. Mudassir Husain & M. Rafat, An Experience of Physics, Cadplan Publishers.
2. A Manual of Higher Secondary Physics Laboratory Kit, NCERT.
3. Vivek Talati & Vinod Kumar Yadav, Applied Physics-I (with Lab manual), Khanna Book Publishing Co. (P) Ltd.
4. Hussain Jeevakhan, Applied Physics-II (with lab manual), Khanna Book Publishing Co. (P) Ltd.

Course Outcomes:

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

CO1	Demonstrate a systematic approach to performing experiments and reporting results with significant figures and calculating experimental errors.
CO2	Measure volume, area of cross-section, radius of curvature, temperature, spring constant and focal length using appropriate instruments or methods and calculate the associated uncertainties.
CO3	Design an ammeter or a voltmeter using moving coil galvanometer and identify relationship between current and voltage.

Course Code:	**:**	**ECOES113**
Course Title	**:**	**IT Systems and Computer Programming Lab**
Number of Credits	**:**	**2 (L: 0, T: 0, P: 4)**
Prerequisites	**:**	**IT Systems and Computer Programming Theory**
Course Category	**:**	**ES**

Course Objectives:

- To understand the functionalities of various MS office tools such as Word, PowerPoint and Excel for document creation and presentations.
- To apply C programming concept such as decision-making, loops and arrays for problem solving.
- To write C programs using functions, graphics, structures and pointers to manipulate data and generate visual outputs.

List of Experiments/Programs:

1. Identify various word options dialog and make your resume to showcase your skills and experience.

2. Make a question paper of applied mathematics of your course using equation editor of word.

3. Make a power point presentation to discuss the importance of IT system and computer programming.

4. Design a spreadsheet using Excel to convert Celsius to Fahrenheit and Fahrenheit to Celsius.

5. Write an algorithm and program in C to check whether a given number is even or odd.

6. Write an algorithm and program in C to input marks of five subjects, i.e., Physics, Applied Mathematics, Information Technology, Digital Electronics and Workshop, and compute the percentage as well as grade according to the following conditions: If percentage >= 90%: Grade A; If percentage >= 80%: Grade B; If percentage >= 70%: Grade C; If percentage >= 60%: Grade D; If percentage >= 40%: Grade E; If percentage < 40%: Grade F (Failed). Modify this program using logical AND operator.

7. Draw a flowchart to print the multiplication table of a number entered by the users; also write a program for generating the multiplication table using different types of loops.

8. Write an algorithm and program in C to add "n" numbers using two-dimensional array.

9. Write a program in C using function to calculate the factorial of a given number.

10. Write a program in C to draw any two-dimensional object using built-in graphics functions.

11. Write a program in C using structure to store and display the information of a book.

12. Write a program in C using pointers to swap two numbers entered by user.

Course Outcomes:

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

CO1	Design professional documents, presentations and spreadsheets using MS office tools.
CO2	Develop C programs using control structures, different types of loops and arrays.
CO3	Implement various types of problems using functions, structures, pointers and graphics.

Course Code	**:**	**EEES114**
Course Title	**:**	**Fundamentals of Electrical Engineering lab**
Number of Credits	**:**	**1 (L: 0, T: 0, P: 2)**
Prerequisites	**:**	**Fundamentals of Electrical Engineering Theory**
Course Category	**:**	**ES**

Course Objectives:

- To verify Ohm's law and analyze series and parallel combination of resistances in the circuit.
- To familiarize students with measurement and analysis of active, reactive and apparent power in a single phase R-L, R-C and R-L-C series circuit and to understand the concept of power factor using impedance triangle.
- To determine the permeability of a magnetic material by plotting B-H curve and analyze the transformation ratio of a single-phase transformer.

List of Experiments:

1. To verify the Ohm's law and draw its I-V characteristics.
2. To verify the relation $R_T = R_1 + R_2 + R_3 + \ldots\ldots\ldots + R_N$ in series combination of resistances.
3. To verify the relation $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots\ldots\ldots \frac{1}{R_N}$ in parallel combination of resistances.
4. To determine the permeability of magnetic material by plotting its B-H curve.
5. To measure the voltage, current and power in single phase R-L series circuit. Draw its voltage, impedance and power triangle.
6. To measure the voltage, current and power in single phase R-C series circuit. Draw its voltage, impedance and power triangle.
7. To measure the voltage, current and power in single phase R-L-C series circuit. Draw its voltage, impedance and power triangle.
8. To determine the transformation ratio of single phase transformer.

Course Outcomes:

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

CO1	Verify Ohm's law, series and parallel combination of resistances.
CO2	Measure and calculate active, reactive and apparent power, impedance and power factor in a single-phase R-L, R-C and R-L-C series ac circuits.
CO3	Determine the permeability of a magnetic material and able to find the transformation ratio of a single-phase transformer.

Course Code:	**:**	**MEES116**
Course Title	**:**	**Engineering Graphics**
Number of Credits	**:**	**2 (L: 0, T: 0, P: 4)**
Prerequisites	**:**	**Nil**
Course Category	**:**	**ES**

Course Objectives:

- To understand the language of graphics which is used to express ideas, convey instructions while carrying out engineering jobs.
- To develop drafting and sketching skills, to know the applications of drawing equipment and get familiarize with Indian Standards related to engineering drawings.
- To develop skills to visualize actual object and to draw, read various engineering curves, projections, dimensioning styles and understand common symbols used in engineering.

Course Content:

Introduction to Engineering Drawing:

Drawing Instruments and supporting materials, Sizes and layout of standard drawing sheets, Sizes of drawing boards, Method to use them with applications.

Lines:

Convention of lines and their applications, Different types of lines in engineering drawing as per BIS Specifications, Practice of vertical, horizontal and inclined lines.

Lettering:

Free hand and instrumental lettering (Alphabet and numerals) – upper case (Capital Letter), single stroke, vertical and inclined at 75degrees, series of 5,8,12 mm of free hand and instrumental lettering of height 25 to 35 mm in the ratio of 7:4.

Dimensioning Techniques:

Necessity of dimensioning, Dimensioning techniques as per BIS (Board of Indian standard) SP-46:2003 – types and applications of chain, parallel and coordinate dimensioning. Dimensioning of overall sizes, circles, threaded holes, chamfered surfaces, angles, tapered surfaces, holes, equally spaced on P.C.D., counter sunk holes, counter bored holes, cylindrical parts, narrow spaces and gaps, radii, curves and arches.

Scales:

Scales and their need and importance, Type of scales, Representative Fractions - reduced, enlarged and full-size scales; Engineering Scales such as plain, diagonal scale and Vernier scale.

Geometrical Constructions:

Construction of ellipse, parabola and hyperbola by eccentricity method and other methods, cycloids, epicycloids and hypocycloids, regular polygons, involute.

Projections:

Introduction to projections, Basic concepts of projection techniques, Projection of points and lines, Projection of Points in different quadrant, Projection of Straight Line (First angle and Third angle) Line parallel to both the planes, Line perpendicular to any one of the reference planes, Line inclined to any one of the reference planes.

Common Symbols and Conventions used in Engineering:

Important Terms used in Building Drawing, Civil Engineering sanitary fitting symbols, Electrical fitting symbols for domestic interior installations.

S. No.	Practical Exercises
1	Draw lines and letter writing in single and double strokes.
2	Select and construct appropriate drawing scales, use drawing equipments and understand Indian Standard of Engineering Drawing.
3	Construct the various curves, draw views of given object and understand engineering convention used in drawing.

References:

1. Bhatt, N. D. Engineering Drawing. Charotar Publishing House, Anand, Gujarat.
2. P S Gill, Engineering Drawing, SK Kataria and sons. Delhi.
3. Jain & Gautam, Engineering Graphics & Design, Khanna Publishing House, New Delhi.
4. Dhawan, R. K. Engineering Drawing. S. Chand and Company, New Delhi.
5. Shah, P. J. Engineering Drawing. S. Chand and Company, New Delhi.
6. Jeyapoovan, T. Essentials of Engineering Drawing and Graphics using AutoCAD. Vikas Publishing House Pvt. Ltd, Noida.

Course Outcomes:

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

CO1	Draw lines and letter writing in single and double stroke.
CO2	Select and construct appropriate drawing scales, use drawing equipment's, and understand Indian Standards of engineering drawing.
CO3	Construct the various curves, draw views of given object and understand engineering convention used in drawing.

Course Code	**:**	**CEES 201**
Course Title	**:**	**Engineering Mechanics**
Number of Credits	**:**	**3 (L:2, T: 1, P: 0)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**ES**

Course Objectives:

- To obtain resultant of various forces and support reactions through condition of equilibrium.
- To know the centre of gravity and moment of inertia of composite.
- To understand motion, work, power and energy.
- To understand role of friction in equilibrium problems.
- To know fundamental laws of machines and their applications to various engineering problems.

Course Contents:

Unit-I

Basics of Mechanics and Force System:

Basics of Mechanics: Significance and relevance of Mechanics, Applied mechanics, Statics, Dynamics. Space, time, mass, particle, flexible body and rigid body, scalar and vector quantity, units of measurement (SI units) - Fundamental units and derived units.Force Systems: units, representation as a vector and by Bow's notation, characteristics and effects of a force, principle of transmissibility of force, force system and its classification, resolution of a force -orthogonal components of a force, Composition of forces – Resultant, analytical method for determination of resultant for concurrent, non-concurrent and parallel co-planar force systems– Law of triangle, parallelogram and polygon of forces.

Unit-II

Equilibrium:

Force: Equilibrium and Equilibrant, Free body and Free body diagram, Analytical and graphical methods of analyzing equilibrium, Lami's Theorem – statement and explanation, Application for various engineering problems. Moment: Moment of a force, Varignon's theorem, Types of beam, supports (simple, hinged, roller and fixed) and loads acting on beam (vertical and inclined point load, uniformly distributed load, couple), Beam reaction for cantilever, simply supported beam with or without overhang – subjected to combination of point load and uniformly distributed load, beam reaction graphically for simply supported beam subjected to vertical point loads only.

Unit-III

Centre of Gravity and Moment of Inertia:

Centre of Gravity: Centre of gravity and centroid of geometrical plane figures (square, rectangle, triangle, circle, semi-circle, quarter circle). Centroid of composite figures composed of not more

than three geometrical figure. Centre of Gravity of simple solids (Cube, cuboid, cone, cylinder, sphere, and hemisphere), Centre of Gravity of composite solids composed of not more than two simple solids. Moment of Inertia: Definition, M.I. of plane lamina, Radius of gyration, section modulus, Parallel and Perpendicular axes theorems (without derivations), M.I. of rectangle, square, circle, semi-circle, quarter circle and triangle section (without derivations), M.I. of symmetrical and unsymmetrical I-section, Channel section, T-section, Angle section, Hollow sections and built up sections about centroidal axes and any other reference axis, Polar moment of Inertia of solid circular sections.

UNIT-IV

Motion, Work, Power and Energy:

Rectilinear Motion: Newton's law of motion, momentum, conservation of momentum, impulse, torque. Circular motion: Angular motion, Equation of motion, angular momentum, torque, centripetal and centrifugal force. Work, Power & Energy: Definition of terms, Work Energy principles, Conservation of Mechanical Energy, simple numerical problems.

Unit-V

Friction and Simple Lifting Machine:

Friction: Friction and its relevance in engineering, types and laws of friction, limiting equilibrium, limiting friction, co-efficient of friction, angle of friction, angle of repose, relation between coefficient of friction and angle of friction, equilibrium of bodies on level surface subjected to force parallel and inclined to plane, equilibrium of bodies on inclined plane subjected to force parallel to the plane only. Simple Lifting Machine: Simple lifting machine, load, effort, mechanical advantage, applications and advantages, velocity ratio, efficiency of machines, law of machine, Ideal machine, friction in machine, maximum mechanical advantage and efficiency, reversible and non-reversible machines, conditions for reversibility, velocity ratios of Simple axle and wheel, Differential axle and wheel, Worm and worm wheel, Single purchase and double purchase crab winch, Simple screw jack, Weston's differential pulley block, geared pulley block.

References:

1. D.S. Bedi, Engineering Mechanics, Khanna Publications, New Delhi.
2. Khurmi, R.S., Applied Mechanics, S. Chand & Co. New Delhi.
3. Bansal RK, A text book of Engineering Mechanics, Laxmi Publications.
4. Ramamrutham, Engineering Mechanics, S. Chand & Co. New Delhi.
5. Ram, H. D., Chauhan, A. K., Foundations and Applications of Applied Mechanics, Cambridge University Press.
6. Meriam, J. L., Kraige, L.G., Engineering Mechanics-Statics, Vol. I, Wiley Publication, New Delhi.
7. Upadhay A. K., Applied Mechanics, S.K. Kataria & Sons, New Delhi.

Course Outcomes:

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

CO1	Determine unknown forces and support reactions of different engineering systems.
CO2	Find the centroid, centre of gravity and moment of inertia of various components in engineering systems.
CO3	Apply work, power and energy concept to solve rectilinear and circular motion problems.
CO4	Apply the principles of friction in various conditions for useful purposes.
CO5	Select the relevant simple lifting machine(s) for given purposes.

Course Code	**:**	**ECBS202**
Course Title	**:**	**Applied Chemistry**
Number of Credits	**:**	**3 (L: 2, T: 1, P: 0)**
Prerequisites	**:**	**High School Chemistry Course**
Course Category	**:**	**BS**

Course Objectives:

- To understand atomic structure concepts (Rutherford's model, Bohr's theory, quantum numbers) and chemical bonding (ionic, covalent, coordination) to understand molecular structures (H_2O, NH_3, CH_4) and concentration methods (molarity, normality, mole fraction).
- To explore water hardness and its effects on industrial processes, to learn methods for determining hardness and water-softening techniques (soda lime, zeolite, ion exchange) and to examine municipal water treatment and drinking water standards.
- To study metal extraction and iron-based materials (cast iron, steel), to understand heat treatment and alloys (brass, bronze and duralumin) and to learn about polymers (types, preparation, applications).
- To classify and analyze the combustion of fuels, to calculate calorific values and to study the properties of fuels (LPG, CNG) and to learn about lubricants' physical and chemical properties.
- To understand the principles of electrochemistry including oxidation-reduction reactions and corrosion types, to learn methods for preventing corrosion such as design, alloying, cathode protection and coating.

Course Contents:

Unit-I
Atomic Structure, Chemical Bonding and Solutions:

Rutherford model of atom, Bohr's theory, Quantum numbers - orbital concept, Shapes of s, p and d orbital, Pauli's exclusion principle, Hund's rule of maximum multiplicity, Aufbau rule and electronic configuration, Concept of chemical bonding – cause of chemical bonding, types of bonds: ionic bonding (NaCl example), covalent bond (H_2, F_2, HF, $BeCl_2$, BF_3, CH_4, NH_3, H_2O), coordination bond in NH_4^+, and anomalous properties of NH_3, H_2O due to hydrogen bonding, Solution – idea of solute, solvent and solution, methods to express the concentration of solution-molarity, normality, strength, ppm, mass percentage, volume percentage, mass by volume percentage and mole fraction.

Unit-II
Water:

Classification of soft and hard water, salts causing water hardness, unit of hardness and simple numerical on water hardness, Problems caused by the use of hard water in boiler (scale and sludge, foaming and priming, corrosion etc), and quantitative measurement of water hardness by EDTA method. Estimation of dissolved oxygen, free chlorine, chloride ion and alkalinity, Water softening techniques – soda lime process, zeolite process and ion exchange process, Municipal water treatment (in brief only) - sedimentation, coagulation, filtration, sterilization, Water for human consumption for drinking and cooking purposes from any water sources and enlist Indian standard specification of drinking water (collecting data and understand standards).

Unit-III
Engineering Materials:

Natural occurrence of metals - minerals & ores of iron, Pig Iron, Cast iron, Steel and Heat treatment of steal, Alloys – definition, purposes of alloying, Composition, properties and uses of Brass, Bronze, Gun metal, Invar and Duralumin, Polymers – monomer, homo and co polymers, simple reactions involved in preparation and their application of thermoplastics and thermosetting polymers (PVC, PS, PTFE, nylon–6, nylon-6,6 and Bakelite), rubber and vulcanization of rubber.

Unit-IV
Chemistry of Fuels and Lubricants:

Definition of fuel and combustion of fuel, classification of fuels, calorific values (HCV and LCV), Calculation of HCV and LCV using Dulong's formula, Fractional distillation of crude petroleum, octane number and cetane number, Chemical composition, calorific values and applications of LPG, CNG, Water gas, Coal gas and Producer gas, Lubrication – function and characteristic properties of good lubricant, classification with examples, lubrication mechanism - hydrodynamic and boundary lubrication, physical properties (viscosity and viscosity index, oiliness, flash and fire point, cloud and pour point) and chemical properties of lubricant (acid number, saponification value).

Unit-V
Electrochemistry:

Electronic concept of oxidation, reduction and redox reactions, Definition of terms: electrolytes, non-electrolytes with suitable examples, Faraday's law of electrolysis, Introduction to Corrosion of metals: Definition, types of corrosion: Chemical and Electrochemical corrosion, Galvanic corrosion, Concentration corrosion, Pitting corrosion and Stress corrosion, Protection of corrosion by Proper designing, Alloying, Cathodic and anodic protection and Coating methods, Primary and Secondary Cells.

References:

1. Anju Rawlley & Devdatta Vinayakrao Saraf, Applied Chemistry (with lab manual), Khanna Book Publishing Co. (P) Ltd. Delhi.
2. Chemistry for Class XI& XII (Part-I, Part-II), N.C.E.R.T., Delhi.
3. Agarwal, & Shikha, Engineering Chemistry, Cambridge University Press, New Delhi.

4. C.N. R. Rao, Understanding Chemistry, Universities Press (India) Pvt. Ltd. Dara, S. S. & S. S. Umare, Engineering Chemistry, S. Chand. Publication, New Delhi.
5. Jain & Jain, Engineering Chemistry, Dhanpat Rai and Sons, New Delhi.
6. S. Vairam, Engineering Chemistry, Wiley India Pvt. Ltd., New Delhi.
7. G. H. Hugar & A. N. Pathak, Applied Chemistry Laboratory Practices (Vol. I and Vol. II), NITTTR Publications, Chandigarh.
8. Rajesh Agnihotri, Chemistry for Engineers, Wiley India Pvt. Ltd.

Course Outcomes:

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

CO1	Explain atomic models, describe the concept of quantum numbers, and predict the shape and properties of molecules based on different types of chemical bonding, including ionic, covalent, and coordination bonds, as well as calculate the concentration of solutions using various methods.
CO2	Classify water as hard or soft, understand the causes of water hardness, calculate water hardness, and describe methods of water softening and municipal water treatment processes, while adhering to Indian standards for drinking water.
CO3	Identify the natural occurrence of metals, understand the properties and uses of alloys like brass, bronze, and duralumin, and explain the characteristics and applications of polymers, including thermoplastics, thermosetting plastics, and rubber.
CO4	Classify fuels based on their combustion properties, calculate calorific values using Dulong's formula, and describe the types of lubrication, the properties of lubricants, and their functions in industrial applications.
CO5	Explain redox reactions, differentiate between electrolytes and non-electrolytes, identify types of corrosion, and outline methods for preventing corrosion in metals.

Course Code	**:**	**MEES203**
Course Title	**:**	**Fundamentals of Mechanical Engineering**
Number of Credits	**:**	**3 (L: 2, T: 1, P: 0)**
Prerequisites	**:**	**Nil**
Course Category	**:**	**ES**

Course Objectives:

- To demonstrate the safety care and precautions in various mechanical shops while working with tools and machines.
- To understand working principles of lathe operations and power transmission.
- To understand laws of thermodynamics and heat transfer processes.
- To understand the working principles of heat engines.
- To understand working principles of power developing and power absorbing devices.

Course Contents:

Unit-I

Introduction to Mechanical Shops:

Introduction, safety, care and precaution in workshop, Material, operations & tools used in carpentry shop, fitting shop, smithy shop, Welding Shop, Principle of operation of Arc welding and gas welding, tools and equipment used in arc and gas welding, soldering and brazing.

Unit-II

Lathe & Its Operations:

Introduction, Function of various parts of a lathe, Classification and specification of various types of lathe, Lathe operations - Plain and step turning, facing, taper turning, drilling, reaming, boring, threading and knurling, Milling Machine, Shaper and Planer Machines, Drilling Machine, Grinding Machine. Modes of Power Transmission: Transmission of Power through belt: flat belt V belt open belt and cross belt device, Derivation of tension ratio for flat belt, power transmission through chain and gears, Spur, Helical, Bevel, Rack and Pinion

Unit-III

Basic Thermodynamics:

Fundamental concept of Thermodynamics: Introduction, Define Systems, Thermodynamic Equilibrium, Properties, State, Process and Cycle, Elementary introduction to Zeroth, First and Second laws of thermodynamics, Practical application of thermodynamics. Steam boiler: Introduction, classification, boiler accessories and mountings, construction and working of Cochran boiler, Babcock & Wilcox boiler

Steam turbine: Impulse and Reaction Turbines

Unit-IV

Heat Engines:

Heat Engines: Introduction, classifications, Components of IC engines, Cylinder, crankcase, crankpin, crank, crankshaft, connecting rod, wrist pin, piston, cooling pins cylinder heads, exhaust valve, inlet valve; Working of four-stroke and two-stroke petrol and diesel engines; Comparison of two stroke and four stroke engines; Comparison of C. I. and S. I. engines.

Unit-V

Thermal & Fluid Systems:

Refrigeration and Air Conditioning System: Introduction and applications, Ton of refrigeration (TR), coefficient of performance, vapour compression cycle, vapour absorption cycle, Window air conditioner. Pumps: working principle of Reciprocating and centrifugal pump. Air compressor: working principle of rotary air compressor (root blower, vane blower), Fluid systems: Working principle of hydraulic jack, hydraulic lift, hydraulic coupling

References:

1. M. P. Poonia & S.C. Sharma, Basic Mechanical Engineering, Khanna Pub. House, Delhi.
2. M L Mathur, F S Mehta and R. P. Tiwari, Elements of Mechanical Engineering, Jain Brothers, New Delhi.
3. B S Raghuvanshi, Workshop Technology (Vol.1 & 2), Dhanpat Rai and Sons, New Delhi.
4. J. Benjamin, Textbook of Basic Mechanical Engineering, Publisher: Kollam, Pentex.
5. Roy Chaudhary, Basic Engineering Thermodynamics, Tata McGraw Hill, Delhi.

Course Outcomes:

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

CO1	Identify tools used in various mechanical workshops.
CO2	Understand functions and operations of machine tools including milling, shaping, grinding and lathe machines and mode of power transmission in machines.
CO3	Explain laws of thermodynamics and its practical application of thermodynamics.
CO4	Illustrate various parts of internal combustion engine .
CO5	Understand basics of pump, compressor and refrigeration and air-conditioning systems.

Course Code:	**:**	**ECES204**
Course Title	**:**	**Fundamentals of Electronics Engineering**
Number of Credits	**:**	**2 (L: 2, T: 0, P: 0)**
Prerequisites	**:**	**Nil**
Course Category	**:**	**ES**

Course Objectives:

- To get the ideas about the applications of electronics engineering in different fields of life.
- To gain in-depth knowledge of p-n junction diode and its applications in electronic switching and rectifier circuits.
- To explore the idea of electronic filtration process by using various filter circuits.
- To gain knowledge about the zener diode and its application in voltage regulator.
- To get familiarized with bipolar junction transistor and its applications in electronic switching and amplifier circuits.

Course Contents:

Unit-I

PN Junction Diode:

PN Junction diode, Depletion layer, Potential barrier, Behavior of P-N junction diode under forward and reverse bias, Cut-in voltage, Reverse saturation current, V-I characteristics, Breakdown phenomenon, Static and dynamic resistance and their calculations from diode characteristics, Dynamic resistance of the diode in terms of diode current, Diode ratings and specifications.

Unit-II

Rectifiers and Filters:

Rectifier circuits, Principle of operation and output waveforms of half wave rectifier, centre tapped and bridge type rectifier, Average value and RMS value of output voltage and load current, Performance analysis of rectifier circuits: ripple factor and rectification efficiency, Filter circuits, Shunt capacitor filter, Series inductor filter, L-type and pie type filter, Physical explanation of working of the shunt capacitor and series inductor filter and their suitability.

Unit-III

Special Purpose Diodes:

Zener diode: construction and operation, zener and avalanche breakdown mechanism, V-I characteristics, Zener ratings: zener voltage, minimum zener current, maximum zener current, maximum zener power dissipation and zener resistance, Application of Zener diode in voltage regulator circuit, Brief description with V-I characteristics and applications of varactor diode and light emitting diode.

Unit-IV

Bipolar Junction Transistor:

Concept of bipolar junction transistor as a two junction three terminal device, NPN and PNP transistor, Principle of operation of transistor, Transistor current relation, Different

configurations: CB, CE, and CC, concept of leakage current and effect of temperature on it, input and output characteristics, Determination of input, output dynamic resistances and current amplification factor from the characteristics, Comparison of the three configurations.

Unit-V

Amplifier and Biasing Circuits:

Transistor as an amplifier in CE configuration, DC equivalent circuit, DC load line and operating point, Factors affecting operating point, Thermal runway condition of transistor, Effect of fixing operating point in cut off and saturation region, Different biasing circuits: Fixed biasing, collector to base biasing, potential divider biasing and emitter biasing circuit, Calculation of operating point for these biasing circuits, Merits and demerits.

References:

1. N. N. Bhargava, D. C. Kulshrestha, S. C. Gupta, Basic Electronics and Linear Circuits, Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. V. K. Mehta, Rohit Mehta, Principles of Electronics, S. Chand and Company, New Delhi.
3. Albert Malvino, David Paul, Electronics Principles, McGraw Hill Education, New Delhi.
4. R. S. Sedha, A Text Book of Applied Electronics, S. Chand and Company, New Delhi.
5. David Bell, Fundamental of Electronic Devices and Circuits, Oxford University Press.

Course Outcomes:

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

CO1	Explain the construction, working and characteristics of p-n junction diode.
CO2	Gain knowledge about the rectifier and filter circuits in converting ac signal into smooth dc signal.
CO3	Develop the ability to understand the application of zener diode in voltage regulator circuit.
CO4	Gain in-depth knowledge about the construction, working and characteristics of bipolar junction transistor.
CO5	To understand the applications of bipolar junction transistor in switching and amplification.

Course Code	**:**	**ECBS205**
Course Title	**:**	**Applied Mathematics-II**
Number of Credits	**:**	**3 (L: 2, T: 1, P: 0)**
Prerequisites	**:**	**Applied Mathematics-I**
Course Category	**:**	**BS**

Course Objectives:

- To develop mathematical foundations.
- To explore advanced problems-solving techniques.
- To understand and apply geometrical and analytical concepts.
- To develop the ability to solve first and second order differential equations.
- To enhance computational skills in vectors.

Course Contents:

Unit-I

Differential Calculus: Concept of limits and continuity (without problems), Four standard limits:$\lim_{n\to a}\frac{x^n-a^n}{x-a}$, $\lim_{x\to 0}\frac{\sin x}{x}$, $\lim_{x\to 0}\frac{a^x-1}{x}$, and $\lim_{x\to 0}(1+x)^{\frac{1}{x}}$. Differentiation of functions by first principle, Differentiation of sum, difference, product and quotient of two functions, Differentiation of function of a function (Chain rule), Differentiation of trigonometric and inverse trigonometric functions, Logarithmic differentiation, Higher order derivatives (or successive differentiation).

Unit-II

Integral Calculus: Integration as inverse operation of differentiation, Simple integration by substitution**,** by parts and by partial fractions, Use of $\int_0^{\frac{\pi}{2}} \sin^m x \cos^n x\, dx$ for solving problems, where *m* and *n* are positive integers, Evaluation of definite integral, Properties of definite integral, area bounded by a curve between two ordinates and *x*-axis.

Unit-III

Co-ordinate Geometry of Two Dimensions: Definition of locus with problems, Equations of straight lines in various forms, Angle between two lines, Perpendicular distance formula, Study of properties of Circle, Parabola, Ellipse and Hyperbola.

Unit-IV

Ordinary Differential Equations: Ordinary differential equation, Order and degree of differential equations, Solution of differential equations of first order and first degree, Variable separable, Homogeneous and Linear differential equations, Complementary function and Particular integral of linear differential equations of 2nd order with constant coefficient.

Unit-V

Vectors: Scalars and vectors, addition and subtraction of vectors and their simple applications,

multiplication of a vector by a scalar, Scalar and vector product of two vectors and their simple applications, Scalar product of three vectors and its geometrical interpretation.

References:

1. H.K. Das, Rama Verma & Rajneesh Verma, Mathematics for Polytechnics, CBS Publishers.
2. R.D. Sharma, Applied Mathematics, Dhanpat Rai Publications.
3. Deepak Singh, Mathematics-I, Khanna Book Publishing Co. Pvt. Ltd.
4. Garima Singh, Mathematics-II, Khanna Book Publishing Co. Pvt. Ltd.

Course Outcomes:

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

CO1	Use the concept of limits and differentiation to find derivatives of functions, including applications of sum, difference, product, quotient, chain rule, and differentiation of trigonometric, inverse trigonometric and logarithmic functions.
CO2	Apply integration techniques such as substitution, integration by parts, and partial fractions to evaluate integrals, and understand the properties of definite integrals for finding areas and solving related problems.
CO3	Analyze and solve problems related to the equations of straight lines, conic sections, and loci, and apply the properties of geometric shapes like circles, parabolas, ellipses, and hyperbolas.
CO4	Formulate and solve ordinary differential equations of first and second order, including separable, homogeneous, and linear equations, and find complementary functions and particular integrals.
CO5	Understand and perform operations on vectors, including addition, subtraction, scalar multiplication, scalar and vector products, and apply these operations in geometric contexts and real-world applications.

Course Code	**:**	**CEES 211**
Course Title	**:**	**Engineering Mechanics Lab**
Number of Credits	**:**	**1 (L: 0,T: 0, P: 2)**
Prerequisites	**:**	**Engineering Mechanics Theory**
Course Category	**:**	**ES**

Course Objectives:

- To obtain resultant of various forces and calculate support reactions through conditions of equilibrium for various structures.
- To understand the role of friction in equilibrium problems.
- To know fundamental laws of machines and their applications to various engineering problems.

List of Experiments (Any 10):

1. To find the M.A., V.R., Efficiency and law of machine for Differential Axle and Wheel.
2. To find the M.A., V.R., Efficiency and law of machine for Simple Screw Jack.
3. Derive Law of machine using Worm and worm wheel.
4. Derive Law of machine using Single purchase crab.
5. Derive Law of machine using double purchase crab.
6. Derive Law of machine using Weston's differential or wormed geared pulley block.
7. Determine resultant of concurrent forces by Y-stem applying Law of Polygon of forces using force table.
8. Determine resultant of concurrent forces by Y-stem graphically.
9. Determine resultant of parallel forces by Y-stem graphically.
10. Verify Lami's theorem.
11. Study forces in various members of Jib crane.
12. Determine support reactions for simply supported beam.
13. Obtain support reactions of beam using graphical method.
14. Determine coefficient of friction for motion on horizontal and inclined plane.
15. Determine centroid of geometrical plane figures.

Course Outcomes:

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

CO1	Determine unknown force/s of different engineering systems.
CO2	Apply the principles of friction in various conditions for useful purposes.
CO3	Select the relevant simple lifting machine/s for given purposes.

Course Code	**:**	**ECBS212**
Course Title	**:**	**Applied Chemistry Lab**
Number of Credits	**:**	**1 (L: 0, T: 0, P: 2)**
Prerequisites	**:**	**Applied Chemistry Theory**
Course Category	**:**	**BS**

Course Objectives:

- To perform chemical analysis to determine the purity of oxalic acid, analyze NaOH and KOH mixtures and estimate various water quality parameters such as hardness, chloride ions, free chlorine, dissolved oxygen and alkalinity.
- To estimate temporary, permanent and total water hardness using the EDTA method and assess water quality by measuring chloride ions, free chlorine and dissolved oxygen.
- To determine the viscosity of lubricating oils using the Redwood Viscometer and estimate the moisture content in coal samples.

List of Experiments:

1. To determine the purity percentage of oxalic acid in a given impure mixture.
2. To analyse a mixture of NaOH and KOH (given a solution contacting 2.5g mixture of NaOH and KOH per litre).
3. To estimate the calcium and magnesium hardness in the given water sample.
4. To estimate the Chloride ion (Cl^-) in the given water sample.
5. To estimate the free Chlorine (Cl_2) in the given water sample.
6. To estimate the dissolved Oxygen (D.O) in the given water sample.
7. To estimate the Alkalinity in the given water sample.
8. To estimate the temporary, permanent and total hardness in the given water sample by EDTA method.
9. To determine the viscosity of a lubricating oil by Redwood Viscometer.
10. To determine the moisture percentage in a coal sample.

References:

1. A. Rawlley &D.V. Saraf, Applied Chemistry (with lab manual), Khanna Book Publishing Co. (P) Ltd. Delhi.
2. G. H. Hugar & A. N. Pathak, Applied Chemistry Laboratory Practices (Vol. I and Vol. II), NITTTR Publications, Chandigarh.

Course Outcomes:

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

CO1	Recall and explain the principles and methods used in the quantitative analysis of chemical substances, including the estimation of purity, hardness, and chloride ions and dissolved oxygen in water samples.

CO2	Demonstrate the ability to apply appropriate analytical techniques, such as titration and viscosity measurement, to determine chemical concentrations and physical properties in various samples including water, lubricants and coal.
CO3	Analyze experimental data, evaluate the results for accuracy and precision and assess the impact of different factors (e.g. impurities, water quality) on the outcomes of chemical and physical measurements.

Course Code:	**:**	**ECES214**
Course Title	**:**	**Fundamentals of Electronics Engineering Lab**
Number of Credits	**:**	**1 (L: 0, T: 0, P: 2)**
Prerequisites	**:**	**Fundamentals of Electronics Engineering Theory**
Course Category	**:**	**ES**

Course Objectives:

- To develop understanding of characteristics of p-n junction, zener and light emitting diode in different biasing conditions.
- To analyze the performance of various rectifiers without and with different filter circuits.
- To plot input and output characteristics curves for common base and common emitter bipolar junction transistor.

List of Experiments:

1. To draw V-I characteristics of p-n junction diode and to calculate its static and dynamic resistances in forward and reverse bias conditions.
2. To draw V-I characteristics of zener diode and to calculate its static and dynamic resistances in forward and reverse bias conditions.
3. To draw V-I characteristics of light emitting diode and to calculate its static and dynamic resistances in forward and reverse bias conditions.
4. To calculate ripple factor for half wave rectifier without filter and with filters.
5. To calculate ripple factor for centre-tap full wave rectifier without filter and with filters.
6. To calculate ripple factor for bridge type full wave rectifier without filter and with filters.
7. To draw input characteristics for common base transistor and to calculate its static and dynamic resistances.
8. To draw output characteristics for common base transistor and to calculate its static and dynamic resistances.
9. To draw input characteristics for common emitter transistor and to calculate its static and dynamic resistances.
10. To draw output characteristics for common emitter transistor and to calculate its static and dynamic resistances.

Course Outcomes:

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

CO1	To calculate static and dynamic resistance of various semiconductor diodes in forward and reverse bias conditions.
CO2	To measure and calculate the ripple factor produced by various rectifiers without and with different filter circuits.
CO3	To compute static and dynamic input and output resistances of bipolar junction transistor.

Course Code	**:**	**MEES216**
Course Title	**:**	**Engineering Workshop Practice**
Number of Credits	**:**	**2 (L: 0 T: 0 P: 4)**
Prerequisites	**:**	**Nil**
Course Category	**:**	**ES**

Course Objectives:

- To understand the use of different tools, equipment and safety precautions in the workshop.
- To understand, identify, select and use various marking, measuring, and holding, striking and cutting tools and equipment.
- To understand and interpret job drawings, produce jobs and acquire skills to operate and inspect the job for specified dimensions.

Course Contents:

S. No.	Details of Practical Content
1	**Carpentry Shop:** 1. Safety Precautions to be served in the shop. 2. Demonstration of different wood working tools/machines and different wood working processes, like plaining, marking, chiselling, grooving, turning of wood etc. 3. One simple job involving any one joint like mortise and tenon dovetail, bridle, half lap etc.
2	**Fitting Shop:** 1. Safety Precautions to be served in the shop 2. Demonstration of different fitting tools different operations like chipping, filing, drilling, tapping, sawing, cutting etc. 3. One simple fitting job involving practice of above operations
3	**Welding Shop:** 1. Safety Precautions to be served in the shop 2. Demonstration of different welding tools / machines, and arc Welding, Gas Welding, MIG, MAG welding, gas cutting and rebuilding of broken parts with welding 3. One simple job involving butt and lap joint
4	**Sheet Metal shop:** 1. Safety Precautions to be served in the shop 2. Demonstration of different sheet metal tools / machines 3. Demonstration of different sheet metal operations like sheet cutting, bending, edging, end curling, lancing, soldering, brazing, and riveting 4. One simple job involving sheet metal operations and soldering and riveting.
5	**Smithy Shop:** 1. Safety Precautions to be served in the shop 2. Demonstration and detailed explanation of tools, equipment used 3. One simple job involving operation of forging a square headed bolt.

6	**Machine Shop:** 1. Safety Precautions to be served in the shop 2. Study and sketch of lathe machine, bench grinder, milling machine, drilling machine. 3. Study of various operations on lathe machine such as turning, step turning, taper turning, facing, and knurling.

References:

1. S K Hajara Chaudhary, Workshop Technology, Media Promoters and Publishers, New Delhi.
2. H S Bawa, Mechanical Workshop Practice, McGraw Hill Education.
3. B S Raghuwanshi, Workshop Technology, Dhanpat Rai and sons, New Delhi.
4. K Venkat Reddy, Workshop Practice Manual, BS Publications, Hyderabad.
5. Kents Mechanical Engineering Hand book, John Wiley and Sons, New York.

Course Outcomes:

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

CO1	Acquire practical skills of using various marking, measuring, holding, striking and cutting tools, equipment and machines.
CO2	Understand job drawing, job material and complete jobs as per specification in allotted time.
CO3	Operate, control different machines and equipment adopting safety practices.

Course Code	**:**	**ECHS217**
Course Title	**:**	**Sports and Yoga**
Number of Credits	**:**	**1 (L: 0 T: 0 P: 2)**
Prerequisites	**:**	**Nil**
Course Category	**:**	**HS**

Course Objectives:

- To make the students understand the importance of sound health and fitness principles as they relate to better health.
- To expose the students to a variety of physical and yogic activities aimed at stimulating their continued inquiry about Yoga, physical education, health and fitness.
- To create a safe, progressive, methodical and efficient activity-based plan to enhance improvement and minimize risk of injury.

Course Contents:

Introduction to Physical Education:

Meaning and definition of physical education, Aims & objectives of physical education and changing trends in physical education.

Olympic Movement:

Ancient & Modern Olympics (Summer & Winter), Olympic Symbols, Ideals, Objectives & Values, Awards and Honors in the field of Sports in India (Dronacharya Award, Arjuna Award, Dhayanchand Award, Rajiv Gandhi Khel Ratna Award etc.)

Physical Fitness, Wellness & Lifestyle:

Meaning and importance of physical fitness & wellness, Components of physical fitness, Components of health-related fitness, Components of wellness, Preventing health threats through lifestyle change and concept of positive lifestyle.

Fundamentals of Anatomy & Physiology in Physical Education, Sports and Yoga:

Define Anatomy, Physiology & its importance, Effect of exercise on the functioning of various body systems. (Circulatory System, Respiratory System, Neuro-Muscular System etc.).

Kinesiology, Biomechanics & Sports:

Meaning and importance of Kinesiology & Biomechanics in physical education & Sports, Newton's Law of Motion & its application in sports and Friction and its effects in Sports.

Postures:

Meaning and concept of postures, Causes of bad posture., Advantages and disadvantages of weight training, Concept and advantages of correct posture, Common postural deformities - Knock Knee; Flat Foot; Round Shoulders, Lordosis, Kyphosis, Bow Legs and Scoliosis, Corrective measures for postural deformities.

Yoga:

Meaning & Importance of Yoga, Elements of Yoga, Introduction - Asanas, Pranayama, Meditation & Yogic Kriyas, Yoga for concentration & related Asanas (Sukhasana; Tadasana; Padmasana and Sha-shankasana), Relaxation Techniques for improving concentration - Yog-nidra.

Yoga & Lifestyle:

Asanas as preventive measures, Hypertension: Tadasana, Vajrasana, Pavan Muktasana, Ardha Chakrasana, Bhujangasana, Sharasana, Obesity: Procedure, Benefits & contraindications for Vajrasana, Hastasana, Trikonasana, Ardh Matsyendrasana. Back Pain: Tadasana, Ardh Matsyendrasana, Vakrasana, Shalabhasana, Bhujangasana. Diabetes: Procedure, Benefits & contraindications for Bhujangasana, Paschimottasana, Pavan Muktasana, Ardh Matsyendrasana. Asthema: Procedure, Benefits & contraindications for Sukhasana, Chakrasana, Gomukhasana, Parvatasana, Bhujangasana, Paschimottasana, Matsyasana.

Training and Planning in Sports:

Meaning of training, Warming up and limbering down, Skill, technique and style, Meaning and objectives of planning, Tournament - Knock-out, League/Round Robin and Combination

Psychology and Sports:

Definition & Importance of Psychology in Physical Edu.& Sports, Define & Differentiate Between Growth & Development, Adolescent Problems & Their Management, Emotion: Concept, Type & Controlling of emotions, Meaning, Concept & Types of Aggressions in Sports, Psychological benefits of exercise, Anxiety & Fear and its effects on Sports Performance, Motivation, its type & techniques.

Doping:

Meaning and concept of doping, Prohibited substances and methods, Side effects of prohibited substances.

Sports Medicines:

First Aid – Definition aims and objectives, Sports injuries: Classification, causes and prevention, Management of injuries: Soft tissue injuries and bone and joint Injuries.

Sports / Games:

Following sub topics related to any one Game/Sport of choice of student out of: Athletics, Badminton, Basketball, Chess, Cricket, Kabaddi, Lawn Tennis, Swimming, Table Tennis, Volleyball, Yoga etc. History of the Game/Sport, Latest General Rules of the Game/Sport, Specifications of play fields and related sports equipment, Important tournaments and venues, Sports personalities, Proper sports gear and its importance.

References:

1. Modern Trends and Physical Education by Prof. Ajmer Singh.
2. Light on Yoga by B. K. S. Iyengar.
3. Health and Physical Education – NCERT (11th and 12th Classes)

Course Outcomes:

On successful completion of the course the students will be able to:

CO1	Improve personal fitness and development of understanding of health and psychological problems associated with the age and lifestyle.
CO2	Learn techniques for increasing concentration and decreasing anxiety which leads to stronger academic performance.
CO3	Understand basic skills associated with yoga and physical activities and perform yoga movements in various combination and forms.

Course Code	**:**	**ECAU200**
Course Title	**:**	**Environmental Science**
Number of Credits	**:**	**0 (L: 2, T: 0, P: 0)**
Prerequisites	**:**	**High School Science**
Course Category	**:**	**AU**

Course Objectives:

Technicians working in industries or elsewhere essentially require the knowledge of environmental science so as to enable them to work and produce most efficient, economical and eco-friendly finished products.

- Solve various engineering problems applying ecosystem to produce eco-friendly products.
- Use relevant air and noise control method to solve domestic and industrial problems.
- Use relevant water and soil control method to solve domestic and industrial problems.
- To recognize relevant energy sources required for domestic and industrial applications.
- Solve local solid and e-waste problems.

Course Contents:

Unit-I

Ecosystem:

Structure of ecosystem, Biotic and abiotic components, Food chain and food web, Aquatic (Lentic and Lotic) and terrestrial ecosystem Carbon, Nitrogen, Sulphur, Phosphorus cycle, Global warming -Causes, effects, process, Green House Effect, Ozone depletion

Unit-II

Air and Noise Pollution:

Definition of pollution and pollutant, Natural and manmade sources of air pollution (Refrigerants, I.C., Boiler), Air Pollutants: Types, Particulate Pollutants: Effects and control (Bag filter, Cyclone separator, Electrostatic Precipitator), Gaseous Pollution Control: Absorber, Catalytic Converter, Effects of air pollution due to Refrigerants, I.C., Boiler

Noise pollution: sources of pollution, measurement of pollution level, Effects of Noise pollution, Noise pollution (Regulation and Control) Rules, 2000.

Unit-III

Water and Soil Pollution:

Sources of water pollution, Types of water pollutants, Characteristics of water pollutants Turbidity, pH and total suspended solids, total solids BOD and COD: Definition, calculation, Waste Water Treatment: Primary methods: sedimentation, froth floatation, Secondary methods: Activated sludge treatment, Trickling filter, Bioreactor, Tertiary Method: Membrane separation technology, RO (reverse osmosis), Causes, Effects and Preventive measures of Soil Pollution: Causes-Excessive use of Fertilizers, Pesticides and Insecticides, Irrigation, E-Waste.

Unit-IV

Renewable Sources of Energy:

Solar Energy: Basics of Solar energy, Flat plate collector (Liquid & Air), Theory of flat plate collector, Importance of coating, Advanced collector, Solar pond, Solar water heater, solar dryer, Solar stills, Biomass: Overview of biomass as energy source, Thermal characteristics of biomass

as fuel, Anaerobic digestion, Biogas production mechanism, Utilization and storage of biogas, Wind energy: Current status and future prospects of wind energy, Wind energy in India, Environmental benefits and problem of wind energy, New Energy Sources: Need of new sources. Different types new energy sources, Applications of (Hydrogen energy, Ocean energy resources, and Tidal energy conversion), Concept, origin and power plants of geothermal energy.

Unit-V

Solid Waste Management, ISO 14000 and Environmental Management:

Solid waste generation- Sources and characteristics of: Municipal solid waste, E- waste, biomedical waste, Metallic wastes and Non-Metallic wastes (lubricants, plastics, rubber) from industries, Collection and disposal: MSW (3R, principles, energy recovery, sanitary landfill), Hazardous waste, Air quality act 2004, air pollution control act 1981 and water pollution and control act1996, Structure and role of Central and state pollution control board, Concept of Carbon Credit, Carbon Footprint, Environmental management in fabrication industry, ISO14000: Implementation in industries, Benefits.

References:

1. Rao, C. S., Environmental Pollution Control and Engineering, New Age International Publication.

2. O.P. Gupta, Elements of Environmental Pollution Control, Khanna Publishing House, New Delhi.

3. S.C. Sharma & M.P. Poonia, Environmental Studies, Khanna Publishing House, New Delhi.

4. C.N. R. Rao, Understanding Chemistry, Universities Press (India) Pvt. Ltd.

5. Arceivala, Soli Asolekar, Shyam, Waste Water Treatment for Pollution Control and Reuse, Mc-Grawilliam, Cohen, Lisa, Environmental Engineering Science, Willy, New York.

6. Rao, M. N. Rao, H.V.N, Air Pollution, Tata Mc-Graw Hill Publication, New Delhi.

7. Frank Kreith, Jan F Kreider, Principles of Solar Engineering, McGraw-Hill, New York.

8. Aldo Vieira, Da Rosa, Fundamentals of renewable energy processes, Academic Press Oxford, UK.

9. Patvardhan, A.D, Industrial Solid Waste, Teri Press, New Delhi.

10. Metcalf & Eddy, Waste Water Engineering, Mc-Graw Hill, New York.

11. Keshav Kant, Air Pollution & Control, Khanna Publishing House, New Delhi.

Course Outcomes:

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

CO1	Understand the ecosystem and terminology and solve various engineering problems applying ecosystem knowledge to produce eco – friendly products.

CO2	Explain the suitable air, extent of noise pollution, and control measures and acts.
CO3	Observe the water and soil pollution, and control measures and acts.
CO4	Distinguish different renewable energy resources and efficient process of harvesting.
CO5	Understand solid Waste Management, ISO 14000 & Environmental Management.

Course Code:	**:**	**ECPC301**
Course Title	**:**	**Electronics Devices & Circuits-I**
Number of Credits	**:**	**3 (L: 2, T: 1, P: 0)**
Prerequisites	**:**	**Fundamentals of Electronics Engineering**
Course Category	**:**	**PC**

Course Objectives:

- To familiarize with various transistor biasing and stabilization circuits.
- To understand about different small signal amplifiers.
- To understand about different large signal amplifiers.
- To get idea of single and double tuned voltage amplifiers.
- To learn different types of feedback amplifiers with their practical aspect.

Course Contents:

Unit-I

Single Stage Small Signal Amplifier:

Single stage transistor amplifier with proper biasing components, Explanation of phase reversal of the output voltage with respect to input voltage, AC and DC load lines, Concept of power gain as a product of voltage gain and current gain, Development of transistor hybrid low frequency model in CE configuration, Complete analysis of the transistor using approximate and exact hybrid equivalent circuit in CE configuration, Loading effects of R_S and R_L.

Unit-II

Multi-stage Transistor Amplifier:

Need of multi-stage amplifier, Gain of multi-stage amplifier, Different coupling schemes used in multi-stage amplifiers, Decibels and its significance, R-C coupled multi-stage amplifier: working, advantages, disadvantages, applications and frequency response, Transformer coupled amplifier: working, advantages, disadvantages, applications and frequency response, Direct coupled amplifier: working, advantages, disadvantages, applications and frequency response, Darlington pair amplifier, Difference amplifier: typical circuit diagram and working.

Unit-III

Transistor Audio Power Amplifier:

Need of power amplifier, Difference between voltage and power amplifier, Performance parameters, Classification of power amplifiers (class A, B, AB & C), Single ended class A amplifier, Importance of impedance matching, Class A amplifier,: characteristics, collector efficiency and overall frequency, Class B amplifier: characteristics, collector efficiency and

overall frequency, Maximum power dissipation curve and its significance, Heat sinks and its importance, Distortion in amplifiers.

Unit-IV

Transistor Audio Power Amplifier and Tuned Voltage Amplifier:

Working principle of push-pull amplifier circuits, its advantages over single-ended power amplifier, Construction and working of class A and class B push-pull amplifier, Cross-over distortion in class B power operation and its reduction, Working principle of complementary symmetry push-pull amplifier circuits and its advantages, Transformer-less class B push=pull amplifier and their typical applications, Introduction to tuned voltage amplifier, Classification of amplifiers on the basis of frequency, Expression of resonant frequency and impedance at resonance, Relation between resonant frequency, Q-factor and bandwidth, Single tuned and double tuned amplifiers: working principle, frequency response, limitation and remedy.

Unit-V

Feedback Amplifiers:

Feedback concept and principle, Type of feedbacks, Derivation of expression for the gain of an amplifier employing feedback, Effect of negative feedback on gain, stability, distortion and bandwidth, Typical practical feedback circuits, R-C coupled amplifier circuit with emitter bypass removed, Emitter follower and its application, Simple mathematical analysis for voltage gain and input impedance of above circuits.

References:

1. N. N. Bhargava, D. C. Kulshrestha, S. C. Gupta, Basic Electronics and Linear Circuits, Tata McGraw-Hill Publishing Company Limited, New Delhi.

2. V. K. Mehra, Rohit Mehta, Principles of Electronics, S. Chand and Company, New Delhi.

3. Albert Malvino, David Paul, Electronics Principles, McGraw Hill Education, New Delhi.

4. S. K. Sahdev, Electronics Devices and Circuits, Dhanpat Rai and Company, New Delhi.

5. David Bell, Fundamental of Electronic Devices and Circuits, Oxford University Press.

Course Outcomes:

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

CO1	Learn about the need of biasing in an amplifier and various stabilization

	techniques.
CO2	Learn the working of small signal amplifiers.
CO3	Learn the principles of working of various large signal amplifiers.
CO4	Learn the working of single and double tuned amplifiers..
CO5	Learn about the feedback amplifiers.

Course Code:	**:**	**ECPC302**
Course Title	**:**	**Digital Electronics**
Number of Credits	**:**	**3 (L: 2, T: 1, P: 0)**
Prerequisites	**:**	**Fundamentals of Electronics Engineering**
Course Category	**:**	**PC**

Course Objectives:

- To develop an understanding of number systems, binary codes and logic gates.
- To provide knowledge of Boolean algebra and simplification techniques for efficient circuit design.
- To enable students to design basic combinational circuits.
- To familiarize students with sequential circuits including flip-flops and shift registers and their practical applications.
- To provide knowledge of different techniques of A/D and D/A converters.

Course Contents:

Unit-I

Number Systems and Logic Gates:

Difference between analog and digital signals, Number system types (Radix, Symbols) - Binary, Octal, Decimal and Hexadecimal. Representation of Binary number system: 1's complement and 2's complements, BCD code, Excess-3 code and Grey code, Concept of logic gates: Graphical symbols, algebraic form, truth tables, Basic logic gates: AND, OR and NOT gates, Universal gates: NAND and NOR gates, X-OR and X-NOR gates, Graphical symbols, algebraic form and truth tables.

Unit-II

Boolean Algebra:

Boolean Algebra Relations: Commutative law, Associative law, Distributive law, OR laws, AND laws, Double inversion, Redundancy law, De Morgan's Theorems and simplifications of Boolean expressions using Boolean laws and theorems, Karnaugh Map (K-map): Sum of product in terms of minterms, product of sum in terms of maxterms, Karnaugh map construction and properties, minimization of the Boolean function using k-map.

Unit-III

Combinational Logic Circuits:

Introduction to combinational circuits, Arithmetic circuits: Half adder, Full adder, Half subtractor and Full subtractor, Multiplexers (MUX) and Demultiplexer (DEMUX), Encoders and Decoders.

Unit-IV

Sequential Logic Circuits:

Introduction to sequential circuits, S-R flip-flop, J-K flip-flop, D flip-flop and T flip-flop,

Shift Registers: Shift registers operation: serial in - serial out, serial in - parallel out, parallel in - serial out and parallel in - parallel out.

Unit-V

A/D and D/A Converters:

Introduction, Specification of D/A converters, D/A Converters: Weighted - resistor D/A converter, R-2R Ladder D/A converter, A/D Converters: Dual slope A/D converter, Successive Approximation A/D Converter and Flash A/D converter, Commercial ICs of D/A and A/D converters.

References:

1. M. Morris Mano, Digital Design, Pearson Education, India.

2. R. P. Jain, Modern Digital Electronics, McGraw Hill Publication, New Delhi.

3. Ramesh S. Gaonkar, Microprocessor Architecture, Programming and Applications with 8085, New Age International Publication, New Delhi.

4. Thomas L. Floyd, Digital Fundamentals, Pearson Education, India

5. M. Morris Mano, Digital Logic and Computer Design, Pearson Education, India.

Course Outcomes:

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

CO1	Understand the difference between analog and digital signals, number systems, binary codes and basic logic gates.
CO2	Solve logic expressions by using Boolean laws, theorems and K-map.
CO3	Understand the working of combinational circuits.
CO4	Explain the working of different flip-flops and their use to design shift registers.
CO5	Gain knowledge about the working of different techniques of A/D and D/A converters.

Course Code:	**:**	**ECPC303**
Course Title	**:**	**Principles of Communication Engineering**
Number of Credits	**:**	**3 (L: 2, T: 1, P: 0)**
Prerequisites	**:**	**Fundamentals of Electronics Engineering**
Course Category	**:**	**PC**

Course Objectives:

- To understand about the fundamentals of basic communication system.
- To explore the need of modulation in communication system.
- To understand about various continuous and pulse modulation systems.
- To get knowledge about various processes involved in pulse code modulation system.
- To learn about the antenna terminologies, structures, characteristics and applications of various antennas and understand about the fundamental wave propagation techniques.

Course Content:

Unit-I

Introduction:

Communication process and system, difference between line communication and wireless communication, block diagram of basic communication system, communication channels, classification of various communication processes and systems, the modulation process, needs of modulation: practicability of antenna, frequency division multiplexing, band edge ratio and narrow banding, types of modulation, communication resources: bandwidth and power requirement, electromagnetic spectrum: radio frequency spectrum, infra-red spectrum and visible light spectrum and their applications in communication systems.

Unit-II

Amplitude Modulation:

Definition, expression, waveform of AM signal, modulation index of AM, sidebands and frequency spectrum, types of AM: DSB-FC, DSB-SC, SSB-SC and VSB modulation systems, Generation of different types of AM signals: generation of DSB-FC signal by square law diode modulator, DSB-SC signal by balanced modulator, SSB-SC signal by phase shift and filter method, Detection of message signal from various types of AM signals, AM transmitters: types of transmitters, block diagram of high and low level transmitters, AM receivers: TRF receiver, super heterodyne radio receiver.

Unit-III

Frequency Modulation:

Definition, expression and waveform, modulation index of FM, frequency deviation, frequency sensitivity and bandwidth requirement, frequency spectrum, types of FM: narrow band FM and wide band FM, effect of noise in FM, generation of FM signal: Varactor diode FM modulator and Armstrong FM modulator, Detection of message signal from FM signal: basic principle of detection, slope detector, Foster Sealy ratio detector, FM receiver: block diagram, AFC stereophonic FM receiver, Phase locked loop (PLL), comparison between AM and FM.

Unit-IV

Phase & Pulse Modulations:

Definition of phase modulation, expression of PM signal, phase sensitivity, frequency deviation in PM signal, relation between frequency and phase sensitivity, bandwidth requirement, comparison between FM and PM.

Pulse Modulation: Definition of pulse modulation, types: analog pulse modulation (APM) and digital pulse modulation (DPM), analog pulse modulation: pulse amplitude modulation (PAM), pulse width modulation (PWM) and pulse position modulation, definitions and waveforms, digital pulse modulation: pulse code modulation (PCM), sampling, quantization, encoding and PCM transmitter.

Unit-V

Antenna & Wave Propagation:

Basic antenna action, antenna terminologies: directive gain, directivity, power gain, antenna resistance: ohmic resistance and radiation resistance, bandwidth, beamwidth and polarization: horizontal polarization and vertical polarization, Different types of antennas: half wave dipole and folded dipole, Yagi-Uda, turnstile, loop, ferrite rod, rhombic and log periodic, broadside and end fire antenna arrays, Electromagnetic wave propagations: general characteristics, frequency band, applications and limitations of surface wave, sky wave and space wave propagations.

References:

1. Anokh Singh, Principles of Communication Engineering, S. Chand and Company, New Delhi.
2. George Kennedy, Electronic Communication Systems, Tata McGraw Hill Education Private Limited, New Delhi.
3. R. P. Singh, S. D. Sapre, Communication Systems Analog & Digital, Tata McGraw Hill Education Private Limited, New Delhi.
4. Louis E. Fresnel Jr., Principles of Electronic Communication Systems, Mc Graw Hill Publication, New Delhi.
5. B. P. Lathi, Communication Systems, BS Publications, Hyderabad.
6. Herbert Taub, Donald L Schilling, Tata McGraw Hill Education Private Limited, New Delhi.
7. J. S. Katre, Principles of Communication, Tech-Max Publications, Pune.

Course Outcomes:

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

CO1	Familiarize with the basic block diagram of a communication system.
CO2	Understand the frequency and time domain representation of signals.
CO3	Know how and why signals are modulated and different types of analog modulation systems including pulse modulation.
CO4	Understand the functions and operating principles of transmitting and receiving systems.
CO5	Acquire knowledge on propagation of electromagnetic wave of different frequency bands using different paths.

Course Code:	**:**	**ECPC304**
Course Title	**:**	**Networks & Transmission Lines**
Number of Credits	**:**	**3 (L: 2, T: 1, P: 0)**
Prerequisites	**:**	**Nil**
Course Category	**:**	**PC**

Course Objectives:

- To learn analysis techniques of various network theorems.
- To get the practical importance of network analysis.
- To know about symmetrical and asymmetrical networks and their characteristics.
- To familiarize with various types of attenuators and filters.
- To get brief idea of transmission lines.

Course Contents:

Unit-I

Network Theorems:

Superposition theorem, Thevenin's theorem, Norton's theorem and Maximum power transfer theorem, their statements and uses for solving numerical problems, Star/Delta transformation, Star/Delta transformation and solution of simple problems.

Unit-II

Four Terminal Networks:

Balanced and unbalanced structures, Symmetrical and asymmetrical structures, T and π structures and their equivalence, Image, iterative and characteristics impedances, propagation constant, Ladder and lattice network.

Unit-III

Attenuators:

Symmetrical T and π type attenuators and their design equations, L type attenuator for impedance matching.

Unit-IV

Filters:

Brief idea of the use of filter networks in different communication systems, constant k-type or proto-type low pass, high pass, band pass filters and their attenuation and phase shift characteristics without analysis, simple design problems, m-derived filters and their characteristics: simple design problems, composite filters and their applications.

Unit-V

Transmission Lines:

Transmission lines and their significance in communication systems, primary and secondary constants of a line, their relationship with primary constant, concept of infinite line, transmission line equation for voltage, current and input impedance at a point on the transmission line with losses and without losses, reflection in transmission lines, standing wave, voltage reflection coefficient in terms of terminating and characteristics impedance (without analysis), voltage

standing wave ratio (VSWR) and its relation with voltage coefficient, role of transmission line at high frequencies.

References:

1. A. Chakrabarti, Circuit Theory Analysis & Synthesis, Dhanpat Rai & Co, New Delhi.
2. Joseph A Edminster, Network Theory, Schaum Series, McGraw Hill Publishers.
3. D. Roy Choudhury, Networks and Systems, Wiley Eastern Limited.
4. K. D. Prasad, Antenna Theory, Satya Prakashan, Tech India Publications, New Delhi.
5. A. V. Bakshi, Transmission line and waveguides, Technical Publications.
6. Hayt & Kemerly, Engineering Circuit Analysis, McGraw Hill Publishers.

Course Outcomes:

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

CO1	Understand about the different types of network theorems and their use in solving simple problems.
CO2	Know the practical importance of network analysis.
CO3	Understand about the symmetrical and asymmetrical networks and their characteristics.
CO4	Learn about the various types of attenuators and filters.
CO5	Understand the significance of transmission lines in communication systems.

Course Code:	**:**	**EEPC305**
Course Title	**:**	**Electrical & Electronic Measurements**
Number of Credits	**:**	**2 (L: 2, T: 0, P: 0)**
Prerequisites	**:**	**Nil**
Course Category	**:**	**PC**

Course Objectives:

- To understand the concepts and different methods of electrical and electronic measurements.
- To understand the working principle, types & construction of electrical and electronic instruments for measurement of various parameters.
- To use relevant measuring instrument in electrical and electronics applications.
- To know the methods of extension of instruments range such as voltmeter and ammeter for measurement of large values of electrical parameters.
- To understand the concept of bridge circuits and oscilloscope for measurement of various electrical parameters.

Course Contents:

Unit- I

Fundamentals of Measurements:

Important terms (measurement, accuracy, precision, resolution, sensitivity),Types of errors and their calculations, Calibration and its need, Classification of measuring instruments, Essential requirements of indicating instruments.

Unit-II

Measurement of Voltage and Current:

Principle of operation, construction and working of moving coil and moving iron instruments and their comparison, Electrostatic instruments, Rectifier type instruments, Extension of range of instruments.

Unit-III

Measurement of Electrical Power and Energy:

Concepts of measurement of power, Construction and working of electrodynamometer type wattmeter, measurement of three phase power, Construction and working of energy meter.

Unit- IV

Measurement of Resistance:

Concepts of measurement of resistance, Measurement of low resistance (ammeter-voltmeter method and Kelvin double bridge method), Measurement of medium resistance (substitution method and Wheatstone bridge method), Measurement of high resistance (Deflection method and Loss of charge method) and Multimeter.

Unit-V

AC Bridges and Digital Instruments:

Basic principle of AC Bridges, Quality factor, Measurement of inductance (Hay's bridge, Maxwell's bridge and Anderson's bridge), Measurement of capacitance and frequency (Wien's bridge and Schering's bridge), CRO and its applications.

References:

1. A. K. Sawhney, Electrical and Electronic Measurement & Instrumentation, Dhanpat Rai and Sons, New Delhi.
2. V. N. Mittal, Basic Electrical Engineering, Tata McGraw Hill New Delhi.
3. H. S Kalsi, Electronic Instrumentation, Tata McGraw Hill.
4. W.D. Cooper, Modern Electronic Instrumentation and Measuring Techniques, Prentice Hall India.
5. E.W. Golding, Electrical Measurements and Measuring Instruments, Reem Publications Pvt. Ltd.

Course Outcomes:

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

CO1	Learn the concepts of electronic measurements and instruments, and know the definition and significance of various terms used in measurements.
CO2	Understand the construction &working of instruments to measure various electrical quantities such as voltage, current, power and energy.
CO3	Know the ranges of low, medium and high resistances and various methods of their measurements and also able to choose a specific method for particular range.
CO4	Use the different bridge circuits for various applications such as measurement of inductance, capacitance and frequency.
CO5	Employ CRO for measurement of voltage, phase and frequency.

Course Code:	**:**	**ECPC311**
Course Title	**:**	**Electronics Devices & Circuits-I Lab**
Number of Credits	**:**	**1 (L: 0, T: 0, P: 2)**
Prerequisites	**:**	**Electronics Devices & Circuits-I Theory**
Course Category	**:**	**PC**

Course Objectives:

- To construct different types of amplifiers and measure their parameters.
- To familiarize with the frequency response of different small signal and large signal amplifiers.
- To learn about different types of feedback amplifiers with their practical importance and to understand single and double tuned voltage amplifiers.

List of Experiments:

1. Measurement of voltage and frequency with CRO.
2. Study of single stage transistor amplifier.
3. Study of multi-stage R-C coupled transistor amplifier.
4. Study of transformer coupled amplifier.
5. Study of single ended class A amplifier.
6. Study of push-pull amplifier.
7. Study of tuned voltage amplifier.
8. Study of negative feedback series current and voltage amplifier.
9. Study of negative feedback shunt current and voltage amplifier.

Course Outcomes:

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

CO1	Understand the need of biasing in an amplifier and stabilization techniques.
CO2	Gain knowledge about the working of small signal and large signal amplifiers.
CO3	Know about the practical importance of feedback amplifiers and tuned voltage amplifiers.

Course Code:	**:**	**ECPC312**
Course Title	**:**	**Digital Electronics Lab**
Number of Credits	**:**	**1 (L: 0, T: 0, P: 2)**
Prerequisites	**:**	**Digital Electronics Theory**
Course Category	**:**	**PC**

Course Objectives:

- To gain knowledge of fundamental logic gates.
- To design and implement combinational circuits as adders and subtractors.
- To gain hand-on experience with digital integrated circuits.

List of Experiments:

1. To verify the truth tables of basic logic gates (AND, OR and NOT).
2. To verify the truth tables of universal gates (NAND and NOR.
3. To design and verify the truth tables of basic logic gates by using NAND gate.
4. To design and verify the truth tables of basic logic gates by using NOR gates.
5. To design and verify the truth tables of Ex-OR gate by using NAND gates.
6. To design and verify the truth tables of Ex-NOR gate by using NOR gates.
7. To design and verify the circuit and truth table of Half Adder.
8. To design and verify the circuit and truth table of Full Adder.
9. To design and verify the circuit and truth table of Half Subtractor.
10. To design and verify the circuit and truth table of Full Subtractor.

Course Outcomes:

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

CO1	Verify the truth tables of all basic and universal gates.
CO2	Design adder and subtractor circuits using logic gates and verify their functioning.
CO3	Design circuits using digital ICs and verify their working.

Course Code:	**:**	**ECPC313**
Course Title	**:**	**Principles of Communication Engineering Lab**
Number of Credits	**:**	**1 (L: 0, T: 0, P: 2)**
Prerequisites	**:**	**Principles of Communication Engineering Theory**
Course Category	**:**	**PC**

Course Objectives:

- To understand and test different types of communication systems (Simplex, Half-Duplex and Full-Duplex).
- To study the process of modulation and demodulation in AM and FM systems.
- To analyze receiver characteristics such as selectivity, sensitivity and demodulation performance.

List of Experiments:

1. To establish a simplex, semi duplex and duplex communication link.
2. To measure the characteristics impedance of a symmetrical T and ∏ networks.
3. To measure the characteristics impedance of a low pass and high pass filters.
4. To generate and study a DSB-FC amplitude modulated wave.
5. To calculate the modulation index for AM signal.
6. To study an AM demodulator circuit using linear diode detector.
7. To study the output of various stages of an AM receiver.
8. To generate and study a FM signal using voltage controlled oscillator.
9. To generate and study a FM demodulated signal using Foster Sealy/Ratio Detector.
10. To study the output of various stages of a stereophonic FM receiver.

Course Outcomes:

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

CO1	Understand how modulation and demodulation help in transmitting and receiving signals.
CO2	Generate and analyze AM and FM modulated signals.
CO3	Learn how receivers decode modulated signals and how selectivity and sensitivity affect communication quality.

Course Code:	**:**	**EEPC315**
Course Title	**:**	**Electrical and Electronic Measurements Lab**
Number of Credits	**:**	**1 (L: 0, T: 0, P: 2)**
Prerequisites	**:**	**Electrical and Electronic Measurements Theory**
Course Category	**:**	**PC**

Course Objectives:

- To familiarize students with the calibration of electrical measurement instruments like energy meters.
- To develop skills in measuring electrical parameters such as resistance, capacitance, inductance and frequency using bridge circuits.
- To enhance the understanding of CRO for the measurement of amplitude of voltage, phase and frequency.

List of Experiments:

1. To calibrate the single phase Energy meter.
2. To measure the low resistance using Kelvin's Bridge.
3. To measure the inductance using Hay's bridge.
4. To measure the inductance using Maxwell's bridge.
5. To measure the inductance using Anderson's bridge.
6. To measure the capacitance and frequency using Wien's bridge.
7. To measure various electrical quantities and parameters using digital multimeter.
8. To measure the voltage, phase and frequency using CRO.

Course Outcomes:

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

CO1	Calibrate single-phase energy meter and understand its practical applications.
CO2	Measure resistance, capacitance, inductance and frequency using appropriate bridge methods.
CO3	Employ digital multimeter, CRO and bridge circuits effectively to determine various electrical quantities and parameters.

Course Code:	**:**	**ECSI316**
Course Title	**:**	**Summer Internship-I**
Number of Credits	**:**	**2 (L: 0, T: 0, P: 0)**
Prerequisites	**:**	**Nil**
Course Category	**:**	**SI**

The course includes at least four week summer internship mandatory for students. The students are supposed to have practical understanding and training in a suitable industry or organization. The students are required to apply their classroom learning for identification of problem. They are required to prepare reports and present the output. Summer Internship-I should be undertaken in an industry/Govt. or Pvt. Certified agencies which are in social sector/Govt. Skill Centres/Institutes/Schemes.

Course Objectives:

- To provide industrial exposure to students that will help them to gain real life experience.
- To engage students with experienced professionals that can help them further in their careers.
- To provide industrial exposure to student to the real time.
- To enable the students to work on short industry projects and gain the skills of preparing report describing its result and findings.
- To identify the gap between existing knowledge and industry expectations.

Course Code:	**:**	**ECPC401**
Course Title	**:**	**Electronics Devices & Circuits-II**
Number of Credits	**:**	**3 (L: 2, T: 1, P: 0)**
Prerequisites	**:**	**Electronics Devices & Circuits-I**
Course Category	**:**	**PC**

Course Objectives:

- To understand the working principles, construction and operation of different types of Field Effect Transistors (FETs) including JFETs and MOSFETRs.
- To gain in-depth knowledge of various oscillators and their applications in electronic circuits.
- To explore the operation of multivibrators using BJTs, their applications and triggering techniques.
- To study optoelectronic devices and their applications including photodiodes, phototransistors, LCDs and opto-couplers.
- To understand the concepts of Integrated Circuits (ICs), their fabrication processes and applications in modern electronics.

Course Contents:

Unit-I

Field Effect Transistor:

Construction, operation, characteristics and parameters of Junction Field Effect Transistor (JFET), Construction, operation, characteristics and parameters of Metal Oxide Semiconductor Field Effect Transistor (MOSFET) in both depletion and enhancement modes, Comparison of JFET and MOSFET, Simple FET amplifier circuit and its working principle.

Unit-II

Sinusoidal Oscillators:

Sinusoidal oscillators, Use of positive feedback for generation of oscillations, Barkhausen criterion for oscillation, Applications of oscillators, Construction, principle of operation of Tuned Collector, Hartley Colpitt's, Phase shift, Wein-bridge and crystal oscillators.

Unit-III

Multivibrators Using BJT:

Transistor as a switch, Explanation using CE output characteristics, Calculation of component values for a practical transistor switch, Transistor switching time, Use of speed up capacitor (physical explanation only), Construction and operation using wave shapes of a collector coupled bistable, monostable and astable multivibrators circuits, Expression of time period (No mathematical derivation), Triggering techniques for bistable multivibrators (symmetrical and asymmetrical triggering), Operation of Schmitt trigger, Calculation of upper trigger potential (UTP) and lower trigger potential (LTP), Voltage controlled oscillator (basic principle only) and applications.

Unit-IV

Opto-Electronics:

Working principle and characteristics of photo resistors, photodiodes and phototransistors, Photovoltaic cell, LCDs and opto-couplers, Seven-segment display and simple applications.

Unit-V

IC Fabrication and Development:

Importance of ICs in modern electronics, Classification of ICs, Some examples of ICs and their functions/applications, Fabrication of transistor by planar process, Typical fabrication processes for ICs (brief explanation), Difference between SSI, MSI, LSI and VLSI, Mention of different IC packages, Brief introduction to different IC technologies and their comparison, Block diagram of IC timer (555) and its working, Use of 555 timer as monostable and astable multivibrators.

References:

1. Robert L. Boylested, Louis Nashelsky, Electronic Devices and Circuit Theory, Pearson Education, India.
2. Adel S. Sedra and Kenneth C. Smith, Microelectronic Circuits, Oxford University Press.
3. Jacob Millman and Christos C. Halkias, Integrated Electronics, Tata McGraw Hill Publication, New Delhi.
4. Thomas L. Floyd, Electronic Devices, Pearson Education, India.
5. R. S. Sedha Applied Electronics, S. Chand Publication, New Delhi.
6. S. Salivahan, N. Suresh Kumar and A Vallavaraj, Electronic Devices and Circuits, Tata McGraw Hill Publication, New Delhi.

Course Outcomes:

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

CO1	Analyze and design Field Effect Transistor circuits (JFET & MOSFET).
CO2	Acquire the knowledge to design and analyze various sinusoidal oscillators and understand their applications.
CO3	Develop the skills to design and understand the operation of transistor-based multivibrators (bistable, monostable and astable).
CO4	Understand and apply optoelectronic devices such as photodiodes, phototransistors and LCDs in practical circuits.
CO5	Gain insight into the fabrication processes of Integrated Circuits (ICs) and understand their applications in modern electronic systems.

Course Code:	**:**	**ECPC402**
Course Title	**:**	**Industrial Electronics**
Number of Credits	**:**	**3 (L: 2, T: 1, P: 0)**
Prerequisites	**:**	**Electronics Devices & Circuits-I**
Course Category	**:**	**PC**

Course Objectives:

- To control, regulate and manage electric power with high efficiency.
- To significantly amplify the voltage difference between two input signals and to understand its applications in various linear and non-linear mathematical operations.
- To understand how electrical power can be converted from one form to another.
- To explain how an inverter functions as a device that converts direct current electricity into alternating current electricity.
- To provide foundational understanding of what a Programmable Logic Controller is.

Course Contents:

Unit-I

Power Electronics Devices:

Silicon Controlled Rectifier (SCR): Theory and working of SCR and its V-I characteristics, Methods of turn-on and turn-off SCR, Controlled half wave and full wave rectifier circuits using SCR, Phase control methods of SCR, Device specifications, rating and nomenclature, Series and parallel operation of SCRs, Operation, V-I characteristics, equivalent circuit and parameters of UJT, Description of UJT relaxation oscillator, Use of UJT relaxation oscillator for triggering thyristors, Operation, V-I characteristics and equivalent circuits of DIAC and TRIAC and their applications.

Unit-II

Operational Amplifier and its Applications:

Concept of ideal operational amplifier, Ideal and practical op-amp parameters, Pin configuration of IC LM741, Operational amplifier as: inverting amplifier, sign changer, non-inverting amplifier, voltage follower, summing amplifier, adder, difference amplifier, subtractor, integrator, differentiator, comparator and square wave generator.

Unit-III

Converters:

Introduction to converter, Principle of operation of basic inverter circuits, Basic series and parallel commutated inverters (without analysis), Principle of operation of cyclo converter, Choppers and dual converters and their applications, Principles and applications of induction and dielectric heating (without mathematical analysis).

Unit-IV

Inverters:

Introduction to inverter, Single phase inverters using thyristors with R, RL loads and output voltage control in inverter, Methods of obtaining sine wave output from an inverter, Typical inverter circuit, three phase inverter circuit and inverter characteristics through pass inverter

circuit, Applications of inverters, DC transmission: Block diagram, parallel inverter using MOSFETSs and IGBTs and advantages.

Unit-V

Programmable Logic Controller:

Introduction to Programmable Logic Controller, Relays, Part of PLC: processor, memory, input and output modules, Digital and analog I/Os, Communication with PLC logic functions (OR, AND, NAND & EX-OR), Ladder programming bit instruction, Timer/counter, Program control instruction, Data handling instruction, Simple ladder diagram for DOL, Star-Delta starter.

References:

1. M. H. Rashid, Power Electronics, PHI Publication Pvt. Ltd., New Delhi.
2. Harish C. Rai, Industrial and Power Electronics, Umesh Publication, New Delhi
3. Dr. P. S. Bimbhra, Power Electronics, Khanna Publication, New Delhi
4. M. D. Singh & K. B. Khan Chandani, Power Electronics, Tata McGraw Hall Publication, New Delhi.
5. Pradeep Kumar & Srivastava, Programmable Logic Controller, BPB Publication.
6. Richard A. Cox, Programmable Controllers, Vikas Publishing Houses.

Course Outcomes:

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

CO1	Understand about the power control with the help of SCR, DIAC, TRIAC and UJT.
CO2	Explore the applications of operational amplifier to perform various linear and non-linear mathematical operations.
CO3	Know how to transform AC signal to DC signal or DC signal to AC signal depending upon the need.
CO4	Learn about the functions of an inverter as a device that converts direct current (DC) electricity into alternating current (AC) electricity.
CO5	Gain knowledge about the functions and key components of PLC

Course Code:	**:**	**ECPE403**
Course Title	**:**	**Digital System Design**
Number of Credits	**:**	**2 (L: 2, T: 0, P: 0)**
Prerequisites	**:**	**Digital Electronics**
Course Category	**:**	**PE**

Course Objectives:

- To simplify logic equations using K-map, tabular method, MUX and MSI approach.
- To understand about different logic families.
- To study RAM and ROM structure and logic design using ROM.
- To understand programmable logic devices (PLD) and their applications.
- To design and analyze sequential circuits.

Course Contents:

Unit-I

Combinational Circuits:

Review of logic variable, Boolean expression, Minimization of Boolean expression using map method, Tabular method of function minimization, Design of code converter using decoder, Design of full adder, BCD adder and full subtractor using MUX, Code converter, Magnitude comparator using MSI approach.

Unit-II

Logic Families:

Digital integrated circuits, Bipolar and MOS logic families, Characteristics of digital ICs, DTL, TTL, I^2L, ECL & MOS digital ICs, Design examples of different gates using logic families, Charts of CMOS & NMOS, Compatibility or interfacing: Interfacing CMOS with TTL.

Unit-III

Semiconductor Memories:

Introduction, Classification of memories, Basic memory structure of RAM and ROM, Flash memory and Design of combinational circuits using ROM.

Unit-IV

Programmable Logic Devices:

Introduction, ROM as a Programmable Logic Device (PLD), Programmable Logic Array (PLA), Programmable Array Logic (PAL), Field Programmable Gate Array (FPGA) and applications.

Unit-V

Sequential Logic Design:

Asynchronous or ripple counters, Synchronous counters, Design of modulo-N counters, General sequential circuits, Classification: Mealy and Moore Machines and Design of binary adders.

References:

1. S. Salivahanan & S. Arivazhagan, Digital Circuit and Design, Vikas Publishing. House Pvt. Ltd. New Delhi.

2. M. Morris Mano, Digital Design, Pearson Education.

3. Thomas L. Floyd, Digital Fundamentals, Pearson Education.

Course Outcomes:

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

CO1	Apply simplification techniques like K-map and tabular methods for optimization of logic expressions and design combinational circuits using decoder, MUX and MSI techniques.
CO2	Explain different logic families and their characteristics.
CO3	Understand the structure of RAM and ROM and design combinational circuits using ROM.
CO4	Explain programmable logic devices and design using PLDs.
CO5	Design asynchronous and synchronous counters using flip-flops and binary adders as sequential machines.

Course Code:	**:**	**ECPE404**
Course Title	**:**	**Microwave & RADAR Engineering**
Number of Credits	**:**	**3 (L: 2, T: 1, P: 0)**
Prerequisites	**:**	**Principles of Communication Engineering**
Course Category	**:**	**PE**

Course Objectives:

- To understand the fundamentals of microwave, microwave bands, electronic emission and high frequency limitations of conventional tubes.
- To gain knowledge of the working of waveguides and waveguide components.
- To get in-depth knowledge about the generation and amplification of wave signal using tube and solid state devices.
- To understand the working of different microwave antennas and their parameters.
- To gain knowledge about the basic principle, parameters and working of various radar system.

Course Contents:

Unit -I

Introduction to Microwaves:

Introduction to microwaves and its applications, Classification on the basis of its frequency bands (HF, VHF, UHF, L, S, C, Ka and Ku), Basic concepts of thermionic emission and vacuum tubes, Effects of inter electrode capacitance, Lead inductance and transit time on the high frequency .Performance of conventional vacuum tubes and their steps to extend their high frequency.

Unit -II

Waveguides and Components:

Introduction to waveguides, Types of waveguides, TE & TM modes in rectangular waveguide (without derivation), Method of excitation of waveguide, Waveguide passive components such as Waveguide Cavity Resonators, Magic Tees, Directional Couplers, Circulators and Isolators.

Unit -III

Microwave Operations Devices:

Constructional features, characteristics and operating principle and typical applications of the following Multi cavity klystron, Reflex klystron, multi cavity magnetron, travelling wave tube, Gun diode and Impatt diode.

Unit-IV

Microwave Antennas:

Structure, characteristics, types and applications of Horn and Dish antenna, Simple numerical problem to calculate various antenna parameters such as Gain, Beam width etc, Parabolic Feed

Mechanisms, Microwave Measurement: Techniques to measure Power, Frequency, Impedance, attenuation, VSWR, Q and other parameters.

Unit-V

Radar Systems:

Introduction and Basic Principle of Radar, Applications of Radar, Radar Range Equation (Derivation and Simple Numerical), Block diagram and basic principle of Pulse Radar, CW (Doppler radar), Frequency modulated CW radar and Moving Target Indicator (MTI) Radar, Concepts of Blind speed, and Maximum unambiguous range.

Reference Books:

1. Er. Rajesh Dhiman, Microwave and Radar Engineering S. K. Kataria& Sons.
2. A.K. Gautam, Microwave Engineering, S. K. Kataria & Sons, New Delhi.
3. Y Lion Samuel, Microwave Devices and Circuits, PHI Learning New Delhi.
4. George Kennedy, Electronic Communication System, Tata McGraw Hill, New Delhi.
5. Louis E. Frenzel, Communication Electronics principles and applications, Tata McGraw Hill, New Delhi.

Course Outcomes:

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

CO1	Explain the microwave, microwave bands and electronic emission.
CO2	Understand the working and uses of waveguides and components.
CO3	Explain the methods of generation and amplification of microwave signals.
CO4	Understand the working of different microwave antennas and measuring various microwave signals.
CO5	Gain insight of the working principle of different radar systems and their parameters.

Course Code:	**:**	**ECPC405**
Course Title	**:**	**Computer System Architecture**
Number of Credits	**:**	**3 (L: 2, T: 1, P: 0)**
Prerequisites	**:**	**Digital Electronics**
Course Category	**:**	**PC**

Course Objectives:

- To familiarize the basic concepts of register transfer and micro-operation.
- To understand the hardware implementations of various logic micro-operations and design of ALU.
- To familiarize the design of computer instructions and basic CPU organization.
- To help students in understanding various memory devices.
- To familiarize students in learning input-output communication.

Course Contents:

Unit-I

Register Transfer and Micro-operations:

Register transfer language, Register transfer, Bus and memory transfer, Three-state bus buffers, Memory transfer, Arithmetic micro-operation: Binary adder, Binary subtractor, Binary Incrementer and Arithmetic circuit.

Unit-II

Logic Micro-operations:

List of logic micro-operations, Hardware implementation and applications, Shift micro-operations: Hardware implementation, Arithmetic logic shift unit.

Unit-III

Basic Computer Organization and Design:

Instruction codes: Stored program organization, Indirect address and Computer registers: Common bus system, Computer instructions: Instruction set completeness, Timing and control, Instruction cycle: Fetch and decode, Determination of the type of instruction, Register-reference instructions.

Unit-IV

Memory Organization:

Memory hierarchy, Types of main memory, Types of auxiliary memory, Associative memory, Cache memory and virtual memory.

Unit-V

Input-Output Organization:

Input-output interface: I/O versus memory bus, Isolated versus memory-mapped I/O, Asynchronous data transfer, Modes of transfer, Priority interrupt, Direct memory access (DMA) and Input-output processor (IOP).

References:

1. M. Morris Mano, Computer System Architecture, Pearson Education, India.

2. Ghoshal, Subrata, Computer Architecture and Organization, Pearson Education, India.
3. Behrooz, P, Computer Architecture, Oxford Publication.
4. William Stallings, Computer Organization and Architecture, Pearson Education, India.

Course Outcomes:

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

CO1	Understand register transfer language and transfer of data between registers and memory.
CO2	Understand various logic micro-operations and their hardware implementation.
CO3	Understand instruction codes, instruction cycle and instruction set.
CO4	Compare and select various memory devices as per requirement.
CO5	Compare various types of I/O mapping techniques and understand the working of I/O processor.

Course Code:	**:**	**ECPC411**
Course Title	**:**	**Electronics Devices & Circuits-II Lab**
Number of Credits	**:**	**1 (L: 0, T: 0, P: 2)**
Prerequisites	**:**	**Electronics Devices & Circuits-II Theory**
Course Category	**:**	**PC**

Course Objectives:

- To understand the characteristics and applications of electronics devices.
- To analyze and design various types of oscillators and multivibrators.
- To study and apply IC 555 in multivibrator modes.

List of Experiments:

1. To draw the drain and transfer characteristics of n-channel JFET.
2. To draw the drain and transfer characteristics of n-channel D type MOSFET.
3. To draw the drain and transfer characteristics of n-channel E type MOSFET.
4. To measure the frequency of oscillations for different values of R and C in Phase Shit Oscillator.
5. To tabulate the frequency of oscillations for different positions of variable capacitance in Hartley Oscillator.
6. To tabulate the frequency of oscillations for different positions of variable capacitance in Colpitt Oscillator.
7. To determine the frequency of an Astable Multivibrator using IC 555 timer.
8. To determine the frequency of an Monostable Multivibrator using IC 555 timer.

Course Outcomes:

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

CO1	Understand the characteristics and applications of n-channel JFETs and MOSFETs.
CO2	Design and troubleshoot basic oscillators such as Hartley, Colpitt and Wein Bridge oscillators.
CO3	Implement multivibrators using IC 555 in astable and monostable modes.

Course Code:	**:**	**ECPC412**
Course Title	**:**	**Industrial Electronics Lab**
Number of Credits	**:**	**1 (L: 0, T: 0, P: 2)**
Prerequisites	**:**	**Industrial Electronics Theory**
Course Category	**:**	**PC**

Course Objectives:

- To understand how a Silicon Controlled Rectifier controls and rectifies high voltage and current signal.
- To gain hands-on experience and understanding of their behavior and applications in electronic circuits, including amplifying, filtering, and performing various mathematical operations.
- To demonstrate and understand how an operational amplifier can be used as a voltage comparator.

List of Experiments:

1. To study and plot V-I characteristics of Silicon Controlled Rectifier.
2. To design and realize inverting amplifier using 741 op-amp IC.
3. To design and realize non-inverting amplifier using 741 op-amp IC.
4. To design and verify operation of op-amp as an integrator.
5. To design and verify operation of op-amp as a differentiator.
6. To design and verify operation of op-amp as a comparator.
7. To design square wave generator using comparator.
8. To design triangular wave generator using op-amp.

Course Outcomes:

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

CO1	Apply Silicon Controlled Rectifier as a power controlling device.
CO2	Get familiarized with the linear and non-linear applications of operational amplifiers.
CO3	Implement a voltage comparator by using operational amplifier in non feedback mode.

Course Code:	**:**	**ECPE413**
Course Title	**:**	**Digital System Design Lab**
Number of Credits	**:**	**1 (L: 0, T: 0, P: 2)**
Prerequisites	**:**	**Digital System Design Theory**
Course Category	**:**	**PE**

Course Objectives:

- To develop logic expression for given problem and simplify using K-map or tabular method and verify using gates.
- To design and verify the combinational circuits.
- To study about the Arithmetic Logic Unit (ALU).

List of Experiments:

1. To simplify the logic expressions using De-Morgan's theorem and verify with logic gates.
2. To simplify Boolean function expressions using K-map and verify with logic gates.
3. To study four bit full adder for binary addition and verify the truth table.
4. To study digital comparator and verify the truth table.
5. To study BCD to seven segment decoder/driver and display digital digitals 0-9 using BCD to seven segment decoder/driver.
6. To verify Binary to Gray code conversion and to obtain Gray codes using Ex-OR gates.
7. To study and verify the truth table of 4x1 multiplexer (MUX).
8. To study the Arithmetic Logic Unit (ALU) using IC 74181 and perform (a) Logic operation, (b) Arithmetic operation and (c) Comparisons of binary numbers.

Course Outcomes:

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

CO1	Gain ability to simplify logic expressions using Boolean algebra, K-map and tabular method, and implement the result using gates.
CO2	Design and implement combinational circuits using MUX and decoder.
CO3	Design and implement sequential circuits such as ALU using IC-74181.

Course Code:	**:**	**ECPE414**
Course Title	**:**	**Microwave & RADAR Engineering Lab**
Number of Credits	**:**	**1 (L: 0, T: 0, P: 2)**
Prerequisites	**:**	**Microwave & RADAR Engineering Theory**
Course Category	**:**	**PE**

Course Objectives:

- To understand the microwave active and passive components.
- To measure different microwave parameters.
- To study about different types of microwave antennas and their radiation pattern.

List of Experiments:

1. To study and identify various microwave components and set-up microwave test bench.
2. To study microwave instruments such as Klystron power supply, Gunn power supply and SWR meter.
3. To plot characteristics of Reflex Klystron Tube and determine its electronic tuning range.
4. To study and plot V-I characteristics of Gunn Diode.
5. To determine output power and frequency of Gunn Diode as a function of bias voltage.
6. To study and verify the operation of Magic Tee.
7. To study and plot radiation pattern of Horn, Dish and Dielectric antennas.
8. To study the voice communication by using Microwave test bench.
9. To setup a voice communication link using wireless Microwave test bench and study the effect of variable attenuator and radiation pattern on voice communication.
10. To determine frequency of given tube by slotted line method and wave meter method and calculate error.

Course Outcomes:

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

CO1	Gain hands-on experience with microwave sources, waveguides and passive components.
CO2	Measure microwave parameters such as frequency, power, impedance and VSWR accurately.
CO3	Plot radiation patterns and characteristics of different antennas such as Horn, Dish and Dielectric.

Course Code:	**:**	**ECPR416**
Course Title	**:**	**Minor Project**
Number of Credits	**:**	**2 (L: 0, T: 0, P: 2)**
Prerequisites	**:**	**Nil**
Course Category	**:**	**PR**

Course Objectives:

- To understand the method of applying engineering knowledge to solve specific problems.
- To apply engineering and management principles while executing the project.
- To identify and solve complex engineering problems using professionally prescribed standards and demonstrates good verbal presentation and technical report writing skills.

Guidelines:

1. Project will have to be done by a group in their area of interest.
2. Each group has to select a contemporary topic that will use the technical knowledge of their program of specialization.
3. Allocation of the guides preferably in accordance with the expertise of the faculty.
4. The students will be assigned a faculty guide who would be the supervisor of the student.
5. The number of projects that a faculty can guide would be limited to two groups.
6. The projects can be carried out on-campus or in an industry or an organization with prior approval from the Principal through Head of Section.
7. The project shall be completed and submitted at least one month before the last teaching day.
8. The project should be presented by students using power point once before submission of project.

Course Outcomes:

After going through this course, the students will be able to:

CO1	Conceptualize, design and implement solutions for specific problems.
CO2	Communicate the solutions through presentations and technical reports.
CO3	Apply project and resource management skills, professional ethics and societal concerns.

Course Code	**:**	**ECAU400**
Course Title	**:**	**Indian Knowledge & Tradition**
Number of Credits	**:**	**0 (L: 2, T: 0, P: 0)**
Prerequisites	**:**	**Nil**
Course Category	**:**	**AU**

Course Contents:

Basic Structure of Indian Knowledge System: वेद, (ii) उऩवेद (आयुवेद, धनुवेद, गन्धवेद ,स्थाऩत्यआदद) (iii) वेदथाथांग (शिक्था, कलऩ, ननरुत , व्थाकरण , ज्योनतषछथांद), (iv) उऩथाइग (धर्मशथास्र , र्ीर्थाथांसथा, नुरथाण, तकशरथास्र), Modern Science and Indian Knowledge System, Yoga and Holistic Health care and Case Studies.

Reference Books:

1. Sivaramakrishna, Cultural Heritage of India-Course Material, BharatiyaVidyaBhavan, Mumbai, 5th Edition, 2014
2. Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan.
3. Fritzof Capra, The wave of Life.
4. Fritzof Capra, Tao of Physics.
5. V. N. Jha, Arkasangraha of Annam Bhatta, International Chinmay Foundation, Velliarnad,Amakua.
6. R. N. Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakasham, Delhi.

Course Code:	**:**	**ECPC501**
Course Title	**:**	**Advance Communication Systems**
Number of Credits	**:**	**3 (L: 2, T: 1, P: 0)**
Prerequisites	**:**	**Principles of Communication Engineering**
Course Category	**:**	**PC**

Course Objectives:

- To understand about the digital baseband and digital passband transmissions and advantages and disadvantages of digital communication over analog communication.
- To understand about the basic idea of information theory and coding.
- To understand about the need and applications of optical communication systems.
- To understand about the need and application of satellite communication systems.
- To understand about the concept of modern cellular communication systems.

Course Contents:

Unit-I

Digital Communication:

Difference between analog and digital communication, Basic block diagram of digital communication system, Pulse code modulation: sampling, sampling rate, Nyquist rate, aliasing error, quantization, quantization error, encoding, signaling rate, transmission bandwidth of PCM system, Channel encoding, Line encoding, Digital modulation techniques: amplitude shift keying, frequency shift keying and phase shift keying, Advantages and disadvantages of digital communication over analog communication.

UNIT-II

Information Theory and Coding:

Information, Information sources, Information content of a discrete memory less source, Information content of a symbol, Entropy i.e. Average Information, Information rate, Huffman coding and Shannon-Fano coding, Coding efficiency and redundancy.

Unit-III

Optical Communication:

Evolution of optical fiber communication, introduction of optical fiber, basic block diagram of optical fiber communication, advantages and disadvantages of optical communication, construction of optical fibers: core, cladding and protective jackets, materials used in core and cladding, types of optical fibers, propagation of light through optical fiber, modes of propagation, various losses in optical fibers, numerical aperture of optical fiber and applications of optical communication.

Unit-IV

Satellite Communication:

Need of satellite communication, Satellite orbits, Types of satellite orbits: equatorial, polar and inclined orbit, Geo synchronous and Geo asynchronous satellites, Classification of satellite based on their altitudes: LEO, MEO and GEO satellites, Apogee and Perigee of a satellite, Kepler's

Law, Elements of satellite communication link, Frequency bands used in satellite communication, Communication satellites and GPS.

Unit-V

Mobile Communication:

Introduction, Mobile communication principles: early mobile telephone system architecture and Modern cellular system architecture: cells, clusters, frequency reuse, cell splitting and handoff, Cellular system components, Mobile communication standard: GSM, Various generations of mobile communication.

References:

1. Sapna Katiyar Advanced Communication Systems, S. K. Kataria & Sons Publisher, New Delhi.
2. Sanjay Sharma, Digital Communication, S. K. Kataria & Sons Publisher, New Delhi.
3. John Gowar, Optical Communication Systems, Prentice-Hall of India Publication, New Delhi.
4. K. K. Sharma, Satellite Communication, S. K. Kataria & Sons Publisher, New Delhi.
5. Theodore S. Rappaport, Wireless Communications, Pearson Education, India.

Course Outcomes:

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

CO1	Gain in depth knowledge digital communication and its advantages and disadvantages over analog communication systems.
CO2	Learn about the basic idea of information theory and coding including their efficiency and redundancy.
CO3	Explore the applications of enormous bandwidth of optical fibers along with other advantages.
CO4	Explore the idea of global communication with the help of satellite communication.
CO5	Understand the basic principles of mobile communication.

Course Code:	**:**	**ECPC502**
Course Title	**:**	**Microprocessors and Applications**
Number of Credits	**:**	**2 (L: 2, T: 0, P: 0)**
Prerequisites	**:**	**Computer System Architecture**
Course Category	**:**	**PC**

Course Objectives:

- To understand the basic concepts of microprocessor.
- To understand the architecture and instruction set of 8085/8086 microprocessors.
- To understand the instruction set and write basic program in assembly language for 8085 microprocessor.
- To understand concept of interrupts and data transfer schemes.
- To interface I/O devices with 8085.

Course Contents:

Unit-I

Introduction to 8085 Microprocessor:

Evolution of Microprocessors, Classification and applications of Microprocessor, Features of 8085, PIN diagram of 8085 and related signals, Busses, 8085 architecture, Registers, De-multiplexing the address data bus.

Unit-II

8085 Instruction set and programming:

Programming model of 8085, Instruction set of 8085, format of instruction, single, double and three byte instructions, Addressing modes, Instruction timing diagram, Examples of assembly language programming, Programs related to loops.

Unit-III

Interrupts of 8085 Microprocessor:

Interrupts classifications, Hardware and software interrupts, Interrupt handling diagram, RIM and SIM instructions, EI & DI instruction and Interrupt controller PIC 8259.

Unit-IV

Interfacing of I/O Devices:

Introduction, Data transfer schemes, Memory mapped I/O and I/O mapped I/O, INTEL 8212 non programmable I/O ports, PPI 8255; PIT 8253/8254; DMA controller 8257; USART 8251.

Unit-V

Introduction to Advance Microprocessors:

Features of 8086 Microprocessor, Comparison of 8085 and 8086 processors, Pin diagram and architecture of 8086, BIU, EU and registers of 8086, data and address bus.

References:

1. R S Gaonkar, Microprocessor Architecture, Programming and Applications with 8085, Dhanpat Rai & Sons, New Delhi.

2. B Ram, Microprocessor and Applications.
3. Adithya P Mathur, Introduction to Microprocessor, Tata McGraw Hill Publishers, New Delhi.
4. Vaneet Singh and Gurmeet Singh, Introduction to Microprocessor, Satya Prakashan.
5. Shweta Goyal and Swati Goyal, Microprocessor, Katson Publication, New Delhi.

Course Outcomes:

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

CO1	Describe the general architecture of a microcomputer system, architecture and organization of 8085 microprocessor and understand the difference between 8085 and advanced microprocessors.
CO2	Understand and classify the instruction set of 8085 microprocessor and distinguish the use of different instructions and apply it in assembly language programming.
CO3	Understand and realize the interfacing of memory and various I/O devices with 8085 microprocessor.
CO4	Understand the concepts of interrupts and interrupts handling.
CO5	Understand the architecture of advance microprocessors.

Course Code:	**:**	**ECPE503**
Course Title	**:**	**Consumer Electronics**
Number of Credits	**:**	**3 (L: 2, T: 1, P: 0)**
Prerequisites	**:**	**Basic and Industrial Electronics**
Course Category	**:**	**PE**

Course Objectives:

- To understand the characteristics of audio systems, including microphones, loudspeakers and public address systems.
- To understand the principles and techniques of magnetic and digital sound recording and reproduction.
- To understand the fundamentals of monochrome television, including scanning, modulation and signal requirements.
- To understand the concepts of colour television systems, modern display technologies, advanced TV standards and broadcasting technologies like smart TVs and DTH.
- To understand the working principles and applications of common consumer electronic devices.

Course Contents:

Unit-I

Audio System:

Characteristics of audio wave, frequency range, pitch, timbre and loudness, Microphone and their types: Carbon, moving coil, velocity, condenser, crystal, cordless etc., Loudspeaker: Direct radiating horn LS, tweeter, woofer, multi-speaker system, baffles and enclosures, Functional block diagram of PA system and Hi-Fi stereo system.

Unit-II

Sound Recording:

Principles of sound recordings: Magnetic recording/reproduction, Digital sound recording on tape and CD system, MP3-features, advantages, disadvantages and uses.

Unit-III

Monochrome Television:

Block diagram of TV communication system, Television fundamentals: Aspect ratio, persistence of vision, image continuity, Scanning types and its need, Need of synchronizing and blanking pulses, VSB modulation, Composite video signal, Difference positive and negative modulation, Horizontal and vertical resolution and BW requirement for a TV channel and Digital Fax Communication.

Unit-IV

Colour Television:

Compatibility of colour TV system with B&W TV system, colour theory, Grossmann's law, additive and subtractive colour mixing, colour burst signal, characteristics of colour signal, block diagram of colour TV transmitter and receiver, Introduction to PAL, NTSC, SECAM colour

system, Brief idea of HDTV, LCD, LED, PLASMA, OLED, QLED TVs, Smart TV 4K/8K TV technology, Introduction to CCTV and digital Satellite television-DTH.

Unit-V

Consumer Electronic Devices:

Basic block diagrams, working principles and applications of consumer electronic devices: calculator, cordless telephone, washing machine, digital watch/clock, microwave oven, photocopier machine, vacuum cleaner and electronic ignition system for automobiles.

References:

1. J Malhotra, Consumer Electronics a Fundamental Approach, Satya Prakashan.
2. B. R. Gupta, V. Singhal, Consumer Electronics, S. K. Kataria & Sons, New Delhi.
3. R. R. Gulati, Modern Television Practices, New Age International Publication (P) Ltd. New Delhi.
4. R G Gupta, Audio and Video System - Principle, Maintenance and Troubleshooting, McGraw Hill Education.
5. S. P. Bali and R. Bali, Audio Video Systems: Principles, Practices & Troubleshooting, Khanna Book Publishing Company Pvt. Limited.
6. R. G. Gupta, TV ENGG & VIDEO SYSTEM, McGraw Hill Education (India) Private Limited.
7. R S Khandpur, Modern Electronic Equipment Troubleshooting, Repair and Maintenance, Tata McGraw Hill Education Pvt. Ltd. New Delhi.

Course Outcomes:

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

CO1	Understand the characteristics of audio waves and the principles of microphones and loudspeakers.
CO2	Familiarize with the functional block diagrams and working of PA systems, Hi-Fi Stereo systems and sound recording technologies.
CO3	Get the ideas of the fundamentals of monochrome television systems including scanning, synchronization and modulation techniques.
CO4	Gain knowledge about the operation of colour television systems and modern display technologies like LCD, LED and smart TVs.
CO5	Develop the understanding of working principles and applications of common consumer electronic devices such as calculators, microwave ovens and washing machines.

Course Code:	**:**	**COOE504**
Course Title	**:**	**Cyber Security**
Number of Credits	**:**	**3 (L: 2, T: 1, P: 0)**
Prerequisites	**:**	**IT Systems and Computer Programming**
Course Category	**:**	**OE**

Course Objectives:

- To understand the basics of cyber security, law and intellectual property rights with respect to cyber space.
- To analyze the theories of criminal psychology and behavior intelligence.
- To understand the basics of forensic science and ethical hacking concept.
- To analyze various tools and techniques in cybercrime.
- To apply cryptography algorithm for encrypting data and check the authenticity of users.

Course Contents:

Unit-I

Legal Aspects of Computing:

Introduction to cyber security, Cybercrimes, Evolution of the IT Act, Various authorities under IT Act and their powers, Penalties and offences, amendments, Case laws on cyber space jurisdiction and jurisdiction issues under the IT Act, E-commerce and laws in India, Digital and electronic signature in Indian laws, Intellectual property rights, Domain names and Trademark disputes, Concept of patent right, Sensitive personal data and Information in cyber law.

UNIT-II

Criminal Psychology and Behavior Intelligence:

Nature and history of criminal and Forensic psychology, Social context of crime: Extent of criminality, Changing nature of crime: Conservative and radical interpretations in complexity of victimization, Types of offenders, Violent offenders: Media influences, Theories of Homicide: Psychological disposition, Socio-biological theory and multi-factorial approach, Mental illness and Crime: Problem of evidence, Mental illness, and crime in general and Eyewitness testimony.

Unit-III

Forensic Science and Ethical Hacking:

Digital forensic science, Cyber forensic and digital evidence, Digital forensic life cycle, Network forensic, Forensics and social networking sites, Digital image forgery detection: active and passive methods, Hacking and ethical hacking concepts, Hacker behavior and mindset, Hacking methodology, Social engineering and countermeasures and passive attacks.

Unit-IV

Cybercrime:

Introduction to cybercrime and cybercriminals, Classification of cybercrimes, Botnets, Tools and methods used in cybercrime: Proxy servers and anonymizers, Phishing, Password cracking, Key loggers and Spywares, Virus and Worms, Trojan horses and backdoors, Steganography, Attack on wireless network and identity theft.

Unit-V

Cryptography:

Cryptography, cryptanalysis, cryptology and classical cryptosystem: shift cipher, affine cipher, substitution, transposition techniques, Block ciphers and Modes of operations: Data encryption standard, Block cipher principles, block cipher modes of operation, Hash functions, Digital signature and authentication protocol.

References:

1. Sushma Arora, Raman Arora, Cyber Crimes and Laws, Taxmann Publication.
2. Hewitt D., Introduction to Forensic and Criminal Psychology, Pearson Publication.
3. Behrouz A. Forouzan, Debdeep M., Cryptography and Network Security, McGraw Hill Publication.
4. Michael G., Roberto T., Introduction to Computer Security, Pearson Publication.

Course Outcomes:

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

CO1	Describe cyber laws with respect to Indian IT Act and Intellectual property rights.
CO2	Differentiate between criminal psychology and behavior.
CO3	Explain different methods used in forensic science and ethical hacking.
CO4	Protect their valuable data from cybercriminals.
CO5	Use various private and public key cryptosystems for encryption, key exchange and authentication algorithm.

Course Code	**:**	**ECHS505**
Course Title	**:**	**Entrepreneurship and Start-ups**
Number of Credits	**:**	**3 (L: 3, T: 0, P: 0)**
Prerequisites	**:**	**Nil**
Course Category	**:**	**HS**

Course Objectives:

- To acquire entrepreneurial spirit and resourcefulness.
- To understand the concept and process of entrepreneurship – its contribution and role in the growth and development of individual and the nation.
- To acquire entrepreneurial quality, competency and motivation.
- To eliminate unproductive activities under the control of the management, supervisor, workers and the design of products and processes.
- To use the charts to record the activities of the people, materials and equipment to find alternative methods which minimize waste and to implement the best method.

Course Contents:

Unit-I

Introduction to Entrepreneurship and Start-Ups:

Definitions, Traits of an entrepreneur, Entrepreneurship, Qualities to becomes entrepreneur, Motivation, Types of Business Structures, Similarities/differences between entrepreneurs and managers, Small Scale of industries, Business Ideas and their implementation, Business Plan.

Unit-II

Idea to Start-Up:

Market Survey, Project report, Market Analysis – Identifying the target market, Competition evaluation and Strategy Development, Marketing and accounting, Risk analysis, Communication of Ideas to potential investors – Investor Pitch, Patenting and Licenses, exit strategies for entrepreneurs, bankruptcy, and succession and harvesting strategy.

Unit-III

Principles of Management:

Definition of Management, Administration Organization, F.W. Taylor's and Henry Fayol's Principles of Management, Functions of Manager, Types of Organization: Line, Staff, and committee type, Directing, Leadership; Styles of Leadership; Qualities of a good leader; Motivation, Positive and Negative Motivation, Modern Management Techniques, Management Information Systems, Objectives and Importance.

Unit-IV

Production, Planning and Control:

Introduction, Major functions of Production Planning and Control, Methods of forecasting, Concept of Critical Path Method (CPM), Types of Production: Mass Production, Batch

Production and Job Order Production, Principles of Product and Process Planning, Quality Control: Definition, Objectives, Sampling Inspection, Benefits of ISO to the organization, Concept of ISO 9001:2008, Quality Management System, Registration/Certification.

Unit-V

Financial Management:

Financial Institutions, Financing methods available for start-ups in India, Fixed and Working Capital; Resources of Capital; Shares Preference and Equity Shares; Debentures; Public Deposits; Factory Costing: Direct Cost; Indirect Cost; Factory Overhead; Selling Price of a product; Profit.

References:

1. S.C. Sharma, Industrial Engineering & Management, Khanna Book Publishing Co. Pvt. Ltd. Delhi.
2. O.P. Khanna, Industrial Engineering and Management, Revised Edition, Dhanpat Rai Publications Pvt. Ltd. New Delhi.
3. Steve Blank and Bob Dorf, K & S Ranch, The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company.
4. Eric Ries, The Lean Startup: How Today's Entrepreneurs use Continuous Innovation to Create Radically Successful Businesses, Penguin, UK.
5. Heinz Weihrich, Harold Koontz, Management, A global perspective, 10th Edition, McGraw Hill International Edition 1994.
6. M. Mahajan, Industrial Engineering and Production Management, Dhanpat Rai & Co.

Course Outcomes:

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

CO1	Understand the concept and process of entrepreneurship.
CO2	Understand the ideas of start-up, finance and protection.
CO3	Explain the production planning and quality control, and its functions.
CO4	Understand the basic principles, approaches and functions of management and identify concepts to specific situations.
CO5	List and explain the different financial sources and methods of inventory management.

Course Code:	**:**	**ECPC511**
Course Title	**:**	**Advance Communication Systems Lab**
Number of Credits	**:**	**1 (L: 0, T: 0, P: 2)**
Prerequisites	**:**	**Advance Communication Systems Theory**
Course Category	**:**	**PC**

Course Objectives:

- To understand and analyze different modulation techniques like Pulse Code Modulation (PCM), Amplitude Shift Keying (ASK) and Frequency Shift Keying (FSK)
- To study signal multiplexing techniques such as Time Division Multiplexing (TDM) and Frequency Division Multiplexing (FDM).
- To set up and examine fiber optic communication systems including signal transmission, bending loss, and attenuation loss.

List of Experiments:

1. To set up and study the TDM signal.
2. To set up and study the FDM signal.
3. To set up and study the ASK signal.
4. To set up and study the FSK signal.
5. To set up and study the Fiber Optics Analog Link.
6. To set up and study the Fiber Optics Digital Link.
7. To set up and study the FM signal using optical link.
8. To study the bending loss in an optical link.
9. To measure the propagation loss in optical fiber
10. To set up and study the voice communication through fiber optic cable.

Course Outcomes:

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

CO1	Implement and analyze various digital and analog modulation techniques.
CO2	Understand how TDM and FDM are used for efficient signal transmission.
CO3	Gain practical knowledge of fiber optic communication including loss measurement and signal transmission using AM/FM.

Course Code:	**:**	**ECPC512**
Course Title	**:**	**Microprocessors and Applications Lab**
Number of Credits	**:**	**1 (L: 0, T: 0, P: 2)**
Prerequisites	**:**	**Microprocessors and Applications Theory**
Course Category	**:**	**PE**

Course Objectives:

- To study the internal structure, registers, instruction set of 8085 and 8086.
- To write, debug and execute programs using assembly language to perform arithmetic, logical and control operations.
- To interface microprocessors with simple input and output devices such as LED, motors, LCD displays etc.

List of Experiments:

1. To add two 8-bit numbers in which the sum should be in 8-bit.
2. To add two 8-bit numbers in which the sum should be with carry.
3. To add two 16-bit numbers in which the sum should be in 16-bit.
4. To subtract two 8-bit numbers in which the difference should be in 8-bit.
5. To write a program for finding the 2's complement of a 16-bit number.
6. To subtract 8-digit decimal numbers.
7. To form 8-bit numbers in consecutive locations and to store them in another consecutive locations.
8. To find the larger of two numbers.
9. To write a program for finding the largest number from the series of numbers.
10. To find larger numbers in a data array.

Course Outcomes:

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

CO1	Develop and test assembly language programs using microprocessor kits and simulators.
CO2	Connect and control peripherals such as LEDs, LCD Displays, motors etc.
CO3	Create simple microprocessor based systems for real time applications like automation and control.

Course Code:	**:**	**ECPE513**
Course Title	**:**	**Consumer Electronics Lab**
Number of Credits	**:**	**1 (L: 0, T: 0, P: 2)**
Prerequisites	**:**	**Consumer Electronics Theory**
Course Category	**:**	**PE**

Course Objectives:

- To analyze audio signal properties (frequency, pitch, timbre, loudness) using an oscilloscope and understand their impact on sound quality.
- To study the working and characteristics of microphones, loudspeakers, home appliances (microwave oven, digital clock) and television systems (monochrome and color TV).
- To set up and examine the signal reception process in a DTH and Satellite TV system.

List of Experiments:

1. To analyze the frequency, pitch, timber and loudness of audio signals using oscilloscope.
2. To study the characteristics of different types of microphones (Moving Coil, Condenser and Ribbon).
3. To study the characteristics of different loudspeakers (Woofer, Tweeter and Multi-speaker system).
4. To set up a basic PA system and test the functionality.
5. To assemble a basic set up of a DTH and a Satellite TV system and analyze its signal reception process.
6. To study the various stages of a monochrome TV receiver.
7. To study the various stages of a colour TV receiver.
8. To do the voltage measurement of different stages of colour TV before and after fault creations.
9. To study the control panel and components of a Microwave oven.
10. To study the components and working principle of a Digital clock.

Course Outcomes:

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

CO1	Measure and analyze the frequency, pitch, timbre and loudness of audio signals using an oscilloscope to interpret sound wave characteristics.
CO2	Understand the functions of different microphones, loudspeakers, household appliances, and the working of monochrome and color TV receivers.
CO3	Gain practical knowledge of setting up of a DTH system, Satellite TV signal reception and transmission.

Course Code:	**:**	**ECSI516**
Course Title	**:**	**Summer Internship-II**
Number of Credits	**:**	**1 (L: 0, T: 0, P: 2)**
Prerequisites	**:**	**Nil**
Course Category	**:**	**SI**

Four week summer internship is mandatory for the students. The students are supposed to have practical understanding and training in a suitable industry or organization. Summer Internship-II should be undertaken in an industry only. It should be based on real/live problems of the Industry/Govt./NGO/MSME/Rural Sector or an innovative idea having the potential of a Start-up.

Course Objectives:

- To provide industrial exposure to students that will help them to gain real life experience.
- To engage students with experienced professionals that can help them further in their careers.
- To provide industrial exposure to students to the real time.
- To enable the students to work on short industry projects and gain the skill of preparing report describing its results and findings.
- To identify the gap between existing knowledge and industry expectations.

Course Code:	**:**	**ECPR517**
Course Title	**:**	**Major Project-I**
Number of Credits	**:**	**1 (L: 0, T: 0, P: 2)**
Prerequisites	**:**	**Nil**
Course Category	**:**	**PR**

Course Objectives:

- To understand the method of applying engineering knowledge to solve specific problems.
- To apply engineering and management principles while executing the project.
- To identify and solve complex engineering problems using professionally prescribed standards and demonstrates good verbal presentation and technical report writing skills.

Guidelines:

1. Project will have to be done by a group in their area of interest.
2. Each group has to select a contemporary topic that will use the technical knowledge of their program of specialization.
3. Allocation of the guides preferably in accordance with the expertise of the faculty.
4. The student will be assigned a faculty guide who would be the supervisor of the students.
5. The Major Project-I requires:
   - To specify project topics
   - To complete introduction and literature review
   - To specify methodology completely
   - T specify the line diagram and requirements of parts and materials in case of fabrication project

Course Outcomes:

After going through this course, the students will be able to:

CO1	Conceptualize, design and implement solutions for specific problems.
CO2	Communicate the solution through presentation and technical report.
CO3	Apply project and resource management skills, professional ethics and societal concerns.

Course Code:	**:**	**ECPC601**
Course Title	**:**	**Microcontrollers and Embedded Systems**
Number of Credits	**:**	**3 (L: 2, T: 1, P: 0)**
Prerequisites	**:**	**Microprocessors and Applications**
Course Category	**:**	**PC**

Course Objectives:

- To understand the difference between microprocessor and microcontroller.
- To understand the architecture and instruction set of 8051 microcontrollers.
- To write basic program in assembly and embedded C.
- To understand Arduino, Arduino IDE and EDSIM-51 simulator.
- To construct basic projects using 8051 Arduino.

Course Contents:

Unit-I

Architecture of 8051:

Introduction and classification of microcontrollers, Overview of microcontroller families, Comparison of microprocessor and microcontroller, Salient features of INTEL 8051, Functional pin diagram, Pin diagram and block diagram of INTEL 8051 microcontroller, ALU, Special function registers, Data memory structure and program memory structure of INTEL 8051 and Concept and advantages of register banks of 8051.

Unit-II

Instruction Set:

Programmer's view of 8051, Program counter, PSW register, Stack pointer, I/O ports, Instruction set of 8051: Data transfer group, arithmetic group, logical group and batch processing group.

Unit-III

Programming of 8051:

Addressing modes of 8051: immediate addressing, register addressing, direct addressing, indirect addressing, index addressing and implied addressing, simple programming examples in assembly and embedded C.

Unit-IV

Advance Topics in 8051:

Interrupts and interrupt structure of 8051, Interrupt handling in8051, IE and IP register, External interrupts, TCON register, Serial port, SCON register, Timers of 8051, TMOD register, Mode0, Mode1 and Mode2 operation of Timer/Counter.

Unit-V

Arduino and Interfacing of 8051:

Introduction of Arduino, Classification, Arduino IDE software, Arduino UNO, Programming using Arduino, Basic projects, EDSIM-51 simulator, Interfacing LEDs, Switches, 7-segment display, LCDs with 8051.

References:

1. Mazidi & Mazidi, The 8051 Microcontroller and Embedded System using Assembly and C, Pearson Education.
2. Dogan Brahim, Microcontroller Projects in C for 8051, Newson Publication.
3. K. Udaya Kumar, B. S. Umashankar, 8085 Microprocessor Architecture, Programming and Interfacing, Pearson Education.
4. Ankaj Gupta, Fundamentals of Microcontroller and Embedded System, Katson Books.

Course Outcomes:

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

CO1	Understand the difference between a microprocessor and microcontroller and the architecture of 8051 microcontroller.
CO2	Learn the instruction set of 8051 microcontroller.
CO3	Gain knowledge about the addressing modes of 8051 and able to write the simple program using Assembly and Embedded C.
CO4	Understand about the interrupts and timer facilities available in 8051 microcontroller.
CO5	Define Arduino and construct basic projects using Arduino and 8051 microcontroller.

Course Code:	**:**	**ECPC602**
Course Title	**:**	**Data Communication and Networking**
Number of Credits	**:**	**3 (L: 2, T: 1, P: 0)**
Prerequisites	**:**	**Analog and Digital Communication**
Course Category	**:**	**PC**

Course Objectives:

- To familiarize with the basics of Data Communication.
- To study different types of network topology and understand the responsibilities of different layers of OSI model and TCP/IP model.
- To get idea of various flow and error control protocols and learn various error detection and correction techniques.
- To analyze circuit, packet and message switched networks.
- To familiarize with ISDN and ATM network.

Course Contents:

Unit-I

Introduction to Data Communication:

Data communication fundamentals, Data transmission and Transmission media: Twisted pair, coaxial and fiber optic cable, Data modulation, Line encoding: Unipolar, polar and bipolar.

Unit-II

Network and Models:

Network topology: Mesh, Star, Bus and Ring topology, LAN, WAN, Hub, Bridge, Switches, Routers, DTE-DCE interface, OSI-model, TCP/IP model, Comparison between OSI and TCP/IP models.

Unit-III

Error Detection and Correction Techniques:

Flow and error control protocols: Stop and Wait ARQ, Go-Back-N ARQ and Selective Repeat ARQ, Error detection and correction techniques: Simple parity checker, Checksum, Cyclic redundancy check and Hamming Code.

Unit-IV

Switching and Multiplexing:

Multiplexing techniques: FDM and TDM, CDMA, Switching techniques: Circuit switching, packet switching and message switching networks and routing techniques, x.25.

Unit-V

ISDN and ATM:

ISDN and ATM networks, Narrowband ISDN: services, system architecture and interface, Broadband ISDN, ATM architecture: services and switching.

References:

1. Behrouz A. Forouzan, Data Communication and Networking, Tata McGraw Hill Publication, New Delhi.

2. William Stallings, Data and Computer Communication, PHI Publication.
3. Andrew S. Tanenbaum, Computer Networks, Pearson Education.
4. Godbole, Data Communication and Networking, Tata McGraw Hill Publication, New Delhi.

Course Outcomes:

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

CO1	Understand about the basics of data communication and networking.
CO2	Learn about the OSI and TCP/IP protocol suite.
CO3	Learn about the error detection and correction techniques.
CO4	Understand about the concept of multiplexing and switching.
CO5	Learn about the basic idea of ISDN and ATM networks.

Course Code:	**:**	**ECPE603**
Course Title	**:**	**VLSI Design and Technology**
Number of Credits	**:**	**3 (L: 2, T: 1, P: 0)**
Prerequisites	**:**	**Electronics Devices and Circuits**
Course Category	**:**	**PE**

Course Objectives:

- To understand the principles and concepts of VLSI design and MOSFET technology.
- To explore the fabrication processes of MOSFETs and CMOS devices.
- To analyze and design COS and CMOS circuits including logic gates and inverters.
- To introduce students to Hardware Description Languages (HDL) like Verilog.
- To study the effects of scaling and challenges in modern VLSI systems.

Course Contents:

Unit-I

Introduction:

Classification of IC Technology: SSI, LSI, VLSI and ULSI, MOSFET's current equation in linear and saturation mode, Threshold voltage: Definition and derivation, Body effect and effect of body effect on Threshold voltage, Short channel effect: Channel length modulation, hot electron effect and mobility variation effect.

Unit -II

VLSI Concepts:

Resistance and capacitance estimation of MOSFET, C-V (capacitance-voltage) characteristics of MOS capacitor, Principle of MOS scaling, types of scaling and functional limitation of scaling.

Unit-III

Wafer Processing with C -Z Method:

Definition and application of Mask generation, Oxidation, Diffusion, Ion implantation, Metallization, Photolithography in MOSFET, Basic process steps of NMOS, Basic process steps of CMOS (n Well, p Well & Twin Tube), Latch-up in CMOS and its prevention.

Unit-IV

MOS Inverters:

Aspect ratio and inverter ratio, NMOS inverter with resistive load, NMOS inverter with EMD load, NMOS inverter with DMD load, CMOS inverter, Logic gates using NMOS and CMOS (only circuit diagram and operation), Realization of any Boolean equation using NMOS and CMOS.

Unit-V

Hardware Description Language:

Feature of Verilog-Entity, Architecture, Configuration, Package, Bus, Driver, Attributes process, Behavioral modeling, Sequential processing, Data types and configurations.

References:

1. John P. Uyemura, Introduction to VLSI Circuits and Systems, Wiley Publication.

2. Weste, Neil H. E., Principles of CMOS VLSI Design, Addison Wesley Publication.
3. Douglas A. Pucknell, Kamran Eshraghian, Basic VLSI Design, Prentice-Hall Publication.
4. Morris Mano, Digital Design, Pearson Education.
5. M. J. Smith, Application-Specific Integrated Circuits, Addison Wesley Publication.

Course Outcomes:

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

CO1	Understand and explain the basic principles of VLSI technology and MOSFET operation.
CO2	Analyze and design digital circuits using MOSFET and CMOS technologies.
CO3	Calculate key parameters like threshold voltage and body effect in MOS devices.
CO4	Understand the challenges and limitations associated with MOS scaling and its impact on VLSI design.
CO5	Gain hands-on experience with hardware description language (HDL) like Verilog.

Course Code:	**:**	**COOE604**
Course Title	**:**	**Artificial Intelligence**
Number of Credits	**:**	**3 (L: 2, T: 1, P: 0)**
Prerequisites	**:**	**IT Systems and Computer Programming**
Course Category	**:**	**OE**

Course Objectives:

- To understand basics of artificial intelligence and intelligent agents.
- To apply propositional logic for representing knowledge to achieve a goal.
- To analyze the real-world problems using first-order logic.
- To evaluate different types of machine learning algorithms.
- To apply algorithms and knowledge that allow computer to learn from data and make predictions.

Course Contents:

Unit-I

Intelligent Agents and Problem Solving:

Introduction to Artificial Intelligence (AI), Foundations and history of AI, Agents and environments, Concept of rationality, Nature of environments, and Structure of agents, Problem-solving agents, Toy and real-world problem, Searching for solutions, Uninformed search strategies, and informed (Heuristic) search strategies, and Heuristic functions.

Unit-II

Logical Agents:

Knowledge-based agents, The Wumpus world problem, Logic, Propositional logic, Propositional Theorem Proving, Effective propositional model checking, and Agents based on propositional logic.

Unit-III

First-Order Logic:

Representation, Syntax and semantics of first-order logic (FOL), Using FOL, Knowledge engineering in FOL, Inferences in FOL: Propositional vs First-order inference, unification and lifting, Forward chaining, Backward chaining, and Resolution.

Unit-IV

Learning:

Forms of learning, Supervised and unsupervised learning, Learning decision trees: The decision tree representation, expressiveness of decision trees, Inducing decision trees from examples, Theory of learning, Regression and classification with linear models, Artificial Neural Networks (ANN), Support Vector Machine (SVM), Ensemble learning, and Practical machine learning (ML): Handwritten digit recognition and House price prediction.

Unit-V

Knowledge in Learning:

Logical formulation of learning: Examples and hypotheses, Current-best-hypothesis search and least commitment search; Knowledge in learning, Explanation-based learning, Inductive logic

programming: An example, Top-down inductive learning methods, Inductive learning with inverse deduction, Introduction to reinforcement learning.

References:

1. Russell S. J. and Norvig P., Artificial Intelligence-A Modern Approach, Pearson, 4th Edition, 2022, ISBN-10: 9356063575
2. Padhy N. P., Artificial Intelligence and Intelligent Systems, Oxford University Press.
3. Goel L., Artificial Intelligence: Concepts and Applications, Wiley.
4. Deisenroth M. P., Faisal A. A., and Ong C. S., Mathematics for Machine Learning, Cambridge University Press.

Course Outcomes:

At the end of this course, the students will be able to:

CO1	Describe the basics of AI and different types of searching.
CO2	Solve the problems related to propositional logic.
CO3	Represent knowledge using first-order logic in AI-based systems.
CO4	Differentiate among different forms of learning, decision trees, ANN, and SVM.
CO5	Demonstrate knowledge in learning.

Course Code:	**:**	**ECPC611**
Course Title	**:**	**Microcontrollers and Embedded Systems Lab**
Number of Credits	**:**	**2 (L: 0, T: 0, P: 4)**
Prerequisites	**:**	**Microcontrollers and Embedded Systems Theory**
Course Category	**:**	**PC**

Course Objectives:

- To move beyond theoretical knowledge and provide hands-on experience with microcontrollers and their applications.
- To write and execute the programs using assembly and embedded C.
- To learn how to connect the microcontrollers to various interfacing devices such as LED, motors, LCD display etc.

List of Experiments:

1. To write a 8051 ALP to copy a block of 10 bytes from RAM locations starting at 37H to RAM locations starting at 59H.
2. To write an 8051 ALP for addition of first 10 natural numbers.
3. To write an 8051 ALP for addition of two 16-bit numbers.
4. To write an 8051 ALP using Timer 0 to create a 10 kHz square wave on P1.0.
5. To write an 8051 ALP on display 'SUPERB' on LCD display.
6. To write an 8051ALP for addition of two numbers stored at 6200H and 6201H memory locations and show the result on LCD display.
7. To write an 8051ALP for multiplication of two numbers stored at 6200H and 6201H memory locations and show the result on LCD display.
8. To write an ALP for 8051 to check the number stored in memory for being even and odd. This program displays the message 'ODD 'or 'EVEN' as per the number.
9. To write an Alp for 8051 to push and POP the contents of R5 and R6 registers when bank 2 is the working bank.
10. To find the biggest of a series of 3 numbers where the numbers are stored in RAM locations 45H, 46H and 47H and to load the biggest number.

Course Outcomes:

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

CO1	Write, debug and optimize code for micro-controller to perform specific task.
CO2	Connect microcontrollers to various interfacing devices.
CO3	To design projects for real-world applications.

Course Code:	**:**	**ECPC612**
Course Title	**:**	**Data Communication and Networking Lab**
Number of Credits	**:**	**2 (L: 0, T: 0, P: 4)**
Prerequisites	**:**	**Data Communication and Networking Theory**
Course Category	**:**	**PC**

Course Objectives:

- To familiarize with various ways of data transmission and to make Ethernet cable connection for local area network.
- To simulate different types of network topology.
- To know and implement simple parity checker for error detection.

List of Experiments:

1. To make RJ45 connection for unshielded twisted pair (UTP) cable (Category 6).
2. To study PC to PC communication using Ethernet crossover cable.
3. To study different types of transmission media.
4. To design and verify the operation of C (4, 3) simple parity check code for error detector circuit.
5. To study OSI and TCP/IP model.
6. To study and simulate star topology network using NetEmul software.
7. To study PC to PC communication using Serial Port (RS-232).
8. To study fiber optics communication using Data Communication Trainer Kit.
9. To study wireless communication using Data Communication Trainer Kit.
10. To study modem communication using Data Communication Trainer Kit.

Course Outcomes:

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

CO1	Understand about the basics of computer networking and handle advanced communication gadgets.
CO2	Learn about the different transmission modes of data communication.
CO3	Get familiarize with the idea of error detection and correction techniques.

Course Code:	**:**	**ECSE616**
Course Title	**:**	**Seminar**
Number of Credits	**:**	**1 (L: 0, T: 0, P: 2)**
Prerequisites	**:**	**Nil**
Course Category	**:**	**SE**

A seminar course at diploma engineering level covers a range of topics within the electronics and communication engineering field including VLSI Design and Technology, Microprocessors and Applications, Microwave and RADAR Engineering, Data Communication and Networking, Wireless Communication Systems, Microcontrollers and Embedded Systems, Cyber Security and Artificial Intelligence. The focus is on analysis and presentation of a chosen topic. The chosen topic and activities should be as per curricular interest to students and of professional value to industrial field organizations. Each teacher is expected to supervise 8-10 students.

Guidelines:

The student may choose any topic for seminar presentation as prescribed below:

- 5G Technology and its Impact on Communication Systems
- Introduction to IoT (Internet of Things) in Communication Systems
- Basics of Wireless Communication and its Applications
- Fundamentals of Fiber Optic Communication
- Overview of Embedded Systems in Communication Devices
- VLSI Design and its Role in Modern Electronics
- Basic Principles of Digital Communication Systems
- Error Detection and Correction Techniques
- Radio Frequency Engineering
- Satellite Communication Systems
- Microwave and RADAR Engineering
- Data Communication and Networking
- Cyber Security of Digital Data
- Artificial Intelligence and Machine Learning

Course Code:	**:**	**ECPR617**
Course Title	**:**	**Major Project-II**
Number of Credits	**:**	**3 (L: 0, T: 0, P: 6)**
Prerequisites	**:**	**Nil**
Course Category	**:**	**PR**

Course Objectives:

- To understand the method of applying engineering knowledge to solve specific problems.
- To apply engineering and management principles while executing the project.
- To identify and solve complex engineering problems using professionally prescribed standards and demonstrates good verbal presentation and technical report writing skills.

Guidelines:

1. Project will have to be done by a group in their area of interest.
2. Each group has to select a contemporary topic that will use the technical knowledge of their program of specialization.
3. Allocation of the guides preferably in accordance with the expertise of the faculty.
4. The student will be assigned a faculty guide who would be the supervisor of the students.
5. The number of projects that a faculty can guide would be limited to two groups.
6. The project can be carried out on-campus or in an industry or an organization with prior approval from the Principal through Head of Section.
7. The project shall be completed and submitted at least one month before the last teaching day.
8. The project should be presented by students using power point once before submission of project.

Course Outcomes:

After going through this course, the students will be able to:

CO1	Conceptualize, design and implement solutions for specific problems.
CO2	Communicate the solutions through presentations and technical reports.
CO3	Apply project and resource management skills, professional ethics and societal concerns.

Course Code	**:**	**ECAU600**
Course Title	**:**	**Indian Constitution**
Number of Credits	**:**	**0 (L: 2, T: 0, P: 0)**
Prerequisites	**:**	**Nil**
Course Category	**:**	**AU**

Course Contents:

Unit-I

The Constitution – Introduction:

The History of the Making of the Indian Constitution, Preamble and the Basic Structure, and its interpretation, Fundamental Rights and Duties and their interpretation, State Policy Principles.

Unit-II

Union Government:

Structure of the Indian Union, President - Role and Power, Prime Minister and Council of Ministers, Lok Sabha and Rajya Sabha.

Unit-III

State Government:

Governor - Role and Power, Chief Minister and Council of Ministers and State Secretariat.

Unit-IV

Local Administration:

District Administration, Municipal Corporation, Zila Panchayat.

Unit-V

Election Commission:

Role and Functioning, Chief Election Commissioner and State Election Commission.

References:

1. Rajeev Bhargava, Ethics and Politics of the Indian Constitution, Oxford University Press, New Delhi.
2. B.L. Fadia, The Constitution of India, Sahitya Bhawan.
3. DD Basu, Introduction to the Constitution of India, Lexis Nexis.

APPENDIX-I

LIST OF PROGRAM ELECTIVE COURSES

S.. No.	Course Title	Course Code
1	Digital System Design	ECPE###
2	Antenna and Wave Propagation	ECPE###
3	Microwave and RARDAR Engineering	ECPE###
4	Digital Communication Systems	ECPE###
5	Industrial Automation	ECPE###
6	Electronic Equipment Maintenance	ECPE###
7	Linear Integrated Circuits	ECPE###
8	Consumer Electronics	ECPE###
9	Electronics Circuit Design	ECPE###
10	VLSI Design and Technology	ECPE###

###: Three digit numeric code

APPENDIX-II

LIST OF OPEN ELECTIVE COURSES

S.. No.	Course Title	Course Code
1	Cyber Security	COOE###
2	Internet of Things	COOE###
3	Introduction to E-Governance	COOE###
4	Web Designing & Multimedia Technology	COOE###
5	Artificial Intelligence	COOE###
6	Smart Systems	ECOE###
7	3-D Printing	ECOE###
8	Soft Computing Techniques	EEOE###
9	Renewable Energy Technologies	EEOE###
10	Robotics	MEOE###

###: Three digit numeric code

APPENDIX-III

EXIT POLICY

By implementing the guidelines of NEP-2020, if any student fails to continue with the Diploma Engineering Course of 3 year duration after passing second year of the enrolled discipline of the course due to any reason/s, he/she may be awarded with a Certificate in the respective discipline of engineering.

The result for the same will be prepared according to the following table:

S. No.	Year	Weightage	Maximum Marks
1	First	25 Percent	500
2	Second	75 Percent	1500
		Grand Total	2000

APPENDIX-IV

FINAL RESULT PREPARATION

S. No.	Year	Weightage	Maximum Marks
1	First	25 Percent	500
2	Second	75 Percent	1500
3	Third	100 Percent	2000
		Grand Total	4000