Curriculum Structure & Syllabi

(As per National Education Policy 2020)

of

B.Tech.

In

Electronics and Communication Engineering (ECE)

(w.e.f. 2024-2025)

Overall Credit Structure

Curriculum

Syllabus

Offered By

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

MADAN MOHAN MALAVIYA UNIVERSITY OF TECHNOLOGY (MMMUT) GORAKHPUR-273 010, UP, INDIA
JULY 2024

B. Tech. in Electronics & Communication Engineering

Vision

To become a leader of education, research, and innovation in Computer Science and Engineering and to produce under graduates who are globally recognized as innovative and well-prepared computing professionals.

Mission

1. To create, share and disseminate knowledge through research and education in the theory and application of computing
2. To train the students in different aspects of computing discipline for enhancing, augmenting, and updating their technical skills
3. To inculcate the spirit of analysis, teamwork, innovation, and professionalism among the students

Programme Educational Objectives (PEO)

PEO-1 To inculcate the knowledge of the fundamentals of the mathematics, science & engineering disciplines for developing the ability to formulate, solve and analyze the problems of Computer Science & Engineering field and to provide them the skills for the pursuit of under-graduate studies, research and development and higher education.

PEO-2 To provide an understanding of the prerequisite of the software, technical aspects, and design for coming up with novel engineering solutions and efficient product developments.

PEO-3 To assist the students in the pursuit of a successful career by adopting ethical practices and social responsibility.

PEO-4 To provide students with the technical as well as soft skills required by the national as well as international organizations.

PEO-5 To elevate cognizance in the students toward unending learning and to inculcate ethical and moral ways.

PEO-6 To give students the knowledge of the contemporary technologies, practical experiences, and possibilities in the field of Computer Science & Engineering and to provide the multidisciplinary knowledge to develop the team spirit and leadership qualities by working on multidisciplinary projects.

Programme Outcome (POs)

PO-1 The students will develop the ability towards the application of fundamental knowledge of computing, mathematics, algorithms and computer science & engineering precepts and rationales for developing the solutions of critical engineering problems. (Rudimentary engineering analytical skills).

PO-2 The under graduating students will be able to model and carry out the experiments by using the fundamental knowledge of computer science & engineering discipline and derive the conclusions by analyzing and interpreting the data.

PO-3 The students will be able to analyze, design, implement and assess a computer-based information system, procedure, module, or program to fulfil the requirements along with the consideration of economic, social, privacy and reliability constraints. (Innovative skills)

PO-4 The students will be able to perform efficaciously in multi-disciplinary teams. (Team spirit)

PO-5 The students will develop the analytical skills to critically analyze, recognize, formulate, and devise solutions to the engineering problems by using adequate computing and engineering skills and knowledge. (Engineering problem solving skills)

PO-6 The students will have the awareness towards the professional, ethical practices, legal, security & social consequences, and obligation. (Professional integrity).

PO-7 The students will have efficient speaking skills and written/interpersonal communication skills. (Oral & written communication skill)

PO-8 To impart exhaustive education to the students required to understand and analyze the local and global consequences of computer science & engineering solutions ranging from individuals and organizations to society. (Engineering consequences assessment skills)

PO-9 The students will develop the realization of the requirement of and the ability to indulge in maintaining professional growth and unending learning. (Continuing education cognizance).

PO-10 The students will have the cognition towards the current issues and problems. (Societal awareness)

PO-11 The students will possess the ability to utilize the knowledge of innovative computing equipment's required for engineering tasks. (Pragmatic skills)

PO-12 The students will be able to apply the design and evolution precepts in the development of software and hardware computer systems of variable complications. (Software hardware interface).

Programme Specific Outcome (PSOs)

PSO1. Ability to be lifelong learner to adapt innovation.

PSO2. Ability to learn the best practices regarding ideating, innovating and to be able to attain successful career with globally employable capabilities.

PSO3. Ability to be open to international cultures and demands.

SYLLABUS AND CREDIT STRUCTURE FOR B. TECH. (ELECTRONICS AND COMMUNICATION ENGINEERING) (SESSION 2024-2025 AND ONWARDS)

OVERALL CREDIT STRUCTURE FOR B.TECH. (ECE)

<table>
<tr><th colspan="4">Credit Courses</th></tr>
<tr><th colspan="2">Core Courses (CC)</th><th colspan="2">Electives Courses (EC)</th></tr>
<tr><th>Category</th><th>Min. Credits</th><th>Category</th><th>Min. Credits</th></tr>
<tr><td>Basic Sciences & Maths (BSM)</td><td>20</td><td rowspan="3">Professional Electives (PE)/ Open Electives (OE)</td><td rowspan="3">36</td></tr>
<tr><td>Engineering Fundamentals (EF)</td><td rowspan="2">24</td></tr>
<tr><td>Professional Skill (PS)</td></tr>
<tr><td>Professional Core (PC)</td><td>48</td><td>Humanities & Social Science Elective (HSSE)</td><td>04</td></tr>
<tr><td>Management (M)</td><td>04</td><td></td><td></td></tr>
<tr><td>Humanities & Social Science (HSS)</td><td>08</td><td></td><td></td></tr>
<tr><td>Minor Project (P)</td><td>06</td><td></td><td></td></tr>
<tr><td>Industrial Practice (IP) (In Industry)/ Major Project (MP) (In University)</td><td>10</td><td></td><td></td></tr>
<tr><td>Sub-total</td><td>120</td><td>Sub-total</td><td>40</td></tr>
<tr><td>Grand Total</td><td>160</td><td colspan="2"></td></tr>
<tr><th colspan="4">Non-Credit Courses</th></tr>
<tr><td colspan="3">One Expert Lecture per semester for students (Mandatory).
(BSM-Ist year), (PC-2nd Year), (T&P-3rd Year)</td><td>Non-Credit</td></tr>
<tr><td colspan="3">Social work/Training of at least 60 hours during break after first/ second semester (Mandatory) (Dean of Extension, Field Outreach and Alumni Relations).</td><td>Non-Credit</td></tr>
<tr><td colspan="3">Industrial Training during the summer break after fourth semester (Mandatory).</td><td>Non-Credit</td></tr>
<tr><td colspan="3">One -week workshop during the winter break after fifth semester on professional/ industry/ Social/ entrepreneurial orientation (Mandatory) (Dean of Extension, Field Outreach and Alumni Relations).</td><td>Non-Credit</td></tr>
<tr><td colspan="3">Value Added Courses (VAC) / Audit Courses (AC)
Two of the Value-Added Courses / Audit Courses are compulsory.</td><td>Non-Credit</td></tr>
<tr><td colspan="3">Extracurricular Activities Courses (ECA)
Two compulsory courses from the following S. No (ii) to (v) non-credit courses:
(i) Induction Program (compulsory)
(ii) Skill development
(iii) Unity and Discipline (NCC or NSS)</td><td>Non-Credit</td></tr>
</table>

(iv) Sports, Cultural and Games (v) Personality Development	
Minor Degree (MD) from any Department and Micro Specializations (MS) within the Department	
• The total number of credits for graduation will be kept to minimum 160. The additional 18-20 credits required for Minor Degree Courses. • Micro specializations (MS) will be run by the department in order to aligned to industry careers or higher studies	Offered as a Professional Electives (PE)

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SEMESTER WISE CREDIT STRUCTURE FOR B. TECH. (ECE)

Category/Semesters	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**Total**
Basic Sciences & Maths (BSM)	8	8	0/4	4/0					**20***
Humanities & Social Science (HSS)	4	4							**08***
Humanities & Social Science Elective (HSSE)					4				**04***
Management (M)						4			**04***
Engineering Fundamentals (EF)	4	4	8/4	0/4					**16***
Professional Skill (PS)	4	4							**08***
Professional Core (PC)			12	12	12	12			**48***
Professional Electives (PE)/ Open Electives (OE)				4-8	28-32				**36***
Minor Project (P)						0	6		**06***
Industrial Practice (IP) (in Industry)/ Major Project (MP) (In University)								10	**10***
Total Credit	**20***	**20***	**20***	**20-24***	**16*-32***	**16*-32***	**6-30***	**10-30***	**160***
	80-84*				**76-80***				
Total Courses Offered	**05***	**05***	**05***	**05*-06***	**04*-08***	**04*-08***	**00-06***	**00-05***	**36***

**Minor variation is allowed as per need of the respective disciplines.*

First Year, Semester I

S. N.	Category	Paper Code	Subject	L	T	P	Credit
1.	BSM	BSM-110	Engineering Mathematics - I	3	1	0	4
2.	BSM	BSM-140 / 190	Environmental Science and Green Chemistry	3	0	2	4
3.	EF	BEE- 110 / BEE-160	Basic Electrical Engineering	3	0	2	4
4.	PS	BEC-106	Electronic Components Testing and Measurement	2	0	4	4
5.	HSS	BHS- 102/152	Technical Writing and Professional Communication (TW&PC)	2	1	2	4
			Total	**13**	**2**	**10**	**20**
6.	ECA-I		Induction Program	-	-	-	0

First Year, Semester II

S. N.	Category	Paper Code	Subject	L	T	P	Credit
1.	BSM	BSM-160	Engineering Mathematics - II	3	1	0	4
2.	BSM	BEC-131 / 181	Engineering Physics	3	0	2	4
3.	EF	BCS-110/160	Introduction to C Programming	3	0	2	4
4.	PS	BEC-157	Electronic Workshop	2	0	4	4
5.	HSS	BHS- 101/151	Universal Human Values (UHV)	3	1	0	4
			Total	**14**	**2**	**8**	**20**
6.	VAC/AC	BEC-170	Design Thinking in Electronics & Communication Engineering	0	0	2	0
7.	ECA-II			**-**	**-**	**-**	**0**

List of Extra Curricular Activity (ECA) Courses

ECA-II						
S. No.	Branch	Category	Subject Name	Subject Code	Hours/ Week	Credit
1.	Open to all Branches	ECA	Skill Development-I	ECA-151	2	0
2.	Open to all Branches	ECA	Unity and Discipline (NCC)-I	ECA-171	2	0
3.	Open to all Branches	ECA	Unity and Discipline (NSS)-I	ECA-172	2	0
4.	Open to all Branches	ECA	Games & Sports-I	ECA-181	2	0
5.	Open to all Branches	ECA	Cultural, Art & Literary-I	ECA-182	2	0

List of Value-Added Courses (VAC)/Audit Courses (AC)

S. No.	Subjects	Codes
1.	Constitution of India	AUC01
2.	Indian Culture and Heritage	AUC02
3.	Indian Architecture	AUC03
4.	Indian Festivals	AUC04
5.	Vaidic Mathematics	AUC05
6.	Astronomy	AUC06
7.	Arts of India	AUC07
8.	Intellectual Property Right	AUC08
9.	Human Rights	AUC09
10.	Logical Research	AUC10
11.	Professional Ethics	AUC11
12.	Environmental Law	AUC12
13.	Health Law	AUC13
14.	National Cadet Corps	AUC14
15.	Basics of Human Health and preventive medicines	AUC15

SKILLS - ENHANCEMENT COURSES FOR EXIT (Electronics & Communication Engineering) for B. Tech 1st year (ECE) (After First Year: UG Certificate (Engineering.).

TWO-Months internship for 6-Credits OR Two courses mentioned below of 4 to 6 credits.

(a) The candidate should pass the following two additional courses (ITI Level) OR any two suitable skill-based courses to qualify for UG Certificate (Engineering.).

1. Consumer Electronic/Radio Engineering /Digital Electronics (Any one course)
2. Electronics Servicing and Maintenance

OR

(b) Equivalent skills-enhancement two courses (4 to 6 credits) from MOOCs / SWAYAM.

BSM-110 : Engineering Mathematics-I

Course category : Basic Sciences & Maths (BSM)
Pre-requisite Subject : NIL
Contact hours/week : Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits : 4
Course Assessment methods : Continuous assessment through tutorials, attendance, home assignments, quizzes and Two Minor tests and One Major Theory Examination
Course Objectives : The course is aimed to develop the basic mathematical skills of engineering students that are imperative for effective understanding of engineering subjects.

Course Outcomes : The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course.

1. Use of basic differential operators in various engineering problems.
2. Understand the concepts of limit theory and nth order differential equations and their applications to our daily life.
3. Solve linear system of equations using matrix algebra.
4. Know about qualitative applications of Gauss, Stoke's and Green's theorem.
5. To know the applications of double and triple integration in finding the area and volume.
6. To inculcate the habit of mathematical thinking and lifelong learning.

Topics Covered

UNIT-I 9

Differential Calculus: Limit, Continuity and Differentiability, Mean value theorems. Leibnitz theorem, Partial derivatives, Euler's theorem for homogenous function, Total derivative, Change of variable. Taylor's and Maclaurin's theorem. Expansion of function of two variables, Jacobian, Extrema of function of several variables.

UNIT-II 9

Linear Algebra: Symmetric, Skew-symmetric matrices, Hermitian, Skew Hermitian Matrices, orthogonal and unitary matrices and basic properties, linear independence and dependence of vectors, Rank of Matrix, Inverse of a Matrix, Elementary transformation, Consistency of linear system of equations and their solution, Characteristic equation, Eigenvalues, Eigen-vectors, Cayley-Hamilton theorem, Diagonalization of matrices.

UNIT-III 9

Multiple Integrals: Double and triple integrals, change of order of integration, change of variables. Application of multiple integrals to surface area and volume. Beta and Gamma functions, Dirichlet integral.

UNIT-IV 9

Vector Calculus: Gradient, Divergence and Curl. Directional derivatives, line, surface and volume integrals. Applications of Green's, Stoke's and Gauss divergence theorems (without Proofs).

Books & References

1. B.S. Grewal: Higher Engineering Mathematics; Khanna Publishers
2. Erwin kreyszig: Advanced Engineering Mathematics, John Wiley & Sons.
3. R. K. Jain and Iyenger: Advanced Engineering Mathematics, Narosa Publications.
4. B.V. Ramana: Higher Engineering Mathematics, Tata Mc. Graw Hill Education Pvt. Ltd.,

BSM-140/BSM-190	**Environmental Science and Green Chemistry**
Course category:	Basic Sciences & Maths (BSM)
Pre-requisite Subject:	NIL
Contact hours/week	Lecture: 3, Tutorial: 0, Practical: 2
Number of Credits:	4
Course Assessment methods:	Continuous assessment through home assignments, quizzes, minor tests, practical work, viva-voce, practical exam and major theory Examination
Course Objectives	Understanding the principles and concepts of Chemistry viz. Chemical Bonding, acidity and basicity, Atmospheric

Chemistry & Water Chemistry, Spectroscopic analytical methods and Green Chemistry and solving industrial problems using solid foundation in Chemistry.

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. To develop the concepts of basic chemistry.
2. To make the students aware of global environmental issues e.g. global warming & Greenhouse effect, Ozone depletion, pollution and its prevention and understand various aspects of atmospheric chemistry.
3. To understand the analytical and conceptual skills required for environmental chemistry research.
4. To understand water treatment for all types of uses and need to protect environment.
5. To understand the specifications of pure water and its purification techniques.
6. To develop the knowledge about Green Chemistry and Green Technology.

Unit 1: **9**

Basic Chemical Concepts

Periodic properties of elements, Ionization potential, electron affinity and electronegativity; mole concept, molarity and normality, Chemical Bonding – MO Theory, MO diagram of diatomic molecules, hydrogen bonding, electrophiles, nucleophiles, inductive effect and mesomeric effect. Reaction Mechanism. Acidity and basicity - Concept of ph.

Unit 2: **9**

Atmospheric chemistry & Water Chemistry

The atmosphere of Earth, layers of atmosphere and temperature inversion, Air pollution, Global warming and Greenhouse effect. Acid rain and Ozone layer depletion. Chemical and photochemical Smog. Sources of water, conservation of water, impurities in water and their effects. WHO guideline and BIS guideline for drinking water. Hardness of water, Softening of water by Zeolite process, Lime Soda process, Ion exchange process and Reverse osmosis.

Unit 3: **9**

Spectroscopic analytical methods

Absorbance, Transmittance and Beer-lamberts Law. Basic principles of UV-Visible spectroscopy, Fluorescence spectroscopy, Infrared spectroscopy, NMR Spectroscopy. Use of these instrumental techniques for monitoring of environmental pollution.

Environmental problems posed by the use of non-biodegradable polymers widely used in day-to-day life. Incineration as the key method for disposal of polymeric waste. Bio-degradable polymers.

Unit 4: **9**

Green Chemistry

Green Chemistry and Green Technology: New trends in Green chemistry; Green Chemistry Methodologies-Microwave heating, ultrasound technique. Green Chemical Synthesis Pathways; Green reagents, Green solvents.

Experiments:

1. Determination of temporary and permanent hardness in water sample using EDTA as standard solution.
2. Determination of alkalinity in the given water sample.
3. Determination of chloride content in the given water sample by Mohr's method.
4. Determination of percentage of available chlorine in bleaching powder sample.
5. Determination of iron content in the given sample using $K_3[Fe(CN)_6]$ as an external indicator.
6. Determination of Electrical conductivity/TDS of a given water sample using conductivity meter.
7. Determination of dissolved Carbon Dioxide of given water sample.
8. Determination of the biochemical oxygen demand of sewage influent.
9. To calculate the lambda max of the given compound by using UV-Visible spectrophotometer.
10. Determination of nickel / cobalt / copper solutions by UV–visible spectrometry.
11. Examples of Green Synthesis /Reactions.
12. Determination of Turbidity of Water
13. Iodoform test
14. Synthesis of a polymer Bakelite or Polyacrylic acid.

Books & References

1. A Text Book of Environment and Ecology, Shashi Chawla, Tata McGraw Hill
2. Environmental Studies, Raj Kumar Singh, Tata McGraw Hill
3. Engineering Chemistry, Wiley India
4. Engineering Chemistry, Tata McGraw Hill
5. Organic Chemistry, Morrison & Boyd, 6th edition, Pearson Education
6. Fundamentals of Environmental Chemistry, Manahan, Stanley E., Boca Raton: CRC Press LLC.
7. Environment and Ecology, R K Khandal, Wiley India
8. An Introductory Text on Green Chemistry: For Undergraduate Students, lndu Tucker Sidhwani, Rakesh K. Sharma, Wiley
9. A text book of Green Chemistry, Shankar Prasad Deo and Nayim Sepay, Techno World Publication.
10. Introduction to Green Chemistry, John Andraos, Albert S. Matlack, CRC Press

BCS-110/160 Introduction to C Programming

Course category:	Engineering Fundamental (EF)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 0, Practical: 2
Number of Credits:	4

Course Assessment methods:	Continuous assessment through attendance, home assignments, quizzes, practical work, record, Viva-voce, two tests and One Major Examination (T & P)

Course Objective: The course covers the basics of programming and demonstrates fundamental programming techniques, customs and terms including the most common library functions and the usage of the pre-processor. The salient features of course objectives are given below.

1. To develop C Programs using basic programming constructs
2. To develop C programs using arrays and strings
3. To develop applications in C using functions and structures

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course.

1. Basic terminology used in computer programming.
2. Programs development in C Language by writing, compiling, and debugging.
3. Design of programs involving simple statements, conditional statements, iterative statements, array, strings, functions, recursion, structure, and union.
4. Difference between call by value and call by reference.
5. Dynamic memory allocations and use of pointers.
6. Basic operations on a file.
7. Basics of dynamic memory.

UNIT-I **9**

Basics of programming: Approaches to Problem Solving, Concept of Algorithm and Flow Charts, Types of Computer Languages: Machine Language, Assembly Language and High-Level Language, Concept of Assembler, Compiler, Linker, and Loader. Data types, Storage Classes: Auto, Extern, Register and Static. Operators, Expressions, Operator Precedence and Associativity. **Fundamentals of C Programming:** Structure of C Program, Writing and Executing the First C Program, Components of C Language, Standard I/O, Formatted I/O. Conditional Program Execution: Applying if and switch Statements, Nesting if and else. Program Loops and Iterations: Use of while, do while and for Loops, Multiple Loop Variables, Use of break and continue Statements, goto Statement.

UNIT-II **9**

Arrays: One Dimensional, Multidimensional Array and Their Applications, Declaration and Manipulation of Arrays.
Strings: String Variable, String Handling Functions, Array of Strings.
Functions*:* Designing Structured Programs, Functions in C, User Defined and Standard Functions, Formal vs. Actual Arguments, Function Category, Function Prototype, Parameter Passing, Recursive Functions. Storage Classes revisited.

UNIT-III **9**

Pointers: Pointer Variable and its Importance, Pointer Arithmetic Pointers and Arrays, Pointer and Character Strings, Pointers and Functions, Array of Pointers, Pointers to Pointers.
Structure: Declaration and Initialization of Structures, Structure as Function Parameters, Structure Pointers.
Union: Declaration and Initialization of Unions, Union as Function Parameters, Union Pointers.

UNIT-IV **9**

Dynamic Memory Allocation: malloc, calloc, realloc, free functions.
File Management: Defining and Opening a File, Closing a File, Input/ Output Operations in Files. The Pre-processor Directives, Macros. Command Line Arguments. Introduction to Graphics Programming.

EXPERIMENTS

1. Write programs to print statements in sequential order using simple printf, scanf input/output functions.
2. Write programs to implement if-else condition (simple as well as nested) on suitable problems.
3. Write a program to implement switch-case conditional logic on suitable examples.
4. Write programs to implement for, while and do-while loop control statements on suitable problems.
5. Write programs to implement 1D & 2D array concepts on suitable problems such as sorting of elements, searching of element, matrix addition, subtraction, multiplication etc.
6. Write programs to implement string related concepts such as sorting of a string, finding its length, reversing, concatenation, comparing two strings etc.
7. Write programs to implement concept of user defined functions (call by value, call by reference, recursive calling etc.) on suitable examples.
8. Write programs to implement concepts of pointer.
9. Write programs to implement the concept of structure and union.
10. Write programs to implement dynamic memory allocation functions (calloc, malloc, free, realloc)
11. Write programs to implement file handling concepts such as reading from a file, writing to a file using file related functions (fclose, fopen, sscanf, sprint, fread, fwrite, getc, putc, getw, putw etc.)

Textbooks

1. Jeri R. Hanly and Elliot B. Koffman, Problem Solving and Program Design in C, 7th Edition, Pearson.
2. Schildt, Herbert, Complete Reference with C, Tata McGraw Hill.
3. Kerninghan and Ritchie, The C programming Language, 2nd Edition, Prentice Hall.
4. Richard Bird, Introduction to Functional Programming using Haskell, 2nd Edition, Prentice- Hall International, 1998.

Reference Books

1. Greg Michaelson, An Introduction to Functional Programming Through Lambda Calculus, Dover Edition, Addition Wesley Publication.
2. Samuel P. Harbison, and Guy L. Steele Jr., C-A Reference Manual, Fifth Edition, Prentice Hall, 2002.

BEC-106 Electronic Component Testing and Measurement

Course category	:	Professional Skills (PS-1)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture:2, Tutorial :0 , Practical: 4
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through attendance, assignments, quizzes, practical work, record, viva voce and two Test and One Major Theory & Practical Examination

Course Objectives

The objective of this course is to gain knowledge of basic electronic components and develop an understanding of the working principle of different electronic devices such as diode, transistor MOSFET, voltmeter, multimeter, CRO, etc. Also, to identify different electronic components & to develop an understanding of testing of different electronic components.

Course Outcomes : The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course:

1. Able to memorize the basic concept of electronic circuits using Diode, BJT (Bipolar Junction Transistor), FET (Field Effect Transistor), etc.
2. Able to execute and examine the general characteristics of electronic circuits.
3. Compute different parameters for characterizing different circuits like rectifiers, amplifiers, integrators, etc.
4. Examine the working principle of the digital voltmeter, and mustimeters using the block diagram approach.
5. Able to identify electronic components.
6. Discuss and calculate voltage, current, phase, and frequency using CRO.

Topics Covered

UNIT-I

Semiconductor Diode: Depletion layer, V-I characteristics, ideal and practical Diodes, Diode Equivalent Circuits, Zener Diodes breakdown mechanism (Zener and avalanche) 6
Diode Application: Diode Configuration, Half and Full Wave rectification, Clippers, Clampers etc.
Special Purpose Diodes: Light-Emitting Diodes, Photo Diodes etc.

UNIT-II

Bipolar Junction Transistor: Transistor Construction, Operation, Amplification action. Common Base and Common Emitter Configuration, input/output characteristics, Biasing of transistors-fixed bias and potential divider bias. 6

UNIT-III

Field Effect Transistor: Construction and working of JFETs. Transfer Characteristic and Output Characteristic of JFETs. MOSFET (MOS) (Depletion and Enhancement) Type, Transfer Characteristic and Output Characteristic of MOSFETs. 6

UNIT-IV

Operational Amplifiers and Electronics Instruments: Introduction, Op-Amp basic, Practical Op-Amp Circuits (Inverting Amplifier, Non-inverting Amplifier etc). Working principle of digital Storage Oscilloscope, CRO (its working with block diagram). 6

EXPERIMENTS

Note: Minimum eight experiments are to be performed:

1. To plot the forward / Reverse Characteristics of Si P-N junction diode.
2. To plot the forward/Reverse Characteristics of Zener diode.
3. Study and plot the characteristic of Zener diode as voltage regulator.
4. Study of half wave rectifier and draw the nature of input / output signal. Calculate the value of I_{dc}, I_{rms} and ripple factor.
5. Study of Full wave rectifier and draw the nature of input / output signal. Calculate the value of I_{dc}, I_{rms} and ripple factor.
6. Study of Bridge Rectifier and draw the nature of input / output signal. Calculate the value of I_{dc}, I_{rms} and ripple factor.
7. Draw input-output characteristic curve of n-p-n transistor in CE or CB or CC configuration.
8. Draw the drain and transfer curve of JFET.
9. Study of OP-AMP (741) and calculate the gain in (i) Inverting mode and (ii) non-inverting mode.

10. Study of OP-AMP as a (i) Summer (ii) Integrator (iii) Differentiator; and plot the nature of input & output waveform.
11. To identify the components which are used in electronic circuits. (R, L, C, diode etc).
12. To study the resistance, voltage, current measurement by using of mustimeter.
13. To get familiarization and to study the operation of a function generator instrument and visualize the types of waveforms produced by a function generator.
14. To study the DSO and to find the Amplitude, Time-period and Frequency of a sinusoidal waveform using DSO.
15. Study of Lissajous patterns and measurement of frequency through Lissajous patterns.
16. Measurement of time constant of RC circuit.
17. Measurement of unknown resistance using Wheatstone bridge.

Books & References

1. Electronic Devices and Circuits-Boylestad and Nashelsky, 6e, PHI, 2001
2. Electronic Devices and Circuits, A Mottershead, PHI,2000, 6e
3. Digital Computer Design, Morris Mano, PHI,2003
4. Electronic Instrumentation-H.S. Kalsi, 2e, TMH, 2007

BHS- 102/152 TECHNICAL WRITING AND PROFESSIONAL COMMUNICATION (TW&PC)

Course Category : HSS
Prerequisite subject : None
Number of Credits : 4
Contact Hours/Week : Lectures: 2, Tutorial: 1, Practical: 2
Course Assessment Methods : Continuous assessment through Two tests, teacher's assessment (quiz, tutorial, assignment, attendance), and One Major Theory Examination.

Course Objectives: The objectives of this course are to: -

1. To sensitize the students to understand the role and importance of communication for personal and professional success.
2. To enable the learners to enhance their writing skills in techno-cultural and professional echo-system.
3. To equip learners to differentiate technical writing from general writing.
4. To equip them with technical writing skills.
5. To enable learners to exhibit knowledge, skills, attitude and judgment in and around human communication that facilitate their ability to work collaboratively with others in an interpersonal environment.

Course Outcomes: The students will be able to demonstrate the following knowledge, skills, and attitudes upon completion of the course: -

1. Overcome the problems she/he shall faces in oral and written communication.
2. Acquire knowledge of and methods for using technical communication, such as reports, proposals, technical letters, etc.
3. Use and Practice compositions correctly.
4. Give presentations in different sessions and make self-appraisal.
5. Learn and understand the various facets of Communication Skills, such as (LSRW) Listening, Speaking, Reading, and writing, and identify, formulate, and solve real-life problems with a

positive attitude; also inculcate, the habit of learning and developing communication and soft skills.

Unit 1: Language and Communication **6**

Language Vs communication: Communication as coding and decoding – signs, symbols & pictograph – verbal and non–verbal symbols – Language & communication; Types of Communication- functional, situational, verbal, and non-verbal, interpersonal, group, interactive, public, Mass Communication. Thinking and Articulation, critical, creative aspects of articulation.

Skills of Language Acquisition: Natural Language Acquisition Skills: Listening, Speaking, Reading& Writing {LSRW}; Language Acquisition Through Training: Listening, Speaking, Reading, Writing, Grammar & Vocabulary {LSRWGV}

Phrase, Clause & Sentence in Professional Drafting-Simplicity, Clarity and Conciseness of a Presentation, differentiating between Professional and Creative Writing, Blending of Artistic/Professional Writing, Avoiding gender, racial, and other forms of bias in Professional Writing.Pre-writing, Drafting, and Re-writing.

Unit 2: Towards Technical Writing **6**

Technical Paper Writing: Professional Paper Elements-Front Matter of a Paper, Main Text of a Paper, End Matter of a Paper: Organizing References and Bibliography, Order of a thesis and Paper Elements, Concluding Remarks. **Methods of Research Paper Writing:** Identification of Author and His Writing-Author's name and Affiliation, Joint Authorship of a Paper, Identification of Writing- Title, Keywords, Synopsis, Preface and Abstract. Drafting Research Article & Methodology.

Thesis/Dissertation Writing: Thesis Elements-Front Matter of a Thesis, Main Text of a Thesis, End Matter of a Thesis, Specimen—Thesis and Research Paper, Chapters and Sections-Introductory Chapters and Sections, Statement of the Problems, Plan and Scope, Core Chapters and Sections- Theoretical Analysis and Synthesis, Basic Assumption and Hypothesis.

Professional Presentation & Seminar Delivery Tools: Designing the Presentation; Establishing the Objectives. Making Professional PowerPoint Presentations, Signaling Structure of Presentation through Sentences and Crisp Phrases, Preparing Notes for Professional/Technical Presentation, Text Animation, White Board, Flip Charts, Diagrams, Preparing Cards. Seminar Presentations: Purpose modes and methods. Nascent Emerging Platforms for On-line Presentations viz. Zoom, Webex, Team& Meet etc.

Unit 3: Drafting Skills & Career Correspondence **6**

Professional Drafting: Letters vs. e-mails, Formal and Informal emails, Parts of e-mails, Types of e-mails, Managing tone of E-mails and business Letters, Examples of Letters and E-mail, Professional Correspondence through E-mail, Job Applications and cover Letters. Introduction to DOs (Demi- Official Letters)

Career & Correspondence: Developing a Professional C.V, Bio Data & Resume. Report Writing, Kinds of Reports, Length of Report, Parts of a Report, Terms of Reference, Collection of Facts, Outlines of Report, Examples of Report, Technical Proposal, Elements of Proposal, Examples of Proposal, drafting of proposal.

Unit 4: Professional Practices with ICT Interface **6**

Conducting Professional Meeting: Pre-meeting Preparation, During Meeting: Action Taken Report (ATR) & New Agenda Points, Post Meeting Follow ups. Notice, Circular, Agenda & Meeting Minutes.

Introduction to Generation–Z, Cyber Identity & Professional Netiquettes for Netizens: DraftingE-mails, Blogs on social media, Videoconferencing. Managing Profiles on social media. What to Write and Share on social media. Telephone Etiquettes & Phubbing.

List of Practical:

1. Introduction to Vowel and Consonant Sounds
2. Monophthongs and Diphthongs
3. Syllable, Word Stress & Intonation
4. Harnessing Non-verbal Communication Skills in Cross-Cultural Environment for the establishment of an ideal Ecosystem to ensure Professional Success
5. Developing Speech, and Proofreading the Same
6. Argumentative Skills & Group Dynamics
7. Preparing CV, Biodata & Resume
8. Types of Interview and Interview Skills
9. GD, PI & Telephonic Interview
10. Presentation Skills, Extempore, Debate and Video Conferencing
11. Netiquettes while Writing Blogs on social media.
12. Ethical Usages of Generative AI

Text / Reference Books

1. Acharya Anita. (2012) Interview Skills- Tips & Techniques. Yking Books, Jaipur.
2. Basu, B. N., (2008) Technical Writing. PHI Learning Pvt. Ltd.., New Delhi.
3. Chauhan, N. K & Singh, S. N. (2013) Formal Letters, Pankaj Publication International, New Delhi.
4. Chhabra T.N. (2018) Business Communication. Sun India Publication New Delhi.
5. Dubey Arjun et.al. (2016) Communication for Professionals. Alfa Publications, Delhi.
6. Gibaldi, Joseph (2021). The MLA Handbook for Writers of Research Papers. Ed. IXth, Modern Language Association of America, NY, US.
7. Gurumani, N. (2010) Scientific Thesis Writing and Paper Presentation, MJP Publishers, Chennai.
8. Hamilton Richard. (2009) Managing Writers. Penguin, India.
9. Mc Graw S. J. (2008) Basic Managerial Skills for All. Ed. 08th, Prentice Hall of India, New Delhi.

BSM-160	**Engineering Mathematics - II**
Course category	: Basic Sciences & Maths (BSM)
Pre-requisite Subject	: NIL
Contact hours/week	: Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits	: 4
Course Assessment methods	: Continuous assessment through tutorials, attendance, home assignments, quizzes and Two Minor tests and One Major Theory Examination
Course Objectives	: The course is aimed to develop the basic mathematical skills of engineering students that are imperative for effective understanding of engineering subjects.
Course Outcomes	: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. To solve the ordinary differential equations.
2. To solve the partial differential equations using Lagrange and charpit's method.
3. To solve and understand the properties of Bessel`s and Legendre`s differential equation.
4. Application of partial differential equation in real life problems
5. To solve ODE and PDE with the help of Laplace transform
6. To inculcate the habit of mathematical thinking and lifelong learning.

Topics Covered

UNIT-I 9

Ordinary Differential Equations I: Linear differential equations with constant coefficients ($n^{th} order$), complementary function and particular integral. Simultaneous linear differential equations, solution of second order differential equations by changing dependent and independent variables, Method of variation of parameters, Applications of differential equations to engineering problems

UNIT-II 9

Ordinary Differential Equations II: Series solution of second order differential equations with variable coefficient (Frobeneous method). Bessel and Legendre equations and their series solutions, Properties of Bessel function and Legendre polynomials.

UNIT-III 9

Partial Differential equations: Partial differential equations of the first order, Lagrange's solution, Charpit's general method of solution, Partial differential equations of the second order: Constant coefficient and reducible to constant coefficient, Classification of linear partial differential equations of second order.

UNIT-IV 9

Laplace Transform: Laplace Transform, Laplace transform of derivatives and integrals. Unit step function, Laplace transform of Periodic function. Inverse Laplace transform, Convolution theorem, Applications to solve simple linear and simultaneous differential equations and Partial Differential Equations.

Books & References

1. B.S. Grewal: Higher Engineering Mathematics; Khanna Publishers
2. Erwin kreyszig: Advanced Engineering Mathematics, John Wiley & Sons.
3. R. K. Jain and Iyenger: Advanced Engineering Mathematics, Narosa Publications.
4. B.V. Ramana: Higher Engineering Mathematics, Tata Mc. Graw Hill Education Pvt. Ltd.
5. M.D. Raisinghania, Ordinary and Partial Differential Equations. S Chand Publications.

BSM-131/181 ENGINEERING PHYSICS

Course Category: Basic Sciences and Maths (BSM)

Pre-requisite Subject: Physics at 12th Standard

Contact hours/week: Lecture: 3, Tutorial: 0, Practical: 2

No. of Credits: 4

Course Assessment Methods: Continuous assessment through, Home assignments, quizzes and two minor test, attendance, one major theory.

Course Objective: Understanding of the principles and concept of Optics, Quantum Mechanics, Fiber Optics, Electrodynamics and Physics of Advanced Materials.

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills, and attributes after completing this course.

1. Understand the basics principles of Optics and its applications in Engineering and Technology.
2. Compare and understand the uses of various lasers in different fields of Engineering.
3. Know the knowledge of Optical Fibre and their applications in Photonics.
4. Understand the principles of Quantum Mechanics and their applications in Engineering and Technology.

5. Know the principles of Electrodynamics and their applications in Engineering and Technology.
6. Understand the basic properties of advanced materials and their engineering applications.

UNIT-I: Optics: 9

Interference: Interference of light, Interference in thin films, Newton's rings. Refractive index and wavelength determination.

Diffraction: Fresnel and Fraunhofer class of diffraction. Resultant of n-hormonic waves, single, double and N- slit diffraction, Diffraction grating, Grating spectra, Dispersive power.

Polarization: Phenomena of double refraction, Nicol prism, Production and analysis of plane, circular and elliptical polarized light, Retardation Plate, Polarimeter.

Laser: Spontaneous and stimulated emission of radiation, Population inversion, Concept of 3 and 4 level Laser, Construction and working of Ruby, He-Ne lasers, and laser applications.

UNIT-II : Quantum Mechanics and Fiber Optics: 9

Quantum Mechanics: de Broglie waves, Davisson-Germer experiment, Concept of Phase and Group velocities, Uncertainty principle and its applications, Derivation of time independent and time dependent Schrodinger wave equations. Postulates of quantum mechanics, Significance of wave function, Application of Schrodinger wave equation for a particle in one dimensional infinite potential well.

Fiber Optics: Fundamentals of optical fiber, Acceptance angle and cone, Numerical aperture, Single and Multi-Mode Fibers, Step index and graded index fiber, Propagation Mechanism in optical fibers.

UNIT-III: Electrodynamics: 9

Scalar and Vector fields, Gradient, Divergence and curl, Concept of displacement current, Maxwell's equation in differential and integral forms, Physical significance of each equation.

Maxwell's equation in free space, Velocity of electromagnetic wave, Transverse nature of the electromagnetic wave, Poynting vector, Maxwell's equations in dielectric and conducting medium, and skin depth.

UNIT-IV: Physics of Advanced Materials: 9

Concept of energy bands in solids, Semiconducting materials**,** Concept of direct and indirect band gap in semiconductors, Carrier concentration and conductivity in semiconductors, Optoelectronic Materials, Superconducting Materials**,** Temperature dependence of resistivity in superconducting materials, Effect of magnetic field (Meissner effect), Type I and Type II superconductors, London Equations, BCS theory (Qualitative), Introduction of nanoscience, Nanotechnology and its applications.

EXPERIMENTS

1. To determine the specific resistance of a given wire using Carrey Foster's Bridge.
2. To determine the wavelength of sodium light using Newton's Ring experiment.
3. To determine the wavelength of spectral lines of white light using plane diffraction grating.
4. To determine the specific rotation of cane sugar solution using polarimeter.
5. To study the variation of magnetic field along the axis of current carrying circular coil.
6. To study the Hall's effect and to determine Hall coefficient in n type Germanium.
7. To study the energy band gap of Germanium using four probe method.
8. To determine the height of Tower by Sextant.

Books & References

1. Optics- Ajoy Ghatak, Tata McGraw-Hill
2. Optics- N. Subrahmanyam, Brij Lal, M.N. Avadhanulu, S. Chand

3. Quantum Mechanics: Theory and Applications- Ajoy Ghatak, Tata McGraw-Hill
4. Fiber optics and laser Principles and Applications-Anuradha De, New Age International
5. Optical Fibers and its application as sensors by R. K. Shukla, New Age International.
6. Introduction to Electrodynamics by David J. Griffiths, Pearson
7. Physics of Semiconductor Devices, by S. M. Sze, Wiley
8. Concepts of Modern Physics by Arthur Beiser, Tata MCGraw Hill.
9. Introduction to Solid State Physics by C. Kittel, Wiley.
10. Engineering Physics by B. K. Pandey and S. Chaturvedi, 3e Cengage Learning Pvt. Limited, India.
11. Engineering Physics by H. K. Malik and A. Singh Tata MCGraw Hill.
12. Advanced Practical Physics Vol. I and Vol. II by D. K. Dwivedi, Victorius Publishers, New Delhi.

BEE-110/160 **Basic Electrical Engineering**

Course category	:	Engineering Fundamentals (EF)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 0, Practical: 2
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through attendance, home assignments, quizzes, practical work, record, viva voce, Minor tests and One Major Theory & Practical Examination.
Course Objectives	:	**1.** To demonstrate and understand the basic knowledge of electrical quantities such as current, voltage, power, energy, and frequency to understand the impact of technology in a global and societal context. **2.** To demonstrate and understand the basic concepts of analysis of simple DC and AC circuits used in electrical engineering and apply the basic concepts in Electrical engineering for multi-disciplinary tasks.

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course:

1. Understand the basic properties of electrical elements, and solve problem based on basic electrical circuits & DC network theorems.
2. Understand the fundamental behaviour of AC circuits and solve AC circuit problems.
3. Apply the knowledge gained to explain the behaviour of the circuit at series & parallel resonance of circuit & the effect of resonance.
4. Classify different electrical measuring equipment's and understanding their principles.
5. Understand the basic concepts of magnetic circuits.
6. Explain construction and working principle of transformer.

Topic Covered

UNIT I

D C Circuit Analysis and Network Theorems: **9**

Circuit Concepts: Concepts of network, Active and passive elements, Voltage and current sources, Concept of linearity and linear network, Unilateral and bilateral elements, R, L and C as linear elements, Source transformation, Kirchhoff's laws, Loop and nodal methods of analysis, Star-delta transformation, Network theorems: Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem.

UNIT II **9**

Introduction to AC Circuits:

AC fundamentals, Analysis of single phase series, parallel and series-parallel RLC Circuits, Resonance in series and Parallel circuit.

Three Phase AC Circuits: Three phase system-its necessity and advantages, Star and delta connections, Balanced supply and balanced load, Line and phase voltage/current relations, three-phase power, and its measurement.

UNIT III **9**

Measuring Instruments:

Fundamentals of measurement & instrumentation, Units, Dimensions and Standards. Error Analysis, types of errors & its analysis. Measuring instruments, construction and working principles of PMMC, Moving Iron and Electro-dynamometer type voltmeters & ammeters, Use of shunts and multipliers.

UNIT IV **9**

Magnetic Circuits and Transformers:

Magnetic circuit concepts, analogy between electric & magnetic circuits, B-H curve, Hysteresis, and eddy current losses.

Single Phase Transformer: Principle of operation, Construction, EMF equation, Power losses, Efficiency, O.C & S.C Test and Introduction to auto transformer.

EXPERIMENTS

1. Verification of Kirchhoff's Law.
2. Verification of Norton's Theorem.
3. Verification of Thevenin's Theorem.
4. Verification of Superposition Theorem.
5. Verification of Maximum Power Transfer Theorem.
6. Verification of Series R-L-C circuit.
7. Verification of Parallel R-L-C circuit.
8. Measurement of Power and Power factor of three phase inductive load by two wattmeter method.
9. To perform O.C. and S.C. test of a single-phase transformer.

Textbooks:

1. Fundamentals of Electric Circuits, C.K. Alexander and M.N.O. Sadiku; TATA McGraw-Hill.
2. Principles of Electrical Engineering, V. Del Toro; Prentice Hall International.
3. Electrical and Electronics Technology, Edward Hughes; Pearson.
4. Basic Electrical Engineering, D P Kothari, I.J. Nagarath; Tata McGraw Hill
5. Electrical Technology, B. L. Thareja and A. K. Thareja; S. Chand.

BEC-157 Electronic Workshop

Course category	:	Professional Skills (PS-2)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 2, Tutorial :0 , Practical: 4
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through attendance, assignments, quizzes, practical work, record, viva voce and two Test and One Major Theory & Practical Examination
Course Objectives		The objective of this course is to develop the skill and working of different circuit board & prototypes of the designed electronics circuits.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course:

1. To identify the circuit components and their application specially for electronics PCB design.
2. Understand the design processes and production methods used in the manufacturing of a printed circuit board.
3. Understand the use and application of chemical itching and drilling in the manufacture of an electronic circuit.
4. Be able to design and manufacture a prototype printed circuit board and use it to assemble and test an electronic circuit.
5. Able to design rectifier and filter and study their practical applications.
6. Able to have knowledge of these circuits using breadboard.

Topics Covered

Unit 1: Introduction to Electronics **6**

Overview of basic electronic components (resistors, capacitors, diodes, transistors, transformers, potentiometers etc.), Introduction to circuits (series, parallel, combination), Understanding Ohm's Law and Kirchhoff's Laws, Introduction to basic electronic tools (mustimeter, oscilloscope)

Unit 2: PCB Designing Basics **6**

Introduction to PCB (Printed Circuit Board) design, Understanding PCB layout and components placement, Introduction to PCB design software (e.g., Eagle, KiCad, Proteus), Hands-on practice in designing a simple PCB layout

Unit 3: Advanced PCB Designing **6**

Understanding PCB design considerations (trace width, spacing, vias, etc.), Signal integrity and noise reduction techniques, Designing for manufacturability (DFM) and design for testing (DFT), Advanced PCB design software features and techniques

Unit 4: Project-Based Learning **6**

Minor PCB design project, Presentations and demonstrations of the completed projects, Troubleshooting, Feedback and evaluation of the projects

EXPERIMENTS

Note: Minimum eight experiments are to be performed:

1. Winding shop: Step-down transformer winding of less than 5VA.
2. Soldering shop: Fabrication of DC regulated power supply.
3. Printing of circuits on PCB.
4. Design a PCB using Etching & drilling.

5. Coating of etched PCB to protect it from oxidation.
6. Convert the power supply circuit into PCB & simulates its 2D & 3D view.
7. Design a full wave center tapped rectifier & study the effect of capacitive filter & it's output on a virtual oscilloscope.
8. Design a RLC resonance circuit & verify the transient & phase response for different values of R, L&C.
9. Assemble electronic circuit/system on general purpose PCB, test and show the functioning.
10. Construct various electronic circuits on breadboard
11. Identify and test different types of ICs.
12. To study the specifications and working of a Transistor radio kit and perform measurements on it.
13. Study the working of Distortion Meter.
14. To study the working of Spectrum analyzer and determine the bandwidth of different signals.

Books & References

1. Electronics Components and Materials by SM Dhi, Tata McGraw Hill, New Delhi
2. Electronics Device and circuits by Millman and Halkias; McGraw Hill.

BHS- 101/151 Universal Human Values: Understanding Harmony

Course Category	: HSS
Prerequisite subject	: None
Number of Credits	: 4
Contact Hours/Week	: Lectures: 3, Tutorial: 1, Practical: 0
Course Assessment Methods	: Continuous assessment through Two tests, teacher's assessment (quiz, tutorial, assignment, attendance), and One Major Theory Examination.

Course Objectives: The objectives of this course are to: -

1. Develop a holistic perspective in students based on self-exploration about themselves (human being), family, society and nature/existence.
2. Develop understanding (or developing clarity) in students about harmony in the human being, family, society and nature/existence.
3. Strengthen self-reflection in students.
4. Develop commitment and courage in students to act.

Course Outcomes:

The students will be able to demonstrate the following knowledge, skills, and attitudes upon completion of the course: -

1. Ability to understand the interconnectedness of humanity and nature as well as the importance of values in interpersonal relationships.
2. Ability to recognize their role as global citizens and understand the importance of actively contributing to the betterment of society through responsible actions.
3. Ability to engage in critical reflection on their own values and beliefs, challenging assumptions and biases to foster personal growth and development.

4. Ability to appreciate and respect diversity thereby promoting communication and conflict resolution skills, promoting dialogue and understanding in resolving interpersonal and intergroup conflicts.

Topics Covered

Unit 1 **9**

Introduction to Values: origin, definition, meaning, and types of values; Values in Education System; difference between Values, Morals, and Ethics; Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and 'Experiential Validation' as the process for self-exploration; Continuous Happiness and Prosperity- A look at basic human aspirations; Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority; Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario; Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Unit 2 **9**

Understanding human being as a co-existence of the sentient 'I' and the material 'Body'; Understanding the needs of Self ('I') and 'Body' - happiness and physical facility; Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer); Understanding the characteristics and activities of 'I' and harmony in 'I'; Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail; Programs to ensure Sanyam and Health.

Unit 3 **9**

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship; Understanding the meaning of Trust; Difference between intention and competence; Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship; Understanding the harmony in the society

(society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals; Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Unit 4 **9**

Understanding the harmony in the Nature; Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature; Understanding Existence as Co-existence of mutually interacting units in all-pervasive space; Holistic perception of harmony at all levels of existence; Natural acceptance of human values; Definitiveness of Ethical Human Conduct; Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order; Competence in professional ethics.

Text & Reference Books:

1. Andrews, C. (2006). *Slow is beautiful*. New Society Publishers.
2. Gandhi, M. K. (1909). *Hind Swaraj or Indian Home Rule*. Navjeevan Trust.
3. Gandhi, M. K. (2009). *An Autobiography or The Story of My Experiments with Truth* (Mahadev Desai, Trans.). Navjeevan Mudranalay. (Original work published 1925).
4. Gaur, R. R., Sangal, R., & Bagaria, G. P. (2010). *A Foundation Course in Human Values and Professional Ethics*. Excel Books.

5. Govindrajan, M., Senthilkumar, S., & Natarajan, M. S. (2013). *Professional Ethics and Human Values*. Prentice Hall India.
6. Kumarappa, J. C. (2017). *Economy of Permanence.* Sarva Seva Sangh Prakashan.
7. Naagarazan, R. S. (2022). *A Textbook on Professional Ethics and Human Values*. New Age International.
8. Rolland, R. (2010). *Life of Vivekanad* (4th Ed.). Advait Ashram.
9. Schumacher, E. F. (1973). *Small is beautiful. A study of Economics as if people mattered*. Blond & Briggs.
10. Suresh, J., & Raghavan, B. S. (2003). *Human Values and Professional Ethics*. S Chand.

BEC-170	**Design Thinking in Electronics & Communication Engineering**
Course category	: Audit Course (AC)
Pre-requisite Subject	: NIL
Contact hours/week	: Lecture: 0, Tutorial: 0, Practical: 2
Number of Credits	:
Course Assessment methods	: Continuous assessment through assignments, attendances, quizzes and practical exam tests.

Course Objectives :

- Inculcate the fundamental concepts of design thinking
- Develop the students as a good designer by imparting creativity and problem-solving ability
- Conceive, conceptualize, design and demonstrate innovative ideas using prototypes
- To propose a concrete, feasible, viable and relevant innovation project/challenge

Course Outcomes : The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. To expose the student with state-of-the-art perspectives, ideas, concepts, and solutions related to the design and execution of projects using design thinking principles.
2. To prepare the mindset and discipline of systemic inspiration driven by a desire to identify new sources of ideas, and new models especially outside their regular working atmosphere.
3. Demonstrate the critical theories of design, systems thinking, and design methodologies
4. Produce great designs, be a more effective engineer, and communicate with high emotional and intellectual impact.
5. Understand the diverse methods employed in design thinking and establish a workable design thinking framework to use in their practices
6. Conceive, organize, lead and implement projects in interdisciplinary domain and address social concerns with innovative approaches

Experiments:

1. Using David Kolb's Model, to identify Experiential Learning Cycle for VLSI design system.
2. To Study all stages in the Design Thinking Process and Prototype and examine any Digital circuit simulation process by Brainstorming prototype.
3. To study Problem Solving and Functional Fixedness and applied on IoT based agricultural system, also comparison Between Eco-Reps and Non-Eco-Reps .
4. By development of scenarios planning and evaluation tools, illustrate an experiment Interactive Drama for an AI based IoT system.
5. Via advanced communication system-based discussions in a group setting be used to assess residents' clinical skills.
6. With the help of Cognitive bias categories in Strengthen communication, to identify Complementary interviews.
7. By creating a Culture of Innovation, to develop different Strategies for Business Growth and Success of Microelectronics & VLSI Design system.
8. Depict an importance of Experimental Prototyping and to Construct a Prototype Experiment for an Electromagnetic Field theory and Antenna system.
9. To identify all Prototype Testing, Design, Test, and Implement Your Ideas with creation of Smart cities.
10. Design and experimentation of 3d printed pattern and wooden pattern for sand casting process.
11. To corelate an Ergonomics and sustainability in the design of everyday use products.
12. A Step-by-Step Guide to Build a Minimum Viable Product (MVP) in terms of Entrepreneurship for Silicon based IC.
13. Experimentation and startup performance /business ideas: Evidence from A/B testing
14. How to translate subjective customer needs into precise target specs? How could the team resolve.
15. What is creative problem-solving & why is it important?
16. How to Build a Functional Product Design Outstanding Feedback Loop in 7 Steps?
17. Individual Differences in Psychology: Everything You Should Know For UPSC CSE!

Text and Reference Books

1. E. Balaguruswamy (2022) Developing Thinking Skills (The way to Success), Khanna Book Publishing Company.
2. Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage",Harvard Business Press , 2009.
3. Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve– Apply", Springer, 2011