Curriculum Structure & Syllabi

(As per National Education Policy 2020)

of

B.Tech.

In

Electronics and Communication Engineering (IOT)

(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

JUNE 2025

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) (IOT)

<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)
(iv) Sports, Cultural and Games
(v) Personality Development</td><td>Non-Credit</td></tr>
<tr><td colspan="4">Minor Degree (MD) from any Department and Micro Specializations (MS) within the Department</td></tr>
</table>

• 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)

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING
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GORAKHPUR-273 010, UP, INDIA

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

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**

Second Year, Semester III

S. N.	Category	Paper Code	Subject	L	T	P	Credit
1.	BSM	BSM-216	Applied Probability and Statistics	3	1	0	4
2.	EF	BEC-207	Digital Electronics	3	0	2	4
3.	PC	BEC-208	Network Theory: Analysis & Synthesis	3	1	0	4
4.	PC	BEC-209	Electronic Measurement & Instrumentation	3	0	2	4
5.	PC	BEC-210	Electronic Devices & Circuits Theory	3	1	0	4
			Total	**15**	**1-5**	**0-8**	**20**
6.	VAC/AC	AUC-108	Intellectual Property Right	2	0	0	0
7.	ECA-III			**-**	**-**	**-**	0

Second Year, Semester IV

S. N.	Category	Paper Code	Subject	L	T	P	Credit
1.	EF	BEC-258	Electromagnetic Field Theory	3	1	0	4
2.	PC	BEC-259	Analog Communication	3	0	2	4
3.	PC	BEC-260	Signal & Systems	3	1	0	4
4.	PC	BEC-261	Analog Integrated Circuits	3	0	2	4

	Student may choose either PE-1 or PE-2 or Both PE-1 and PE-2.						
5.	PE-1	EEC-151	Introduction to Drones	3	1	0	4
6.	PE-2	EEC-152	Fundamentals of Analog and Digital	3	0	2	4
			Total	**15-18**	**0-6**	**0-12**	**20-24**
7.	VAC/AC	AUC-101	Constitution of India	2	0	**0**	0
8.	ECA-IV			**-**	**-**	**-**	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	AUC 101
2.	Indian Culture and Heritage	AUC 102
3.	Indian Architecture	AUC 103
4.	Indian Festivals	AUC 104
5.	Vaidic Mathematics	AUC 105
6.	Astronomy	AUC 106
7.	Arts of India	AUC 107
8.	Intellectual Property Right	AUC 108
9.	Human Rights	AUC 109
10.	Logical Research	AUC 110
11.	Professional Ethics	AUC 111
12.	Environmental Law	AUC 112
13.	Health Law	AUC 113
14.	National Cadet Corps	AUC 114
15.	Basics of Human Health and preventive medicines	AUC 115

SKILLS-ENHANCEMENT COURSES FOR EXIT (ELECTRONICS & COMMUNICATION ENGINEERING) IOT:

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

A. After First Year: UG Certificate (Engg.).

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

S. N.	Category	Paper Code	Subject	L	T	P	Credit
1.	Skill Enhancement	BEC-180	Electronics Mechanics	1	0	2	2
2.	Skill Enhancement	BEC-181	Mini Project	0	0	8	4

OR

Equivalent skills-enhancement courses from MOOC/SWAYAM.

B. After Second Year: UG Diploma (Engg.).

The candidate should pass the following two additional courses **OR** any two suitable skill-based courses to qualify for **UG Diploma (Engg.).**

S. N.	Category	Paper Code	Subject	L	T	P	Credit
1.	Skill Enhancement	BEC-281	Consumers Electronics	1	0	2	2
2.	Skill Enhancement	BEC-282	Mini Project	0	0	8	4

Syllabus

First year

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, practical work, record, viva voce, one Minor test 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 tutorials, attendance, home assignments, quizzes, practical work, record, viva voce, one Minor test and one 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 tutorials, attendance, home assignments, quizzes, practical work, record, viva voce, one Minor test and one Major Theory Examination

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 tutorials, attendance, home assignments, quizzes, practical work, record, viva voce, one Minor test and one Major Theory 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 tutorials, attendance, home assignments, quizzes, practical work, record, viva voce, one Minor test 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 ofCommunication- 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, practical work, record, viva voce, one Minor test 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, Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce, one Minor test and one Major Theory Examination

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 tutorials, attendance, home assignments, quizzes, practical work, record, viva voce, one Minor test and one Major Theory 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 tutorials, attendance, home assignments, quizzes, practical work, record, viva voce, one Minor test and one Major Theory 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 tutorials, attendance, home assignments, quizzes, practical work, record, viva voce, one Minor test 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.

Course Code: 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 tutorials, attendance, home assignments, quizzes, practical work, record, viva voce, one Minor test and one Major Theory Examination
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

Syllabus

Second year

BSM-216/266	**Applied Probability and Statistics**
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 One Minor tests and One Major Theory Examination
Course Objectives	: The course is aimed to develop the basic statistical 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 understand the basic concepts of probability and probability Distributions.
2. To understand the central tendency, correlation, and correlation coefficient and also regression.
3. To understand the fitting of various curves by method of least square
4. To apply the statistics for testing the significance of the given large and small sample data by using t- test, F- test and Chi-square test.
5. Application of probability and statistics in real life.
6. To inculcate the habit of statistical thinking and lifelong learning.

Topics Covered

UNIT-I

Basic Statistics: Frequency distribution, Mean, Median, Mode, Moments, Moment Generating function, Skewness, Types of Skewness, Measurement of Skewness, Kurtosis, and its types. Curve fitting: Method of Least Squares, Fitting of Straight lines, Fitting of Parabola of second degree. 9

UNIT-II

Applied Statistics: Correlation, Correlation coefficient, Spearman's rank correlation coefficient, Regression, Equation of regression lines, linear, and non-linear regression analysis. Relation between Regression Analysis and Correlation Analysis 9

UNIT-III

Probability: Random experiment, outcome, trial and event, Exhaustive events, favourable events, independent events, sample space, classical and empirical definition of probability, addition theorem of probability, multiplication theorem of probability, conditional probability, Baye's theorem. 9

UNIT-IV

Probability Distribution: Discrete and continuous random variable and their properties, distribution functions, Binomial, Poisson and Normal Distribution and evaluation of statistical parameter of these three distributions. **Test of significance:** sampling, large sample test for single proportion, difference of proportions, single mean, difference of means and difference of standard deviation, Chi-square test for goodness of fit. 9

Books & References

1. D. C. Montgomery and G. C. Runger, Applied Statistics and Probability for Engineers, Wiley.
2. J. L. Devore, Probability and Statistics for Engineering and the Sciences, Cengage Learning.
3. S.M. Ross, Introduction to Probability and Statistics for Engineers and Scientists, Academic Press; 5th edition
4. Robert V Hogg, Joseph McKean, Allen T Craig, Introduction to Mathematical Statistics, Pearson Edu.
5. Mood, Graybill and Boes, Introduction to the Theory of Statistics, Tata McGraw- Hill.

Course Code: BEC-207 **DIGITAL ELECTRONICS**

Course category : Engineering Fundamental (EF-4)

Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 0, Practical: 2
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce, minor test and Major Theory & Practical Examination
Course Objectives	:	The course aims to provide knowledge of digital electronics, combinational and sequential circuits, state machines, and digital system design.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Acquired knowledge about basics of digital electronics and solving problems related to number systems and Boolean algebra.
2. Ability to identify, analyze and design combinational circuits.
3. Ability to identify, analyze and design sequential circuits.
4. To design, implement and evaluate various synchronous and asynchronous sequential circuits and applications.
5. Acquired knowledge about internal circuitry and logic behind digital systems.
6. Able to understand State machine design procedure with sequential PLDs.

Topics Covered

UNIT-I **9**

Digital system and Binary numbers: Signed binary numbers, Floating point number, Binary Codes, Cyclic codes, Error detecting and correcting codes, Hamming codes. NAND and NOR implementation, Minimization of circuit using K-map and Tabular method up to five variables, POS and SOP simplification, Logic family- TTL, DTL, ECL, CMOS, HMOS

UNIT-II **9**

Combinational Logic: Analysis and Design procedure for Combinational circuits, Binary adder/subtractor, Binary multiplier, Booth Algorithm, Magnitude comparator, Encoder/Multiplexer, Decoder/Demultiplexer.

UNIT-III **9**

Sequential logic: Sequential circuits, Latches, Flip-flops, Conversion of flip-flops, Analysis of clocked sequential circuits, State reduction and assignments. Registers and counters: Shift registers, Asynchronous counter, Synchronous counter, Sequential circuit analysis and design procedure, Circuit with latches, Hazards.

UNIT-IV

Memory and programmable logic: Read only Memory, Read/Write Memory-SRAM and DRAM. Programmable Logic Devices,-PLAs, PALs and their applications; Sequential PLDs and their applications; State machine design with sequential PLDs: Introduction, to field programmable gate arrays (FPGAs).

LIST OF EXPERIMENTS

1. Design and verification of following arithmetic circuits using 74xx family ICs.
   i) Half adder and Full adder
   ii) Half subtractor and full subtractor

2. To perform the code conversion- binary to gray and gray to binary and its truth table verification.
3. To design a combinational logic circuit using 74xx family ICs and its truth table verification in both SOP and POS forms.
4. Realization of 2:4 decoders and 4:2 encoder circuit and verification of its truth table.
5. To design and verify the truth table of multiplexer and demultiplexer circuits.
6. To design a 1-bit comparator using 74xx family ICs and to study the performance of4- bit comparator IC7485.
7. Design and verification of basic Flip-Flops using 74xx family ICs and master-slave JK flip-flop using IC7476
8. To realize and verify the truth table of shift register-SIPO/SISO and PISO/PIPO.
9. Design and verification of asynchronous counter design and Mod-n counter.
10. To realize and verify the truth table of synchronous counter design

Books & References

1. Hill & Peterson, "Switching Circuit & Logic Design", Wiley
2. Mano, M. Morris. Digital design. Pearson Educación, 2002.
3. Digital principle and applications Malvino and Leach-(TMH)

BEC-208	**Network Theory: Analysis & Synthesis**
Course category	: Program Core (PC)
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, assignments, quizzes, minor test and major theory examination.
Course Objective	: The course aims to develop skills in circuit analysis, Laplace transforms, network synthesis, and transfer function realization for electrical systems.
Course Outcomes	: The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course

1. Able to apply the electric circuit concept and theorems with nodal and mesh on the complex RL, RC & RLC circuits in time and frequency domain.
2. Able to apply the concept of Laplace Transform to evaluate the system function for single and two port networks.
3. Able to synthesize the LC, RC & RL immittance networks using the Foster and
4. Cauer approaches.
5. Able to realize the synthesize the transfer functions of two port networks and active networks.

Topics Covered

UNIT-I

Signal and System analysis, Definition and basic circuits concepts, Mesh and nodal analysis, General characteristics of signals and wave forms: step, impulse, ramp, and gate function; Initial and final conditions in circuits, Network Theorem: Maximum Power Transfer Theorem, Milliman's Theorem; Solution of network equations: Transient Response &steady state response, Convolution Integral of basic signals. **9**

UNIT-II

Laplace Transform: Introduction, Region of Convergence, Laplace transform of common basic signals, Properties, Inverse Laplace Transforms, Application of Laplace Transform Techniques to Electrical Circuits analysis, Transform Circuits, Thevenin and Norton's Theorem, Initial and Final Value theorem. **9**

Two-Port Network functions: Introduction, Parameters, Condition for reciprocity and symmetry, Relation between port parameters, Interconnection of two ports networks.

UNIT-III

Element of Realizability: Concepts of Poles and Zeroes, Causality & Stability, Hurwitz polynomials, Positive real functions; Network Synthesis using Cauer and Foster: Properties of real immittance functions, synthesis of LC driving point immittances, Properties of RC driving point impedances, Synthesis of RC impedances or RL admittances, Properties of RL impedances and RC admittances. **9**

UNIT-IV **9**

Transfer function synthesis: Properties of transfer function, Zeroes of Transmission, Synthesis of Y_{21}& Z_{21} with 1-ohm termination, Introduction to Active network synthesis: Operation of filters, filter design, frequency scaling.

Textbooks

1. Franklin F. Kuo, 'Network Analysis and synthesis', 2nd Edition, Wiley India Pvt Ltd.
2. M.E. Van Valkenberg, 'Network Analysis', 2nd Edition, Prentice Hall of India Ltd.
3. M.S. Sukhija, T.K. Nagsarkar, 'Circuits and Networks' 2nd Edition, Oxford University Press.
4. S.P. Ghosh, A.K. Chakraborty, 'Network Analysis and Synthesis' McGraw Hill Education Pvt Ltd.

BEC-209	**Electronic Measurement & Instrumentation**
Course category	: Program Core (PC)
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, Minor Test and Major Theory Examination

Course Objectives	Upon completion, students will be able to explain quality measurements, use digital display devices, solve circuit problems, illustrate transducer principles, and understand instrumentation and DAS applications.
Course Outcomes	: The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course.

1. Able to explain the quality measurements with electronic instruments.
2. Able to use the digital display devices in practical applications.
3. Able to solve and illustrate the numerical problem for DC/AC bridge-based circuits.
4. Able to illustrate the principles of various types of transducers and their applications.
5. Able to explain the construction, principle of operation, and applications of electromechanical and electronic instruments along with Data Acquisition System (DAS).
6. Able to articulate the range of measuring instruments.

UNIT-I **9L**

Measuring Instruments: classification, absolute and secondary instruments, Performance Characteristics, Error in measurement, Sources of error, Arithmetic mean, Deviation from the mean, Average deviation, Standard deviation, Limiting errors. PMMC instruments, Expression for the deflecting torque and control torque, Analog to digital (Linear and digital ramp method, successive approximation method) and Digital to analog (R-2R method) converters. Digital Display Devices: LED, LCD, Incandescent Display, LVD (Liquid Vapour Display)

UNIT-II **9L**

DC/AC Bridges: General equations for bridge balance, Self-inductance measurement by Maxwell's bridge, Hay's bridge, Capacitance measurement by De Sauty bridge, Schering bridge and Wein Bridge, Method of measuring low, medium and high resistance: Kelvin's double bridge for measuring low resistance, Wheat-stone's bridge, measurement of high resistance, Basics of wattmeter and energy meter

UNIT-III **9L**

Transducers: Introduction, Selection Parameters of Transducer, Type of Transducer, Resistive Transducer: Strain Gauges, Inductive Transducer: LVDT, Capacitive Transducer, Photo-electric Transducer: Photo conductor, Photodiode and Photo-Voltaic Cell, Thermoelectric Transducers: RTDs, Thermistor and Thermocouple, Piezoelectric Transducer, Digital Transducer.

UNIT-IV **9L**

Electromechanical Instruments: Ammeter, Voltmeter and Ohmmeter, Extension of range using shunts and series resistance. Analog and Digital electronic Instruments: Emitter-follower voltmeters, operational amplifier voltmeter, Digital voltmeter system, Digital mustimeters, Digital frequency meter

system. Data Acquisition System, Single and Multichannel DAS, Data Loggers: Block diagram, principle of operation.

List of Experiments:

1. Study of semiconductor diode voltmeter and its us as DC average responding AC voltmeter.
2. Study of L.C.R. bridge and determination of the value of the given components.
3. Study of distortion factor meter and determination of the % distortion of the given oscillator.
4. Study of the transistor tester and determination of the parameters of the given transistors.
5. Study of the following transducer (i) PT-100 transducer (ii) J- type transducer (iii) K-type transducer (iv)Pressure transducer.
6. Measurement of phase difference and frequency using CRO (lissajous figure)
7. Measurement of low resistance using Kelvin's double bridge.
8. Radio Receiver Measurements

Text & Reference Books

1. H. S. Kalsi, "Electronic Instrumentation", 3rd Ed., McGraw Hill Education(India), 2015.

2. David A. Bell, "Electronic Instrumentation and Measurements", 3rd Ed., Oxford University Press, 2013.

BEC-210		**Electronic Devices & Circuits Theory**
Course category	:	Department Core (PC)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 2, Tutorial : 1, Practical: 0
Number of Credits	:	3
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, and Two Minor tests and One Major Theory & Practical Examination
Course Objectives	:	The course aims to provide understanding of diodes, high-frequency applications, FET characteristics, high-power devices, and charge-transfer operations.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Ability to understand the basic operation and working of BJT.
2. Able to understand the small-signal operation and models of BJT.
3. To understand and use of the device models to explain and calculate the characteristics of the field effect transistors.
4. Able to understand the small-signal operation and models of MOSFET.
5. To be able to understand and analyze the feedback amplifiers.
6. Understand the basic principles of oscillators.

Topics Covered

UNIT-I **9**

BJT: Review of device structure operation and V-I characteristics, BJT circuits at DC, BJT as amplifier and switch, biasing in BJT amplifier circuit;

Small-signal operation and models, single stage BJT amplifier, BJT internal capacitances and high frequency model, frequency response of CE amplifier. Darlington pair, BJT differential pair, Cascode and Cascade amplifier.

UNIT-II **9**

FET: Review of device structure operation and V-I characteristics, FET Circuits at DC, FET as Amplifier and switch, Biasing in FET amplifier circuits; Small-signal operation and models, single stage FET amplifier, FET internal capacitances and

high frequency model, frequency response of CS amplifier

UNIT-III **9**

Feedback Amplifiers: The general feedback structure, properties of negative feed- back, the four basic feedback topologies, the series-shunt feedback amplifier, the series-series feedback amplifier, the shunt-shunt and shunt-series feedback amplifier.

UNIT-IV **9**

Oscillators: Basic principles of sinusoidal oscillators, RC Phase-shift Oscillator circuits, Resonant-circuit based LC oscillators.

Books & References

1. Milman, Halkias&Jit- Electronics Devices and Circuits- TMH
2. Donald ANeaman, "Semiconductor Physics and Devices Basic Principles", 3e, TMH India.

BEC-258 **Electromagnetic Field Theory**

Course category	**:**	Program Core (PC)
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, assignments, quizzes, minor test and major theory Examination
Course Outcomes	**:**	Understand electromagnetic fields, wave propagation, transmission lines, impedance transformation, and solve problems using Smith charts.
Course Outcomes	**:**	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course.

1. Understanding the basic mathematical concept related to electromagnetic vector fields and principles of electrostatic.
2. Apply the principles of magneto statics to the solutions of the problem relating to magnetic field.
3. Apply Maxwell's equations to solutions of problems relating to uniform plane wave propagation.

4. Understand characteristics and wave propagation on high frequency transmission lines.
5. Carryout impedance transformation on transmission line.
6. Use smith chart to find the solution of various transmission line problems.

UNIT-I **9**

Electrostatics Fields: Various co-ordinate system, Coulombs law and field intensity, Electric field due to charge distribution, Electric flux density, Gauss's Law – Maxwell's equation, Electric dipole and flux lines, Divergence Theorem, Poisson's and Laplace's equation, Energy density in electrostatic fields. Electric field in material space: Properties of materials, Convection and conduction currents, conductors, Polarization in dielectrics, Dielectric Constants, continuity equation and relaxation time, Boundary condition. Method of images.

UNIT-II **9**

Magneto-static fields, Biot-Savart's Law, Ampere's circuit law for a current element, magnetic scalar and vector potential, Magnetic dipole, Magnetic flux density- Maxwell's equation, Maxwell's equation for static fields, Magnetic forces, materials and devices: Forces due to magnetic field, Magnetic torque and moment, a magnetic dipole, Magnetization in materials, magnetic boundary conditions, Magnetic energy. Waves and applications: Faraday's Law, Transformer and motional electromotive forces, Displacement current, Maxwell's equations in differential and integral form.

UNIT-III **9**

Electromagnetic wave propagation: Derivation of wave equation and their general solution, Wave propagation in lossy dielectrics, Plane waves in lossless dielectrics, Plane wave in free space, Plain waves in good conductors, Poynting's theorem, Power and the Poynting vector, Reflection of a plane wave at normal and Oblique incidence.

UNIT-IV **9**

Transmission Lines- Equations of Voltage and Current on TX line, Propagation constant and characteristic impedance, and reflection coefficient and VSWR, Impedance Transformation on Loss-less and Low loss Transmission line, Power transfer on TX line, Smith Chart, Admittance Smith Chart, Applications of transmission lines: Impedance Matching, use transmission line sections as circuit elements.

Text & Reference Books

1. W. H. Hayt and J. A Buck "Electromagnetic field Theory" 7th Ed. TMH

2. M. N. O. Sadiku, "Elements of Electromagnetics", 4th Ed, Oxford University Press

BEC-259 **Analog Communication**

Course category	:	PC
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial : 0, Practical: 2
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce, minor test and Major Theory & Practical Examination
Course Objectives	:	Understand analog communication concepts, analyze modulation schemes, evaluate noise effects, and study pulse modulation and multiplexing techniques for signal transmission.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Able to understand the basic concept of analog communication system
2. Able to analyze the various amplitude modulation schemes.
3. Able to distinguish angle modulation with amplitude modulation
4. Able to analyze various modulation/demodulation techniques of angle modulation
5. Able to classify the types of noise sources added in communication channel and analyse its performance in analog communication system.
6. Able to describe and analyse the various pulse modulation and multiplexing techniques for the digital transmission of analog signal

Topics Covered

UNIT-I **9**

Introduction: Overview of Communication system, Communication channels, Need for modulation, Baseband and Pass band signals, Comparison of various AM systems

Amplitude Modulation: Double side-band with Carrier (DSB-C), Double side-band without Carrier, Single Side-band Modulation, SSB Modulators and Demodulators, Vestigial Side-band (VSB), Quadrature Amplitude Modulator.

UNIT-II **9**

Introduction to Angle Modulation: Frequency modulation, Narrowband and Wideband FM, Generation of FM waves, Indirect FM and direct FM, FM modulators and demodulators, Phase locked loop, Angle Modulation by Arbitrary Message Signal, Phase Modulation, Pre-emphasis and De-emphasis, Linear and Nonlinear Modulation, Comparison between Angle Modulation and Amplitude Modulation, Radio Receivers.

UNIT-III **9**

Noise: Source of Noise, Frequency domain, Representation of noise, Linear Filtering of noise, Noise in Amplitude modulation system, Noise in SSB-SC,DSB and DSB-C, Noise Ratio, Noise Comparison of FM and AM, Pre-emphasis and De-emphasis, Figure of Merit

UNIT-IV **9**

. Pulse Modulation and Digital Transmission of Analog Signal: Sampling Theorem and its applications, Concept of Pulse Amplitude Modulation, Pulse width modulation and pulse position modulation, PCM, Pulse Time Modulation, TDM and FDM. Line Coding, Quantizer, Quantization Noise, Compounding multiplexer, Basics of TDMA, FDMA and CDMA.

LIST OF EXPERIMENTS

1. To study Amplitude modulation using a transistor and determine depth of modulation.
2. To study envelope detector for Demodulation of AM signal and observe diagonal clipping.
3. To study frequency modulation using reactance modulator.
4. Narrow band FM generation using varactor modulator.
5. Generation of DSB-SC signal using balanced modulator.
6. Generation of single side band signal.
7. Study of PLL and detection of FM signal using PLL
8. To study and implement Pre-emphasis and De-emphasis circuits.
9. To design and test the circuits of voltage to frequency converter usingIC-555.
10. To understand and implement Pulse Amplitude Modulation (PAM) usingIC-555.
11. To understand and implement Pulse Width Modulation (PWM) usingIC-555.
12. To understand and implement Pulse Position Modulation (PAM) usingIC-555.

Books & References

1. H. Taub, D L Schilling, Goutom Saha, "Principles of Communication", 3e, Tata McGraw-Hill Publishing Company Ltd.
2. B.P. Lathi, "Modern Digital and Analog communication Systems", 3e, Oxford University Press,2009.
3. Simon Haykin, "Communication Systems",4e, Wiley India.
4. H. P. HSU & D. Mitra, "Analog and Digital Communications", 2e, Tata McGraw-Hill Publishing Company Ltd.

BEC-260 **SIGNAL & SYSTEMS**

Course category	:	Department Core (PC)
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, Minor test and Major Theory & Practical Examination
Course Objectives	:	The course aims to develop mathematical modeling of signals and systems, spectral analysis, and transformation tools for system analysis and design.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Able to describe the signals and systems mathematically and understand how to perform mathematical operations on signals and systems.
2. Able to analyze spectral characteristics and system properties based on impulse response and Fourier analysis.
3. Apply the Laplace transform for analyzing of continuous-time time signals and systems.
4. Apply the Z- transform for analyzing of discrete-time signals and systems.
5. Able to apply the transformation tools (continuous and discrete) on the analysis of spectral densities, design of system function

6. Able to apply the transformation tools to design system function through its block diagram representation.

Topics Covered

UNIT-I **9**

Signals: Definition, types of signals and their representations: Continuous-time/discrete-time, Periodic/non-periodic, Even/Odd, Energy/Power, Deterministic/Random, One dimensional /Multidimensional, Commonly used signals (in continuous-time as well as in discrete-time): Unit impulse, Unit step, unit ramp (and their interrelationships), Exponential, Rectangular pulse, Sinusoidal; Operations on continuous-time and discrete-time signals (including transformations of independent variables).

Systems: Classification, Linearity, Time-invariance and causality, Impulse response, Characterization of linear time-invariant (LTI) systems, Unit sample response, Convolution summation, Step response of discrete time systems, Stability, Poles and zeros

UNIT-II **9**

Fourier Series (FS) and Fourier Transforms (FT): (i) Fourier series representation and some important properties (ii) Definition, conditions of existence of FT, properties, Magnitude and phase spectra, Some important FT theorems, Parseval's theorem, Inverse FT, relation between LT and FT (iii) Discrete time Fourier transform (DTFT), Inverse DTFT, Convergence, Properties and theorems, Comparison between continuous time FT and DTFT

UNIT-III **9**

Laplace-Transform (LT) and Z-transform (ZT): (i) One-sided LT of some common signals, Important theorems and properties of LT, inverse LT, Solutions of differential equations using LT, Bilateral LT, Regions of convergence (ROC) (ii) One sided and Bilateral Z-transforms, ZT of some common signals, ROC, Properties and theorems, Solution of difference equations using one-sided ZT, s- to z-plane mapping

UNIT-IV **9**

Time and frequency domain analysis of systems: Convolution integral, Co-relations, Signal energy and energy spectral density, signal power and power spectral density, Properties of power spectral density, Analysis of first order and second order systems, continuous-time (CT) system analysis using LT, System functions of CT systems, Block diagram representations; discrete-time system functions,block diagram representation, Illustration of the concepts of system bandwidth and rise time through the analysis of a first order CT low pass filter

Books & References

1. Chi-Tsong Chen, `Signals and Systems', 3rd Ed., Oxford University Press,2004
2. V.Oppenheim,A.S.WillskyandS.HamidNawab,'Signals&System',PearsonEducation,2nd Ed.,2003
3. P. Ramakrishna Rao, `Signal and Systems' 2008 Ed., Tata McGraw Hill, NewDelhi

BEC-261 **Analog Integrated Circuits**

Course category : Program Core (PC)
Pre-requisite Subject : Fundamentals of Electronics Engineering
Contact hours/week : Lecture: 3, Tutorial: 0, Practical: 2

Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through Viva voce, Practical work, attendance, minor test, major & practical examination
Course Objectives	:	The course aims to develop skills in op-amp characteristics, circuit design, linear/non-linear applications, feedback amplifiers, filters, and advanced integrated circuits.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course

1. Explain about the operational amplifiers and its characteristics as well as various types of op-amps.
2. Acquire the ability to design and test practical circuits for amplifiers.
3. Able to implement the concept of Op-Amp to design Op-Amp based linear and non-linear applications.
4. Understand the operation of feedback amplifiers and oscillators.
5. Able to learn the basic functioning of filters, and advanced applications of OP- amp to design first and second order filter.
6. Able to design integrated circuits for advanced applications.

Topics Covered

UNIT-I

Introduction to Integrated Circuit Design **9**

Review of electronics integrated circuits, Block diagram of Op-AMP, differential amplifiers, Current mirrors using BJT and MOSFETs, Base current compensated mirrors, Wilson current mirrors, Widlar current source, Basic OPAMP configurations and characteristics, OPAMP non-idealities,

UNIT-II

Op-amp circuits: **9**

Amplifiers, summers, differentiators, integrators, and oscillators.

Linear and Nonlinear applications of Op-amp:

V-I and I-V converters, Log-antilog amplifiers, Precision rectifier, Peak detector, Sample and Hold Circuits, Analog multiplier and their applications, Op-amp as a comparator, Zero-crossing detector, Schmitt trigger, stable and Monostable multivibrator using Op-Amp, Generation of triangular waveform.

UNIT-III

Filters: **9**

Characteristics of filters, Classification of filters: LPF,HPF,BPF,BSF,APF

Design of first and second order filter:Butterworth filters, Chebyshev filters, Bessel filters.

UNIT-IV

Advance Applications of integrated circuits: **9**

Frequency Divider, PLL IC, 555 IC timer, Design of astable and monostable Multivibrators using 555 Timer IC, VCO.

LIST OF EXPERIMENTS

1. Study the characteristics of inverting operational amplifier.
2. Design of an instrumentation amplifier.
3. Design and test an astable multivibrator for a given frequency.
4. Study the characteristics of integrator circuit.
5. Design of Analog filters.
6. Design of a Phase Locked Loop (PLL)
7. Realization of Schmitt trigger circuit.
8. Op-amp (741) as an integrator and realization of low pass filter, and op-amp as differentiator and realization high pass filter.
9. (a) Verify the operation of voltage comparator circuit.
   (b) Verify the operation of zero crossing detector circuit.

Text Books

1. Microelectronic Circuits, Sedra and Smith, 7th Edition, Oxford, 2017.
2. Behzad Razavi: Design of Analog CMOS Integrated Circuits, TMH.

EEC-151		**Introduction to Drones**
Course category	:	Professional Electives
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, practical work, record, viva voce, and one Minor test and one Major Theory & Practical Examination.
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 principles of flight and the evolution of drone technology.
2. Demonstrate knowledge of various types of drones, their classifications, and applications.
3. Explain the working of key drone components including flight controller, ESCs, motors, propellers, GPS, and communication systems.
4. Analyze and apply fundamental concepts of drone aerodynamics and flight stability.
5. Understand regulatory, safety, and ethical aspects related to drone operation.
6. Gain practical knowledge on drone assembly, calibration, pre-flight checks, and basic flight maneuvers.

Topics Covered

UNIT-I

History and evolution of drones: milestones and generations, Classification of drones: fixed-wing, rotary-wing (quadcopters, hexacopters), hybrid drones, Applications: agriculture, defense, surveillance, delivery, environmental monitoring, cinematography, Basic drone components: airframe, motors, ESC (Electronic Speed Controllers), flight controllers, batteries, Types of flight controllers and autopilots, Introduction to drone communication systems and telemetry basics. **9**

UNIT-II

Detailed airframe design principles and material selection (carbon fiber, plastic composites, aluminum), Propulsion systems: brushless DC motors, propellers, thrust and torque concepts, Sensors overview: **9**

IMU (accelerometer, gyroscope), magnetometer, GPS modules, barometric pressure sensors, Power systems: battery types (LiPo, Li-ion), power management, battery monitoring and charging systems, Communication interfaces: radio frequency, Bluetooth, Wi-Fi, Zigbee, Introduction to payload systems: cameras, sensors, delivery mechanisms

UNIT-III

Aerodynamics fundamentals: lift, drag, thrust, weight, and their relationships, Stability in flight: static and dynamic stability, Degrees of freedom and drone motion: roll, pitch, yaw, Flight modes: manual, stabilized, GPS hold, waypoint navigation, Introduction to flight control algorithms: PID control basics, Manual vs automated flight operation, Pre-flight calibration and setup procedures. **9**

UNIT-IV

Drone safety protocols and risk management, National (DGCA India, FAA USA) and international drone regulations and legal frameworks, Airspace classifications and no-fly zones, Privacy concerns and ethical issues in drone usage, Routine maintenance: battery care, motor inspection, firmware updates, Troubleshooting common issues: signal loss, motor failure, sensor calibration errors, Emerging trends: swarm drones, BVLOS (Beyond Visual Line of Sight) operations. **9**

Books & References

1. Austin, R. Unmanned Aircraft Systems: UAVs Design, Development and Deployment, Wiley, 2010.
2. Zhang, Q. and Yang, L.T., Intelligent UAVs for Mobile Inspection: A Deep Learning Perspective, Springer, 2021.
3. R. K. Sharma, Fundamentals of UAVs and Drone Technology, Khanna Publishing House, 2022.
4. Paul G. Fahlstrom and Thomas J. Gleason, Introduction to UAV Systems, Wiley, 3rd Edition, 2012.
5. Tiwari, R. and Ghosh, A., Drone Technology and Applications, BPB Publications, 2021.

EEC-152		**Fundamentals of Analog and Digital Electronics**
Course Category	**:**	**Professional Electives**
Pre-requisite Subject	**:**	**NIL**
Contact hours/week	**:**	Lecture:3, Tutorial:0, Practical:2
Number of Credits	**:**	4
Course Assessment methods	**:**	Continuous assessments through teaching assessment, attendance, home assignments, quizzes, two minor tests and one major theory examination.
Course Objectives	**:**	To equip students with foundational knowledge of analog and digital electronics through the study of diodes, transistors, and logic circuits. The course emphasizes practical applications in circuit design, switching operations, and digital systems using combinational and sequential logic.
Course Outcomes	**:**	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1: Analyze the characteristics and applications of various types of diodes, including their behavior in rectifiers and switching circuits.

2: Explain the operation, configurations, and biasing techniques of BJTs and FETs, and evaluate their performance in analog applications.

3: Design and implement combinational logic circuits such as adders, subtractors, multiplexers, and encoders.

4: Develop and analyze sequential logic circuits including flip-flops, counters, and shift registers for various digital applications.

5: Apply the concepts of analog and digital electronics to build basic electronic systems and prepare for advanced study in embedded system design.

1. Be able to convert a real world problem (RWP) into a binary digital system (BDS).

Topics Covered

Unit I **9**

Diode Characteristics and Applications:

P-N junction diode and its characteristics, Mathematical analysis of built-in potential, depletion width, Diode applications (half-wave and full-wave rectifiers, clippers, clampers), Non-ideal diode models, Zener diodes and its applications, Diode capacitance and switching times, Types of diodes (LED, Varactor diode, Schottky diode, Photodiode).

Unit II **9**

Transistor Basics and applications

BJT: Bipolar Junction Transistor (BJT types, operation, configurations, characteristics), Cut-off and saturation operations, Q point, BJT switching times, Applications of BJT, BJT biasing.

FET: Field Effect Transistor (FET types, operation, configurations, characteristics), MOS structure, CV characteristics, Metal-Oxide Semiconductor FET, Complementary MOSFET (CMOS), FET biasing.

Unit III **9**

Combinational Logic Circuits

Basics of Boolean Algebra, Logic Gates, Half Adder, Full Adder, Half Subtractor, Full Subtractor, Full adder using half adder, BCD Adder. Carry Look ahead Adder, Multipliers. Multiplexer/Demultiplexers, Encoders and Decoders, Application of universal logic gates.

Unit IV **9**

Sequential Logic Circuits

Latches, Edge Triggered Flip Flops: SR, D, JK, Master slave JK. Synchronous and Asynchronous counters, Up/Down Counters, Design of Synchronous counters, Cascaded Counters, Counter applications. Shift register functions, Serial in/serial out shift registers, serial in parallel out/shift registers, Parallel In/Parallel out shift registers, bidirectional Shift registers, Shift register counters, Shift register Applications.

LIST OF EXPERIMENTS:

1. V-I Characteristics of PN junction and Zener diode.
2. Clipper and clamper circuit design using PN junction diode.
3. Half-Wave, Full wave rectifier with and without filter.
4. V-I Characteristics of Bipolar Junction Transistor.
5. Verify the truth table of all basic and universal logic Gates using their ICs and implement a Boolean function using Basic and Universal Gates.
6. Design four/eight- b i t binary adder and subtractor circuit.
7. Design a circuit to implement a Boolean function using Multiplexer.
8. Design and implement a Seven Segment Display system to display numbers 0 to 9.
9. Design Latch and Flip flops Using logic Gates.
10. Design and Testing of Ripple Counters Using Counter ICs.

Text and Reference Book

Textbook:

1. Adel S. Sedra, Kenneth C. Smith, "Microelectronic Circuits", Oxford University Press, 7th Edition, 2017.
2. Robert Boylestad, Louis Nashelsky, "Electronic Devices and Circuit Theory", Prentice Hall, 11th Edition, 2015.
3. Digital Design 5e, Mano / Ciletti, Pearson.
4. Digital Circuits and Design 5e, Salivahanan, Oxford.

References:

1. Jacob Millman, Christos C. Halkias, "Integrated Electronics: Analog and Digital Circuits and Systems", Tata McGraw Hill, 2nd Edition, 2017.
2. Donald A. Neamen, "Microelectronics: Circuit Analysis and Design", McGraw Hill, 5th Edition, 2012.
3. Digital Electronics: Principles and Integrated Circuits, Maini, Wiley.
4. Digital Electronics, Kharate, Oxford.
5. Digital Design: Principles and Practices, 4e, Wakerly, Pearson.

EEC-251	**Introduction to IoT Devices and Applications**
Course category	: PE-2
Pre-requisite Subject	: NIL
Contact hours/week	: Lecture : 3, Tutorial : 0, Practical:2
Number of Credits	: 4
Course Assessment methods	: Continuous assessment through tutorials, attendance, home assignments, quizzes, Minor test and One Major Theory l Examination

Course Objective : The course focuses on IoT devices, gateways, data management, application design, sensor integration, real-time tracking, and supply chain automation.

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

1. Use of Devices, Gateways and Data Management in IoT.
2. Design IoT applications in different domain and be able to analyse their performance
3. Implement basic IoT applications on embedded platform.
4. Using sensor-enabled IoT systems like Traffic, Humidity and Temperature.
5. Real-time data on the product's location and transportation is provided through IoT.
6. IoT supply chain system captures data on vehicle that prompts automated condition modification.

Topics Covered

UNIT-I **9**

IoT & Web Technology, The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.

UNIT-II **9**

M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2Mto IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

UNIT-III **9**

IoT Architecture -State of the Art – Introduction, State of the art, Architecture. Reference Model-Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture-Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views, IoT Applications for Value Creations Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT.

UNIT-IV **9**

Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT for Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth. Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, Smartie Approach. Data Aggregation for the IoT in Smart Cities.

EXPERIMENTS

Note: Minimum eight experiments are to be performed

1. Controlling the Light Emitting Diode (LED) with a push button.
2. To interface the IR Sensor with Arduino and write a program to detect an object.
3. To interface the RGB LED with the Arduino and write a program to turn on the LED.
4. Controlling the LED blink rate with the potentiometer interfacing with Arduino.
5. Interfacing of DHT11 temperature/humidity sensor LM35 with Arduino.

6. Interfacing Servo Motor with the Arduino and writing a program with angle of deflection.
7. Interfacing of the Active Buzzer with Arduino and writing a program to turn on the buzzer every 3 seconds.
8. Interfacing of the Relay with Arduino and writing a program to turn on the serial monitor.
9. Building an Intrusion Detection System with Arduino and Ultrasonic Sensor.
10. Directional control of the DC motor using Arduino.

Books & References

1. Vijay Madisetti and Arshdeep Bahga, “Internet of Things: (A Hands-on Approach)”, Universities Press (INDIA) Private Limited, 2014, 1st Edition.
2. Michael Miller, “The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World”, Pearson Education, 2015.
3. Francis da Costa, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, Apress Publications, 2013, 1st Edition.
4. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice”, Wiley, 2014.

Skill-Based Courses to Qualify for UG Certificate (Engg.) in Electronics & Communication Engineering (IOT)

Skill Enhancement Courses for Exit (Electronics and Communication Engg.)

(A) After First Year: UG Certificate (Engg.)

1. BEC 180: Electronics Mechanics (LTP: 1-0-2)
2. Mini Project (LTP: 0-0-8)

(B) After Second Year: UG Diploma (Engg.)

1. BEC-281 Consumers Electronics (LTP: 1-0-2)
2. Mini Project (LTP: 0-0-8)

Electronics Mechanic (BEC-180)

Course Code: BEC- 180

Course Name: Electronics Mechanic

Course Category: Skill Development

Pre-requisite Subject: Basic Science and Mathematics

Contact hours/week: Lecture: 1, Tutorial: 0, Practical: 2 (L-T-P: 1-0-2)

Number of Credits: 2

Course Duration: 2 Months

Course Assessment methods:

Continuous assessment through and practical work, lab record maintenance, attendance, viva-voce during lab sessions, and final theory examination and practical examination.

Course Outcomes (COs):

Upon successful completion of this course, students will be able to:

1. Understand and apply safety procedures in an electronics workshop and identify, test & utilize basic hand tools.
2. Identify, test, and understand the characteristics of passive components (resistors, capacitors).
3. Perform soldering and desoldering operations on PCBs.
4. Understand, test, and characterize basic semiconductor devices (diodes, transistors).
5. Construct and test basic electronic circuits like rectifiers, transistor switches, amplifiers, and oscillators.
6. Understand and verify the functionality of basic digital logic gates and ICs like Op-Amp IC 741.

Unit wise Syllabus

UNIT-I:

Fundamental electrical concepts (AC/DC, voltage, current, resistance, Ohm's Law), passive components (resistors, capacitors - types, identification, combinations), soldering/desoldering techniques, basic switches (2)

UNIT-II:

Semiconductor fundamentals (P-type, N-type, PN junction), diodes (working, characteristics, testing), and basic power supply concepts (rectification, half-wave, full-wave, bridge rectifiers, filters). (2)

UNIT-III:

Transistors (BJT - NPN/PNP, terminals, biasing), transistor as a switch, Common Emitter amplifier (basic introduction) (2)

UNIT-IV:

Digital electronics (analog/digital signals, binary/decimal), logic gates (AND, OR, NOT, NAND, NOR, XOR - symbols, truth tables, ICs), operational amplifiers (Op-Amp IC 741 - block diagram, inverting/non-inverting amplifiers). (2)

Experiments:

Experiment 1: Workshop Familiarization & Basic Testing

a) Practice identifying and safely using common hand tools.
b) Construct a simple series test lamp and learn its safe usage for checking mains electrical supply.
c) Understand and practice workshop safety precautions.

Experiment 2: Passive Component Testing

a) Identify resistors and determine their values using color codes and verify with a digital multimeter.

b) Identify different types of capacitors and perform basic tests using a multimeter or an LCR meter.

Experiment 3: Soldering & De-soldering Practice

a) Practice soldering electronic components onto a PCB.
b) Practice de-soldering components from a PCB.
c) Attempt to repair a broken PCB track and test continuity.

Experiment 4: Rectifier Circuit Construction & Testing (anyone from a, b, c)

a) Test PN junction diodes using a multimeter.
b) Construct and test a half-wave rectifier circuit.
c) Construct and test a full-wave rectifier circuit.

Experiment 5: Transistor Testing & Switching Circuit (anyone from a, b)

a) Identify BJT terminals and test functionality using a multimeter.
b) Construct and test a transistor switching circuit.

Experiment 6: Basic Amplifier Circuit

- Construct and test a single-stage Common Emitter (CE) transistor amplifier.

Experiment 7: Logic Gate Verification (anyone from a, b)

a) Identify and test basic logic gate ICs using a digital IC tester or trainer kit.
b) Construct circuits to verify the truth tables of basic logic gates.

Experiment 8: IC Application Circuit (Op-Amp)

- Construct and test an inverting amplifier circuit using an Op-Amp IC 741.

Books:

1. How to diagnose and fix everything Electronics by Michael Jay Geier, TMH.
2. Integrated electronics by Jacob Millman, Christos Halkias, Chetan D Parikh, TMH.

Skill-Based Courses to Qualify for UG Diploma (Engg.) in Electronics & Communication Engineering (IOT)

BEC-281 : CONSUMER ELECTRONICS

Course category	:	PS
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 1, Tutorial: 0, Practical: 2
Number of Credits	:	2
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 Carryout trouble shooting of different basic consumer electronic products like TV, Audio

COURSE OUTCOMES

After completion of the subject, the students will be able to:

1. Able to understand the various type of microphones and loud speakers.
2. Able to identify the various digital and analog signal.
3. Able to describe the basis of television and composite video signal.
4. Able to describe the various kind of colour TV standards and system.
5. Able to compare the various types of digital TV system.
6. Able to understand the various type of consumer goods.

TOPICS COVERED

Unit I: Audio Systems

Microphones and Loudspeakers, Concept to fidelity, Noise and different types of distortion in audio system. (2)

Unit II: Television

Basics of Television, Colour Television, PAL TV Receiver, NTSC, PAL, SECAM (2)

Unit III: Digital Transmission and Reception

- Digital satellite television, Direct-To-Home (DTH) satellite television, CCTV, High Definition (HD)-TV., Introduction to Liquid Crystal and LED Screen Televisions, Basic block diagram of LCD and LED Television and their comparison. (2)

Unit IV: Introduction to different type of domestic/commercial appliances

- Operation of Micro-wave oven
- Food Processors
- Digital Electronic Lock

- Vacuum cleaner
- Xerox Machine
- Scanner

(2)

LIST OF PRACTICALS

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

RECOMMENDED BOOKS

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