Curriculum Structure & Syllabi

(As per National Education Policy 2020)

of

B. Tech.

in

(ELECTRONICS AND COMMUNICATION ENGINEERING)

(w.e.f. 2024-25)

Vision

Mission

Program Educational Objectives

Program Outcomes

Program Specific Outcomes

Overall Credit Structure

Curriculum

Syllabus

Offered By

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
MADAN MOHAN MALAVIYA UNIVERSITY OF TECHNOLOGY (MMMUT)
GORAKHPUR-273 010, UP, INDIA
JULY 2024

Department of Electronics and Communication Engineering

CURRICULA & SYLLABI

B. Tech. Electronics and Communication Engineering

Vision:

To become a leader of education, research and innovation in the area of Electronics and Communication Engineering and to train students to be innovative and well-prepared professionals in the area of Electronics and Communication Engineering.

Mission:

1. Educate and mentor students to meet the current as well as future challenges by providing them with a firm foundation in both theory and practice of Electronics and Communication Engineering.
2. Create, develop and disseminate new knowledge by top quality applied research in Electronics and Communication Engineering by interacting with government agencies and private industry.
3. Promote a sense of leadership and service to the society.

Program Educational Objectives (PEOs)

PEO-1: Excel in professional career and/or higher education by acquiring knowledge in area of Electronics and Communication Engineering.

PEO-2: Analyse real life problems, design appropriate system to provide solutions that are technically sound, economically feasible and socially acceptable.

PEO-3: Exhibit professionalism, ethical attitude, communication skills, teamwork in their profession and adapt to current trends by engaging in life-long learning.

Programs Outcomes (POs)

B.Tech. Electronics and Communication Engineering students will demonstrate the ability to:

PO-1 **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of

complex engineering problems.

PO-2 **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO-3 **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO-4 **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO-5 **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO-6 **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO-7 **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO-8 **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO-9 **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO-10 **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO-11 **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO-12 **Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programs Specific Outcomes (PSOs)

PSO-1 An ability to understand the concepts of basic Electronics & Communication Engineering and to apply them to various areas like Signal processing, VLSI, Embedded systems, Communication Systems, Digital & Analog Devices, etc.

PSO-2 An ability to solve complex Electronics and Communication Engineering problems, using latest hardware and software tools, along with analytical skills to arrive cost effective and appropriate solutions.

PSO-3 Wisdom of social and environmental awareness along with ethical responsibility to have a successful career and to sustain passion and zeal for real-world applications using optimal resources as an entrepreneur.

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

OVERALL CREDIT STRUCTURE FOR B.TECH. (ELECTRONICS AND COMMUNICATION ENGINEERING)

<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 colspan="2">Grand Total</td><td colspan="2">160</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 duringbreak 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/</td><td>Non-Credit</td></tr>
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industry/ Social/ entrepreneurial orientation (Mandatory) (Dean of Extension, Field Outreach and Alumni Relations).	
Value Added Courses (VAC) / Audit Courses (AC) Two of the Value-Added Courses / Audit Courses are compulsory.	**Non-Credit**
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	**Non-Credit**
Minor Degree (MD) from other Department and Micro Specializations (MS) from within the Department.	
• The total number of credits for graduation will be kept to a minimum of 160 and the additional 18-20 credits are required for Minor Degree. • Micro specializations will be run by the department in order to align to industry careers or higher studies.	Offered as a Professional Electives (PE)

DEPARTMENT OF (ELECTRONICS AND COMMUNICATION ENGINEERING)
MADAN MOHAN MALAVIYA UNIVERSITY OF TECHNOLOGY (MMMUT)
GORAKHPUR-273 010, UP, INDIA
SEMESTER WISE CREDIT STRUCTURE FOR B.TECH.

(ELECTRONICS AND COMMUNICATION ENGINEERING)

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					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)/				4-8	28-32				**36***
Minor Project (P)						0	6		**06***
Industrial Practice (IP) (in Industry)/ Major								10	**10***
Total Credit	**20***	**20***	**20***	**20-**	**16*-**	**16*-**	**6-**	**10-**	**160***
	80-84*				**76-80***				
Total Courses Offered	**05***	**05***	**05***	**05*-**	**04*-**	**04*-**	**00-**	**00-**	**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

 # Group-1: CSE, IT, CH, CE; Group-2:ECE, ECE(IOT), ME, EE

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 inElectronics & CommunicationEngineering	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	AUC01	Constitution of India	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-259	Electromagnetic Field Theory	3	1	0	4
2.	PC	BEC-260	Signal & Systems	3	1	0	4
3.	PC	BEC-261	Microprocessor and Applications	3	0	2	4
4.	PC	BEC-262	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-101	Introduction to Space Technology	3	1	0	4
		EEC-102	Electronics Material, Devices and Circuits	3	1	0	4
6.	PE-2	EEC-201	Semiconductor Devices and Applications	3	1	0	4
		EEC-202	Fundamentals of Photonics	3	1	0	4
		EEC-203	Probability and Stochastic Process for Communication Engineering	3	1	0	4
		EEC-204	Fundamentals of Nanoelectronics	3	1	0	4
			Total	**15-18**	**0-6**	**0-12**	**20-24**
7.	VAC/AC	AUC08	Intellectual Property Right	2	0	**0**	0
8.	ECA-IV			-	-	-	0

List of Extra Curricular Activity (ECA) Courses

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

ListofValue-AddedCourses(VAC)/AuditCourses(AC)

S. No.	Subjects	Codes
1.	Constitutionof India	AUC 101
2.	Indian Cultureand Heritage	AUC 102
3.	Indian Architecture	AUC 103
4.	Indian Festivals	AUC 104
5.	Vaidic Mathematics	AUC 105
6.	Astronomy	AUC 106
7.	Artsof 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.	Basicsof Human Health and preventive medicines	AUC 115

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

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	PaperCode	Subject	L	T	P	Credit
1.	Skill Enhancement	BEC-180	ElectronicsMechanics	1	0	2	2
2.	Skill Enhancement	BEC-181	MiniProject	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	PaperCode	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

BSM-110

: Engineering Mathematics-I

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

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

Topics Covered

UNIT-I 9

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

UNIT-II 9

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

UNIT-III 9

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

UNIT-IV 9

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

Proofs).

Books & References

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

BSM-140/BSM-190	**Environmental Science and Green Chemistry**
Course category:	Basic Sciences & Maths (BSM)
Pre-requisite Subject:	NIL
Contact hours/week	Lecture: 3, Tutorial: 0, Practical: 2
Number of Credits:	4
Course Assessment methods:	Continuous assessment through home assignments, quizzes, minor tests, practical work, viva-voce, practical exam and major theory Examination
Course Objectives	Understanding the principles and concepts of Chemistry viz. Chemical Bonding, acidity and basicity, Atmospheric Chemistry & Water Chemistry, Spectroscopic analytical methods and Green Chemistry and solving industrial problems using solid foundation in Chemistry.
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

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

Unit 1: **9**

Basic Chemical Concepts

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

Unit 2: **9**

Atmospheric chemistry & Water Chemistry

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

Unit 3: **9**

Spectroscopic analytical methods

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

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

Unit 4: **9**

Green Chemistry

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

Experiments:

1. Determination of temporary and permanent hardness in water sample using EDTA as standard solution.
2. Determination of alkalinity in the given water sample.
3. Determination of chloride content in the given water sample by Mohr's method.
4. Determination of percentage of available chlorine in bleaching powder sample.
5. Determination of iron content in the given sample using $K_3[Fe(CN)_6]$ as an external indicator.
6. Determination of Electrical conductivity/TDS of a given water sample using conductivity meter.
7. Determination of dissolved Carbon Dioxide of given water sample.
8. Determination of the biochemical oxygen demand of sewage influent.

9. To calculate the lambda max of the given compound by using UV-Visible spectrophotometer.
10. Determination of nickel / cobalt / copper solutions by UV–visible spectrometry.
11. Examples of Green Synthesis /Reactions.
12. Determination of Turbidity of Water
13. Iodoform test
14. Synthesis of a polymer Bakelite or Polyacrylic acid.

Books & References

1. A Text Book of Environment and Ecology, Shashi Chawla, Tata McGraw Hill
2. Environmental Studies, Raj Kumar Singh, Tata McGraw Hill
3. Engineering Chemistry, Wiley India
4. Engineering Chemistry, Tata McGraw Hill
5. Organic Chemistry, Morrison & Boyd, 6th edition, Pearson Education
6. Fundamentals of Environmental Chemistry, Manahan, Stanley E., Boca Raton: CRC Press LLC.
7. Environment and Ecology, R K Kandal, Wiley India
8. An Introductory Text on Green Chemistry: For Undergraduate Students, lndu Tucker Siddhani, 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

BEE-110/ 160	**:**	**Basic Electrical Engineering**
Course category	:	Engineering Fundamentals (EF)
Pre-requisiteSubject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 0, Practical: 2
Number of Credi*ts*	:	4
Course Assessment method*s*	:	Continuous assessment through attendance, home assignments, quizzes, practical work, record, viva voce, Minor tests and One Major Theory & Practical Examination.

Course Objectives:

1. To demonstrate and understand the basic knowledge of electrical quantities such as current, voltage, power, energy, and frequency to understand the impact of technology in a global and societal context.

2. To demonstrate and understand the basic concepts of analysis of simple DC and AC circuits used in electrical engineering and apply the basic concepts in Electrical engineering for multi-disciplinary tasks.

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

1. Understand the basic properties of electrical elements, and solve problem based on basic electrical circuits & DC network theorems.
2. Understand the fundamental behaviour of AC circuits and solve AC circuit problems.
3. Apply the knowledge gained to explain the behaviour of the circuit at series & parallel resonance of circuit & the effect of resonance.

4. Classify different electrical measuring equipment's and understanding their principles.
5. Understand the basic concepts of magnetic circuits.
6. Explain construction and working principle of transformer.

Topic Covered

UNIT I **9**

D C Circuit Analysis and Network Theorems:

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**

Steady- State Analysis of Single-Phase AC Circuits:

AC fundamentals: Sinusoidal, square, and triangular waveforms – Average and effective values, Form and peak factors, Concept of phasor, phasor representation of sinusoidally varying voltage and current, Analysis of 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 & Magnetic Circuit:

Types of instruments, Construction and working principles of PMMC and Moving Iron type voltmeters & ammeters, Use of shunts and multipliers.

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

UNIT IV **9**

Single-Phase Transformers:

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-106 Electronic Component Testing and Measurement

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

Course Objectives

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

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

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

Topics Covered

UNIT-I

Semiconductor Diode: Depletion layer, V-I characteristics, ideal and practical Diodes, Diode Equivalent Circuits, Zener Diodes breakdown mechanism (Zener and avalanche) 6

Diode Application: Diode Configuration, Half and Full Wave rectification, Clippers, Clampers etc.

Special Purpose Diodes: Light-Emitting Diodes, Photo Diodes etc.

UNIT-II

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

UNIT-III

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

UNIT-IV

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

EXPERIMENTS

Note: Minimum eight experiments are to be performed:

1. To plot the forward / Reverse Characteristics of Si P-N junction diode.
2. To plot the forward/Reverse Characteristics of Zener diode.
3. Study and plot the characteristic of Zener diode as voltage regulator.
4. Study of half wave rectifier and draw the nature of input / output signal. Calculate the value of I_{dc}, I_{rms} and ripple factor.
5. Study of Full wave rectifier and draw the nature of input / output signal. Calculate the value of I_{dc}, I_{rms} and ripple factor.
6. Study of Bridge Rectifier and draw the nature of input / output signal. Calculate the value of I_{dc}, I_{rms} and ripple factor.
7. Draw input-output characteristic curve of n-p-n transistor in CE or CB or CC configuration.
8. Draw the drain and transfer curve of JFET.
9. Study of OP-AMP (741) and calculate the gain in (i) Inverting mode and (ii) non-inverting mode.
10. Study of OP-AMP as a (i) Summer (ii) Integrator (iii) Differentiator; and plot the nature of input & output waveform.
11. To identify the components which are used in electronic circuits. (R, L, C, diode etc).
12. To study the resistance, voltage, current measurement by using of mustimeter.

13. To get familiarization and to study the operation of a function generator instrument and visualize the types of waveforms produced by a function generator.
14. To study the DSO and to find the Amplitude, Time-period and Frequency of a sinusoidal waveform using DSO.
15. Study of Lissajous patterns and measurement of frequency through Lissajous patterns.
16. Measurement of time constant of RC circuit.
17. Measurement of unknown resistance using Wheatstone bridge.

Books & References

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

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

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

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

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

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

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

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

Unit 1: Language and Communication **6**

LanguageVscommunication: Communicationascodinganddecoding– signs,symbols&pictograph–verbalandnon–verbalsymbols– Language&communication;TypesofCommunication- functional, situational, verbal,and non-verbal, interpersonal, group, interactive,public, Mass Communication. Thinking and Articulation, critical, creative aspectsofarticulation.

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

Phrase,Clause&Sentence inProfessionalDrafting- Simplicity,ClarityandConcisenessofaPresentation,differentiatingbetweenProfessionaland CreativeWriting,BlendingofArtistic/ProfessionalWriting,Avoidinggender,racial, andotherformsofbiasinProfessionalWriting.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 aPaper, End Matter of a Paper: Organizing References and Bibliography, Order of a thesis and PaperElements, Concluding Remarks. **Methods of Research Paper Writing:** Identification of Author andHis Writing-Author's name and Affiliation, Joint Authorship of a Paper, Identification of Writing-Title,Keywords,Synopsis, Prefaceand Abstract.Drafting ResearchArticle & Methodology.

Thesis/Dissertation Writing: Thesis Elements-Front Matter of a Thesis, Main Text of a Thesis, EndMatterofaThesis,Specimen—ThesisandResearchPaper,ChaptersandSections-Introductory Chapters and Sections, Statement of the Problems, Plan and Scope, Core Chapters and Sections-TheoreticalAnalysis andSynthesis,BasicAssumption and Hypothesis.

Professional Presentation & Seminar Delivery Tools: Designing the Presentation; Establishing theObjectives. Making Professional PowerPoint Presentations, Signaling Structure of Presentationthrough Sentences and Crisp Phrases, Preparing Notes for Professional/Technical Presentation, TextAnimation, White Board, Flip Charts, Diagrams, Preparing Cards. Seminar Presentations: Purposemodesandmethods.NascentEmergingPlatformsforOn-linePresentationsviz.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, ProfessionalCorrespondence through E-mail, Job Applications and cover Letters. Introduction to DOs (Demi-OfficialLetters)

Career & Correspondence: Developing a Professional C.V, Bio Data & Resume.

ReportWriting, Kinds of Reports, Length of Report, Parts of a Report, Terms of Reference, Collection ofFacts, Outlines of Report, Examples of Report, Technical Proposal, Elements of Proposal, ExamplesofProposal, drafting of proposal.

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

Conducting Professional Meeting: Pre-meeting Preparation, During Meeting: Action Taken Report(ATR)&NewAgendaPoints,PostMeeting Followups.Notice,Circular,Agenda&Meeting Minutes.

Introduction to Generation–Z, Cyber Identity & Professional Netiquettes for Netizens: DraftingE-mails,Blogsonsocialmedia,Videoconferencing.ManagingProfilesonsocialmedia.WhattoWrite andShareon 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/ReferenceBooks

1. AcharyaAnita.(2012)InterviewSkills-Tips &Techniques.Yking Books,Jaipur.
2. Basu,B.N.,(2008)Technical Writing.PHILearningPvt. Ltd..,NewDelhi.
3. Chauhan,N.K&Singh,S.N.(2013)FormalLetters,PankajPublicationInternational,NewDelhi.
4. ChhabraT.N.(2018)Business Communication.SunIndiaPublicationNewDelhi.
5. DubeyArjunet.al.(2016)CommunicationforProfessionals.AlfaPublications,Delhi.
6. Gibaldi,Joseph(2021).TheMLAHandbookforWritersofResearchPapers.Ed.IXth,ModernLanguageAssociation ofAmerica, NY, US.
7. Gurumani,N.(2010)ScientificThesisWritingandPaperPresentation,MJP Publishers,Chennai.
8. HamiltonRichard.(2009)ManagingWriters.Penguin,India.
9. McGrawS.J.(2008)BasicManagerialSkillsforAll.Ed.08th,PrenticeHallofIndia,NewDelhi.

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

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

Topics Covered

UNIT-I 9

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

UNIT-II 9

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

UNIT-III 9

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

UNIT-IV 9

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

Books & References

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

5. M.D. Raisinghania, Ordinary and Partial Differential Equations. S ChandPublications.

BSM-131/181 ENGINEERING PHYSICS

Course category	:	Basic Sciences and Maths (BSM)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 0, Practical: 2
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through, home assignments, quizzes and two minor test, attendance, one major theory.

Course Objectives : 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.

Topics Covered

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

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.

BCS-110/160 **Introduction to C Programming**

Course category: Engineering Fundamental (EF)

Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 0, Practical: 2
Number of Credits:	4
Course Assessment methods:	Continuous assessment through attendance, home assignments, quizzes, practical work, record, Viva-voce, two tests and One Major Examination (T & P)

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

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

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

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

UNIT-I **9**

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

UNIT-II **9**

Arrays: One Dimensional, Multidimensional Array and Their Applications, Declaration and Manipulation of Arrays.

Strings: String Variable, String Handling Functions, Array of Strings.

Functions*:* Designing Structured Programs, Functions in C, User Defined and Standard Functions, Formal vs. Actual Arguments, Function Category, Function Prototype, Parameter Passing, Recursive Functions. Storage Classes revisited.

UNIT-III **9**

Pointers: Pointer Variable and its Importance, Pointer Arithmetic Pointers and Arrays, Pointer and Character Strings, Pointers and Functions, Array of Pointers, Pointers to Pointers.

Structure: Declaration and Initialization of Structures, Structure as Function Parameters, Structure Pointers.

Union: Declaration and Initialization of Unions, Union as Function Parameters, Union Pointers.

UNIT-IV **9**

Dynamic Memory Allocation: malloc, calloc, realloc, free functions.

File Management: Defining and Opening a File, Closing a File, Input/ Output Operations in Files. 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-157 Electronic Workshop

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

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

Topics Covered

Unit 1: Introduction to Electronics **6**

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

Unit 2: PCB Designing Basics **6**

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

Unit 3: Advanced PCB Designing **6**

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

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

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

EXPERIMENTS

Note: Minimum eight experiments are to be performed:

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

Books & References

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

BHS- 101/151 **Universal Human Values: Understanding Harmony**

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

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

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

Course Outcomes:

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

1. Ability to understand the interconnectedness of humanity and nature as well as the importance of values in interpersonal relationships.
2. Ability to recognize their role as global citizens and understand the importance of actively contributing to the betterment of society through responsible actions.
3. Ability to engage in critical reflection on their own values and beliefs, challenging assumptions and biases to foster personal growth and development.
4. Ability to appreciate and respect diversity thereby promoting communication and conflict resolution skills, promoting dialogue and understanding in resolving interpersonal and intergroup conflicts.

Topics Covered

Unit 1 **9**

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

Unit 2 **9**

Understanding human being as a co-existence of the sentient 'I' and the material 'Body'; Understanding the needs of Self ('I') and 'Body' - happiness and physical facility; Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer); Understanding the characteristics and activities of 'I' and harmony in 'I'; Understanding the

harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail; Programs to ensure Sanyam and Health.

Unit 3 **9**

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

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

Unit 4 **9**

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

Text & Reference Books:

1. Andrews, C. (2006). Slow is beautiful. New Society Publishers.
2. Gandhi, M. K. (1909). Hind Swaraj or Indian Home Rule. Navjeevan Trust.
3. Gandhi, M. K. (2009). An Autobiography or The Story of My Experiments with Truth (Mahadev Desai, Trans.). NavjeevanMudranalay. (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 assignments, attendances, quizzes and practical exam tests.

Course Objectives :

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

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

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

Experiments:

1. Using David Kolb's Model, to identify Experiential Learning Cycle for VLSI design system.
2. To Study all stages in the Design Thinking Process and Prototype and examine any Digital circuit simulation process by Brainstorming prototype.
3. To study Problem Solving and Functional Fixedness and applied on IoT based agricultural system, also comparison Between Eco-Reps and Non-Eco-Reps .
4. By development of scenarios planning and evaluation tools, illustrate an experiment Interactive Drama for an AI based IoT system.
5. Via advanced communication system-based discussions in a group setting be used to assess residents' clinical skills.
6. With the help of Cognitive bias categories in Strengthen communication, to identify

Complementary interviews.

7. By creating a Culture of Innovation, to develop different Strategies for Business Growth and Successof 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

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 probabilityDistributions.
2. To understand the central tendency, correlation, and correlation coefficientand alsoregression.
3. To understand the fitting of various curves by method of leastsquare
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,Equationofregressionlines,linear,andnon-linearregression analysis. Relation between Regression Analysis and CorrelationAnalysis 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,ProbabilityandStatisticsforEngineeringandtheSciences,Cengage Learning.
3. S.M. Ross, Introduction to Probability and Statistics for Engineers andScientists, Academic Press; 5thedition
4. Robert V Hogg, Joseph McKean, Allen T Craig, Introduction toMathematical Statistics, PearsonEdu.
5. Mood, Graybill and Boes, Introduction to the Theory of Statistics, Tata McGraw- Hill.

Course Code: BEC207 **DIGITAL ELECTRONICS**

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, 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)

Course Code: 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 **9**

impedances and RC admittances.

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.

Course Code: BEC-209	**Electronic Measurement & Instrumentation**
Course category	: Program Core (PC)
Pre-requisite Subject	: Nil
Contact hours/week	: Lecture: 3, Tutorial:0, Practical: 2
Number of Credits	: 4
Course Assessmentmethods	: 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

Radio Receiver Measurements

1. Study of half-wave and full-wave bridge rectifier using resistive load.
2. To design a series RLC circuit and study the condition of resonance.
3. Study of L.C.R. Bridge and determination of the value of the given components.
4. Study of the distortion factor meter and determination of the % distortion of the given oscillator.
5. Study of the transistor tester and determination of the parameters of the given transistors.

6. Measurement of resistance using the Wheatstone bridge.
7. Measurement of phase difference and frequency using CRO (Lissajous figure).
8. Measurement of low resistance using Kelvin's double bridge.
9. To measure the linear displacement using the LVDT trainer kit.
10. To design an IR sensor-controlled LED on a breadboard.

Optional Experiments

1. Measurement of capacitance by Schering Bridge.
2. To measure the value of an unknown inductance with the help of Anderson's Bridge.
3. Measurement of capacitance by Schering Bridge.
4. To measure the value of an unknown inductance with the help of Anderson's Bridge.

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.

Course Code: BEC-210	**Electronic Devices & Circuits Theory**
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, 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.

Course Code: BEC-259	**Electromagnetic Field Theory**	
Course category	**:**	Engineering Fundamental (EF)
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

Course Code: BEC-260		**SIGNAL & SYSTEMS**
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 & Practical Examination
Course Objectives	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course
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 analyse spectral characteristics and system properties based on impulse response and Fourier analysis.
3. Apply the Laplace transform for analysing of continuous-time time signals and systems.
4. Apply the Z- transform for analysing 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

Course Code: BEC-261		**Microprocessors and Applications**
Course category	:	Department Core (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, assignments, quizzes, practical work, record, viva voce, minor and major theory & practical Examination
Course Objectives	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course
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 building blocks of Microprocessors.
2. Acquiring knowledge about 8085 Microprocessor and supporting devices.
3. Foster ability to write the assembly language programming using 8085 microprocessors.
4. Foster ability to understand 8086/8088 microprocessors
5. Foster ability to write the assembly language programming using 8086 microprocessors.
6. Foster ability to develop microprocessor-based system using different peripheral devices.

Topics Covered

UNIT-I **9**

Introduction to Microprocessors: Evolution of Microprocessors, Microprocessor Architecture and its operations, Memory devices, I/O Devices, 8-bit Microprocessor (8085): Introduction, Signal Description, Register Organization, Architecture, Basic Interfacing Concepts for Memory and I/O Devices

UNIT-II **9**

DTFT, Convergence, Properties and theorems, Comparison between continuous time FT and DTFT

8085 Assembly Language Programming: Instruction Classification, Instruction Format, Addressing Modes, 8085 Instructions: Data Transfer operations, Arithmetic operations, Logic Operations, Branch operation, Flow Chart, writing assembly language programs, Programming techniques: looping, counting and indexing.

UNIT-III **9**

16-bit Microprocessors (8086/8088): Architecture, Physical address segmentation, memory 18 organization, Bus cycle, Addressing modes, difference between 8086 and 8088, Assembly Language Programming of 8086

UNIT-IV **9**

Basic Peripherals & their Interfacing: DMA Controller (8257), Programable Peripheral Interface (8255), Programmable Interrupt Controller (8259), Programmable Interval Timer/ Counter (8253/8254)

LIST OF EXPERIMENTS

1. Write a program using 8085 Microprocessor for Decimal addition and subtraction of two numbers.
2. Write a program using 8085 Microprocessor for Hexadecimal addition and subtraction of twonumbers.
3. Write a program using 8085 Microprocessor for addition and subtraction of two BCD numbers.
4. To perform multiplication and division of two 8-bit numbers using 8085.

5. To find the largest and smallest number in an array of data using 8085 instructions set.
6. To write a program to arrange an array of data in ascending order.
7. Write a program to transfer blocks of data.
8. Write a program to find positive and negative numbers from a given series of data.
9. To interface 8253 programmable interval times to 8085 and verify the operation of 8253 in six different modes.
10. To interface 8255 with 8085 and verify the operation of 8255 in different modes.
11. To interface 8259 with 8085 and verify the operation of 8259.

Books & References

4.

1. R. Singh and B. P. Singh: Microprocessor Interfacing and Application, New Age International Publishers, 2nd Edition.
2.D. V. Hall: Microprocessors Interfacing, TMH (2nd Edition).
3.R. S. Gaonkar: Microprocessor Architecture, Programming and Applications with 8085/8080, Penram Publication
4.Y.C. Liu and G.A. Gibson: Microcomputer Systems: The 8086/8088 Family Architecture Programming and Design, PHI 2nd Edition,

Course Code: BEC-262 **Analog Integrated Circuits**

Course category	:	Program Core (PC)
Pre-requisite Subject	:	NIL
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 ops-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 9

Introduction to Integrated Circuit Design

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, Wilder current source, Basic OPAMP configurations and characteristics, OPAMP non-ideal ties,

UNIT-II 9

Op-amp circuits:

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 9

Filters:

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 9

Advance Applications of integrated circuits:

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

EXPERIMENTS

1. To 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.

Books & References

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

Course Code: EEC-101		**IntroductiontoSpaceTechnology**
Course category	:	**ProgramElective (PE-1)**
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture:3,Tutorial:1,Practical:0
Number of Credits	:	4
Course Assessment methods	:	Continuousassessmentsthroughteachingassessment, attendance,homeassignments,quizzes,twominortests and one major theory examination.
Course Objectives	:	Familiarizestudentswiththe concepts of launch vehiclesdesign and missiles and its various parameters required formissiontrajectorydesignandlaunch.Spacedata productsandservicesofSpacetechnologywillbecommunicated to the students.
Course Outcomes	:	Thestudentsareexpectedtobeabletodemonstratethefollowing knowledge, skills and attitudes after completing this course.

1. Discuss concepts of launch vehicle design and missiles
2: Determine various parameters required for mission trajectory design and launch.
3: Use Space data products and services
4: Explain Space technology concepts
5: Able to understand interaction between EM Radiation andmatter.
6: Develop prototype of satellite model.

Topics Covered

UNIT-I **9**

Basics of Launch Vehicle Design and MissilesGNCandSatelliteSystemsEngineering design. Fundamentals of structure and mechanisms. Introduction to launch facilities, launch vehicle assembly, integration and launch readiness. Communication with the ground stations and ground tracking in collaboration with foreign space centres.

UNIT-II **9**

Fundamentals of mission trajectory design Coordinate reference frames, space flight mechanics, satellite orbits, Kepler's laws; lunar and interplanetary missions. Attitude dynamics, Attitude parameterization: direction cosine matrix, Euler axis and angles, quaternions, Euler angles; attitude rates; attitude determination; Euler equations ofmotion and attitude dynamic**s**

UNIT-III **9**

Basics of Space data products and services including AI and ML Definition and Overview of Remote Sensing and Remote Sensing Systems: Electromagnetic Radiation, Laws of Radiation, EM Spectrum, Sources of EMR, Interaction between EM Radiation andmatter,Reflection,AbsorptionandTransmission,InteractionsbetweenEM Radiation andAtmosphere,Atmosphericwindows.Platforms:Typesofplatforms(Ground, AirborneandSpaceborne);Satellitesforearthobservation;GeostationaryandUAV platforms.

UNIT-IV **9**

SpaceTechnologyFundamentalsofDigitalImageProcessing,FundamentalsofPhotogrammetry,Cartograph

y,spacematerialsprocessing;GlobalNavigationSatellite System (GNSS)

Text Books

1.Wie,B.,SpaceVehicleDynamicsandControl,2nded.,AIAAEducationSeries,2008

2. Zarchan,P.,TacticalandStrategic Missile Guidance, 6th ed., Progress in Astronautics and Aeronautics, 2007

References:

1. Joseph, G., Fundamentals of Remote Sensing, Universities Press, 2003
2. Fleeman, E. L., Missile Design and System Engineering, AIAA Education Series, 2012
3. Noton, M., Spacecraft Navigation and Guidance, Springer 1998

Farrell,J.A.,AidedNavigation:GPSwithHigh-Rate Sensor,McGraw-Hill 2008

CourseCode: EEC-102 **ElectronicMaterials,DevicesandCircuits**

Coursecategory	:	PE-1
Pre-requisiteSubject	:	NIL
Contacthours/week	:	Lecture:3,Tutorial:1,Practical:0
NumberofCredits	:	4
CourseAssessment methods	:	Continuous assessment through tutorials, attendance,home Assignments,quizzesandtwominortestsandonemajotheory examination.
CourseObjectives	:	Thecourseisaimedtodevelopthe conceptsofelectronicdevices&circuits skillsofengineeringstudentsthatareimperativeforeffectiveunderstanding of engineering subjects.
CourseOutcomes	:	Thestudentsareexpectedtobeabletodemonstratethefollowing knowledge, skills and attitudes after completing this course.

1. Categorizematerials,explaintheirproperties,explaincrystalstructureofsilicon

2. Elucidateworkingprinciplesofsolid-statedevices

3. Builddiscreteamplifiers

4. BuildOP-AMPbasedcircuits

5. Analyze waveform shaping circuits.

6. Understand concept of multivibrator.

Topics Covered

UNIT-I 9

Typesofmaterials,metals,insulatorsandsemiconductors,Bandgap,Millerindices,Crystal Structure of Silicon, Intrinsic `Semiconductors, Extrinsic semiconductors, Fermi level, Thermal Equilibrium, Law of mass action, mobility, generation recombination, Transport

Equations, Continuity Equations.

9

UNIT-II

P-Njunctioncharacteristics,I-Vcharacteristics,andsmallsignalswitchingmodels;Avalanche breakdown,Zenerdiode,Schottkydiode,rectifyingcircuits,Limitingandclampingcircuits.
MOSFET device structure, current voltage characteristics, DC biasing, small signal analysis, Common Source, Common Gate and Common Collector Configurations, Discrete circuit amplifiers.

9

UNIT-III

OPAMP- Ideal Op-AMP, Inverting Configuration, non-inverting configuration, DC imperfections, difference amplifiers, circuits based on Op-amps: Integrators, differentiators, filters, logarithmic amplifiers.

9

UNIT-IV

Signal generators, waveform shaping circuits, RC oscillatory circuits, LC and Crystal Oscillators, Bistable multivibrators, monostable multivibrators, Timers, Nonlinear waver forming circuits.

TextandReferenceBooks

1. A.S. SedraandK.C.Smith,MicroelectronicCircuits
2. G.Streetman,andS.K.Banerjee,—SolidStateElectronicDevices, ‖7thedition, Pearson,2014.
3. D.Neamen,D.Biswas"SemiconductorPhysicsandDevices,"McGraw-Hill Education
4. S.M.SzeandK.N.Kwok,—PhysicsofSemiconductorDevices, ‖3rdedition,John Wiley &Sons, 2006.
5. C.T.Sah,—Fundamentalsofsolid-stateelectronics, ‖WorldScientificPublishingCo.Inc, 1991.

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1. A.S. SedraandK.C.Smith,MicroelectronicCircuits
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5. C.T.Sah,—Fundamentalsofsolid-stateelectronics, ‖WorldScientificPublishingCo.Inc, 1991.

Course Code: EEC-201 **Semiconductor Devices and Applications**

Course category	:	PE-2
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture:3, Tutorial:1, Practical:0

Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, Home Assignments, quizzes and two minor tests and one major theory examination.
Course Objectives	:	The course is aimed at developing the concepts of electronic devices & circuits skills of engineering students that are imperative for effective understanding of engineering subjects.
Course Outcomes	:	The students are expected to beable to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Ability to understand the fundamentals of semiconductor diodes.
2. Able to understand the thyristors.
3. To understand the Implantation of logic functions.
4. Understand the basic principles of solar cells.
5. Understand the basic principles of advanced FET devices.
6. Understand the basic principles of logic design using advanced transistors.

TopicsCovered

UNIT-I 9

Fundamentals of semiconductor diodes, different diodes: Avalanche diodes LED, Photodiode, , PIN diode, Schottky diode, Tunnel Diode, their working and applications.

9

UNIT-II

Logic gates implementations using BJT and FET devices, Basics of CMOS logic, MESFET, DIAC, TRIAC, SCR, UJT and applications.

UNIT-III 9

Fundamentals of solar cell, types of solar cells, Thermistors, LCD, photoconductive cells, IR emitters.

9

UNIT-IV

Advanced semiconductor transistors: FinFET, CNTFET, GNRFET and their working and characteristics.

Text and Reference Books

1. Milman, Halkias & Jit - Electronics Devices and Circuits-TMH
2. Donald A. Neaman, “Semiconductor Physics and Devices Basic Principles”, TMH India
3. Fin FET Devices for VLSI Circuits and Systems, Samar K. Saha, CRC Press.
4. Quantum Theory, Modeling, Analysis, and Design of Carbon Nanotube Field Effect Transistors, Khairul Alam, University of California, Riverside

CourseCode:EEC-202	**FundamentalsofPhotonics**	
Course category	:	ProgramElectives-2
Pre-requisiteSubject	:	NIL
Contact hours/week	:	Lecture:3,Tutorial:1,Practical:0
Numberof Credits	:	4
CourseAssessment methods	:	Continuousassessmentthroughtutorials,attendance,assignments, quizzes, record, viva voce, two minor tests and one major theoryexamination.
Course Objectives	:	Thiscourseistoequipstudentswithfoundationalknowledgeand analyticalskillsinthefieldofphotonicsandoptics.
Course Outcomes	:	Thestudentsareexpectedtobeabletodemonstratethefollowing knowledge,skillsandattitudesaftercompletingthis course.

1. Interprettheconceptsofoptical electronics.
2. Analyzethe workingprincipleof METheory,EO,andAOeffects.
3. Examinetheworkingmechanisms ofdifferenttypes ofOpticalcomponents, EO,andAOeffects.
4. IllustratethepracticaluseofOpticalcomponents,EO,andAO effects.
5. Understand the concept of Electro-opticdevices.
6. Understand the concept of small-angleandlarge-angleBraggdiffraction.

Topics Covered

Unit I

Fundamentals of Electromagnetic Wave Propagation and Photonics: Wave equation, Plane waves, Applications of photonics, Reflection and Refraction of plane waves, Fresnel Equations, Wave propagation in different mediums, propagation of Electromagnetic waves in Uniaxial and biaxial crystals, the dielectric constant tensor and the 'index ellipsoid'.

Unit II

Optical Phenomena in Dielectric Media: Electromagnetic theory of light, Dielectric media, Monochromatic EM waves, Absorption and dispersion, Polarization of light, Jones Calculus, Poincare sphere. Polarizer's, Quarter, Half, and Full waveplates, Beam splitters: polarizing and non- polarizing, wavelength filters, dichroic mirrors, Lenses.

Unit III

Electro-optics(EO): PockelandKerreffects,Electro-opticdevices:modulators,switches,and scanners, EO effect in liquid crystals; LCDs and SLMs, Applications.

Unit IV

Acoustic-optics (AO): Strain waves in solids and liquids, the strain-optic tensor; theory of Raman-NathandBraggdiffraction;small-angleandlarge-angleBraggdiffraction, AOdevices:Modulators, deflectors, scanners, interconnections, and acousto-optic tunable filters.

References& Textbooks

1. A. Yariv, P. Yeh, Photonics: Optical Electronics in Modern Communications, The Oxford Series in Electrical and Computer Engineering, 2006.
2. B.E. A. Saleh,M. C. Teich,Fundamentals of Photonics, JohnWiley&Sons,Inc., 2nd Ed. (2007)

CourseCode:EEC-203 **Probability and Stochastic Process for Communication Engineering**

Course category	:	Program Electives (PE-2)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits	:	3
Course Assessment Methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce, and one Minor test and one Major Theory.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Explain fundamental concepts of probability theory and conditional probability for engineering applications.
2. Analyze random variables, their distributions, expectations, and transformations.
3. Model random processes and evaluate their temporal and statistical characteristics.
4. Apply correlation, power spectral density, and filtering concepts to random signals.
5. Analyze noise in communication systems using statistical tools.
6. Apply random process theory to wireless communication applications such as fading, modulation, and error probability.

Topics Covered

UNIT-I

Probability Theory and Random Variables: Introduction to probability: Sample space, events, axioms of probability. Conditional probability, independence, total probability theorem, Bayes' theorem. Random variables: Continuous and discrete types. Probability density function (PDF), cumulative distribution function (CDF). Common distributions: Bernoulli, Binomial, Poisson, Gaussian, Exponential, Rayleigh, Rician. Expectation, moments, variance, covariance, characteristic function 9

UNIT-II

Multiple Random Variables & Transformations: Joint, marginal, and conditional distributions. Joint PDFs/PMFs, functions of multiple random variables. Statistical independence; jointly Gaussian random variables. Correlation, covariance, linear estimation. Central Limit Theorem (CLT). Transformations of random variables and Moment Generating Functions (MGF). Random vectors and introduction to multivariate statistics. . 9

UNIT-III

Random Processes: Definition and classification of random processes. Stationary 9

processes: Strict-sense and Wide-Sense Stationarity (WSS). Autocorrelation and cross-correlation functions. Properties of correlation functions; Ergodicity. Power Spectral Density (PSD), relation between PSD and autocorrelation (Wiener–Khinchin theorem). Filtering of random signals: Linear time-invariant filtering of random processes.

UNIT-IV

Applications to Wireless Communications: Noise models: AWGN, thermal noise, narrowband noise. Channel modelling: Fading channels, Rayleigh & Rician fading. Doppler shift, coherence time, coherence bandwidth. Noise figure, SNR, BER analysis using random variables. Random processes in modulation: AM, FM, PM. Probability of error in digital modulation (BPSK, QPSK, M-QAM) using statistical models. Markov chains and their applications in communication systems. 9

Books & References

1. P. Z. Peebles, Probability, Random Variables & Random Signal Principles, McGraw-Hill.
2. H. Stark & J. Woods, Probability and Random Processes with Applications to Signal Processing, Pearson.
3. Simon Haykin, Communication Systems, Wiley.
4. A. Papoulis & S. U. Pillai, Probability, Random Variables, and Stochastic Processes, McGraw-Hill.
5. J. G. Proakis, Digital Communications, McGraw-Hill.

CourseCode:EEC-**204** **Fundamental of Nanoelectronics**

Course category	:	Program Electives (PE-2)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits	:	3
Course Assessment Methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, one minor test and one major theory examination.
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 fundamentals of nanoelectronics and the difference between mesoscopic and nanoelectronics devices.
2. To understand the fundamentals of quantum mechanics in nanoelectronics.
3. To analyse the electronic properties of molecule and electron conduction.
4. To understand the fundamentals of MOSFET as a Ballistic and Diffusive Transport.
5. To analyse the effect of 1D and 2D electrostatics effects on nanoscale devices.
6. To understand the application of MOSFET.

Topics Covered

UNIT-I

Introduction to nanoelectronics – device scaling, Fundamental differences in mesoscopic and nanodevices, Quantum mechanics in nanoelectronics, Introduction to quantum mechanics, Schrödinger equation, Free electron wavefunction, Particle/electron in a box, electrons in solids. Field effect transistors as a resistor, Conductance, Ballistic conductance, Ballistic resistance 9

UNIT-II

Electrons Flow: Density of states, electrochemical potential, Energy window for current flow, Fermi function, Non-equilibrium: Two Fermi Functions, the Linear response at low bias conductance, Drude formula, Elastic resistors, current in elastic resistor, the conductance of long resistor, Degenerate, and Non-degenerate Conductors. 9

UNIT-III

Ballistic and Diffusive Transport: Transit Times, Channels for Conduction. Conductance from Fluctuation, Current Fluctuations in an Elastic Resistor: One-level resistor, multi-level resistor. Energy Band Model: E(p) or E(k) Relation, Density of states, Number of Modes, Electron Density of n-type and p-type conductors. Conductivity of conductors. 9

UNIT-IV

Devices, Circuits, and Systems: Introduction to MOSFET, 1D MOS Electrostatics, 2D MOS Electrostatics, Bipolar transistor, CMOS technology, MOSFET Current-voltage characteristics, Ultimate limits of devices. 9

Books & References

1. Supriyo Datta (2017). *Lessons from Nanoelectronics (Vol. 5)*. 2nd Edition, WorldScientific Publishing Company.
2. Lundstrom, Mark S., and Jing Guo.(2010), *Nanoscale Transistors. 1st Edition,* Springer.
6. Griffiths, D., & Schroeter, D. (2018). *Introduction to Quantum Mechanics* (3rd ed.). Cambridge: Cambridge University Press.

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

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.

(248)

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.

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.