OP JINDAL UNIVERSITY

Raigarh-Chhattisgarh

UNIVERSITY OF STEEL TECHNOLOGY AND MANAGEMENT

Scheme and Syllabus
of
B. Tech

Department of Electrical Engineering School of Engineering
2023-2027

Programme Outcome (PO)

Currently OP Jindal University is offering undergraduate programs (3/4 Years), postgraduate and doctoral programs in the field of engineering, management, and science. OPJU aims to bring high quality education to its students based on a world class industry-based curriculum, the latest teaching methodology, research, innovation, and entrepreneurship developed by committed faculty members. The outcome of each of the Programme in detail is summarized below**:**

Program Outcomes for Engineering Graduate

1. **Engineering Knowledge and Problem Analysis:** Apply the knowledge of the engineering domain with the adequate amalgamation of science, mathematics, and management to identify, formulate, and critically analyze complex engineering problems.

2. **Modern tools and techniques for investigating complex problems:** Apply appropriate tools and techniques to analyze, predict and simulate the data for valid conclusions with a clear understanding of limitations.

3. **Design and development of innovative systems:** Design and develop system components or processes to provide solutions to complex engineering problems that meet the specified conditions of societal, health, safety, and environmental needs.

4. **Communication and Teamwork:** Develop skills to communicate effectively to diverse platforms and contribute meaningfully to different capacities as a leader, team member, or individual.

5. **Project management and finance:** Develop and apply knowledge of engineering, management, and finance principles to handle a project in a multidisciplinary environment.

6. **Life-long learning:** Acquire fundamental knowledge for lifelong learning to participate in the extensive context of socio-technological change as a self-directed member and a leader.

7. **Ethics and citizenship:** Apply ethical principles and commit to professional ethics, norms, and responsibilities of the engineering practice; and act with informed awareness to participate in civic life activities.

8. **Society, Sustainability, and Environment:** Understand the impact of various solutions in the context of societal, economical, health, safety legal and environmental impact for sustainable development.

B.Tech. Electrical Engineering

Graduates from the Electrical Engineering program are expected to achieve the following Program Educational Objectives after graduation**:**

Programme Specific Outcomes (PSO)

PSO1	Apply the fundamentals of mathematics, science and engineering knowledge to identify, formulate, design and investigate complex problems of electrical engineering and allied domains.
PSO2	Apply the appropriate techniques and use modern hardware and software tools in electrical engineering to adapt in multi-disciplinary environments.
PSO3	Solve Ethically and Professionally Various Electrical Engineering problems in Social and Environmental context and communicate effectively.

Electrical Engineering

(Detailed Syllabus of 1st Semester)

L: Lecture, T: Tutorial, P: Practical, C: Credit

SEMESTER I

S. No.	Subject Code	Types Of Course	Courses	Periods Per Week			Scheme of Examination and Marks				Credit (L+ (T+P)/2)
				L	P	T	PRE*		ESE*	Total Marks*	
							MSE	TA			
1	SOS-B-Math-23-101	CC	Engineering Mathematics-I	3	0	0	30	20	50	100	3
2	SOS-B-Phy-23-102	CC	Applied Physics	2	0	0	15	10	25	50	2
3	SOE-B-EE-23-103	CC	Basic Electrical & Electronics Engineering	3	0	0	30	20	50	100	3
4	SOE-B-CSE-23-104	CC	Basic Computation skills (C Programming)	3	0	0	30	20	50	100	3
5	SOE-B-Mech-23-105	CC	Engineering Graphics		0	0	30	20	50	100	4
6	SOS-B-Eng-23-106	AECC	Communicative English	2	0	0	15	10	25	50	2
7	SOE-B-Civ-23-107	AECC	Environmental Sciences	2	0	0	15	10	25	50	2
8	SOE-B-EE-23-108		Basic Electrical & Electronics Lab	0	2	0	0	30	20	50	1
9	SOE-B-CSE-23-109		Basic Computation skills (C Programming) Lab	0	2	0	0	30	20	50	1
10	SOE-B-CSE-23-110		Applied Physics Lab	0	2	0	0	30	20	50	1
Total				19	6	0	165	200	335	700	22

Note: The tutorials of courses Basic Computing & Engineering Graphics shall be conducted in their respective laboratories.

*** End Semester Examination**

****Teacher Assessment**

**** AECC- Ability enhanced compulsory courses**

Environmental Sciences will be in English & Hindi

Programme:	**B.Tech.**	**Semester :**	**I**
Name of the Course:	**Engineering Mathematics-I (Matrices and Linear Algebra)**	**Course Code:**	**SOS-B-MAT-23-101**
Credits :	**3**	**No of Hours :**	**3 Hours/week**
Max Marks:	**100**		

Course Description:

The course will introduce basic concepts and techniques from linear algebra that will be required in later courses in areas such as machine learning, computer graphics, quantum computing. Also, to expose student to understand the basic importance of matrices.

Syllabus:

Unit-I:
Matrix operations. Rank of a matrix. Inverse of matrix. The Gauss-Jordan method. Solvability of systems of linear equations, Gaussian elimination. Row echelon form. Homogeneous and nonhomogeneous systems of linear equations.

Unit-II:
Eigen values, Eigen vectors, Diagonalization of matrices, Reduction of a quadratic form to canonical form. Vector in two and three dimensions. Algebraic properties. Dot products and properties.

Unit-III:
Vector space, subspace, linear span, linear dependence and independence, Basis and dimension of vector space, Row and column spaces. Linear Transformation.

Unit-IV:
Orthogonal vectors, norm of a vector, Inner product spaces, Gram-Schmidt Orthogonalization, Orthonormalisation, Rank and nullity, Rank-Nullity Theorem, Matrix representation of Linear Transformations.

Unit-V:
Application to the intersection of lines and planes, Properties and composition of linear transformations. Rotations, reflections and stretches. Translations using homogeneous coordinates. One-to-one and onto transformations.

Text Book

- Gilbert Strang, “Introduction to Linear Algebra”, Wellesley-Cambridge press.
- J. Defranza and D. Gagliardi, “Introduction to Linear Algebra with Applications”, McGraw-Hill

Reference Book

- Serge Lang, “Introduction to Linear Algebra”, (2nd edition), Springer

- Seymour Lipschutz, Marc Lipson, "Schaum's outlines of Linear Algebra", McGraw-Hill Education (India) Private Limited, New Delhi
- K. Hoffman and R. Kunze, "Linear Algebra", Prentice Hall

Course Outcomes:

CO	After completing the course, the students will be able to:
CO1	find basis of finite dimensional vector spaces.
CO2	learn about inner product, and how to transform a set of non-zero vectors into an orthonormal
CO3	learn to solve systems of linear equations, and to find inverse of a matrix by using Gauss-
CO4	find rank/nullity and eigenvalues/eigenvectors of a matrix and learn about the diagonalization of a matrix.
CO5	understand the properties of linear transformation

CO-PO & PSO Correlation:

Course Name: Engineering Mathematics - I								
Course Outcomes	Program Outcomes							
	1	2	3	4	5	6	7	8
CO1:	1	1						
CO2:	1	2						
CO3	1	1	1					
CO4	1		1					
CO5	1							

Note: 1.: Low 2.: Moderate 3.: High

Programme:	B. Tech.	Semester :	I
Name of the Course:	Applied Physics	Course Code:	SOS-B-PHY-23-102
Credits :	2	No of Hours :	2 Hours/week
Max Marks:	50		

Course Description:

Applied Physics is a science course for students interested in the technical fields. This course is designed for the student who needs a broad understanding of physics and the ability to apply those principles in the work force. The Applied Physics course is basically fundamentals of electronics, theory and applications of laser, fundamentals of X- rays, its characteristics, its production method and uses, basics of nuclear energy and nuclear reactor, formulation and solving the engineering problems on electromagnetism, Introduction to quantum physics and application in 1D and Various interpretations about the origin of Universe. The purpose of studying Applied Physics is to introduce the mind to the scientific method of analysis through which, the practical problems can be identified, explanations generated and logical solutions selected which in essence are requisites for the development of good engineering sense.

Syllabus:

Unit-I: Electronics

Electrons and holes in an intrinsic semiconductor, Donor and acceptor impurities, Fermi level, Carrier densities in semiconductor, Hall effect, Diffusion, Recombination, Junction Diode, PN junction characteristic, Effect of Temperature, Depletion Layer, Breakdown Mechanism: Zener and Avalanche Breakdown, Half wave and full wave rectifiers, filters, Zener diode as a regulator, Transistors (PNP & NPN) Operation, CE, CB, CC configuration.

Unit-II: Lasers

Principles and working of laser, population inversion, Laser characteristics, components of laser, Einstein's coefficients, He-Ne laser, Ruby laser, Laser applications.

Unit-III: Atomic & Nuclear Physics:

X-rays, Properties of X-rays, Bragg's law, Bragg's X-ray spectrometer, Characteristic X-ray spectrum, Moseley's law, Daune-Haun't criteria. Nuclei: properties, Mass defect, Binding energy, Criteria of Critical mass, Nuclear cross section, Nuclear fission: Controlled and uncontrolled chain reaction, Nuclear reactor and its site selection, Nuclear fusion, stellar energy (C-N cycle and P-P cycle).

Unit-IV: Electromagnetism

Motion of Charged Particles in crossed electric & magnetic fields, Velocity Selector & Magnetic focusing, Gauss law, continuity equation, inconsistency in Ampere's Law, Maxwell's equations (differential and integral forms),

propagation of plane electromagnetic waves in conducting and non-conducting medium. Gradient, divergence, and curl of scalar and vector fields, Formulation and solving the engineering problems on electromagnetism.

Unit-V: Quantum mechanics

Introduction to quantum physics, black body radiation, photon concept, de Broglie hypothesis, wave-particle duality, verification of matter waves, wave function and its properties, Phase & group velocity, Uncertainty principle, Schrodinger's equation and its application to particle in 1-D box.

Books for Reference

1. Lengyel, Introduction to Laser Physics, Wiley Interscience 1971.

2. E. Siegman, An Introduction to Laser and Masers, McGraw Hill 1971.

3. P. Malvino, "Electronic Principles", Tata McGraw-Hill, 1979.

4. H. V. Malmstadt, "Electronics for Scientists", New York : W. A. Benjamin, 1962.

5. Beiser, Perspectives in Modern Physics, McGraw Hill, 1969.

6. M.A. Preston and R.K. Bhaduri, Structure of the nucleus, Addison- Wesley, 1975.

7. M.K. Pal, Theory of Nuclear Structure, Affiliated East West Press, 1982.

8. S. H. Patil, Elements of Modern Physics, Tata McGraw Hill, 1989.

9. A.K. Ghatak and S. Loknathan, Quantum Mechanics, Theory and Applications, McMillan India, 1984.

Course Outcomes:

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

CO Number	Course Outcome
CO1	Know the fundamental principles of semiconductors
CO2	Get an notion about LASER
CO3	Acquire knowledge of Atomic and Nuclear physics and explore their technological applications in diverse fields.
CO4	Knowledge of propagation of electromagnetic energy through transmission lines and the design of propagation medium based on the requirements.
CO5	Gain basic knowledge of quantum mechanics and the origin of the Universe.

CO-PO & PSO Correlation

Course Name: Applied Physics								
Course Outcomes	**Program Outcomes**							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
CO1:	**2**	**2**		**1**				
CO2:	**1**	**1**	**1**		**1**			
CO3	**1**	**1**	**1**					
CO4	**1**	**1**	**1**	**1**				
CO5	**1**	**1**	**1**					

Note: 1.: Low 2.: Moderate 3.: High

Programme:	**B.Tech.**	**Semester :**	**I**
Name of the Course:	**Basic Electrical and Electronics Engineering**	**Course Code:**	**SOE-B-EE-23-103**
Credits :	**3**	**No of Hours :**	**3 Hrs Per Week**
Max Marks:	**75**		

Course Description:

The subject curriculum focuses on fundamentals of electrical and electronic circuits. It covers the DC and AC electrical circuit analysis, magnetic circuit analysis and description of basic electronics components and their applications.

Course Outcomes:

After completing the course, the students will be able to:

CO1	Ability to define and explain the meaning/function of charge, current, voltage, power
CO2	Understand the behavior of inductance (L) and capacitance (C) in AC circuit
CO3	Ability to write equations for a network and solve them analytically for different theorems.
CO4	Knowledge to analyze and solve simple electronic circuits
CO5	Knowledge to apply and identify in simple electric circuits in daily life appliances.

Course Contents:

UNIT-1: DC Electrical Circuit Analysis:

Voltage and current sources, dependent and independent sources, Source Conversion, Star-delta and delta-star conversions, Ohm's Law, Kirchhoff's Laws & their limitations, Nodal analysis, loop analysis and Mesh current methods, Superposition principle, Thevenin's and Norton's theorems, Maximum power transfer theorem.

UNIT-2: AC Circuits:

Single- phase AC Circuits: Single phase emf generation, average and effective values of sinusoids, R.M.S. value, form factor and peak factor of AC quantity, Concept of phasor diagram, Concept of Power factor, impedance and admittance, Active, reactive and apparent power, analysis of R-L, R- C, R-L-C series, parallel and series-parallel circuit and Resonance condition.

UNIT-3: Magnetic Circuits:

Basic definitions, magnetization characteristics of Ferro magnetic materials, self-inductance and mutual inductance, energy in linear magnetic systems, coils connected in series, AC excitation in magnetic circuits, magnetic field produced by current carrying conductor, Force on a current carrying conductor. Induced voltage, fundamental laws of electromagnetic Induction, direction of induced E.M.F.

UNIT-4: Semiconductor Diodes:

Introduction to semiconductor, Formation of P-N Junction, P-N Junction Diodes; Semiconductor Diodes, V-I Characteristics, Effect of Temperature on V-I Characteristics, Ideal Diode, Diode equation, Diode Resistance, Transition and Diffusion Capacitance. Light Emitting Diode, Zener Diode, Photodiode. Applications of Diodes.

UNIT-5: Transistors:

Transistor: Introduction, Construction, Types: npn and pnp, Current components. Transistor as amplifier, Transistor Characteristics. Digital logic fundamentals, Boolean Algebra, truth table, Logic Gates.

Text Books:

1. E. Hughes, Electrical Technology, ELBS, 1997.
2. B L Theraja, Electrical technology, Basic Electrical Engineering, Volume 1, S Chand.
3. Integrated Electronics: Analog & Digital Circuit Systems – Jacob Millman & Halkias, TMH.
4. Electronic Devices and Circuit Theory – Boylestad & Nashelsky

Reference Books:

1. Charles & Sadiku, Fundamentals of Electric circuits, TMH, Third Edition.
2. V. D. Toro, Basic Electrical Engineering, PHI, 2000.

CO-PO Correlation:

Course Name: Basic Electrical & Electronics Engineering								
Course Outcome	**Program Outcomes**							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
CO1	**2**	**2**	**2**			**2**		
CO2	**3**	**3**	**2**					
CO3	**3**	**3**	**3**					
CO4	**3**	**3**	**3**					
CO5	**2**	**2**	**2**		1	1		1

Note: 1: Low, 2: Moderate, 3: High

Programme:	B.Tech.	Semester:	I
Name of the Course:	Basic Computation Skills (C Programming)	Course Code:	SOE-B-CSE-23-104
Credits:	3	No of Hours :	3 Hrs/Week
Max Marks:	100		

Course Description:

This course offers lecture, laboratory, and case studies to impart teaching and learning to develop problem solving approaches to systematic represent identified problem into design using flowcharts, algorithms and pseudocode leading towards programming through systemic refinements. This course focus on fundamental concepts of elementary c programming including Arrays, Strings, Pointers, Functions, Structures, Unions, Enum, Storage classes, Dynamic memory allocation and File Handling.

Course Outcomes:

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

CO Number	Course Outcome
CO1	Understand the semantics and syntax of C programming language.
CO2	Analyze problem domain, formulate solution and implement it using C programming language.
CO3	Learn the syntax, semantics and language constructs to write efficient code using C.
CO4	Appreciate the importance and use of pointers and dynamic memory allocation.
CO5	Understand the impact of various solutions in the context of common life for sustainable development.

Syllabus:

Unit- 01: Fundamentals of C Programming

Algorithm & Flowchart: Three construct of Algorithm and flowchart: Sequence, Decision (Selection) and Repetition.

Character Set, Identifiers and keywords, Data types, Constants, Variables. Operators: Arithmetic, Relational and logical, Assignment, Unary, Conditional, Bitwise, Comma, other operators. Expression, statements, Library Functions, Preprocessor. Data Input and Output: getchar ( ), putchar ( ), scanf ( ), printf ( ), gets ( ), puts ( ), Structure of C program .

Unit- 02: Control Structures

Branching: If statement, If-else Statement, Multiway decision. Looping: while do-while, for. Nested control structure: Switch statement, Continue statement Break statement, goto statement.

Unit- 03: Functions and Parameters

Function: Introduction of Function, Function Main, defining a Function, accessing a Function, Function Prototype, Passing Arguments to a Function, Recursion. Storage Classes: Auto, Extern, Static, Register

Unit- 04: Arrays, String, Structure and Union

Array: Concepts, Declaration, Definition, Accessing array element, One-dimensional and Multidimensional array. String: Basic of String, Array of String, Functions in String.h Structure: Declaration, Initialization, structure within structure, Operation on structures, Array of Structure. Union: Definition, Difference between structure and union, Operations on a union

Unit- 05: Pointer and File

Pointer: Introduction, Definition and uses of Pointers, Address Operator, Pointer Variables, Dereferencing Pointer, Void Pointer, Pointer Arithmetic, Pointers to Pointers, Pointers and Array, Passing Arrays to Function, Pointers and Function, Pointers and two-dimensional Array, Array of Pointers, Dynamic Memory Allocation.

Files: Types of Files, File operation- Opening, Closing, Creating, Reading, Processing File.

Text Books:

- Yashavant Kanetkar, Let Us C: Authentic guide to C programming language, 19th Edition, Paperback 2022.
- E Balagurusamy, Programming in ANSI C, 8/e, McGraw-Hill India, 2019.
- Herbert Schildt, C: The Complete Reference, Fourth Edition, McGraw Hill Education, 2017.

References Books:

- B. Chaudhuri, Flowchart and Algorithm Basics: The Art of Programming, Mercury Learning & Information, 2020.
- Brajendra Singh, Jignesh Rawal, Pathik Rawal, Algorithm, Pseudocode and Flowchart: Learn Algorithm in Simple Steps,BeITReady, 2015·
- Laxmi Publications,The Art of Programming Through Flowcharts & Algorithms (First edition), Anil Bikas Chaudhuri, 2018.
- Kamthane, Ashok N., "Programming in C," 2/e. Pearson Education India, 2011.
- Sumitabha Das, "Computer Fundamental and C Programming," McGraw Hill Education, 1st edition.

CO-PO Correlation

	Program Outcomes							
Course Outcomes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
CO1:	**1**							
CO2:	**2**	**2**						
CO3:	**3**							
CO4:		**2**	**1**			**1**		
CO5:								**2**

Note: 1.: Low 2.: Moderate 3.: High

Programme:	B. Tech.	Semester :	I
Name of the Course:	**Engineering Graphics**	**Course Code:**	**SOE–B–ME-23-105**
Credits:	**4**	**No. of Hours:**	**4 hrs/week**
Max Marks:	**100**		

Course Description:

The course in Engineering Graphics is aimed at inculcating the ability of imagination in the mind of the students, to improve their visualization skills and logical thinking, to build in them a capability of communicating through this unique language of engineers by learning conventional graphical techniques as well as computer–aided drawing skills, to develop interpretation competencies of professional drawings, to transfer an abstract object onto the paper through drawing.

Course Outcomes:

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

CO Number	Course Outcome
CO1	Gain knowledge of Fundamentals of Engineering drawing.
CO2	Draw orthographic projections of lines, planes, and solids
CO3	Draw sections of solids and development of lateral surfaces including cylinders, cones, prisms, and pyramids.
CO4	Construct isometric scale, isometric projections, and views.
CO5	Draw projections of lines, planes, solids, and sections of solids including cylinders, cones, prisms, and pyramids using AutoCAD.

Syllabus:

Unit 1: Fundamentals of Engineering Drawing

Introduction to Drawing instruments & their uses, Engineering Lettering, Drawing sheet – Layout of drawing sheets, sizes of drawing sheets, Line – Types of lines and their applications in Engineering Drawing, Dimensioning. Introduction to scales
Engineering Curves: Conic sections and Basic construction of Cycloid, Involutes
Introduction to Computer–Aided Drafting (CAD):

Basic Drawing and Editing Commands, Dimensioning, Knowledge of setting up layers, Text. (To be covered with CAD package)

Unit 2: Projections of Points

Introduction to projections, Projection of points in all four quadrants. Projections of Lines Projections of lines (by First angle projection method only) parallel to one or both the reference planes, perpendicular to one of the reference planes. Projections of lines inclined to either horizontal plane or vertical plane and both the planes i.e., oblique lines. Trace of a line.

Unit 3: **Projection of Planes**

Projections of planes (by First angle projection method only) inclined to either horizontal plane or vertical plane and both the planes i.e., Oblique planes. Use change of positions or Auxiliary plane method.

Projection of Solids

Introduction to Solids, Types of Solids, Projection of Solids inclined to one and both the reference plane. Use change of positions or Auxiliary plane method.

Unit 4:

Section of Solids

Projections of geometric solids cut by plane perpendicular to at least one reference plane (Exclude Curved Section Plane).

Development of Surfaces

Methods of development of lateral surfaces of various solids, development of surfaces of cut solids.

Unit 5:

Orthographic Projection

Orthographic projections of given pictorial view by First angle method of projections only. Drawing of orthographic projections using AutoCAD (only for Term Work)

Isometric Projection

Introduction, Isometric scale, Isometric projection and Isometric views of solids and objects.

Text books:

1. Engineering Drawing, Plane and Solid Geometry by N. D. Bhatt and V.M. Panchal– Charotor Publication House, Anand, Gujarat, India.

2. Engineering Drawing with an Introduction to Auto CAD by Dhaanjay A. Jolhe– Tata McGraw – Hill Publishing Co. Ltd, New Delhi, India.

3. Engineering Drawing by Basant Agrawal and C.M. Agrawal–Tata McGraw– Hill Publishing Co. Ltd, New Delhi, India.

4. Engineering Drawing by K. L. Narayana and P.L. Kannaiah–SciTech Publications (India) Pvt. Ltd. Chennai.

5. Engineering Graphics for Degree by K. C. John–PHI Learning Pvt. Ltd. New Delhi.

6. Engineering Graphics by A. R. Bapat–Allied Publications, New Delhi, India.

7. Engineering Drawing by D. N. Johle– S. Chand and Company Ltd., New Delhi, India.

Reference Books:

1. Fundamental of Engineering Drawing by W. J. Luzadder– Prentice Hall of India.

2. Machine Drawing Include Auto CAD Supplements by Basudeb Bhattacharyya–Oxford University Press, India.

3. Graphic Science by French and Vierck– Mc– Graw Hill international

4. Engineering Drawing and Graphics by K. Venugopal– New Age Publication.

5. Engineering Drawing by R. K. Dhawan– S. Chand and Company Ltd., New Delhi, India.

6. Engineering Drawing by N. B. Shaha and B. C. Rana– Person Education.

7. Engineering Drawing and Design by C. Jensen, J. D. Helsel and D. R. Short– Tata McGraw–hill Publishing Co. Ltd, New Delhi, India.

8. Engineering Drawing and Graphics by using Auto CAD by T. Jeyaproovan– Vikas Publication house, Pvt. Ltd. New Delhi, India.

9. Engineering Graphics by M. L. Dhabhade– Association of technical Authors, Pune India.

10. Engineering Drawing by B. V. R. Gupta, M. Raja Roy– I. K. International Pvt. Ltd, India.

CO–PO Correlation

Course Outcome	Program Outcome							
	1	2	3	4	5	6	7	8
CO1	3	3	1	2		2		
CO2	3	3	1	2		2		
CO3	3	3	1	2		2		
CO4	3	3	1	2		2		
CO5	3	3	1	2		2		

Note: 1: Low 2: Moderate 3: High

Programme:	B.Tech.	Semester:	I
Name of the Course:	Communicative English	Course Code:	SOS-B-HUM-23-106
Credits:	2	No of Hours:	2 Hrs./ Week
Max Marks:	50	L-T-P:	2-0-0

Course Description:

This course is formulated to give students a perfect view of communication its scope and importance in business world. It is designed to study principles, elements, and practices of effective business communication. The course focuses on approaches for planning, creating, and transmitting business information within a variety of business situations found in the global perspective. This provides opportunities for improving academic and workplace language proficiency also.

Course Outcomes: After completion of the course students will be able to:

CO Number	Course Outcome
CO1	Know the various elements, media and principles of effective business communication.
CO2	Demonstrate effective business drafting for the various situations.
CO3	Achieve good presentation skills.
CO4	Analyze a problem and devise a solution in a group.
CO5	Communicate business ideas in a public forum and interview.

Syllabus:

Unit I: Introduction to Business Communication & Listening Skill

Basic Forms of Communication, Process of Communication, Principles of Effective Business Communication, 7Cs of Communication, Types of Communication, Barriers of Communication, Verbal & Non-Verbal Communication, Listening, Types of Listening, Barriers to Listening, Overcoming Listening Barriers.

Unit II: Business Letter Writing & Resume Writing

Need, Functions and Kinds of letters, Structure of Letter Writing and Presentation Styles, Quotation Letters, Complaints and Adjustment letters, Sales letters. Resume / CV writing, Report Writing.

Unit III: Presentation Skill

Characteristics of Presentation, Planning, structuring and Delivery of presentation, use of visual aids

Unit IV: Group Communication

Group Communication, Group discussion, Methodology of Group Discussions, Guidelines of Group Discussion, Role Function in Group Discussions, Types of Non- functional Behaviour, Dealing with Abstract topics; Meetings: notice, agenda & minutes of Meeting.

Unit V: Personal Interview

Introduction to Interviews, Types of interviews, Interview questions, Success in an interview, Important non-verbal aspect, Interview- Dos and Don'ts.

Text Books:

1. Meenakshi Raman and Prakash Singh, Business Communication, Oxford University Press.
2. R. C. Sharma and Krishna Mohan, Business Correspondence and Report Writing, Tata McGraw Hill.

Reference Books:

1. A. Bovee, Thill, J. Business Communication Today, Pearson publication, New Delhi.
2. Sanjay Kumar and Pushplata, Communication Skills, New Delhi: Oxford University Press, 2011

CO-PO Correlation

	Course Name: Communicative English							
	Programme Outcomes							
Course Outcomes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
CO1	**1**				**2**	**1**		
CO2	**2**	**3**			**3**	**1**		
CO3			**2**		**3**	**2**		**1**
CO4	**2**			**1**			**2**	
CO5		**2**	**2**		**2**	**2**	**2**	**1**

Note:1: Low 2.: Moderate 3: High

Program:	B.Tech.	Semester:	1st
Name of the Course:	Environmental Science	Course Code:	SOE-B-CE-23-107
Credits:	2	No of Hours :	2 Hours/week
Max Marks:	50		

Course Description:

The course will empower the undergraduate students by helping them to Gain in-depth knowledge of natural processes and resources that sustain life. Develop critical thinking for shaping strategies for environmental protection, conservation of biodiversity, environmental equity, and sustainable development. Acquire values and attitudes towards understanding complex environmental-economic-social challenges and active participation in solving current environmental problems and preventing future ones. Adopt sustainability as a practice in life, society, and industry.

Course Outcomes:

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

CO Number	Course Outcome
CO1	Gain in-depth knowledge of natural processes and resources that sustain life.
CO2	Develop critical thinking for shaping strategies for environmental protection, conservation of biodiversity, environmental equity, and sustainable development.
CO3	Adopt sustainability as a practice in life, society, and industry.

Syllabus:

Unit-I: Ecology, Environment & Natural Resources

Ecology, Environment & Ecosystem, Bio-diversity: Concept, Importance, and Threats & Conservation, Environmental degradation and its causes; Natural resources, Renewable and Non-renewable Resources & associated problems; Green Revolution & Organic farming, Population Forecasting.

Unit-II: Water and Wastewater Pollution

Point & non-point source; Water pollutants & types, sources, and effects; Water Quality measurement, Coagulant, Dissolved Oxygen, BOD & COD; Water & Wastewater Management, Primary, Secondary & Tertiary stages: Objective, Process overview and Equipment used. Solid Waste Management: Objective, Process & Disposal Techniques.

Unit-III: Unit III: Air Pollution

Classification of air pollutants, sources and effects of CO, SOx, NOx, Hydrocarbons, PM, Acid Rain, Ozone, Photochemical Smog & Peroxy Actyl Nitrate (PAN). Earth's energy balance, Green House Effect, Global warming; Lapse rate & Temperature Inversion; Ambient Air Quality Standard; Air pollution Control Techniques for Gaseous and Particulate air pollutants & equipment used.

Unit-IV: Sustainability and Technology-Driven Solution

Application of Artificial Intelligence and Machine Learning in Agriculture, Smart Farming Technology: Controlled Environment Farming, Hydroponics, Aeroponics; Chemical farming vs Sustainable Natural Farming, Bio-Fertilizer; Develop a smart sustainable technology-driven Project.

Text Books:

1. Joseph, K. & Nagendran, R., "Essentials of Environmental Studies", 1st Edition, Pearson Education, 2004.

1. Dey, A. K., "Environmental Chemistry" New Age International Publishers.

2. Srivastava, S., "Environment & Ecology" S.K. Kataria & Sons, New Delhi.

Reference Books:

1. Keerthinarayana & Yesudian, D., "Environmental Science and Engineering", 1st Edition, Hi-Tech publications, 2004.

2. Bharucha, E., "A Text Book for Environmental Studies", Text Book of University Grants Commission, 2004.

3. Peavy, H.S. et. al., "Environmental Engineering", New York: Mc Graw Hill, 1987.

4. Metcalf & Eddy, "Wastewater Engineering: Treatment and Reuse", New Delhi, Tata McGraw Hill, 2003.

5. Principles of Environmental Science Inquiry & Applications by W.P. Cunningham & Mary Ann Cunningham (Tata Mc Graw Hill Publishing Company Ltd.).

CO-PO Correlation

	Program Outcomes							
Course Outcomes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
CO1:		1	1				2	2
CO2:	2		1					
CO3:	1	2			1		1	3

Note: 1.: Low 2.: Moderate 3.: High

Programme:	**B.Tech.**	**Semester :**	**I**
Name of the Course:	**Basic Electrical and Electronics Engineering lab**	**Course Code:**	**SOE-B-EE-23-108**
Credits:	**1**	**No. of Hours:**	**2**
Max Marks:	**50**		

Course Description:

The response of Electrical Circuit can be verified practically by applying different theorems and fundamental techniques. The students will become sure that the theoretical tricks which they have learned from books are true. The students will become competent in the field of circuit analysis

Course Outcomes:

CO	**After completing the course, the students will be able to:**
CO1	Understand the basic circuit concepts and verification of network theorems.
CO2	Understand the application of different tools and electrical meters
CO3	The knowledge about the component of electronic and electrical circuit.

List of Experiments:

1. Study of Electrical Safety precautions.
2. Study of CRO, DSO, Function Generator, Multi-meter, Power supply.
3. To verify KCL and KVL.
4. To verify Thevenin's Theorems & Norton's Theorems.
5. To verify Superposition Theorem.
6. Determine Resonant Frequency of series R-L-C Circuit.
7. To measure Current, Power, Voltage and Power Factor of series R-L-C Circuit.
8. To measure the Armature and Field resistance using Ohm’s law.
9. Determine the V-I Characteristics of PN junction Diode.
10. Design and Study the characteristics of Common Emitter configuration of NPN transistor.
11. Design and Study the characteristics of Common Collector configuration of NPN transistor.
12. Study different Logic gates and verify their truth table.

Reference Books & Manuals:

1. Basic Practical in Electrical Engineering: P. S. Dhogal (Author), Standard Publishers Distributors (2004).

Equipment's/Machine/Software required: Different types of meters, resistors, DC supply, variance, transformers, rheostat. Some experiments can be done by MATLAB.

CO-PO & PSO Correlation:

Course Name : Basic Electrical & Electronics Lab Code: SOE-B-FY107								
Course Outcomes	**Program Outcomes**							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
CO1	**2**	**2**	**2**			**2**		
CO2	**3**	**3**	**2**					
CO3	**3**	**3**	**3**					

Note :1: Low, 2: Moderate, 3: High

OP JINDAL UNIVERSITY

OP Jindal Knowledge Park, Punjipathra, Raigarh-496109

Department of Electrical Engineering

Programme :	**B.Tech.**	**Semester :**	**I**
Name of the Course:	**Basic Computation Skills (C Programming) Lab**	**Course Code:**	**SOE-B-CSE-23-109**
Credits :	**1**	**No of Hours :**	**2 Hrs/Week**
Max Marks :	**50**		

Course Descriptions:

This course offers lecture, laboratory, and case studies to impart teaching and learning to develop problem solving approaches to systematic represent identified problem into design using flowcharts, algorithms and pseudocode leading towards programming through systemic refinements. This course focus on fundamental concepts of elementary c programming including Arrays, Strings, Pointers, Functions, Structures, Unions, Enum, Storage classes, Dynamic memory allocation and File Handling

Course Outcomes:

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

CO Number	Course Outcome
CO1	Write, debug, resolve syntax & logical errors and execute the programs.
CO2	Make the comparisons and limitations of the various programming constructs and choose the right one for the task in hand.
CO3	Use the concepts of functions and dynamic memory allocations for better and cleaner programs
CO4	Develop programs using various features like control statements, Functions, Arrays Strings, File, Pointer, Structure etc.

The following concepts will be covered in the lab:

- Structure of c program, character set, identifiers and keywords, data types, Constants, variables and development environment.
- Operator and expressions, decision making (if , if else , nested if else , switch case ,Break and continue etc.)
- Iterative construct (for, while, do-while), Arrays and Strings.
- Functions, User defined functions, build-in/library functions, Recursion, pointers, header files.
- Structures, unions, enum, Storage classes, dynamic memory allocation, file management.

Text Books:

- Herbert Schildt, C: The Complete Reference, Fourth Edition, McGraw Hill Education, 2017.
- E Balagurusamy, Programming in ANSI C, 8/e, McGraw-Hill India, 2019.
- A. B. Chaudhuri, Flowchart and Algorithm Basics: The Art of Programming, Mercury Learning & Information, 2020.

CO-PO&PSO Correlation

Course Name: Programming with C												
	Program Outcomes								PSOs			
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3	4
CO1:	1								3			
CO2:	2	2							3			
CO3:	3								2			
CO4:		2	1			1					1	2

- **Note:**1: Low 2.: Moderate 3: High

OP JINDAL UNIVERSITY

OP Jindal Knowledge Park, Punjipathra, Raigarh-496109

Department of Electrical Engineering

Electrical Engineering

(Detailed Syllabus of 2nd Semester)

L: Lecture, T: Tutorial, P: Practical, C: Credit

SEMESTER II

S. N.	Subject Code	Types Of Course	SUBJECT	Periods per week			Scheme of Examination and Marks				Credit (L+(T+P)/2)
				L	T	P	PRE		ESE	Total Marks	
							Mid Sem	TA			
1	SOS-B-Math-23-201	CC	Engineering Mathematics-II	3	0	0	30	20	50	100	3
2	SOE-B-CSE-23-202	CC	Data Structure	3	0	0	30	20	50	100	3
3	SOE-B-EE-23-203	CC	Introduction to material science	3	0	0	30	20	50	100	3
4	SOE-B-EE-23-204	CC	Engineering workshop	0	0	4	15	10	25	50	2
5	SOE-B-CSE-23-205	CC	Python Programming	2	1	0	15	10	25	50	2
6	SOS-B-EE-23-206	GE	Indian Knowledge System (IKS)	3	0	0	30	20	50	100	3
7	SOM-B-MBA-23-207	SEC	Problem Solving & Design Thinking	3	0	0	30	20	50	100	3
8	SOE-B-CSE-23-208	CC	Data Structure Lab	0	0	2	0	30	20	50	1
9	SOE-B-CSE-23-209	CC	Python Programming Lab	0	0	2	0	30	20	50	1
TOTAL				17	01	08	180	180	340	700	21

*** End Semester Examination**

****Teacher Assessment**

***** Progress Review Examination**

Programme:	B.Tech.	Semester :	II
Name of the Course:	Engineering Mathematics-II (Calculus and Differential Equation)	Course Code:	SOS-B-MAT-23-201
Credits :	3	No of Hours :	3 Hours/week
Max Marks:	100		

Course Description:

Calculus is the examination of continuous change and the rates change occurs. It handles the finding and properties of integrals and derivatives of functions. This is an introductory course consisting of Differential calculus, Partial derivatives, Integral Calculus (Multiple Integrals) and Ordinary Differential Equations

Course Outcomes:

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

CO Number	Course Outcome
CO1	apply notion of continuity and differentiability to functions of single and several variables
CO2	apply partial differentiation and find the extremum by using Lagrange multipliers
CO3	apply the notion of a definite integral from a one-dimensional to an n-dimensional space, and be able to describe and evaluate double and triple integrals.
CO4	familiar with the methods of solving ordinary differential equations.
CO5	learn the technique to solve higher order differential equation.

Syllabus:

Unit-I:

Review of single variable calculus: Review of Limit, continuity and differentiability of single variable functions, Indeterminate forms and L'Hospital rule, Mean Value theorem, Maclaurin and Taylor series expansions of functions of one variable.

Unit-II:

Functions of Several variables: Functions of several variables, Limits and continuity, Partial derivatives and differentiability, Linearization and differentials, Chain rule, Gradient vector, Tangent planes, Directional derivatives, Extreme values and saddle points, Lagrange multipliers, Taylor's formula, Partial derivatives with constrained variables.

Unit-III:

Multiple integral: Multiple integral, Double integrals, Change of order of integration, Area and volume by double integral, Double integrals in polar form, Triple integrals in rectangular coordinates, Triple integrals in cylindrical and spherical coordinates, Substitutions in multiple integrals.

Unit-IV:

Ordinary Differential Equations: first order differential equations, variable separation method, Homogeneous Method, exact differential equations; reducible to exact form; Linear equation, Equation reducible to linear differential equation.

Unit-V:

Linear differential equations of higher order with constant coefficients, Method of variation of parameters, Cauchy's and Euler's equations

Text Book

- M. D. Weir and J. Hass, "Thomas' Calculus," 12th edition, Pearson.
- G. B. Thomas and R. L. Finney, Calculus and Analytic Geometry, 9th Ed, Pearson.
- B. S. Grewal, Higher "Engineering Mathematics" Khanna Publishers.
- Erwin Kreyszig "Advanced Engineering Mathematics", John Wiley & Sons.

Reference Book

- Huges-Hallett et al, Calculus: Single and Multivariable, 6th edition, John-Wiley & Sons (USA).
- J. Stewart, Multivariable Calculus, Hybrid Edition.
- Edwards and Penney, Multivariable Calculus with matrices, 6th edition.
- Tom M. Apostol, Calculus Vol. II, 2nd edition, Wiley.
- G. F. Simmons and S. G. Krantz, Differential Equations: Theory, Technique and Practice, Tata McGraw-Hill

CO-PO Correlation:

Course Name: Engineering Mathematics-II (Calculus and Differential Equation)								
Course Outcome	**Program Outcomes**							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
CO1	**1**	**2**	**1**					
CO2	**1**	**1**	**1**					
CO3	**1**	**1**						
CO4	**1**	**2**	**1**					
CO5	**1**	**1**	**1**					

Note: 1: Low, 2: Moderate, 3: High

Programme:	B.Tech.	Semester :	II
Name of the Course:	Data Structures	Course Code:	SOE-B-CSE-23-202
Credits :	3	No of Hours :	3 Hours/week
Max Marks:	100		

Course Description:

This course emphasizes on logical structure of data, it's physical representation and techniques for program development and debugging. In this course, students will also learn how to select best suited data structure to solve a particular problem. This course is also about the computational complexities of different data structures.

Course Outcomes:

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

CO Number	Course Outcome
CO1	To develop proficiency in the specification, representation, and implementation of Data Types and Data Structures.
CO2	To be able to carry out the analysis of Time and Space Complexity of different ADT.
CO3	Ability to assess efficiency trade-offs among different data structure implementations or combinations
CO4	To learn how the choice of data structures and algorithm design methods impacts the performance of programs.
CO5	Understand the data structure and its applications in context of the real world scenarios.

Syllabus:

Unit-I: Introduction

Introduction: Basic Terminology, Elementary Data Organization, Algorithm, Efficiency of an Algorithm, Time and Space Complexity, Asymptotic notations: Big-Oh; Abstract Data Types (ADT): Time-Space trade-off, - Average, best and worst case analysis, Simple recurrence relations and use in algorithms, Sorting and Searching algorithms.

Unit-II: Linear Data Structure

Arrays: Definition, Single and Multidimensional Arrays, Representation of Arrays: Row Major Order, and Column Major Order, Application of arrays. Linked lists: Array Implementation and Dynamic Implementation of Singly Linked Lists, Doubly Linked List, Circularly Linked List, Operations on a Linked List. Insertion, Deletion, Traversal. Stacks: Abstract Data Type, Primitive Stack operations: Push & Pop, Array and Linked Implementation of Stack in C, Application of stack. Queues: Array and Linked Representation and Implementation of Queues, Operations on Queue: Create, Add, Delete, Full and Empty; Circular Queues, D-queues and Priority Queues.

Unit-III: Non-Linear Data Structure:

Trees: Basic Terminology, Binary Trees, Binary Tree Representation, Algebraic Expressions, Complete Binary Tree, Extended Binary Trees, Array and Linked Representation of Binary Trees, Traversing Binary Trees, Threaded Binary Trees, Traversing Threaded Binary Trees, Huffman

Algorithm, Binary Search Tree (BST), Insertion and Deletion in BST, Path Length, AVL Trees, B-trees.

Unit-IV: Nonlinear Data Structure: Graphs

Terminology & Representations, Graphs & Multi-Graphs, Directed Graphs, Sequential Representations of Graphs, Adjacency Matrices, Traversal, Connected Component and Spanning Trees, Minimum Cost Spanning Trees

Unit–V: Hashing

Searching and Hashing: Sequential Search, Binary Search, Comparison and Analysis, Hash Table, Hash Functions, Collision Resolution Strategies, Hash Table Implementation.

Text books:

- Alfred. V. Aho, John. E. Hopcroft, Jeffrey.D. Ullman, "Data Structures and Algorithms", Addison-Wesley Publications.,1985.
- Horowitz and Sahani, “Fundamentals of data Structures”, Galgotia Publication Pvt. Ltd., N Delhi.

Reference books:

- Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education, Asia.1994.
- Jean-Paul Tremblay, Paul. G. Sorenson, "An Introduction to Data Structures with Applications", Tata McGraw Hill second edition, 1991.
- Thomas. H. Cormen, Charles. E. Leiserson, Ronald. L. Rivest, "Introduction to Algorithms", PHI 1998.
- Lipschutz; Data structure (Schaum); TMH
- R. Kruse et al, “Data Structures and Program Design in C”, Pearson Education Asia, Delhi-2002.

CO-PO & PSO Correlation

	Program Outcomes							
Course Outcomes	1	2	3	4	5	6	7	8
CO1:	3	3	2	1	3			
CO2:	2	2	2	1	3			
CO3:	3	3	2	2	3			
CO4:	2	2	1	1	3			
CO5:	3	3	2	2	3			

Note: 1.: Low 2.: Moderate 3.: High

Programme:	B.Tech.	Semester :	II
Name of the Course:	Engineering workshop	Course Code:	SOE-B-EE-23-204
Credits:	2	No. of Hours:	4
Max Marks:	50		

Course Description:

The course deals with the study of workshop practice which includes safety precautions, identification of tools used in workshop and components. Further it includes identification of different parts of machines, materials and tools.

Syllabus:

List of Experiments (Electrical Engineering):

1. Study of Electrical safety precautions and Study of identification of tools.
2. Identification and testing of various Electrical and Electronics components. (Resistor, Inductor, Capacitor, Diode, Transistor (PNP & NPN), Transformer, Breadboard)
3. To calculate the value of resistance using colour coding.
4. To study and perform different types of house wiring.
5. To study the different parts of Electric Motor & Transformer.
6. Design and fabrication of DC Power supply.

List of Experiments (Mechanical Engineering):

7. Study of brick masonry bonds.
8. Concrete preparation and workability test.
9. To prepare a job on lathe with straight or plain turning, facing & chamfering operations.
10. To prepare a job on lathe with step turning, knurling & grooving operations.
11. To prepare a T-Lap joint by using carpentry tools.
12. To Prepare Cross-Lap joint by using carpentry tools.
13. To prepare a Butt-Joint with the help of electric arc welding.
14. To Prepare a Lap-Joint with the help of electric arc welding.

Text Book:

1. Practical in Electrical Engineering, “Dr N. K. Jain Dhanpat Rai & Sons”.
2. Electric Wiring, “Mr. S. Samaddar New Central Book Agency (P) Ltd., Calcutta.”
3. Chapman, W.A.J. and Arnold E., “Workshop Technology” Vol. I & III, Viva Low price student Edition, 1998.

Reference Books:

1. Chaudhary, Hajra, "Elements of Workshop Technology" Media Promoters & Publishers, 1997.
2. Raghuwanshi, B.S., "Workshop Technology" Vol -I &II, Dhanpat Rai and Sons 1998.

Course Outcomes:

CO	After completing the course, the students will be able to:
CO1	Identify and understand the importance of various electrical and electronics components and tools.
CO2	To acquire measuring skills.
CO3	Understand basic construction and operation of various laboratory equipment.
CO4	Understand modern manufacturing operations, including their capabilities, limitations, and how to design economically.
CO5	Learn how to analyze products and be able to improve their manufacturability and make the cost-effectively

CO-PO & PSO Correlation:

Course Name: Workshop Practice				Code: SOE-B-FY208				
Course Outcome	Program Outcome							
	1	2	3	4	5	6	7	8
CO1	3	3	1			1		
CO2	2	2	2	1	1	1		
CO3	1	1	1	1	1	1		
CO4	2		2		1			2
CO5			2		2			2

Programme:	**B.Tech.**	**Semester:**	**II**
Name of the Course:	**Python Programming**	**Course Code:**	**SOE-B-CSE-23-205**
Credits:	**2**	**No of Hours:**	**2 Hrs./ Week**
Max Marks:	**50**		

Course Description:

Python is a next generation multi-purpose programming language that allows different users to create applications of various domains. Students will be able to learn primary fundamentals of python programming and the potential of python is to achieve modern computing requirements.

Course Outcomes:

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

CO Number	Course Outcome
CO1	Apply python for problem solving
CO2	Understand the concept of decision and loop control.
CO3	Perform operations with basic data types.
CO4	Handle the file and exceptions.
CO5	Understand the concepts of python classes and packages.

Syllabus:

Unit-I:

Introduction: History, Variables, Keywords, Basic Operators, Naming Conventions, Understanding python blocks. Data Types, Declaring and using Numeric data types: int, float etc., Executing code from the Command Line.

Unit-II:

Flow Control Conditional blocks: if, else, simple for loops, for loop using ranges, string, list and dictionaries. while loops, loop manipulation using pass, continue, break and else.

Unit-III:

Complex data types: Using string data type and string operations, Defining list and list slicing, Use of tuple data type. String, List and Dictionary, Manipulations Building blocks of python programs, string

manipulation methods, List manipulation. Dictionary manipulation, Programming using string, list and dictionary in-built functions. Functions.

Unit-IV:

Exceptional Handling: Errors, Runtime Errors, The Exception Model, Exception Hierarchy, Handling Multiple Exceptions, raise, assert. File Operations: Reading files, Writing files in python, Understanding read functions, read(), readline(), readlines(). Understanding write functions, write() and writelines() Manipulating file pointer using seek Programming, using file operations.

Unit-V:

Classes in Python, Principles of Object Orientation, Creating Classes, Instance Methods, File Organization, Special Methods, Class Variables, Inheritance, Polymorphism, Packages: Simple programs using the built-in functions of packages matplotlib, numpy, pandas etc.

Text Books:

- Wesley J. Chun, "Core Python Applications Programming".
- Charles Dierbach, "Introduction to Computer Science using Python".

Reference Books:

1. Mark Lutz, "Learning Python", 5th edition, O'reilly Publication
2. John Zelle, "Python Programming: An Introduction to Computer Science", Second edition, Course Technology Cengage Learning Publications.

CO-PO & PSO Correlation

Course Outcomes	Course Name: Python Programming Program Outcomes							
	1	2	3	4	5	6	7	8
CO1	3		2		3			
CO2			2		3			
CO3	2			2	3			
CO4	3			2	3			
CO5				2	3			

Note: 1.: Low 2.: Moderate 3.: High

Programme:	B.Tech.	Semester:	II
Name of the Course:	Indian Knowledge System	Course Code:	SOS-B-HUM-23-206
Credits:	3	No of Hours:	3 Hrs./ Week
Max Marks:	100		

COURSE DESCRIPTION:

India has a rich tradition of intellectual inquiry and textual heritage that goes back several thousands of years. India was advanced in knowledge systems, traditions, and practices since antiquity. The whole range of knowledge systems is multifarious, from the Vedas, and Upanishads to scriptural, philosophical, scientific, technological and artistic sources. The disciplines and domains of knowledge include logic, philosophy, language, technology and crafts, polity, economics and governance, ethics and sociological orders, architecture and engineering, pure sciences, earth sciences, bio sciences, poetics and aesthetics, law and justice, grammar, mathematics and astronomy, metrics, agriculture, mining, metallurgy, trade and commerce, Ayurveda and Yoga, medicine and life sciences, geography, military science, weaponry, ship building, navigation and maritime traditions, biology and veterinary science, etc. The major knowledge tradition prescribes 14 Vidyas- theoretical domains – and 64 Kalas - crafts, skill sets and arts – that are useful in day-to-day living.

COURSE OUTCOMES:

After Completion of the course Students will be able to:

CO Number	Course Outcome
CO1	Understand the rich heritage of society, state and polity in ancient India
CO2	Acquire knowledge about Indian literature, culture, tradition and practices
CO3	Inculcate an understanding of Indian religion, philosophy, and practices
CO4	Understand, analyze and apply the ancient science, management and Indian knowledge system.
CO5	Acquire knowledge of Indian cultural heritage and performing arts

COURSE CONTENT:

UNIT-I: SOCIETY, STATE AND POLITY IN INDIA

State in Ancient India: Evolutionary Theory, Force Theory, Mystical Theory Contract Theory, Stages of State Formation in Ancient India, Kingship, Council of Ministers, Administration, Political Ideals in Ancient India, The Seven Limbs of the State, Society in Ancient India, Purusārtha, Varnāshrama System, Āshrama or the Stages of Life, Marriage, Four-class Classification, Slavery.

UNIT-II: INDIAN LITERATURE, CULTURE, TRADITION AND PRACTICES

Evolution of script and languages in India: Harappan Script and Brahmi Script. The Vedas, the Upanishads, the Ramayana and the Mahabharata, Puranas, Buddhist and Jain Literature in Pali, Prakrit and Sanskrit, Kautilya's Arthashastra, Famous Sanskrit Authors, Indian Languages & Literature, Persian and Urdu, Hindi Literature.

UNIT-III: INDIAN RELIGION, PHILOSOPHY, AND PRACTICES

Pre-Vedic and Vedic Religion, Buddhism, Jainism, Six System Indian Philosophy, Shankaracharya, Various Philosophical Doctrines, Other Heterodox Sects, Bhakti Movement, Sufi movement, Socio religious reform movement of 19th century, Modern religious practices.

UNIT-IV: SCIENCE, MANAGEMENT AND INDIAN KNOWLEDGE SYSTEM

Astronomy in India, Chemistry in India, Mathematics in India, Physics in India, Agriculture in India, Medicine in India, Metallurgy in India, Geography, Biology, Harappan Technologies, Water Management in India, Textile Technology in India, Writing Technology in India, India's Dominance up to Pre-colonial Times.

UNIT-V: CULTURAL HERITAGE AND PERFORMING ARTS

Engineering and Architecture in Ancient India, Sculptures, Seals, coins, Pottery, Puppetry, Dance, Music, Theatre, drama, Painting, Martial Arts Traditions, Fairs and Festivals, Indian Cinema, Indian's Cultural Contribution to the World.

TEXT BOOKS:

1. Cultural Heritage of India-Course Material, V. Sivaramakrishna (Ed.), Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014

2. Indian Art and Culture, S. Baliyan, Oxford University Press, India

3. Romila Thapar, Readings In Early Indian History Oxford University Press , India

REFERENCE BOOKS:

1. Modern Physics and Vedant, Swami Jitatmanand, Bharatiya Vidya Bhavan

2. The wave of Life, Fritz of Capra

3. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta

4. Yoga-darshanam with Vyasa Bhashya, GN Jha (Eng. Trans.) Ed. R N Jha, Vidyanidhi Prakasham, Delhi,2016

5. The Wonder that was India, Basham, A.L., (34th impression), New Delhi, Rupa & co

6. Aspects of Political Ideas and Institutions in Ancient India, Sharma, R.S., Delhi, Motilal Banarsidass,

CO-PO Correlation

Course Name: Indian Knowledge System								
	Program Outcomes							
Course Outcomes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
CO1:	**1**				**1**	**1**	**1**	**1**
CO2:				**2**	**1**			**1**
CO3:		**1**		**3**	**1**	**1**		**1**
CO4:	**1**	**1**		**2**	**1**	**1**	**3**	**1**
CO5:	**1**		**1**		**2**		**1**	**1**

Note: 1: Low 2.: Moderate 3: High

Program :	**B.Tech.**	**Semester :**	**02**
Name of the Course:	**Problem Solving & Design Thinking**	**Course Code:**	**SOM-B-MBA-23-207**
Credits :	**03**	**No of Hours :**	**3 Hrs/Week**
Max Marks :	**100**		

Course Description:

Design Thinking is about approaching things differently with a strong user orientation and fast iterations with multidisciplinary teams to solve complex problems. Design thinking adopts human empathy approach to identify problems or market needs, and then find solutions through creative brainstorming. Design Thinking is a structured method of developing and delivering products, services and experiences that address the unsaid human needs. The structured approach and the use of empathy to innovate, (re)solves many critical business problems and deliver products and services that delight customers. The importance is increasing with the growth of automation and digitalization, as it focuses on the actual human response to a product or service and identifies how to improve customer satisfaction. Design Thinking equips every professional to understand, solve complex business problems that are difficult to decipher. Professionals with applied skills would provide a positive impact on organizational top line and bottom line by developing low-cost working prototypes for various needs and test them in real time. Design-led Business takes advantage in building higher competitiveness with due focus on values and virtues governed by design thinking using the concepts of systematic vision, concern for human, believe in teamwork, innovative spirit and rational thinking. Design thinking creates a collaborative, interconnected work environment where decisions are made quickly through research, prototyping, and testing. This is a mental skill to produce customer-driven solutions as a business game-changer eventually, especially in times of crisis and transformations, otherwise.

Course Outcomes:

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

CO Number	Course Outcome
CO1	Understanding the human behaviour towards a product/process/service/system with a user's perspective.
CO2	Analyzing the users' requirement and define the problem.
CO3	Developing ideas and solutions through brainstorming and design iterations to solve the users' problem.
CO4	Applying the ideas to develop a prototype or solution based on the concept and analysis like a sample.
CO5	Evaluating the effectiveness of the prototype or solution through user-centric tests and soliciting satisfactory feedback.

Syllabus:

Unit-I:
Empathy

Introduction to Design Thinking as an Art; Need, Expectation and Appreciation; Design Thinking as a Process; Design Thinking vs Traditional Thinking; Design Thinking vs Critical Thinking; Creative Thinking vs Innovative Thinking; Principles of Design Thinking - Human-centricity, Empathy, Collaboration, Ideation, Iteration, Action; Approaches of Design Thinking (User-/Customer-Centric, Entrepreneurial, Innovative Mind-set); Building Innovation Culture; Design Thinking and Innovations for Managing Crisis and Stress; Design Thinking in Professional and Social Life; Examples on Successful Design Thinking.

Unit-II:
Define

Lead User Research; Exploring Pain Points; Product Innovation; Designing the problem statement; Sharp key-questions to explore solution; Pitch Design and Communication, Visualization, Storytelling; Plan to address the need (a solution); Confirm users towards the issue with basic trouble.

Unit-III:
Idate

Rules of ideation; Generation of ideas; Big ideas; Selection of a (Desirable-Feasible-Viable) idea; Visualization of idea; Brainstorming for Creative Solutions; Right Brain Thinking; Immersive Research: Tool and Techniques, Challenge Framing and Ideation Techniques; Design Thinking as an enabler; Journey mapping; Convergence and Divergence Design Tools, Narrowing of Ideas; and Storytelling for Impactful Delivery.

Unit-IV:
Prototype

Transforming ideas into Shapes – Prototypes, Representations; NPD Project; Collaborative Product Development; Miniature of Product; Managing Constraints; Innovation; Recommendation of Test Cycles; Achieving Product Integrity, Demonstration of Prototypes; Redesigning.

Unit-V:
Test

Testing of Success for the Prototype; Refine and Redesign a Prototype; Creating Primary Demand; Concept
Development; Product innovation; Confirm with the End-user; Cyclical and Iterative tracking and Testing.

Text Book:

- Change by Design, Tim Brown & Barry Katz, Harper Collins e-Books.

Reference Books:

- Hidden in Plain Sight by Jan Chipchase,
- The Moment of Clarity and Sense-making by Christian Madsbjerg,
- Design Thinking for Strategic Innovation by Idris Mootee.

CO-PO & PSO Correlation

Course Outcomes	Course Name: Problem Solving & Design Thinking							
	1	2	3	4	5	6	7	8
CO1	2	2	3	1	2	2	1	2
CO2	2	2	3	1	2	2	1	2
CO3	2	3	3	1	2	2	1	3
CO4	2	3	3	1	3	2	2	3
CO5	2	2	3	2	2	2	2	2

Note: 1.: Low 2.: Moderate 3.: High

Programme:	B.Tech.	Semester :	II
Name of the Course:	Data Structures Lab	Course Code:	SOE-B-CSE-23-208
Credits :	2	No of Hours :	2 Hours/week
Max Marks:	50		

Course Descriptions:

This lab provides hands-on experience in implementing and analyzing data structures and algorithms. Students gain proficiency in programming, problem-solving, and performance analysis. They design efficient data structures for real-world problems and develop collaboration and documentation skills. Prepares students for advanced data structure concepts.

Course Outcomes:

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

CO Number	Course Outcome
CO1	Ability to select the data structures that efficiently model the information in a problem.
CO2	Ability to assess efficiency trade-offs among different data structure implementations or combinations.
CO3	Implement and know the application of algorithms for sorting and pattern matching.
CO4	Design programs using a variety of data structures, including hash tables, binary and general tree structures, search trees, tries, heaps, graphs, and AVL-trees.

The following concepts will be covered in the lab:

- Time Complexity Analysis
- Linked List Operations
- Stack and Queue Implementations
- Binary Search Tree Operations
- AVL Tree Implementation
- Graph Traversal Algorithms
- Minimum Spanning Tree Algorithms
- Hash Table Implementation
- Huffman Encoding
- B-Tree Operations

Text Books :

- Data Structures Using C and C++ by Langsam, Tanenbaum, Prentice Hall India Learning Private Limited; 2 editions.
- Data Structures, Schaum's Outlines Series, by Seymour Lipschutz
- Fundamentals of Data Structures in C, by Sahni Horowitz, Publisher: Universities Press; Second edition.

OP JINDAL UNIVERSITY

OP Jindal Knowledge Park, Punjipathra, Raigarh-496109

Department of Electrical Engineering

CO-PO & PSO Correlation

Course Name: Data Structure Lab												
	Program Outcomes											
Course Outcomes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**				
CO1:	3	3	2	1								
CO2:	2	2	2	1								
CO3:	3	3	2	2								
CO4:	2	2	1	1								

Note: 1.: Low 2.: Moderate 3.: High

Programme :	**B.Tech.**	**Semester :**	**II**
Name of the Course:	**Python Programming Lab**	**Course Code:**	**SOE-B-CSE-23-209**
Credits:	**1**	**No of Hours :**	**2 Hrs./week**
Max Marks:	**50**		

Course Descriptions:

This course introduces the basic concepts of procedural and object-oriented programming using python programming language. This course also provides practical knowledge and hands-on experience in designing and implementing data structures. Activities covered include introduction to python programming language, datatypes, operators, loop structures, decision-making statements, fundamental data structures, functions, Classes and Objects, Constructor, File Handling, Exception Handling and Numpy module.

Course Outcomes:

After Completion of the course Students will be able to:

CO Number	Course Outcome
CO1	Distinguish between procedural, object-oriented and functional programming paradigm using python programming language.
CO2	Use basic data structures like list, string, tuple, set and dictionary in python.
CO3	Implement various functional programming concepts like class, functions, mutable and immutable data, and recursion.
CO4	Utilize standard Python packages to develop software applications.

The following concepts will be covered in the lab:

- Python environment by implement basic python programs.

- To implement simple statements and basic mathematical expressions.
- Use of existing operators with basic and advanced mathematical calculation using conditional statements.
- Looping-based problems such as prime number, Fibonacci and factorial programs, etc. by using looping conditions.
- Implementing real-time/technical applications using Lists, Tuples.
- Implement real life/ scientific/ technical problems using Sets and Dictionaries.
- Implement real life/ scientific/ technical problems using text strings and functions.
- Understand the data communication during compile/run time using the concept of file handling
- Understand the concept of exception handling in file handing.
- Explore various existing standard python libraries.

Text Books

· Allen B. Downey, "Think Python : How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.

· Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.

Reference Books

· Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.

· G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.

· John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data‘', Third Edition, MIT Press, 2021

CO-PO & PSO Correlation

Course Name: Programming Lab												
	Program Outcomes								PSOs			
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3	4
CO1:	3		3	2	2							
CO2:	3			2	2							2
CO3:	3			2	2							2
CO4				3	3							2

Note: 1: Low 2.: Moderate 3: High

Electrical Engineering

(Scheme of B. Tech 3rd Semester)

L: Lecture, T: Tutorial, P: Practical, C: Credit

SEMESTER III

S.No.	Subject Code	BOS	SUBJECT	Periods per week			Scheme of Examination and Marks				Credits L+(T+P)/2
				L	T	P	PRE**		ESE*	Total Marks	
							Mid Sem	TA			
1	SOE-B-EE301	EE	Electric circuits and network analysis	4	0	0	30	20	50	100	4
2	SOE-B-EE302	EE	Electronic Devices and circuits	3	0	0	30	20	50	100	3
3	SOE-B-EE303	EE	Electrical Machine-I	4	0	0	30	20	50	100	4
4	SOE-B-EE304	EE	Data Structure & Algorithms	3	0	0	30	20	50	100	3
5	SOE-B-MA303	Maths	Engineering Mathematics-III	3	0	0	30	20	50	100	3
6	SOE-B-EE305	EE	Electric circuits and network analysis lab	0	0	4	0	30	20	50	2
7	SOE-B-EE306	EE	Electronic Devices and circuits lab	0	0	4	0	30	20	50	2
8	SOE-B-EE307	EE	Electrical Machine-I lab	0	0	4	0	30	20	50	2
9	SOE-B-EE308	EE	Data Structure lab	0	0	4	0	30	20	50	2
Total				**17**	**0**	**16**	**150**	**220**	**330**	**700**	**25**

* End Semester Examination

**Teacher Assessment

*** Progress Review Examination

Programme:	**B.Tech.**	**Semester :**	**III**
Name of the Course:	**Electric Circuits and Network Analysis**	**Course Code:**	**SOE-B-EE301**
Credits:	**4**	**No. of Hours:**	**4 Hrs Per Week**
Max Marks:	**100**		

Course Description:

This course is an exploratory, first advance course in circuit theory primarily designed for students in Electrical Engineering discipline. The focus of the course is to impart useful skills on the students in order to enhance their circuit analysis capability. Hence, the course is designed to provide students with fundamental knowledge on circuit analysis. This is one of the foundation courses which are required to understand the concepts of advanced courses.

Prerequisite are fundamental knowledge of Electrical Sources and Circuit Elements, basic Mathematics (integration, differentiation, etc.)

Syllabus:

UNIT-1: Network Solution and Reduction

Determination method of network reductions, Nodal analysis, Mesh analysis, Supernode, Supermesh, star-delta transformation, Superposition theorem, Reciprocity theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Millman's theorem (dependent sources).

Network topology:

Graph, Tree, Branch, Link, Tie-set, Cut-set, Incidence Matrix, Loop and nodal analysis, Equilibrium equations (Conductively coupled circuit only).

UNIT-2: Sinusoidal Steady-State Analysis

Introduction: Sinusoids, Phasors, Phasor Relationships for Circuit, Elements, Impedance and Admittance, Kirchhoff's Laws in the Frequency Domain, Nodal Analysis, Mesh Analysis, Superposition Theorem, Source Transformation, Thevenin's and Norton's Equivalent Circuits.

UNIT-3: Three Phase AC circuits

Introduction, Generation of Three-phase EMF, Phase sequence, Connection of Three-phase Windings, Delta and Star connection, Line and Phase quantities, phasor diagrams, power measurement using two wattmeter method.

UNIT-4: Transient analysis

Introduction to Laplace Transformation, Properties of Laplace transformation, initial and final value theorem and convolution integral, Response of R-L and R-C circuit with: DC excitation, Exponential excitation, Sinusoidal excitation. Pulse Input, Pulse Response of Series RC Circuit, Step Response of RLC Series Circuit.

UNIT-5: Two Port network

Two port parameters (Z, Y, h, g, Transmission parameters), Interrelation between parameters, Reciprocity &

Symmetry, interconnections of Two port Networks, T and π networks, Barlett's bisection Theorem, Ladder network.

Text Books:

1. Alexander & Sadiku, "Fundamentals of Electric Circuits", TMH Publications, 2013.
2. M.E.Van Valkenburg, "Network Analysis", PHI Publications, 2019
3. A.Chakrabarti, "Circuit Theory", Dhanpat Rai & Co., 2013.

Reference Books:

1. Franklin S. Kuo, "Network Analysis & Synthesis", Wiley Publication, 2011
2. A. Sudhakar and S.P. Shyam Mohan, "Circuits and Networks Analysis and Synthesis", Tata McGraw Hill Publishing Co. Ltd, 2017.
3. Arumugam & Premkumar, "Electric Circuit Theory", Khanna Publishers, 1979.
4. Hayt, Kemmerly, Durbin, "Electric Circuit Analysis", TMH Publications, 2013.

Course Outcomes:

CO	After completing the course, the students will be able to:
CO1	Analyze circuits with ideal, independent, and controlled (voltage and current) sources.
CO2	Analyze the behavior of sinusoidal and non-sinusoidal waveforms.
CO3	Analyze balanced and unbalanced three phase circuits.
CO4	Analyze the transient circuits and network analysis.
CO5	Understand the different parameters of one port and two port networks.

CO-PO & PSO Correlation:

Course Name : Electric Circuits and Network Analysis Code: SOE-B-EE301											
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1	1	1				1				1	
CO2	2	1			1				2	1	1
CO3	1	1				1			1		
CO4	1	1				1			1		
CO5						2					1

Note: 1: Low, 2: Moderate, 3: High

Programme:	**B.Tech.**	**Semester :**	**III**
Name of the Course:	**Electronic Devices and Circuits**	**Course Code:**	**SOE-B-EE302**
Credits:	**3**	**No. of Hours:**	**3 Hrs Per Week**
Max Marks:	**100**		

Course Description:

The course will embed the quality to understand, construct, analyze, verify, and troubleshoot analog circuits using appropriate techniques and test equipment. The course will emphasize to design diode rectifiers, transistor biasing, JFET, MOSFET based analog circuits. The course also discusses the low- and high-frequency models for amplifiers

Syllabus:

UNIT-1: Review of diodes and its applications

Basic concepts of Semiconductor Diode: Construction, V-I Characteristics, Zener diode: Break down mechanism, V-I Characteristics, Load line analysis of diode circuit, Piecewise linear model of p-n junction diode, Applications of diodes: Wave shaping, Clipper and Clamper Circuits. Rectifier circuit: Half wave and full wave rectifier, parameters calculation, Passive filters (L, C, LC and CLC), Voltage regulator circuit using zener diode

UNIT-2: Bipolar Junction Transistor (BJT)

Construction, BJT types: npn and pnp, Current components, Transistor as an amplifier, Transistor Circuit Configuration: CB, CC, CE Configuration, Early Effect, Transistor biasing: Concept of operating point, Thermal runway, Bias stability, Stability factors, Biasing circuits and stabilization techniques.

UNIT-3: Junction Field Effect Transistor (JFET)

Construction, Basic Operation and V-I Characteristics, Pinch-off voltage, Transconductance, JFET Configuration: CS, CG and CD Configuration, Biasing of FET: Fixed bias, Self bias and Voltage divider bias, Applications of FETS: FET as switch, FET as VVR, FET small signal model

UNIT-4: Metal Oxide Semiconductor Field Effect Transistor (MOSFET)

Introduction, Construction, Basic Operation, V-I Characteristics, MOSFET Types: Depletion MOSFET, Enhancement MOSFET, their characteristics and parameters, Body effect, MOS as a Switch, CMOS devices. Comparison of JFETs and MOSFETs,

MOSFET Biasing: Fixed bias, Self bias and Voltage divider bias.

UNIT-5: Amplifiers Circuits

Transistors as an amplifier, load-line analysis, Graphical Analysis of CE amplifier; h-parameter Models for CB, CE,

CC configurations and their Analysis and Comparison of the three Configurations, Linear analysis of Transistor Circuits, Miller's Theorem and its Dual Simplified Hybrid Models and Calculation of CE and CC Amplifiers; CE hybrid-π model for high frequency: Validity and parameter Variation, Current Gain with Resistive load, frequency response of a single stage CE Amplifier, Gain- Bandwidth product.

Text Books:

1. Sedra, A. S., and K. C. Smith "Microelectronic Circuits" 4th Edition. New York, NY: Oxford University Press, 1998.
2. Millman & Halkias, "Integrated Electronics", Tata Mcgraw Hill, 2001.

Reference Books:

1. R. F. Pierret, "Semiconductor Device Fundamentals", PHI, 2006.
2. Analysis and Design of Analog Integrated Circuit: P. R. Gray, Paul Hurst, S.H. Lewis and R. G. Meyer, John Wiley, 2001.
3. Howe, R. T., and C. G. Sodini, "Microelectronics: An Integrated Approach", Upper Saddle River, NJ, Prentice Hall, 1996.
4. Fonstad, C. G., "Microelectronic Devices and Circuits", New York, NY: McGraw-Hill, 1994.

Course Outcomes:

CO	After completing the course, the students will be able to:
CO1	Understand the operation of p-n junction diodes and design the circuits for rectifiers and filters.
CO2	Explain the concept of bipolar junction transistor (BJT), and compare the different configurations of BJT and biasing circuits.
CO3	Comprehend the characteristics of junction field effect transistor (JFET) and its various applications.
CO4	Understand the characteristics of metal oxide semiconductor field effect transistor (MOSFET) and its various applications.
CO5	Evaluate the critical parameters which influences the functions of the electronic devices such as BJT, JFET and MOSFET as an amplifier for different configurations.

CO-PO & PSO Correlation:

Course Name : Electronic Devices and Circuits (SOE-B-EE302)											
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1	3	1	2			1			3	2	1
CO2	3	1	2			1			3	1	1
CO3	3	1	2			1			3	1	1
CO4						1			3	1	1
CO5	3	2	3			1			3	2	1

Note: 1: Low, 2: Moderate, 3: High

Programme:	**B.Tech.**	**Semester :**	**III**
Name of the Course:	**Electrical Machine – I**	**Course Code:**	**SOE-B-EE303**
Credits:	**4**	**No. of Hours:**	**4 Hrs Per Week**
Max Marks:	**100**		

Course Description:

This course examines the basic theory, characteristics, construction operation and application of Transformers and rotating electrical machines. It includes the study of transformers, direct current motors, direct current generators.

Syllabus:

Unit 1: Principle of Electromechanical Energy Conversion

Energy stored in electric and magnetic fields, energy conversion in single and multi- excited systems and torque production, reluctance torque; description of magnetic and electric circuits, Description of lap and wave windings.

Unit 2: DC Generator

Constructional details of dc machine, Derivation of e.m,f. equation, Function of commutation and interpoles, Armature reaction, D.C. generator characteristics, testing of dc generators. Parallel operation and application of different types of D.C. generators.

Unit 3: DC Motor

Derivation of Torque equation in D.C. motor, D.C motor starters, Characteristics of dc motors, Speed control and braking of D.C. motors, testing of dc motors, Hopkinsons test and Swinburne test. Application of different types of D.C. motor.

Unit 4: Single Phase Transformer

Construction of two winding transformer, Principle of transformer action and derivation of e.m.f. equation. Equivalent circuits and phasor diagrams of Ideal and real transformers, Different losses in transformers, Testing on transformer, Efficiency and voltage regulation. Condition for maximum efficiency, All-day efficiency. Excitation phenomenon in transformer

Unit 5: Three Phase Transformer

Autotransformers: Introduction, Comparison with two winding transformers; Three phase transformer: Construction, phase groupings; Parallel operation; Phase transformation: Three phase to two-phase, single-phase, and six-phase, Application of different types of transformer.

Text Books:

1. P. S. Bimbhra, "Electrical Machines", Khanna Publishers, 2002.
2. Nagarath& D.P. Kothari, "Electrical Machines", TMH Publishers, 4th Edition, 2004.

Reference Books:

1. A. E. Fitzgerald, C. Kingsley, Stephen D. Umans, "Electrical Machines", TMH Publishers, 6th Edition, 2003.
2. V.K.Mehta, "Principles of Electrical Machines", S. Chand Publication, 2014.
3. B.L. Theraja and A.K. Theraja, "A Textbook of Electrical Technology - AC and DC Machines", Vol. 2, S.Chand Publication, 2006
4. J.B. Gupta, "Theory & Performance of Electrical Machines", S K Kataria & Sons, 4th Edition, 2006.
5. A.E. Clayton & N.N. Hancock, "Performance and Design of DC Machines" CBS publishers and distributors pvt. Ltd., 2018.

Course Outcomes:

CO	After completing the course, the students will be able to:
CO1	Realize the energy conversion and torque production phenomenon in single and multi-excited machine.
CO2	Be familiar with constructional features, its operational limitation and proper capacity selection of direct current generators.
CO3	Know various types of starters, limitation of speed control methods, efficiency and application of direct current motor.
CO4	Recognize the various components, its performance analysis, several testing procedures, parallel operation criterion and proper application of single phase transformer.
CO5	Identify various types of three phase transformer, its performance analysis, necessary condition for parallel operation and its applications according to requirement.

CO-PO & PSO Correlation:

Course Name : Electrical Machine – I									**Code: SOE-B-EE303**			
	Program Outcomes								**PSOs**			
Course Outcomes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**
CO1	**3**		**1**		**1**				**3**	**1**		
CO2			**2**		**2**					**1**		
CO3										**1**		
CO4		**2**		**1**		**2**				**2**		
CO5		**1**									**2**	

Note: 1: Low, 2: Moderate, 3: High

Programme:	**B.Tech.**	**Semester :**	**III**
Name of the Course:	**Data Structures & Algorithms**	**Course Code:**	**SOE-B-EE304**
Credits:	**3**	**No. of Hours:**	**3 Hrs Per Week**
Max Marks:	**100**		

Course Description:

This course emphasizes on logical structure of data, it's physical representation and techniques for program development and debugging. In this course, students will also learn how to select the best suited data structure to solve a particular problem. This course is also about the computational complexities of different data structures.

Syllabus:

UNIT – 1: Introduction

Introduction: Basic Terminology, Data types and its classification, Abstract Data Types. Time and Space Analysis of Algorithms, Asymptotic Notations - Average, best and worst case analysis, Simple recurrence relations and use in algorithms, Sorting and Searching algorithms.

UNIT – 2: Linear Data Structure:

Arrays, Stacks, Queues, Linked Lists Arrays, Sparse Matrices, Stacks, Recursion, Queues, Types of queues, linked list, Generalized linked list, Application: Garbage collection and compaction, Conversion of Infix to Postfix Expressions, Polynomial Arithmetic etc.

UNIT – 3: Non-linear Data Structure:

Trees, Binary Trees, Tree Traversal, Threaded Binary trees, Binary Search Tree (BST), balanced trees - AVL Trees, B trees, B+ tree. Application: Huffman coding Algorithm etc.

UNIT- 4: Nonlinear Data Structure: Graphs

Graphs, Directed graph, Undirected graph, Traversal, Application of Graphs: Shortest path - Minimal spanning tree etc.

UNIT – 5: Hashing

Introduction, types, Collision Resolution Strategies, NP-completeness.

Text books:

1. Alfred.V. Aho, John.E. Hopcroft, Jeffrey .D. Ullman, "Data Structures and Algorithms", Addison-Wesley Publications.,1985.

2. Horowitz and Sahani, "Fundamentals of data Structures", Galgotia Publication Pvt. Ltd., N Delhi, 2008

Reference Books:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education, Asia.1994.
2. Jean-Paul Tremblay, Paul.G. Sorenson, "An Introduction to Data Structures with Applications", Tata Mc Graw Hill second edition, 1991.
3. Thomas.H. Cormen, Charles.E. Leiserson, Ronald.L. Rivest, "Introduction to Algorithms", PHI 1998.
4. Seymour Lipschutz, "Data structures with C (Schaum)", TMH, 2017.
5. R. Kruse et al, "Data Structures and Program Design in C", Pearson Education Asia, Delhi-2002.

Course Outcomes:

CO	After completing the course, the students will be able to:
CO1	Identify the correctness of the algorithms.
CO2	Analyse the times complexity of the algorithms using asymptotic analysis.
CO3	Compare between different data structures. Pick an appropriate data structure for a design situation.
CO4	Analyse/ summarize searching and sorting techniques
CO5	Employ and map suitable algorithms to solve engineering problems.

CO-PO & PSO Correlation:

Course Name : Data Structures & Algorithms									**Code: SOE-B-EE304**		
	Program Outcomes								**PSOs**		
Course Outcomes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**
CO1	**2**	**1**				**1**			**2**		
CO2	**2**	**2**	**1**			**1**			**2**	**2**	
CO3	**2**	**2**	**1**			**1**			**2**	**2**	
CO4	**1**		**2**			**1**			**1**		
CO5	**1**		**2**			**1**			**2**	**2**	

Note: 1: Low, 2: Moderate, 3: High

Programme:	**B.Tech.**	**Semester :**	**III**
Name of the Course:	**Engineering Mathematics-III**	**Course Code:**	**SOE-B-MA303**
Credits:	**3**	**No. of Hours:**	**3 Hrs Per Week**
Max Marks:	**100**		

Course Description:

Laplace Transform is a powerful tool for analysis and design of Continuous Time signals and systems. Numerical Method is an important branch in Applied Mathematics. To explore complex systems, physicists, engineers, financiers and mathematicians require computational methods since mathematical models are only rarely solvable algebraically or analytically. This course will emphasize the development of numerical algorithms to provide solutions to common problems formulated in science and engineering. It aims at numerically solving all kinds of mathematical problems which arise from practical applications and can be modelled by different mathematical equations or inequalities, for example, linear or nonlinear differential equations and integral equations. Also this course is helpful to develop the basic understanding of the construction of numerical algorithms, and perhaps more importantly, the applicability and limits of their appropriate use.

Unit 1: Laplace Transform

Definition, Transform of elementary functions, Properties of Laplace transform, Transform of derivatives & integrals, Multiplication by t^n, Division by t, Periodic function, Unit step function, Unit impulse function.

Unit 2: Inverse Laplace Transform and it Applications

Inverse Laplace Transform, Convolution theorem, Simultaneous linear equations with constant coefficients Application to solution of ordinary differential equations.

Unit 3: Solution of Algebraic and Transcendental equation

Errors, Roots of Algebraic and Transcendental Equations, Bisection, Regula-Falsi, Secant and Newton-Raphson Methods, Direct Methods: Gauss Elimination and Gauss-Jordan Methods, Iterative Methods: Jacobi's, Gauss-Siedal Methods.

Unit 4: Interpolation, Numerical Differentiation and Integration

Finite Differences: forward, backward, central and differences, Interpolation Formulae based on forward, backward, Lagrange's Interpolation formula, Newton Divided difference interpolation formula,

Numerical Differentiation using Forward, Backward Formulae, Numerical Integration by Trapezoidal rule, Simpson's $1/3^{rd}$ and $3/8^{th}$ rules.

Unit 5: Numerical Solution of ODE

Single Step Method: Picard's Method, Taylor's Series Method, Euler's Method, Euler's Modified Method, Runge-Kutta Methods, Multi-Step Method: Milne Simpson's Method, Adams-Bashforth-Moulton Method.

Text Books:

1. Numerical Methods in Engineering and Science: Dr. B.S. Grewal, Khanna Publishers.

2. Numerical Methods for Scientific and Engineering Computation: M.K. Jain, S.R. K. Iyengar & R. K. Jain, Wiley Eastern Limited.
3. Higher Engineering Mathematics: B.S. Grewal (38th edition)-Khanna Publishers.

Recommended Books:

1. Advanced Engineering. Mathematics by Erwin Kreyszig (8th edition) – John Wiley & Sons.
2. Higher Engineering Mathematics by B. V. Rammana-Tata Mc Graw Hill.
3. Numerical Methods for Scientists and Engineers by K. Shankar Rao, Prentice Hall of India.
4. Numerical Methods, by S. S. Sastry, Prentice Hall Inc. India.

Course Outcomes:

CO	After completing the course, the students will be able to:
CO1	Solve Laplace Transform.
CO2	Solve Inverse Laplace Transform and its application.
CO3	Find solution of algebraic and transcendental equation.
CO4	Solve interpolation, differentiation and integration
CO5	Solve ordinary differential equation using numerical method.

CO-PO & PSO Correlation:

Course Name : Engineering Mathematics-III (SOE-B-MA303)											
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1	1	1	1						2		1
CO2	1	2							2		1
CO3	1	1	1						1		
CO4	1	1	1						1	1	
CO5	1	1							1	1	

Note: 1: Low, 2: Moderate, 3: High

Programme:	**B.Tech.**	**Semester :**	**III**
Name of the Course:	**Electric Circuits and Network Analysis Lab**	**Course Code:**	**SOE-B-EE305**
Credits:	**2**	**No. of Hours:**	**4 Hr per week**
Max Marks:	**50**		

Course Description:

The response of Electrical Circuit can be verified practically by applying different theorems and fundamental techniques. The students will become sure that the theoretical tricks which they have learned from books are true. In this course circuit modeling and methods of circuit analysis in time domain and frequency domain for solving simple and multi-dimensional circuits including DC and AC circuit theory and network theorems. The laboratory exercises are designed to give students ability to design, build, and implement basic AC and DC circuits.

List of Experiments:

1. State and verify Thevenin's Theorem.
2. State and verify Norton's Theorem.
3. State and verify Maximum Power Transfer Theorem.
4. State and verify Superposition and Reciprocity Theorems.
5. State and verify of Milliman's Theorem.
6. Frequency response of Series & Parallel resonance circuit.
7. Design and Simulation of series resonance circuit.
8. Design and Simulation of parallel resonant circuit.
9. Compute the time constant of a R-C & R-L circuit.
10. Determine the impedance (Z), and admittance (Y) parameters of two-port network.
11. Determine the hybrid and transmission parameters of a two-port network.
12. Generation of Periodic, Exponential, Sinusoidal, Damped Sinusoidal, Step, Impulse, and Ramp signals using MATLAB.
13. Representation of Poles and Zeros in S-plane using MATLAB.
14. Determine the Laplace and Inverse Laplace of different time domain functions using MATLAB.
15. Analysis of different time domain signals using Spectrometer.

Equipments/Machine/Software required:

Resistors, Capacitors, DC supply, Multimeter, Simulation tools like MATLAB, MULTISIM

Reference Books & Manuals:

1. S.K. Bhattacharya, "Experiments in basic electrical engineering", New Age International, 2007.
2. Mehta & Gupta, "Basic shop practical", Dhanpat Rai Publishing, 2014.
3. Dr. N. K. Jain, "Practical in electrical engineering", Dhanpat Rai Publishers, 2004.

Course Outcomes:

CO	After completing the course, the students will be able to:
CO1	Prepare laboratory reports that clearly communicate experimental information in a logical and scientific manner.
CO2	Conduct basic laboratory experiments involving electrical circuits using laboratory test equipment such as multimeters, power supplies, signal generators, and oscilloscopes.
CO3	Explain the concepts of Thevenin-equivalent circuits and linear superposition and apply them to laboratory measurements
CO4	Predict and measure the transient and sinusoidal steady-state responses of simple RC and RL circuits.
CO5	Understand the MATLAB software and its application in Electrical Circuits simulation.

CO-PO & PSO Correlation:

Course Name : Electric Circuits and Network Analysis Lab											Code: SOE-B-EE305
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1			2	2			1		3		4
CO2	3	2				1			2	2	1
CO3		1	1						2	2	1
CO4	1	1	1						1	2	
CO5	1	2	1						1	2	

Note: 1: Low, 2: Moderate, 3: High

Programme:	**B.Tech.**	**Semester :**	**III**
Name of the Course:	**Electronic Devices and Circuits Lab**	**Course Code:**	**SOE-B-EE306**
Credits:	**2**	**No. of Hours:**	**4 Hr per week**
Max Marks:	**50**		

Course Description:

It is an introductory experimental laboratory that explores the design, construction, and debugging of analog electronic circuits. The course intends to provide an understanding of operation and application of the analog building blocks like diodes, BJT, FET, MOSFETs etc for performing various functions like amplifiers, switching, wave shaping.

Syllabus:

List of Experiments:

1. To draw the V-I characteristics of a p-n junction diode.
2. To draw the V-I characteristics of a zener diode.
3. To draw the waveform of the clipper and clamper circuit.
4. To find the ripple factor and efficiency of a half wave rectifier.
5. To find the ripple factor and efficiency of a full wave rectifier.
6. To design a regulator circuit using Zener Diode.
7. To draw the CE characteristics of BJT.
8. To draw the CC characteristics of BJT.
9. To draw the CB characteristics of BJT.
10. To draw the V-I characteristics of FET.
11. To draw the V-I characteristics of MOSFET.
12. To determine the frequency response of a single stage CE amplifier.
13. To determine the frequency response of RC coupled CE amplifier.

Equipment/Software required:

Circuit components, Power supply, CRO, Function generator, Multi meter, Breadboard, Simulation Software.

Reference Books & Manuals:

1. Millman & Halkias, "Integrated Electronics", TMH Publications, 2017.

2. David A. Bell, "Electronic Devices & Circuits", Oxford University Press, 2008.

Course Outcomes:

CO	After completing the course, the students will be able to:
CO1	Learn how to develop and employ circuit models for elementary electronic components, such as resistors, sources, inductors, capacitors, and diodes for rectifiers and filters.
CO2	Become adept at characteristics of BJT and FETs for different configurations.
CO3	Understand the concept of load line and operating point for electronic circuits.
CO4	Design different biasing circuits for analog application.
CO5	Develop the capability to analyze and design simple amplifier circuits containing non-linear elements such as BJTs and FETs.

CO-PO & PSO Correlation:

Course Name :Electronic Devices and Circuits Lab											Code:SOE-B-EE306
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1	3	2	2	1					2	2	
CO2	3	2	2	1					2	2	
CO3	2	1	1	1					1	1	
CO4	3	2	2	1					2	3	
CO5	3	2	2	1					2	3	

Note: 1: Low, 2: Moderate, 3: High

Programme:	**B.Tech.**	**Semester :**	**III**
Name of the Course:	**Electrical Machines - l Lab**	**Course Code:**	**SOE-B-EE307**
Credits:	**2**	**No. of Hours:**	**4 Hrs Per Week**
Max Marks:			

Course Description:

This course examines the construction feature, its operation and application of Transformers and direct current electrical machines. It includes the performance analysis of transformers, direct current machines under various loading conditions and its testing.

Syllabus:

List of Experiments:

1. Magnetization or Open circuit characteristics of a D.C machine.
2. Load test on D.C Shunt generator.
3. Load test on D.C Series generator.
4. Load test on D.C Compound generator.
5. Full load and no load test on a D.C machine using Swinburne's test.
6. Hopkinson's test on the DC Shunt machine.
7. Speed control of D.C. shunt motor by: (i) field control. (ii) Armature voltage control.
8. Field test on DC Series machine.
9. 3- phase to 2- phase conversion (Scott connection).
10. Open & short circuit test of single phase transformer for finding its parameters.
11. Brake test on DC Shunt motor.
12. Separation of losses in DC Shunt motor.
13. Brake test on DC Compound motor.

Reference Books & Manuals:

1. S. G. Tarnekar & P.K. Kharbanda, S.Chand, "A text book of laboratory courses in electrical engineering", 2011.

Course Outcome:

CO	After completing the course the students will be able to:
CO1	Recognize the various components, its performance analysis, and several testing procedures of single phase transformer.
CO2	Identify various types of three phase transformer, its performance analysis, and necessary condition for parallel operation.
CO3	Be familiar with constructional features, its operational limitation of direct current generators.
CO4	Know construction of various types of starters, limitation of speed control methods and performance analysis of direct current motor.

CO-PO & PSO Correlation:

Course Name : Electrical Machines - I Lab									Code: SOE-B-EE307		
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1	3	1	2	1	1	1			3	1	1
CO2	1	3	1	2					2	3	1
CO3	1	1	3	1						2	1
CO4	2	1							1	1	

Note: 1: Low, 2: Moderate, 3: High

Programme:	**B.Tech.**	**Semester :**	**III**
Name of the Course:	**Data Structure Lab**	**Course Code:**	**SOE-B-EE308**
Credits:	**2**	**No. of Hours:**	**4 Hour Per Week**
Max Marks:	**50**		

Course Description:

This is a Lab Course is for the theory counter part of Data Structure to teach programming with an emphasis on problem solving using elementary data structures for solution of engineering problems.

Syllabus:

List of Experiments:

1. Implementation linear data structure using Arrays and perform its various operations.
2. Implement Tower of Hanoi using recursion.
3. Implementation of the various Queues using Arrays. i.e. Linear Queue, Circular Queue, D-queue, and Priority Queues.
4. Implementation of Stack using Arrays & perform infix to postfix conversion.
5. Implementation of a Linked list and its various types i.e. Singly, Double and Circular Linked list.
6. Representation of a polynomial using a Linked list and write functions for polynomial addition.
7. Implement Queues and Stack using a Linked list.
8. Implement and analyze the various Searching algorithms i.e. Linear, Binary and Hashing.
9. Implement and analyze the various Sorting algorithms i.e. Selection, Insertion, Bubble, Quick, Merge, Heap, Radix sort, etc.
10. Implementation of Tree and its applications i.e. Spanning tree, Binary Search Tree, AVL tree and Tree traversal etc.
11. Representation of Graph and Implement some of its application i.e. Shortest path.

Text books:

1. Alfred.V. Aho, John.E. Hopcroft, Jeffrey .D. Ullman, “Data Structures and Algorithms”, Addison-Wesley Publications, 1985.
2. Horowitz and Sahani, “Fundamentals of data Structures”, Galgotia Publications Pvt. Ltd., N Delhi, 2012

Reference books:

1. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C,” Second Edition, Pearson Education, Asia.1994.

2. Jean-Paul Tremblay, Paul.G. Sorenson, "An Introduction to Data Structures with Applications", Tata Mc Graw Hill second edition, 1991.
3. Thomas.H. Cormen, Charles.E. Leiserson, Ronald. L., "Introduction to Algorithms", Rivest PHI, 1998.
4. Seymour Lipschutz, "Data structure (Schaum)", TMH, 2017.
5. C, R. Kruse et. al., "Data Structures and Program Design", Pearson Education Asia, Delhi-2002.

Course Outcomes:

CO	After completing the course the students will be able to:
CO1	Write well-structured procedure-oriented programs of up to 1000 lines of code.
CO2	Analyze run-time execution of previous learned sorting methods, including selection, merge sort, heap sort and quick sort.
CO3	Implement the stack adt using both array based and linked-list based data structures.
CO4	Implement the queue adt using both array based circular queue and linked-list based implementations.
CO5	Implement binary search trees.

CO-PO & PSO Correlation:

Course Name : Data Structure Lab									Code: SOE-B-EE308		
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1	2	2				1			1	2	
CO2	3	2				1			2	2	
CO3	2	2				1			2	2	
CO4	2	2				1			2	2	
CO5	2	2				1			2	2	

Note: 1: Low, 2: Moderate, 3: High

Electrical Engineering

(Scheme of B.Tech 4th Semester)

L: Lecture, T: Tutorial, P: Practical, C: Credit

SEMESTER IV

S. No.	Subject Code	BOS	SUBJECT	Periods per week			Scheme of Examination and Marks				Credits L+(T+P)/2
				L	T	P	PRE**		ESE*	Total Marks	
							Mid Sem	TA			
1	SOE-B-EE401	EE	Power System – I	3	1	0	30	20	50	100	4
2	SOE-B-EE402	EE	Digital Electronics	3	0	0	30	20	50	100	3
3	SOE-B-EE403	EE	Electrical Measurement and Measuring Instruments	3	0	0	30	20	50	100	3
4	SOE-B-EE404	EE	Electromagnetic Field Theory	3	0	0	30	20	50	100	3
5	SOE-B-EE405	EE	Signals and Systems	3	0	0	30	20	50	100	3
6	SOE-B-EE406	EE	Power System Simulation Lab	0	0	4	0	30	20	50	2
7	SOE-B-EE407	EE	Digital Electronics Lab	0	0	4	0	30	20	50	2
8	SOE-B-EE408	EE	Electrical Measurement and Measuring Instruments Lab	0	0	4	0	30	20	50	2
9	SOE-B-EE410	EE	Introduction to PYTHON	0	0	4	0	30	20	50	2
10	SOE-B-EE411	Humanities	Professional Development	1	0	0	0	15	10	25	1
TOTAL				**16**	**1**	**16**	**150**	**235**	**350**	**725**	**25**

* End Semester Examination

**Teacher Assessment

Programme:	**B.Tech.**	**Semester :**	**IV**
Name of the Course:	**Power System – I**	**Course Code:**	**SOE-B-EE401**
Credits:	**4**	**No. of Hours:**	**4 Hrs Per Week**
Max Marks:	**100**		

Course Description:

This course covers the study of electric power systems in the field of generation and distribution of electrical power. Apart from conventional methods it includes basics of wind and solar electric, geothermal and small scale hydroelectric generation.

We cover the study and design of transmission and sub-transmission lines. We analyze primary and secondary distributions systems, voltage drop and power losses. Also, the student will learn advanced system voltage regulation, system protection and system reliability.

Syllabus:

UNIT-1: Electric Power Generation:

Introduction to conventional and non-conventional power plants and their working principles (Hydro, thermal, Nuclear, and renewable energy resources).

UNIT-2: Inductance and Capacitance of Transmission Lines:

Capacitance of Transmission Lines: Electric Field of a Line of Charge, Straight Conductor, The Potential Difference Between Two Points Due to a line Charge, Two Infinite Lines of Charge, Capacitance of a Two Wire Line, Capacitance of a Three Phase Line with Unsymmetrical Spacing, Capacitance of a Double Circuit Line, Inductance of Three Phase Un-Symmetrically Spaced Transmission, Effect of Earth on the Capacitance of Conductors. Line Conductors, Inductance and Capacitance of Single Phase and Three Phase Lines with Symmetrical and Unsymmetrical Spacing, Composite Conductors-Transposition, Bundled Conductors, and Effect of Earth on Capacitance.

UNIT-3: Performance of Long Transmission Lines:

Performance of Lines: Representation of Lines, Short Transmission Lines, The Medium Transmission Lines.

Long Transmission Line: Introduction, ABCD Constants, Ferranti Effect, skin effect, corona, Hyperbolic Form of the Equations, The Equivalent Circuit of a Long Line, Power Flow Through Transmission Line, Reactive Compensation of Transmission Line. Series and Shunt Compensation.

UNIT- 4: Overhead Line Insulators and Distribution System:

Overhead Line Insulators: Insulator Materials, Types of Insulators, Voltage Distribution Over Insulator String,

Methods of Equalizing the Potential Mechanical Design of Overhead Transmission Lines: The Catenary Curve, Sag Tension Calculation, supports at Different Levels, Stringing Chart, Sag Template, Equivalent Span, Stringing of Conductors, Vibration and Vibration Dampers

Distribution: Comparison of Various Distribution Systems, AC Three-Phase Four-Wire Distribution System, Types of Primary Distribution Systems, Types of Secondary Distribution Systems, Voltage Drop in DC Distributors, Voltage Drop in AC Distributors, Kelvin's Law, Limitations of Kelvin's Law, General Design Considerations

UNIT-5: Cables and Power System Earthing:

Insulated Cables: The Insulation, Extra High Voltages Cable, Insulation Resistance of Cable, Grading of Cables, Capacitance of Single Core Cables, Heating of Cables, Current Rating of Cables, Overhead lines Vs Underground Cables, Types of Cable

Power System Earthing: Soil Resistivity, Earth Resistance, Tolerable Step and Touch Voltage, Actual Touch and Step Voltages, Design of Earthing Grid.

Text Books:

1. A. Hussain, "Electrical power systems", CBS Publications, 2007.
2. W. D. Stevenson, "Elements of Power System Analysis", TMH Publishing Company Limited, 2017.
3. D. Das, "Electrical Power System", New Age Publications, 2006.

Reference Books:

1. Power System Analysis, J. John Grainger & W. D. Stevenson, Jr, TMH, 2003 ed., 15th Reprint, 2010.
2. A Course in Electrical Power, Soni, Gupta and Bhatnagar, Dhanpat Rai Publications.
3. Electrical Power Systems, C. L. Wadhwa, 6th ed., New Age International Publishers.
4. Power System Engineering, I. J.Nagrath and D.P. Kothari, TMH Publications.
5. Electric Power System, B. M. Weedy and B. J. Cory, 4th ed., 2008 Wiley India.
6. Elements of Electrical Power Station Design, M. V. Deshpande, 3rd ed., Wheeler Publications, 1998.

Course Outcomes:

CO	After completing the course, the students will be able to:
CO1	Know the complete design and operation of electrical power generating station.
CO2	Analyze the selection procedure and effects of transmission line parameters.
CO3	Design and power transmission in long transmission lines.
CO4	Analyze the mechanical design aspects of transmission lines.

CO5	Acquire knowledge of electrical power distribution process.
CO6	Know the process of underground power transmission.
CO7	Demonstrate the importance of earthing in power system.

CO-PO & PSO Correlation:

Course Name : Power System – I (SOE-B-EE401)											
	Program Outcomes								**PSOs**		
Course Outcomes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**
CO1	**1**		**3**		**2**			**3**	**3**	**2**	**2**
CO2	**1**	**1**	**3**						**3**	**1**	
CO3	**1**	**1**	**3**						**3**	**2**	
CO4	**1**	**1**	**3**		**1**			**1**	**3**	**2**	
CO5	**1**	**2**	**2**		**1**			**1**	**3**	**1**	
CO6	**1**	**2**	**2**		**1**				**3**	**2**	
CO7	**1**	**1**	**3**						**3**	**1**	

Note: 1: Low, 2: Moderate, 3: High

Programme:	**B.Tech.**	**Semester :**	**IV**
Name of the Course:	**Digital Electronics**	**Course Code:**	**SOE-B-EE402**
Credits:	**3**	**No. of Hours:**	**3 Hrs Per Week**
Max Marks:	**100**		

Course Description:

This course is designed to provide sufficient coverage of digital electronics fundamentals. Digital fundamentals will introduce basic topics such as binary topics such as binary arithmetic, logic gates and truth tables, Boolean algebra and minimization techniques, logic families, and digital test equipment. Upon completion of the foundational digital requirements, a more advanced study of digital devices and circuits will include such topics as flip-flops, counters, multiplexers and de-multiplexers, encoding and decoding, displays.

Syllabus:

Unit-I: Number system and Logic Gates

Binary number system, Octal, Hexa decimal, base conversions, signed and unsigned numbers, complements, addition, subtraction using complements, Different Binary codes, operation, Truth tables of different logic gates.

Unit-II: Boolean Algebra and K-maps

Basic Theorems and postulates, properties of Boolean algebra, Boolean functions, standard and canonical forms, 2,3,4- variable K-map methods of simplification, NAND/NOR implementations, other two level implementations, Multi-level implementations, 2-3 variable XOR function.

Unit-III: Combinational Circuit Design

Design procedure, Different Adders and Subtractors-Half Adder, Full Adder, Half Subtractor, Full Subtractor, 4-bit Ripple Carry Adder, Decoder, Encoders, Multiplexers, De-Multiplexers, Magnitude Comparator, etc.

Unit-IV: Sequential Circuit Design

Basics, Latches and Flip-flops, conversion from one FF to another, Designing of serial and Parallel Registers, Synchronous and Asynchronous Counter Designing.

Unit-V: Programmable Logic Devices

Simple and Complex PLDs (SPLD and CPLD), Field-programmable gate array (FPGA), Programmable array logic (PAL), Programmable logic array (PLA), Generic array logic (GAL) Designing. Logic Families: Basic concept, designing of basic logic families like Resistor Transistor Logic (RTL), Direct Coupled Transistor Logic (DCTL), Transistor Transistor Logic (TTL), Emitter Coupled Logic (ECL), etc. A to D and D to A converter circuits.

Text Books:

1. M. Morris Mano, Digital Design, 3rd Edition, Prentice Hall of India Pvt. Ltd.

2. Fundamentals of Digital Electronics: Anand Kumar (PHI)

Reference Books:

1. Digital Integrated Electronics: H. Taub and D. Schilling, McGraw-Hill.
2. Digital Design: John F.Wakerly, Pearson/PHI
3. Digital Logic Applications and Design: John.M Yarbrough, Thomson Learning, 2002.
4. Switching and Finite Automata Theory: Z. Kohavi, Tata McGraw-Hill.

Course Outcomes:

CO	Course Outcome
CO1	Understand the basics of any digital systems such as logic gates, Boolean logic simplification, FFs etc.
CO2	Get familiarized with simulation.
CO3	Perform simple course projects using above design techniques.
CO4	Understand, analyze and design various combinational and sequential circuits.
CO5	Identify basic requirements for a design application and propose a cost effective solution .

CO-PO&PSO Correlation

Course Name : Digital Electronics (SOE-B-EE402)											
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1:	2	1				1			2		
CO2:	1	3	1			1			2	2	
CO3:	1	2	2	1		2			1	2	1
CO4:	1		2	2					1	2	1
CO5:	1		2	2	1				1	2	1

Note: 1: Low 2.: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**IV**
Name of the Course:	**Electrical Measurement and Measuring Instruments**	**Course Code:**	**SOE-B-EE403**
Credits:	**3**	**No. of Hours:**	**3 Hrs Per Week**
Max Marks:	**100**		

Course Description:

This course examines the basic theory, characteristics, construction operation and application of Electromechanical measuring instruments. It includes the measurement of resistance, inductance, capacitances, voltage, currents, active power, reactive power, energy of single and three phase balance and unbalanced systems.

Syllabus:

Unit 1: Introduction to Measurement and Measuring Instruments

Definitions: Accuracy, precision, Errors, Resolutions Sensitivity and tolerance, Classification of instrument system, Errors in Measurement and Measuring Instruments, Classification of Torque: deflecting, control and damping torques.

Unit 2: Measurement of Voltage and Current

Construction, working principle, torque equation, scale shape, sources of error, merits & demerits, & applications of Permanent Magnet Moving Coil (PMMI)and Permanent Moving Iron instrument(PMMI), Electrodynamics instrument, Extension of instrument ranges: shunts & multipliers, Instrument Transformer: Principle, construction, testing and errors of Current Transformer and Potential Transformer; Concept of multi range instruments.

Unit 3: Measurement of Power and Energy

Describe the Construction, principle and working of a Dynamometer type wattmeter, what are the Errors in a Dynamometer type wattmeter and the methods of their correction, Discuss L P F Electro – Dynamometer type wattmeter, Discuss Induction type wattmeter, and Measurement of Power in Single Phase and Three Phase Circuit. Single Phase and Poly-phase Induction Type Energy meters –construction, the working principle and their compensation and adjustments, Testing of Energy Meters.

Unit 4: DC and AC bridges

Classifications of low, medium, and high resistance, Measurement of low resistance by voltage drop, potentiometer method & its applications, Measurement of medium resistance by Wheatstone bridge method and substitution Method, Measurement of high resistance by loss of charge method. Construction & principle of operations (meggers) insulation resistance & Earth resistance megger, Measurement of inductance by Wien's Bridge, Maxwell's Bridge, Measurement of capacitance by Schering Bridge, Hay bridge, and De-sauté bridge.

Unit 5: Electronics Instruments and measurement

Instrumentation Amplifier. Review of basic CRO circuit, Probes, Oscilloscope control. Measurement of voltage, frequency, and phase using a CRO, Digital Storage Oscilloscope (DSO), Current and Voltage Probes, Function Generators, Multimeter, Spectrum analyzers.

Text Books:

1. A course in Electrical and Electronics measurement and instrumentation: Sawhney, Dhanpat Rai Publication.
2. Electrical Measurement & Measuring Instruments, Golding & Widis, Pitman.

Reference Books:

1. Introduction to Instrumentation and Measurements, R. B. Northrop, CRC, 2nd Edition, PHI
2. Electronic Instrumentation & Measurement, David Bell, PHI.
3. Modern Electronic Instrumentation and Measurement Techniques, A. D. Helfrick and W. D. Cooper, PHI.
4. Electronic Instrumentation, H. S. Kalsi, TMH.

Course Outcomes:

CO	After completing the course, the students will be able to:
CO1	Identify various types of electrical instruments suitable for specific measurements.
CO2	Classify various errors present in measuring instruments.
CO3	Develop the knowledge of theoretical and mathematical principles of electrical measuring instruments.
CO4	Measurement of electrical quantity
CO5	Understand construction, working principle and types of oscilloscopes and Comprehend different types of signal generators and analyzers, their construction and operation.

CO-PO & PSO Correlation:

Course Name: Electrical Measurement and Measuring Instruments (SOE-B-EE403)												
	Program Outcomes								PSOs			
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3	4
CO1	3	1				1		1	3			
CO2	2	3					1	1	2	3		
CO3	2						1	1	1	2		
CO4	1	1	1		1	2	2	2	1		3	
CO5	1	1	1		1	2	2	2	1		3	

Note: 1: Low, 2: Moderate, 3: High

Programme:	**B.Tech.**	**Semester :**	**IV**
Name of the Course:	**Electromagnetic Field Theory**	**Course Code:**	**SOE-B-EE404**
Credits:	**3**	**No. of Hours:**	**3 Hrs Per Week**
Max Marks:	**100**		

Course Description:

This course is to acquire the knowledge of Electromagnetic field theory that allows the student to have a solid theoretical foundation to be able in the future to design, emission, propagation and reception of electro- magnetic wave systems.

Syllabus:

UNIT-1: Introduction

Review of conversion of a vector form one coordinate system to another, Coulomb's law, Electric field intensity, electric field due to point charge, line charge, continuous volume charge and surface charge.

UNIT-2: Static Electric Field

Electric flux density, Vector differential operator, Gradient, Divergence, Curl, Divergence theorem, Stokes theorem, Point, Line, Surface and Volume charge distributions, Gauss law and its applications, Gauss Law and its applications, Absolute potential, Potential difference, Electric dipoles, Electrostatic energy and energy density, Maxwell's first equation, Potential differences for different configurations

UNIT-3: Capacitance & Dielectrics

Capacitor properties and boundary conditions, boundary conditions for perfect dielectric materials, Poisson's and Laplace's equation and their solution, Current and current density, Continuity equation, Maxwell's second equation.

UNIT-4: Static Magnetic Field

Magnetic field vector: Magnetic field intensity, flux density & magnetization, Bio-Savart's law, Ampere's law, Stokes theorem, magnetic flux density, magnetic circuit, self-inductance, mutual inductances, Maxwell's third equation, boundary conditions, Force on a moving charge, Force on a differential current element, torque on a closed circuit.

UNIT-5: EM Waves and Time Varying Fields

Faraday's law for Electromagnetic Induction, Maxwell's field equations, Uniform plane wave in free space, Poynting Theorem and Poynting vector, skin effect, EM Boundary condition, Integral and differential form of Maxwell's equation.

Text Books:

1. Engineering Electromagnetics: William H. Hayt and Jr. John A. Buck, Tata McGraw-Hill.
2. Elements of Electromagnetics: Matthew N.O. Sadiku, 4th edition, Oxford University Press, 2006.

Reference Books:

1. Fundamentals of Electromagnetics: Karl E Longman and Sava V Savov, Prentice Hall of India, New Delhi, 2006
2. Electromagnetic Waves and Radiating Systems: E.C. Jordan and K.G. Balmain, Prentice Hall of India 2nd edition.
3. Electromagnetic Field Theory: R. S. Kshetrimayum, Cengage Learning.
4. Field's waves in Electromagnetic systems: Ramo, Whinnery and Duzer, 3rd edition, Wiley, 1994.
5. Electromagnetics: J. D. Kraus, McGraw Hill, 2007.
6. Electromagnetic Field and Waves: S. Baskaran and K. Malathi, Scitech Pub.

Course Outcomes:

CO	After completing the course, the students will be able to:
CO1	Analyze field potentials due to static changes and static magnetic fields.
CO2	Explain how materials affect electric and magnetic fields.
CO3	Compute force and torque for various current carrying elements.
CO4	Compute potential for different charge distributions.
CO5	Gain knowledge about the application of boundary conditions for fields.

CO-PO & PSO Correlation

Course Name : Electromagnetic Field Theory (SOE-B-EE404)												
	Program Outcomes								PSOs			
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3	
CO1	3	2	3			3			3	2	2	
CO2	2	2	3			2			2	3	2	
CO3	3	2	3			3			3	2	2	
CO4	2	2	1			2			2	2	2	
CO5	3	2	3			3			3	2	2	

Note: 1: Low 2: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**IV**
Name of the Course:	**Signals and Systems**	**Course Code:**	**SOE-B-EE405**
Credits:	**3**	**No. of Hours:**	**3 Hrs Per Week**
Max Marks:	**100**		

Course Description:

This course focuses on analyzing signals (sound, voltage, communication transmissions, images, etc.) and the systems that act on them (circuits, physical echoes, modulation, etc.). We concentrate on the Fourier series, Fourier transform, Z-Transform, statistical analysis providing a depth of tools for sampling, manipulating, preserving, and interpreting information signals.

Syllabus:

UNIT-1: Classification of Signals and Systems

Types of Signals: Speech signal, ECG signal, EEG signal. Representation of Signals: Continuous-time and Discrete-time, Digital Signal Processing System, Advantage and Limitations of digital signal processing, Elementary continuous-time and discrete-time signals: unit ramp, unit step, sinusoidal, real exponential, complex exponential signals, Classification of Signals, Representation of Systems, Classification of Systems, FIR and IIR systems.

UNIT-2: Fourier Analysis of Continuous-time Signals

Representation of Continuous time Fourier series(CTFS), Trigonometric form and Exponential form, Properties of CTFS, Fourier Integral Theorem (statement only), merit, limitation, existence of Fourier transform, Fourier Transform of a function, Fourier transform of standard signals such as single, double sided exponential, rectangular pulse, triangular pulse, Properties of CTFT, Fourier transform of periodic signals.

UNIT-3: Analysis of Discrete-time Signals

Signal Operations: Shifting, Time reversal, Time Scaling, Scalar Multiplication, Signal multiplier, Addition operation. Linear Convolution sum, Circular Convolution, Correlation: Cross-correlation, autocorrelation, Computation of correlation, Deconvolution. Discrete-time Fourier Series (DTFS), discrete frequency spectrum and frequency range, Discrete-time Fourier transform (DTFT), Properties of DTFT.

UNIT-4: Analysis of Signal by Z-Transform

Introduction, Definition, Z-Transform and ROC of Finite Duration signal: Right-hand signal, Left-hand signal, Two-side signal. Z-transform and ROC of Infinite Duration signal, ROC of Two-sided signal. Properties of Z-Transform, relationship between Fourier Transform and Z-Transform, relationship between S-plane and Z-plane. Inverse Z-Transform: Long division method, Partial fraction method, Residue method, Convolution method, Analysis of LTI Discrete time systems using Z transform.

UNIT-5: Statistical Signal Processing

Random processes, Random Signals, Random Variable, Discrete-time Random signals. Statistical Properties of Random Signal: Mean, Mean square, Variance, Autocorrelation of Random process, auto-covarience of random process, cross correlation of random processes, cross-covarience of random processes. Wide sense Stationary Random Process (WSRP): Power in a random signal, Erotic process.

Text Books:

1. Signals & Systems: Alan V. Oppenheim & Alan Wilsky, S Nawab, Prentice-Hall Signal Processing Series
2. Signals & Systems: A Anand Kumar, 2nd Ed, PHI
3. Digital Signal Processing: Proakis, Pearson India.

Reference Books:

1. Digital Signal Processing: P. Ramesh Babu, 4th Edition, Scitech Publication.
2. Higher Engineering Mathematics: B.S.Grewal, 43rd Edition.
3. Higher Engineering Mathematics: H K Dass & Rajnish Verma
4. Signal Processing: Thomas J. Cavicchi
5. Digital Signal Processing: Ronald W. Schafer and Alan V. Oppenheim, 1st Edition.

Course Outcomes:

CO	After completing the course, the students will be able to:
CO1	Understand the classification of signals and systems.
CO2	Acquire knowledge about the frequency domain analysis of continuous time and discrete time signals.
CO3	Apply the knowledge of Transform Techniques like, Fourier Transform, Z-Transform to signals.
CO4	Analyze the spectral characteristics of continuous-time and Discrete-time periodic and aperiodic signals using Fourier Transform.
CO5	Understand the process of Z-Transform and the concept of ROC to solve the system equations.
CO6	Understand statically signal Processing concept and use mathematical function to characterize it.

CO-PO & PSO Correlation:

Course Name : Signals and Systems (SOE-B-EE405)												
	Program Outcomes								PSOs			
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3	4
CO1	3	3	3			2			3	2	3	
CO2	2	3	3			3			2	3	2	
CO3	2	3	3			3			3	2	3	
CO4	2	3	2			2			2	3	2	
CO5	2	3	3			3			3	3	2	
CO6	2	3	3			3			3	3	2	

Note: 1: Low, 2: Moderate, 3: High

Programme:	**B.Tech.**	**Semester :**	**IV**
Name of the Course:	**Power System Simulation Lab**	**Course Code:**	**SOE-B-EE406**
Credits:	**2**	**No. of Hours:**	**4 Hrs Per Week**
Max Marks:	**50**		

Course Description:

This is to expose basic concept of MATLAB simulation software and Transmission line simulator. This course covers the design of single line diagram, design of transmission line models, parameter calculations of transmission line, analysis of the transmission line insulators and their properties.

Syllabus:

List of Experiments:

1. Determination of the generalized constants A, B, C, D and voltage regulation of a long transmission line through simulation
2. Dielectric strength test of insulating oil.
3. Determination of breakdown strength of solid insulating material.
4. Study of transmission by transmission line network analyzer.
5. Study of different types of insulator.
6. Study and simulation of Ferranti effect.
7. Obtaining parameters of a transmission Line and Modeling it in MATLAB/SIMULINK
8. Different parameter calculation of a 3-Φ transmission line model by power circle diagram.
9. Measurement of earth resistance by earth tester.
10. Design first element-Bus, transmission line, generator, load, and transformer.
11. Introduction to PSCAD/EMTDC and learn the usage of PSCAD/EMTDC in modeling of ac circuits and plotting of results.
12. To study the effect of real and reactive powers on bus voltages.
13. To obtain the current harmonics drawn by power electronics interface in EMTDC/PSCAD.
14. Understanding reactive power and power factor in single-phase and three-phase circuits.

Equipments/Machine/Software Required:

MATLAB/SIMULINK, transmission line simulator, oil testing kit.

Reference Books & Manuals:

1. Electrical power systems, A. Hussain, CBS Publications.

2. Elements of Power System Analysis, W. D. Stevenson, TMH Publishing Company Limited.

Course Outcomes:

CO	After completing the course, the students will be able to:
CO1	Students familiar with MATLAB simulation software.
CO2	Students will be able to design the first Element-Bus, transmission line, generator, load, and transformer.
CO3	Students are able to perform various tests on long transmission line network analyzers.
CO4	Students will be able to simulate and calculate transmission line parameters
CO5	Students will be able to perform different tests on the power system insulator.

CO-PO & PSO Correlation:

Course Name : Power System Simulation Lab (SOE-B-EE406)												
	Program Outcomes								PSOs			
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3	4
CO1	2	1			1				2			
CO2		3			1				1			
CO3									1	2	1	
CO4			3	1					1		1	
CO5	1	1							1			

Note: 1: Low, 2: Moderate, 3: High

Programme:	**B.Tech.**	**Semester :**	**IV**
Name of the Course:	**Digital Electronics Lab**	**Course Code:**	**SOE-B-EE407**
Credits:	**2**	**No. of Hours:**	**4 Hrs Per Week**
Max Marks:	**50**		

Course Description:

The purpose of the course is to provide students with an understanding of how to analyze, build, and troubleshoot digital circuits. Student should become proficient in using oscilloscopes, signal analyzers, and similar equipment to test digital circuits. In addition, students must learn to write well-organized reports.

Syllabus:

List of Experiments:

1. To verify the truth tables of basic logic gates.
2. To study NAND and NOR gates as a universal logic.
3. To study and prove Demorgan's theorem.
4. To design half adder and full adder.
5. To design half subtractor and full subtractor.
6. To design a comparator circuit & verify its truth table.
7. To design an encoder and decoder circuits and verify its truth table.
8. To design a multiplexer and demultiplexer circuits and verify its truth table.
9. To study and verify the truth table of S-R & JK flip-flops.
10. To study and verify the truth table of T and D flip-flops.
11. To study the 7 segment display.
12. To perform the operation of a BCD counter using 7490.
13. To design shift registers using IC 7474.

Equipment/Machine/Software required:

Circuit components, Power supply, CRO, Function generator, MATLAB.

Reference Books & Manuals:

1. Laboratory Manual for Introductory Electronic Experiments: L K Maheswari, M M S Anand, New Age, 2010.
2. Handbook of Experiments in Electronics and Communication Engineering: S Poornachandra Rao, B Sasikala, Vikas publishers, 2003.

Course Outcomes:

CO	After completing the course, the students will be able to:
CO1	Minimize the Boolean algebra and design it using logic gates.
CO2	Analyze and design combinational and sequential circuits.
CO3	Implement digital systems using programmable logic devices.
CO4	Translate real world problems into digital logic formulations using modern tools and communicate effectively.

CO-PO & PSO Correlation:

Course Name : Digital Electronics Lab (SOE-B-EE407)											
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1	2	1			1				2		
CO2		3			1				1		
CO3									1	2	1
CO4			3	1					1		1

Note: 1: Low, 2: Moderate, 3: High

Programme:	**B.Tech.**	**Semester :**	**IV**
Name of the Course:	**Electrical Measurement and Measuring Instruments Lab**	**Course Code:**	**SOE-B-EE408**
Credits:	**2**	**No. of Hours:**	**4 Hrs Per Week**
Max Marks:	**50**		

Course Description:

This course deals with working Principle, errors, rectification and application of various electrical and electronic measuring instruments. It deals with operational techniques of various analog Meters like Ammeter, Voltmeter Wattmeter, Energy meter, Power Factor Meter, and many more of it's kind. Students will be able to use these tools for measurement of various electrical quantities like Current, Voltage, Power, Energy, Resistance, Inductance, and Capacitance.

Syllabus:

List of Experiments:

1. To measure Current, Power, Voltage using a multimeter.
2. To measure R and L of a Choke Coil.
3. To measure Power in Three Phase Circuit using Two Wattmeter method.
4. To measure 3 - phase Reactive power using Single wattmeter method.
5. Calibration and testing of Single phase Energy meter.
6. Calibration of LPF and UPF wattmeter by Phantom testing.
7. To measure Resistance using Wheatstone's bridge.
8. To measure Resistance using Kelvin's double bridge.
9. To measure Inductance using Hay's bridge.
10. To measure Inductance using Maxwell's bridge.
11. To measure Capacitance using Schering bridge.
12. To measure Capacitance using De-sauty's bridge.
13. To measure unknown frequency using CRO/DSO.
14. To measure percentage ratio and phase angle error of given C.T.
15. Calibration of dynamometer type Power Factor meter.

List of Equipments/Machine required:

1. Bridges, Head Phone.
2. Voltmeter, Ammeter, Multimeters, Resistors, DC Supply.

3. Breadboard, resistances.
4. Lamp, variac, connecting wires, transformer (110/220 V).
5. choke coil, two wattmeters, 3 phase variac, 3 rheostat of same rating.
6. Energy meter, different kits (Wheatstone's bridge, Kelvin's double bridge, Hay's bridge, Maxwell's bridge, Schering bridge, Desauty's bridge).

Reference Books or Manuals:

1. Basic Practical in Electrical Engineering – P. S. Dhogal, Standard Publishers Distributors (2004).

Course Outcomes:

CO	Student completing the course will be able to:
CO1	Take necessary precaution while handling measuring instruments
CO2	Get the standard operating procedure for electrical and electronic measuring instruments.
CO3	Diagnose the possible cause of error and remedy of analog as well as digital instruments.
CO4	Select appropriate type of bridge for measuring electrical parameters.
CO5	Understand several ways of measuring same electrical quantities using various measuring electrical and electronic instruments.

CO-PO & PSO Correlation:

Course Name: Electrical Measurement and Measuring Instruments Lab (SOE-B-EE408)												
	Program Outcomes								PSOs			
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3	4
CO1	2	1			1				2			
CO2		3			1				1			
CO3									1	2	1	
CO4			3	1					1		1	
CO5	1		3	1					1		1	

Note: 1: Low 2: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**IV**
Name of the Course:	**Introduction to Python**	**Course Code:**	**SOE-B-EE410**
Credits:	**2**	**No. of Hours:**	**4 Hour Per Week**
Max Marks:	**50**		

Course Description:

The course will embed the quality to design, write, debug and run programs encoded in the Python language, and to understand the basic concepts of problem solving approach and role of computation of software development technology. The course will emphasize on python programming fundamentals, various data types, conditional and looping operations, add on modules such as numpy, panda, scipy. The course also discusses the fundamentals of machine learning algorithms and their implementation using Python.

Syllabus:

UNIT-1: Introduction to Python

History, Features, Programming Concepts, Identifiers, Keywords, Statements and Expressions, Variables, Operators, Data Types, Indentation, Comments, Reading Input, Output, Type Conversions.

UNIT-2: Loops and Strings

If-else, Loops – For, while; break continue, String manipulations – Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, Formatting Strings, immutability, string functions and methods.

UNIT-3: Python Building Blocks

Functions - Defining , invoking functions, passing parameters, Lists – list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters,

Tuples - tuple assignment, tuple as return value, Sets - Concept of Sets , creating, initializing and accessing the elements, operations, Dictionaries - Concept of key-value pair, creating, initializing and accessing the elements in a dictionary, operations and methods, Modules - Importing module, Math module, Random module, Packages.

UNIT-4: Python for Analytics

Use of OOPs Concepts and Libraries – NumPy – Introduction, creating objects, operations on objects, Pandas – Introduction, series, Data Frame, Panel, operations and statistical functions, SciPy – Introduction, Basic functionality, Cluster, Constants, Statistical functions, plotting with matplotlib.

UNIT-5: Introduction to Machine Learning

Mean, Median, Mode, Standard Deviation, Data Distribution and Normal Data Distributions, Regression– Linear, Polynomial, Multiple regression, Scale, Train/Test– Evaluate Model, operations on Data Sets.

Text Books

1. Introduction to Computation and Programming using Python, by John Guttag, PHI Publisher

2. Python Programming using problem solving Approach by Reema Thareja, Oxford University, Higher Education Oxford University Press; First edition (10 June 2017),ISBN-10: 0199480173

Reference Books:

1. Data Structures and Algorithms in Python by Michael T Goodrich and Robertto Thamassia, Micheal S Goldwasser, Wiley Publisher (2016)
2. Introduction to Machine Learning with Python, A Guide for Data Scientists, by Andreas C. Müller and Sarah Guido, O'Reilly (2017), ISBN:9781449369415

Course Outcomes:

CO	After completing the course, the students will be able to:
CO1	Understand the concepts of evolution of python programming language.
CO2	Analyze the design issues involved in various constructs of python programming language.
CO3	Comprehend the concepts of object oriented languages, functional and logical python programming language
CO4	Analyze the methods and tools to define syntax and semantics of python.
CO5	Apply the concepts and identify the issues involved in other advanced features of programming languages in various advanced fields of research.

CO-PO & PSO Correlation:

Course Name : Introduction to Python (SOE-B-EE410)											
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1		1									
CO2		3	2							1	
CO3		1								2	
CO4		1							1	1	
CO5		1	2		2	1	1	1		2	

Note: 1: Low 2: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**IV**
Name of the Course:	**Professional Development (Effective Speaking Skills)**	**Course Code:**	**SOE-B-EE411**
Credits:	**1**	**No. of Hours:**	**1 Hour Per Week**
Max Marks:	**25**		

Course Description:

'Effective Speaking Skills' course is designed to teach students to apply theories and principles of effective interpersonal and public speaking. This course provides instruction and experience in preparation and delivery of speeches within a public setting and group discussion. Emphasis is on research, preparation, delivery, and evaluation of informative, persuasive, and special occasion public speaking. Upon completion, students should be able to prepare and deliver well-organized speeches and participate in group discussion with appropriate audiovisual support. Students should also demonstrate the speaking, listening, and interpersonal skills necessary to be effective communicators in academic settings, in the workplace, and in the community.

Course Objectives:

The main objective of the course is to improve the students' spoken English and enable them to acquire the art of public speaking. The course is heavily practice oriented and has been designed to develop the skills of speech through presenting papers, giving seminars, participating in group discussions and appearing at interviews, etc.

Syllabus:

UNIT- 1: Speaking: An Overview

Speaking: An Overview, Listening Effectively, Non-Verbal Communication, Art of Persuasion.

UNIT- 2: Dynamics of Professional Speaking

Introduction, Combating Stage Fright, Describing Objects/Situations/People, Delivering Just-a-minute Sessions, Delivering Different Types of Speeches.

UNIT- 3: Professional Presentations

Planning of a Presentation, Designing of a Presentation, Preparing Power Point Slides for Presentations, Individual and Group Presentations, Making Presentation.

UNIT- 4: Group Discussions

Introduction, GD and Debate, Types of GD, Personality Traits to be evaluated, Dynamics of Group Behaviour, DOs and DON'Ts of GD.

UNIT –5: Job Interviews

Introduction, Process, Stages in Job Interviews, Types, Desirable Qualities, Preparation, Tips for Success

Text Books:

1. Soft Skills for Everyone: Jeff Butterfield, CENAGE LEARNING, 2014
2. Communication Skills: Sanjay Kumar and Pushp Lata, Oxford University Press, 2011
3. Communicate or Collapse: A Handbook of Effective Public Speaking, Group Discussion and Interviews: Push Plata and Sanjay Kumar, Prentice Hall of India, 2007
4. The Art of Public Speaking: Dale Carnegie, Ocean Paperbacks, 2016

Reference Books:

1. The Art of Public Speaking: Stephen E. Lucas, Third Edition, Singapore: McGraw-Hill, 1989
2. How to Talk so People Listen: Sonya Hamlin, New York, Throson, 1993
3. The Complete Guide to Public Speaking: Jeff Davidson, Manjul Books PVT. Bhopal, 2006
4. Effective Speaking: Turk, Cristopher, Second Indian Reprint, Taylor and Francis Group, Delhi, 2010.

Course Outcomes:

CO	Upon successful completion of the course, students will be able to:
CO1	Choose a topic and formulate the speech according to the purpose, audience, and time constraints;
CO2	Employ vocal variety in rate, pitch, and intensity as suitable to the message, occasion, and audience;
CO3	Use strategies and skills to manage communication anxiety;
CO4	Present speeches using an extemporaneous style with effective transitions that, establish connectedness, movement from one idea to another, and clarify relationships;
CO5	Use knowledge of digital presentation tools to create and make effective presentations;
CO6	Participate in GD effectively;
CO7	To face interviews confidently.

CO-PO & PSO Correlation:

Course Name : Professional Development (SOE-B-EE411)											
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1				3		1					1
CO2				2							2
CO3				2	2	1					2
CO4				2	2	2					1
CO5				2	1					1	1
CO6				2		1					1
CO7				2						1	1

Note: 1: Low 2: Moderate 3: High

Electrical Engineering

(Detailed Syllabus of 5th Semester)

L: Lecture, T: Tutorial, P: Practical, C: Credit

SEMESTER V

Sr. No.	Subject Code	SUBJECT	Periods per week			Scheme of Examination and Mark				Credit (L+(T+P) /2)
			L	T	P	PRE**		ESE*	Total Marks	
						Mid Sem	TA			
1	SOE-B-EE501	Power Electronics	3	0	0	30	20	50	100	3
2	SOE-B-EE502	Power System-II	3	0	0	30	20	50	100	3
3	SOE-B-EE503	Electrical Machine-II	3	0	0	30	20	50	100	3
4	SOE-B-EE504	Control System	3	0	0	30	20	50	100	3
5	SOE-B-EE505	Linear Integrated Circuits	3	0	0	30	20	50	100	3
6	SOE-B-EE506	Electrical Machine-II Lab	0	0	4	0	30	20	50	2
7	SOE-B-EE507	Power Electronics Lab	0	0	4	0	30	20	50	2
8	SOE-B-EE508	Linear Integrated Circuits Lab	0	0	4	0	30	20	50	2
9	SOE-B-EE509	Control System Lab	0	0	4	0	30	20	50	2
10	SOE-B-EE510	Electric Vehicles	1	0	2	0	30	20	50	2
TOTAL			**16**	**0**	**18**	**150**	**250**	**350**	**750**	**25**

* End Semester Examination
**Teacher Assessment
*** Progress Review Examination

Programme:	**B.Tech.**	**Semester :**	**V**
Name of the Course:	**Power Electronics**	**Course Code:**	**SOE-B-EE501**
Credits:	**3**	**No. of Hours:**	**3 Hrs Per Week**
Max Marks:	**100**		

Course Description:

The subject deals with the conversion, control and switching of electrical energy for power applications and playing a major role in revolutionizing the industrial processes. It provides the essential link between the micro level of electronic controllers and megawatt level of industrial power and processes requirements. It has applications within the whole field of the electrical energy system

Syllabus:

UNIT-1: Power Semiconductor Devices

Concept of power electronics with applications, Various power electronics devices such as power bipolar junction transistor (BJT), TRIAC, GTO and IGBT, MOSFET, SCR, Triggering methods of SCR, Protection of SCR, Firing methods of SCR, Series and Parallel operation of SCR, Commutation technique.

UNIT-2: Phase Controlled Converters

Principle of operation of single phase and three phase half wave, Half controlled, Full controlled converters with R, R-L and RLE loads, Effect of source inductance assuming constant load current, Effect of freewheeling diode, Input line current harmonics, Power factor, Current distortion and displacement factors.

UNIT-3: DC-DC Converters

Principle of operation of DC-DC converters, Step-down chopper, Step-up choppers, Voltage control strategies, Step-up-down chopper, Types of choppers circuits based on quadrant of operation.

UNIT-4: Inverters

Definition, Classification of inverters, Single-phase Half and full Bridge Inverter, Series and parallel inverter, Pulse width modulated (PWM) technique for voltage control, SPWM Technique 1-phase inverters, Three-phase voltage source inverters (120 and 180 Degree conduction modes), Current source inverter, multilevel inverter.

UNIT-5: AC Controllers

Single-phase mid-point and bridge types of step-up and step-down cyclo-converters. Single phase AC Voltage regulators and its basic analysis.

Text Books:

1. Power Electronics, M.H. Rashid, 4th edition, PHI, 2017.
2. Power Electronics, M.D. Singh and K.B. Khanchandani, Tata Mc Graw Hill,2008.
3. Thyristorised Power Controllers, G. K. Dubey, S. R. Doradla, A. Joshi and RMK. Sinha Wiley Eastern Ltd. Publisher,1988.

4. Power Electronics, P.S. Bhimra, Khanna Publishers, 2012.

Reference Books:

1. Elements of Power Electronics: Philip T. Krein, Oxford University Press.
2. Power Electronics: Cyril W Lander MGH Publishers.
3. Modern Power Electronics & AC drives: B.K. Bose, Prentice Hall.
4. Power Electronics: Converters Applications and Design, Media Enhance, Ned Mohon, Wiley; Third edition.
5. Discrete Time Signal Processing, Oppenheim & Schafer, Pearson - PHI

Course Outcomes:

CO	After completing the course, the students will be able to:
CO1	Gain knowledge on AC-DC, DC-DC, DC-AC converters and their operation under various conduction for RLE loads.
CO2	Obtain an ability to solve the require mathematics analysis through electrical circuit and its graphical representation
CO3	Gain knowledge of UPS and SMPS.
CO4	Understand basic operation of electrical drives.

CO-PO & PSO Correlation:

Course Name : Power Electronics (SOE-B-EE501)											
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1	3	3							2		
CO2	3	2							2	1	
CO3	3	2	1						2	2	1
CO4:	3	2	2						2	2	1

Note: 1: Low 2: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**V**
Name of the Course:	**Power System – II**	**Course Code:**	**SOE-B-EE502**
Credits:	**3**	**No. of Hours:**	**3 Hrs Per Week**
Max Marks:	**100**		

Course Description:

Demand of electrical energy is increasing day by day due to improvement in the life style of the people in particular and development of the countries in general. On the other hand, conventional sources of power generation are limited. Under this scenario, the power system network operates in a stressed condition. Effective management of generation, transmission and distribution of electrical power is necessary for optimal system operation, for loss minimization and to avoid the unwanted power cuts. This subject deals with the fundamentals for effective operation and control of the power system.

Syllabus:

UNIT-1: Basic Principles and Representation of Power System Components

One line and impedance diagram, Per unit system, Per unit representation of transformer, impedance diagram of power system.

Power Flow Analysis: Bus classification, formation of bus admittance matrix, load flow problem, Gauss-Seidel method, Newton-Raphson method, Decoupled load flow studies, comparison of load flow methods,

UNIT-2: Symmetrical Components and Unsymmetrical Components:

Symmetrical component transformation, Sequence impedances of transmission lines, Construction of sequence networks of a power system, unsymmetrical faults, analysis of unsymmetrical faults at generator terminals, Single line to ground fault, Line to line fault, Double line to ground fault, Open conductor faults.

UNIT- 3: Economic Operation of Power System:

Statement of economic dispatch problem, input and output characteristics of thermal plant, optimal operation of thermal units without and with transmission loses, statement of unit commitment (UC) problem

Power System Frequency and Voltage Control

Load Frequency Control: Load Frequency Control (LFC) of single area system, LFC of two area system, Automatic Voltage Regulator: Generation and absorption of reactive power, Automatic Voltage Regulator (AVR)

UNIT-4: Power System Stability

Steady state stability, Power angle equation, dynamics of a synchronous machine, swing equation, transient stability, equal area criteria, multi machine stability concept. factors affecting transient stability

UNIT-5: Introduction to Smart Grid:

Introduction, Smart Grid- A road map, Components and model, Smart grid optimization, Integration of renewable energy, Information and communication technologies, phasor measurement unit, data acquisition and controls,

Energy management system, Supervisory control and data acquisition system.

Text Books:

1. Modern Power System Analysis, D.P. Kothari and I.J. Nagrath, Tata McGraw Hill, 4th Edition.
2. Electrical Power Systems: Concept, Theory and Practice 2nd Edition, Kindle Edition, 2014
3. Power System Engineering, D.P Kothari and I.J. Nagrath, Tata McGraw Hill, 2nd Edition 2007.
4. A text book on Power System Engineering, M.L. Soni, P.V. Gupta, U.S. Bhatnagar; A.Chakrabarti, Dhanpat Rai; CO, 2013.

Reference Books:

1. Handbook of Electrical Power Distribution, G. Ramamurthy, University Press, 2nd Edition, 2004.
2. Electric Power Transmission and Distribution, S. Sivanagaraju, S. Satyanarayana, Pearson Education, 1st Edition, 2008.
3. Power System Stability, E.W. Kimbark, Wiley, Vol. I, II and III, 2007.
4. Power Systems Analysis, A. R. Bergen and V. Vittal, Pearson Education, 2nd Edition, 1999.

Course Outcomes:

CO	Student completing the course will be able to:
CO1	Develop mathematical model of a power system
CO2	Understand the techniques to control power flows, frequency and voltage.
CO3	Analyze symmetrical and unsymmetrical faults in power system
CO4	Understand the stability status of power systems
CO5	To understand modern aspects of the power grid

CO-PO & PSO Correlation:

Course Name : Power System – II (SOE-B-EE502)											
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1	3	2	1						3	2	
CO2	3	3	1		1		1		2	2	1
CO3	3	2	1		1				2	3	1
CO4	3	3	3		1		1	1	3	3	1
CO5	3	3	3		1		1	1	3	3	

Note: 1: Low 2: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**V**
Name of the Course:	**Electrical Machine-II**	**Course Code:**	**SOE-B-EE503**
Credits:	**3**	**No. of Hours:**	**3 Hrs Per Week**
Max Marks:	**100**		

Course Description:

This course explains the basic theory, characteristics, construction, operation, application and starting of synchronous and asynchronous electrical machines. It includes the study of three phase slip-ring induction motor, squirrel cage induction motor, synchronous machines, single phase induction motor and special machines.

Syllabus:

UNIT-1: Synchronous machines I

Construction and operation of synchronous generators, Equivalent circuit and phasor diagrams of synchronous machines, Armature reaction, Open circuit, Short circuit and Zero power factor tests on synchronous machines, Synchronous reactance, Voltage regulation of alternators by Synchronous impedance, MMF and Zero power factor method, Theory of salient pole synchronous machines, Two Reaction theory, Phasor diagram, Power angle characteristics.

UNIT-2: Synchronous machines II

Principle of operation, torque equation, starting of synchronous motor, Damper winding, hunting, V-curves, Capability curve, Synchronous condenser. Parallel operation of synchronous machines, Load sharing, Operation of synchronous machines with infinite bus bars, Synchronizing torque, Active and Reactive power flows.

UNIT-3: Three Phase Induction Motor I

Construction details, Principle of operation, slip, equivalent circuit, torque-slip characteristics, condition for maximum torque, losses and efficiency, load test, no load and blocked rotor tests, separation of losses, cogging and crawling, synchronous induction motor, Need for starting, types of starters, DOL, rotor resistance, autotransformer and star- delta starters, speed control, voltage control, frequency control and pole changing, cascaded connection, V/f control, double cage induction motors, Applications.

UNIT-4: Single phase induction motors

Constructional details of single phase induction motor, double field revolving theory and operation, equivalent circuit, no load and blocked rotor test, performance analysis, starting methods of single-phase induction motors, capacitor start capacitor run induction motor

UNIT-5: Special machines

Shaded pole induction motor, repulsion motor, hysteresis motor, AC series motor, servo motors, stepper motors.

Text Books:

1. Electrical Machinery, P. S. Bimbhra-Khanna Publishers, 7th Edition, 2014.
2. Electric Machines, Nagarath and D.P. Kothari, TMH Publishers, 4th Edition, 2004.

Reference Books:

1. Electrical Machines: A. E. Fitzgerald, Charles Kingsley, Stephen D Umans–TMH Publishers, 6th Edition, 2003.
2. Principles of Electrical Machines: V.K.Mehta ,S.Chand Publication
3. A Textbook of Electrical Technology- AC and DC Machines Vol. 2 : B L Theraja and A K Theraja, , S.Chand Publication
4. Theory & Performance of Electrical Machines: J.B. Gupta: S K Kataria& Sons, 4thEdition 2006.
5. Performance and Design of DC Machines: A.E. Clayton & C.I. Hancock.

Course Outcomes:

CO	At the end of this course the student will be able to:
CO1	Understand the operating concept, and analyze the performance of synchronous machine
CO2	Understand the construction, operation and advantages of induction motor in industries
CO3	Understand the operating concept, speed control methods and analyze the performance of Induction machine
CO4	Understand the operation and characteristics of single phase induction motors
CO 5	Understand the operation and applications of special induction machines

CO-PO & PSO Correlation:

Course Name: Electrical Machine-II (SOE-B-EE503)												
	Program Outcomes								PSOs			
Course Outcomes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**
CO1	**3**	**2**	**2**			**2**	**2**	**3**	**3**	**2**	**3**	
CO2	**2**	3	3			**3**	**2**	**2**	2	**3**	**2**	
CO3	**3**	2	2			**3**	**3**	**2**	**3**	**2**	**3**	
CO4	**3**	**3**	**2**			**2**	**2**	**3**	2	**3**	**2**	
CO5	**3**	**2**	**2**			**2**	**2**	**3**	2	**3**	**2**	

Note: 1: Low 2: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**V**
Name of the Course:	**Control System**	**Course Code:**	**SOE-B-EE504**
Credits:	**3**	**No. of Hours:**	**3 Hrs Per Week**
Max Marks:	**100**		

Course Description:

This course is an exploratory, which will develop analytical tools required to analyze and design methods for the control of linear systems. The focus of the course is to impart useful skills on the students in order to enhance their system analysis capability. Hence, the course is designed to provide students with fundamental knowledge on system circuit analysis. This is one of the foundation courses which is required to understand the concepts of advanced courses. This course is intended to introduce the students to mathematical foundation of Control Theory.

Syllabus:

UNIT-1: Introduction

Concepts of control systems, Open loop and closed loop control systems and their differences, Different examples of control systems, Classification of control systems, Feed-Back Characteristics, Effects of feedback.

UNIT-2: Mathematical Modeling

Transfer functions, Transfer functions of Translational and Rotational mechanical systems and its Impulse Response. Block diagram, Signal flow graph, Transfer Function of DC Servo motor, AC Servo motor, Synchro transmitter and Receiver,

UNIT- 3: Time Domain Analysis

Standard test signals, Time response of first order systems, Characteristic Equation of Feedback control systems, Transient response of second order systems, Time domain specifications, Steady state response, Steady state errors and error constants, Effects of proportional derivative, proportional integral systems. Stability analysis: Routh-Hurwitz criterion, Root Locus techniques.

UNIT-4: Frequency Domain Analysis

Introduction, polar plots, Nyquist stability criterion, Bode plots.

UNIT-5: State Variable Analysis and Design

Concept of states, state variables and state model, state model for linear continuous time systems (electrical and mechanical), determination of transfer function from state matrices, solution of state equations, concept of controllability and observability.

Text Books:

1. Control Systems Engineering: I.J. Nagarath and M. Gopal, New Age Pub. Co.,3rd edition, 2007.
2. Automatic Control Systems: B. C. Kuo John wiley and sons, 8th edition,2003.
3. Modern Control Engineering: K. Ogata, PHI, 5th edition.

Reference Books:

1. Control System Engineering: K. Bhattacharya, Pearson, 2nd edition.
2. Control Systems: N. K. Sinha, New Age International (P) Limited Publishers, 3rd Edition, 1998.
3. Automatic Control Systems: Benjamin C. Kuo, Prentice Hall of India, 6th edition.

Course Outcomes:

CO	Student completing the course will be able to:
CO1	Analyze the behavior of steady state and dynamic behavior of control system components.
CO2	Analyze behavior of electrical and mechanical systems.
CO3	Understand the basics and applications of signal flow graphs.
CO4	Analyze both linear and non-linear networks using different methods.
CO5	Identify poles and zeros in system transfer functions; their impact on the stability of the system.
CO6	Demonstrate the different plots and their applications.
CO7	Explain and analyze the different state space systems.
CO8	Learn the real field control process of any process plant

CO-PO & PSO Correlation:

Course Name : Control System (SOE-B-EE504)												
	Program Outcomes								PSOs			
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3	4
CO1	3								2			
CO2	3	1							2	1		
CO3	3	2	2						2	2	1	
CO4	3	3	2						2	2	1	
CO5	3	2	2		2				2	2	1	
CO6	2	2	1		2	1			2	3	1	
CO7	3	2	1				1		2			
CO8	3	2	1									

Note: 1: Low 2: Moderate 3: High

Programme:	**B. Tech.**	**Semester :**	**V**
Name of the Course:	**Linear Integrated Circuits**	**Course Code:**	**SOE-B-EE505**
Credits:	**3**	**No. of Hours:**	**3 Hrs Per Week**
Max Marks:		**100**	

Course Description:

Knowledge of the fundamentals of Op-Amp and its basic amplifier configurations. Ability to analyze the linear and non-linear applications of operational amplifier. Understanding the concepts of Design and Construct various circuits using operational amplifier based ICs. The capability to use abstractions to analyze and design simple electronic circuits. The ability to formulate and solve frequency and phase response of circuits containing Op-Amp and other analog ICs. An understanding of how analog ICs are configured for different signal processing operations in electronics designs.

Syllabus:

UNIT-1: Operational Amplifier Fundamentals

Op-Amp circuit, Op-Amp parameters, Input and output voltage, CMRR and PSRR, Offset voltages and currents, Input and output impedances, Slew rate and Frequency limitations. Op-Amps as DC Amplifiers, Biasing Op-Amps, Direct coupled voltage followers, Non-inverting amplifiers, inverting amplifiers, Summing amplifiers and Difference amplifiers.

UNIT-2: Op-Amps as AC Amplifiers

Capacitor coupled voltage follower, High input impedance, Capacitor coupled non inverting amplifiers, High input impedance, Capacitor coupled inverting amplifiers, setting the upper cut-off frequency, Capacitor coupled difference amplifier. Op-Amp Applications: Voltage sources, current sources and current sinks, current amplifiers, instrumentation amplifier, precision rectifiers.

UNIT-3: Op-Amp Applications

Limiting circuits, Clamping circuits, Peak detectors, Sample and hold circuits, V to I and I to V converters, Differentiating Circuit, Integrator Circuit, Phase shift oscillator, Wein bridge oscillator, Crossing detectors, inverting Schmitt trigger. Log and antilog amplifiers, Multiplier and divider.

UNIT -4: Active Filters and Regulator

First order and second order active Low-pass and high pass filters, Band pass Filter, Band stop Filter. Voltage Regulators: Introduction, Series Op-Amp regulator, IC voltage regulators. 723 general purpose regulators.

UNIT-5: PLL, Timer and Data Conversion Circuits

Phase locked loop: Basic Principles, Phase detector/comparator, Voltage Controlled Oscillator. DAC and ADC convertor: DAC using R-2R, ADC using Successive approximation. Other IC Application: 555 timers, Basic timer circuit, 555 timer used as astable and Monostable multivibrator, case studies and mini project.

Text Book:

1. Integrated Circuits, K. R. Botkar, Khanna Publications, 2004.
2. Operational Amplifiers, R. Gayekwad, Pearson Education, 4th edition, 2015.

Reference Books:

1. Pulse, Digital and Switching Waveforms, Millman & Taub, TMH Publishing Co, 3rd edition 2014.
2. Integrated Electronics by Millman & Halkias, TMH Publishing Co, 2nd edition

Course Outcomes:

CO	Electrical Engineering Graduates will be able to:
CO1	Identify different parameters and configurations of Op-Amp.
CO2	Understand & demonstrate different applications of operational- amplifier based on frequency response.
CO3	Demonstrate the applications of linear and non-linear operations of operational- amplifier.
CO4	Explain different types of active filters and voltage regulators along with their applications.
CO5	Differentiate A/D and D/A converter, understand their types and analyze their applications along with waveform generators and times.

CO-PO & PSO Correlation:

Course Name : Linear Integrated Circuit (SOE-B-EE505)											
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1	3	1	2						3	1	
CO2	3	2	2						3	2	
CO3	3	2	3						3	2	

CO4	**3**	**2**	**3**						**3**	**2**	
CO5	**3**	**2**	**3**						**3**	**2**	

Note: 1: Low 2. Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**V**
Name of the Course:	**Electrical Machines-II Lab.**	**Course Code:**	**SOE-B-EE506**
Credits:	**2**	**No. of Hours:**	**4 Hrs Per Week**
Max Marks:	**50**		

Course Description:

This course examines the basic theory, characteristics, construction, operation, application and starting of synchronous and asynchronous electrical machines. It includes the study of three phase slip-ring induction motor, squirrel cage induction motor, synchronous machines, single phase induction motor and special machines.

Syllabus:

List of Experiments: (Minimum 10 Experiments)

1. To perform Load test on a three-phase induction motor.
2. Determination of Speed control of a three-phase slip-ring induction motor.
3. To perform No Load test and Blocked rotor test on a three-phase induction motor.
4. Study of Synchronous motor starting methods.
5. To plot V and inverted V curves of a Synchronous motor.
6. To conduct OC and SC tests on three-phase Alternator and to find the synchronous impedance through it.
7. To perform the synchronization of an alternator with the grid.
8. Determination of Xd and Xq of a salient pole synchronous machine by Slip test.
9. Study of negative and zero sequence reactance of synchronous generator.
10. To perform parallel operation of alternators.
11. Determination of vector group of three-phase transformer.
12. Study of Parallel operation of three-phase transformers.
13. To study single-phase motor starting methods.
14. To study different types of motor starters for induction motor.

Equipments/Machines/Software required:

Wound Rotor Induction motor, DC Generator, Squirrel cage Induction motor, Synchronous motor, Synchronous induction motor, Alternator, DC Power supply source and various measuring instruments.

Reference Books & Manuals:

1. A textbook of laboratory course in electrical engineering, S. G. Tarnekar, S. Chand Publisher

Course Outcomes:

CO	At the end of this course the student will be able to:
CO1	Understand the construction, operation and performance of three phase squirrel cage and slip ring induction motors.
CO2	Select appropriate starter and speed control techniques of three phase induction motor for various applications in industries.
CO3	Understand the construction, operation and performance of salient and non- salient synchronous generators along with parameter determination, load profile analysis, voltage regulations and efficiency of synchronous generator in various operating conditions.
CO4	Comprehend the construction, operation, starting, speed control and performance of synchronous motor in various industrial operating conditions.
CO5	Know the synchronization process of alternator with another alternator and grid.

CO-PO & PSO Correlation:

Course Name : Electrical Machines-II Lab (SOE-B-EE506)											
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1	3	2	2	2		2		2	3	2	2
CO2	2	3	2	2		2		2	2	3	2
CO3	2	2	3	3		3		3	2	2	2
CO4	2	3	2	2		2		2	2	2	3
CO5	2	2	2	3		2		2	2	2	2

Note: 1: Low 2: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**V**
Name of the Course:	**Power Electronics Lab**	**Course Code:**	**SOE-B-EE507**
Credits:	**2**	**No. of Hours:**	**4 Hr per week**
Max Marks:	**50**		

Course Description:

The course includes the different power modulation techniques as per the availability and requirement of power.

Syllabus:

List of Experiments:

1. To verify and draw the V-I characteristics of SCR.
2. To verify and draw the drain characteristics of a MOSFET.
3. To verify and draw the drain characteristics of an IGBT.
4. To verify and draw the V-I characteristics of a TRIAC.
5. To design and verify a single-phase half-wave controlled rectifier for R /RL load.
6. To design and verify a single-phase bridge controlled rectifier for R /RL load.
7. To design and verify a three-phase half-wave/full-wave controlled rectifier for R load.
8. To perform DC to AC power conversion using a single phase series inverter with R/RLload.
9. To determine the average and RMS output voltage of a single phase parallel inverter with R/RL load.
10. To determine the average and RMS output voltage of a boost converter.
11. To determine the average and RMS output voltage of a buck converter.\
12. Modeling and analysis of single phase step down cyclo-converter for R and RL loads using computer simulation.
13. Modeling and analysis of single phase step up cyclo-converter for R and RL loads using computer simulation.
14. Modeling and analysis of three phase VSI for 180/120 mode of conduction using computer simulation.

Equipments/Machine/Software required: Equipments/Machine/Software required.

Text Books:

1. Power Electronics lab manual, design, testing and simulation, K.R. Verma, Ginnes K John, Chikku Abraham, CBS publishers and distributors Pvt. Ltd.

2. Power Electronics, M.D. Singh and K.B. Khanchandani, Tata Mc Graw Hill.

3. Power Electronics, P.S. Bhimra, Khanna Publishers.

Reference Books:

1. Power Electronics Laboratory, theory, practice and organization, O.P. Arora

Course Outcomes:

CO	After completing the course, the students will be able to:
CO1	Hands on expertise on various power electronic converter operations.
CO2	Solve the require mathematics analysis through electrical circuit and its graphical representation
CO3	Design the power electronics converters using MATLAB or PSPICE.

CO-PO & PSO Correlation:

Course Name : Power Electronics Lab (SOE-B-EE507)											
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1	2	2							2	1	
CO2	2	2							2	1	
CO3	2	3	2						2	2	

Note: 1: Low 2: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**V**
Name of the Course:	**Linear Integrated Circuit Lab**	**Course Code:**	**SOE-B-EE508**
Credits:	**2**	**No. of Hours:**	**4 Hr per week**
Max Marks:	**50**		

Course Description:

This is a course on the design and applications of operational amplifiers and analog integrated circuits. Much attention is given to implementation of op-amp configurations, linear and nonlinear applications of op-amp and active filter synthesis. It also deals with implementation of oscillators, waveform generators and data converters.

Course Objectives:

1. To understand the characteristics of the operational amplifier.
2. To apply operational amplifiers in linear and nonlinear applications.
3. To acquire the basic knowledge of special function IC.
4. To evaluate the use of computer-based analysis tools to review performance of semiconductor device circuit.

List of Experiments:

1. To design and implement frequency response of an inverting amplifier using Op-Amp (IC-741).
2. To design and implement frequency response of a non-inverting amplifier using Op-Amp (IC-741).
3. To determine slew rate and unity gain of an Op-Amp (IC-741).
4. To design a circuit of summing amplifier using Op-Amp.
5. To design a differential amplifier using Op-Amp.
6. To design a differentiator circuit using Op-Amp.
7. To design an integrator circuit using Op-Amp.
8. To design a monostable multivibrator circuit using IC 555.
9. To design an astable multivibrator circuit using IC 555.
10. To design a bistable multivibrator circuit using IC 555.
11. To study the voltage regulation of 78XX and 79XX series of voltage regulators.

Equipments/Machine/Software required:

Discrete components, Power Supply, Function Generator, CRO/Software required.

Text Books:

1. Laboratory Manual for Operational Amplifiers and Linear ICs, David Bell, PHI.

2. Operational Amplifiers and Linear Integrated Circuits, Lal Kishore, PHI, 2007.

3. Design and Applications of Analog Integrated Circuits, Soclof, PHI, 2004.

Course Outcomes:

CO	Electrical Engineering Graduates will be able to:
CO1	Understand oscillators and amplifiers using operational amplifiers.
CO2	Design filters using Op-Amp and perform experiments on frequency response.
CO3	Comprehend the working of PLL and use PLL as frequency multiplier.
CO4	Analyze the performance of oscillators and multivibrators.

CO-PO & PSO Correlation:

Course Name : Analog Electronics Lab (SOE-B-EE508)											
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1	2	1	1						2	1	
CO2	2	2	2						2	2	1
CO3	2	1							2	1	
CO4	2	1							2	1	

Note: 1: Low 2: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**V**
Name of the Course:	**Control System Lab**	**Course Code:**	**SOE-B-EE509**
Credits:	**2**	**No. of Hours:**	**4 Hr per week**
Max Marks:	**50**		

LIST OF EXPERIMENTS:

1. Determine the gain of an open loop and closed loop system.
2. To study the effect of disturbance on an open loop and closed loop system.
3. Perform the analysis of LVDT and plot its characteristics.
4. To study the characteristics of synchro-transmitter and receiver pair.
5. To study a potentiometer as an error detector.
6. Determine the time response of a first and second order system.
7. To study the effect of P, I and D controllers of second order systems.
8. To study PI, PD controller on second order system.
9. To study the PID controller of a second order system.
10. To study the lag compensator and lead compensator.
11. Stability Analysis (Bode plot, Root locus, Nyquist,R-H) using computer simulation.
12. Obtain the state space model for classical Transfer function using computer simulation.

Equipments/Machine/Software required:

Control system components, Power supply, CRO, Function generator, LVDT, DC servomotor, AC servomotor, synchro-transmitter and receiver pair kit, P, I, PI, PD and PID controllers trainer kit, R-L or R-C Circuits, Bread board, CRO, Multi-meters, Function Generator. Lag Compensator, Lead Compensator, Lag-Lead Compensator kits, MATLAB.

Reference Books & Manuals:

1. MATLAB Control Systems Engineering: Lopez, Cesar, springer.
2. Matlab for Control System Engineers: Rao V. Dukkipati (Author),new academic science
3. Linear Control Systems: Kisačanin, Branislav, Agarwal, Gyan C., springer

Course Outcomes:

COs	Student will able to:
CO1	Demonstrate the ability to apply Laplace transform, transfer functions, modeling RLC circuit, block diagrams for simulation and control
CO2	Able to analyze the physical systems represented in transfer function
CO3	Able to apply the control components like ac servo motor, synchro and magnetic amplifier.
CO4	Able to understand the stability of an Electrical, mechanical and other physical systems
CO5	Able to Design controllers, compensators using MATLAB software.

CO-PO & PSO Correlation:

Course Name : Control System Lab (SOE-B-EE509)											
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1	2	1	1						2	1	
CO2	2	2	2						2	2	1
CO3	2	1							2	1	
CO4	2	1							2	1	

Note: 1: Low 2: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**V**
Name of the Course:	**Electric Vehicle**	**Course Code:**	**SOE-B-EE510**
Credits:	**2**	**No. of Hours:**	**3 Hrs Per Week**
Max Marks:	**50**		

Course Description:

This course introduces the fundamental concepts, principles, analysis and design of hybrid Electric vehicles. Comparative study of conventional and electric vehicles performance. Hybrid electric vehicles and its impact on environment. Analysis of various hybrid vehicle configurations and its performance. Interpretation of the electric components used in hybrid and electric vehicles. Design and Selection of sizing the drive systems. Selection of proper energy storage systems for vehicle applications. Identification of various communication protocols and technologies used in vehicle networks. Design a component or a product applying all the relevant standards with realistic constraints.

Syllabus:

UNIT-1: Introduction

Basics of vehicle performance, vehicle power source characterization, transmission characteristics, and mathematical models to describe vehicle performance. History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, future of electric vehicles, comparison with IC engine drive vehicles.

UNIT-2: Electric Vehicle Drive Train and Propulsion Unit

Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Introduction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency. Matching the electric machine and the internal combustion engine (ICE),

UNIT-3: Electric drive system sizing

Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems

UNIT-4: Energy Storage

Introduction to energy storage requirements in hybrid and Electric vehicles, Battery based energy storage and its analysis, fuel cell based and super capacitor based energy storage and its analysis. Hybridization of different energy

storage devices.

UNIT-5: Energy management strategies and Case Studies

Introduction to energy management strategies used in hybrid and electric vehicle, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy strategies - Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV).

Text Books:

1. Electric and Hybrid Vehicles-Design Fundamentals: Iqbal Hussain, CRC Press, 2nd Edition, 2011.
2. Modern Electric, Hybrid and Fuel Cell Vehicles: Fundamentals: Mehrdad Ehsani, Yimin Gao, and Ali Emadi, CRC Press, 2010.

Reference Books:

1. Hybrid Electric Vehicles- Principles and Applications with Practical Perspectives: Chris Mi, MA Masrur, and D W Gao, Wiley, 2011.
2. Battery Management Systems for Large Lithium-Ion Battery Packs: Davide Andrea, Artech House, 2010.

Course Outcomes:

CO	At the end of this course the student will be able to:
CO1	Understand benefits of electric and hybrid electrical vehicles performance in comparison to conventional vehicle and its impact on environment.
CO2	Analyze various hybrid vehicle configurations and its performance. Interpretation of the electric components used in hybrid and electric vehicles.
CO3	Design and sizing the drive systems for electric vehicle.
CO4	Select proper energy storage systems for vehicle applications.
CO5	Identify and apply various communication protocols and technologies used in vehicle networks along with design a component or a product applying all the relevant standards with realistic constraints.

CO-PO & PSO Correlation:

Course Name : Electric Vehicle (SOE-B-EE510)											
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1	3	3	3			2	2	3	3	2	3
CO2	2	2	2			3	2	2	2	3	2
CO3	3	3	2			3	3	2	3	2	3
CO4	3	2	2			2	2	3	2	3	2
CO5	2	3	3			3	3	2	3	3	2

Note: 1: Low 2: Moderate 3: High

Electrical Engineering
(Detailed Syllabus of 6th Semester)
L: Lecture, T: Tutorial, P: Practical, C: Credit

SEMESTER VI

Sr. No.	Subject Code	SUBJECT	Periods per week			Scheme of Examination and Marks				Credit (L+(T+P)/2)
			L	T	P	PRE**		ESE*	Total Marks	
						Mid Sem	TA			
1	SOE-B-EE601	Electrical Drives	3	0	0	30	20	50	100	3
2	SOE-B-EE602	Digital Signal Processing	3	0	0	30	20	50	100	3
3	SOE-B-EE603	Microprocessor & Microcontroller	3	0	0	30	20	50	100	3
4	SOE-B-EE604	Renewable Energy Sources and Systems	3	0	0	30	20	50	100	3
5	SOE-B-EE605	Professional Elective-I (Annexure-I)(T)	3	0	0	30	20	50	100	3
6	SOE-B-EE606	Electrical Drives Lab	0	0	4	0	30	20	50	2
7	SOE-B-EE607	Product Development Lab	0	0	4	0	30	20	50	2
8	SOE-B-EE608	Microprocessor & Microcontroller Lab	0	0	4	0	30	20	50	2
9	SOE-B-EE609	Fundamentals of IOT	2	0	0	0	30	20	50	2
10	SOE-B-EE610	Professional Development	0	0	1	0	30	20	50	1
TOTAL			17	0	13	150	250	350	750	24

Professional Elective-I (Annexure-I)

Sr. No	Subject Code	Courses
1.	SOE-B-EE605(1)	Advance AI & Machine Learning
2.	SOE-B-EE605(2)	Computer Networks
3.	SOE-B-EE605(3)	Industrial Automation
4.	SOE-B-EE605(4)	Utilization of Electric Power
5.	SOE-B-EE605(5)	Electrical Engineering Material

Programme:	**B.Tech.**	**Semester :**	**VI**
Name of the Course:	**Electric Drives**	**Course Code:**	**SOE-B-EE601**
Credits:	**3**	**No. of Hours:**	**3 Hrs Per Week**
Max Marks:	**100**		

Course Description:

The course deals with the variable-speed drives and motion control systems which are used in many industrial processes such as in conveyors, machine tools, pumps, compressors, mining drives, electric vehicles, ship propulsion, wind energy systems, aircraft actuators, servo drives and automation systems, to name a few. The course stresses the basic understanding of characteristic of machines driven from appropriate power electronic converters and controllers. Steady-state torque-speed characteristics of drives driven by power electronic converters, representation of drive dynamics and design of drive control systems will be covered.

Syllabus:

UNIT-1: Fundamentals of Electric Drives

Electric Drive and its parts, advantages of electric drives, Selection of electric drives, classification of electric drives, Fundamental of torque equations, Speed-torque conventions and multi-quadrant operations, constant torque and constant power operation.

UNIT-2: Dynamics of Electric Drives

Load torque: Components, nature, classification and examples, Dynamics of motor-load combination, Steady state stability of electric drives, Transient stability of electric drives.

Selection of Motor Power rating: Thermal model of motor for heating and cooling, classes of motor duty, determination of motor power rating for continuous duty, short time duty and intermittent duty. Load equalization.

UNIT-3: Control of Electric Drives

Modes of operation, Speed control, Close loop control of drives, Purpose and types of electric braking, braking of DC, three phase induction and synchronous motors

Dynamics During Starting and Braking: Calculation of acceleration, time and energy loss during starting of dc shunt and three phase induction motors, methods of reducing energy loss during starting. Energy relations during braking, dynamics during braking

UNIT-4: Power Electronic Control of DC Drives

Single phase and three phase controlled converter fed separately excited dc motor drives (continuous conduction only), dual converter fed separately excited dc motor drive, rectifier control of dc series motor. Supply harmonics,

power factor and ripples in motor current, Chopper control of separately excited dc motor and dc series motor.

UNIT-5: Power Electronic Control of AC Drives

Three Phase Induction Motor Drive: Static Voltage control scheme, static frequency control scheme (VSI, CSI, and Cycloconvertor based), static rotor resistance and slip power recovery control schemes.

Three Phase Synchronous motor: Self-controlled scheme

Special Drives: Switched Reluctance motor, Brushless dc motor. Selection of motor for particular applications

Text Books:

1. Fundamentals of Electric Drives, G. K. Dubey, Narosa publishing House.
2. Modern Power Electronics and AC Drives, B.K. Bose, PHI Publication, 2005

Reference Books:

1. Electric Drives, M. Chilkin- Mir Publishers, Moscow.
2. Fundamentals of Electric Drives, Mohammed A. El-Sharkawi, Thomson Asia, Pvt. Ltd. Singapore.
3. Electric Drives, N. K. De and Prashant K. Sen-Prentice Hall of India Ltd.
4. Electric Drives: Concepts and Applications, P. Subrahmanyam-Tata Mc Graw Hill
5. A First Course on Electric Drives, S. K. Pillai, New Age International.
6. Fundamental of Industrial Drives, B. N. Sarkar, Prentice Hall of India Ltd.

Course Outcomes:

CO	After completion of the course the students will be able to:
CO1	Conceptualize the basic drive system and analyze different types of load.
CO2	Analyze the motor behavior during starting & braking.
CO3	Develop control circuitry and devices for control of motor.
CO4	Estimate the motor rating for different conditions of load.
CO5	Design the convertor circuits for control purpose along with different configurations.
CO6	Use convertor control to drive on the basis of energy efficiency.
CO7	Apply their knowledge in selection, operation and maintenance of an Electric drive in rolling mills, EOT cranes, cement mills, lifts etc.

CO-PO & PSO Correlation:

Course Name : Electric Drives (SOE-B-EE601)												
	Program Outcomes								PSOs			
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3	4
CO1	3								2			
CO2	3	1							2	1		
CO3	3	2	2						2	2	1	
CO4	3	2	2						2	2	1	
CO5	3	2	2		2				2	2	1	
CO6	3	2	3		2	1			2	3	1	
CO7	3						1		2			

Note: 1: Low 2: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**VI**
Name of the Course:	**Digital Signal Processing**	**Course Code:**	**SOE-B-EE602**
Credits:	**3**	**No. of Hours:**	**3 Hrs Per Week**
Max Marks:	**100**		

Course Description:

The course will embed the knowledge to understand, analyze, design, and realize the discrete-time systems for digital signal processing. The course will emphasize on mathematical techniques needed for analysis of discrete time signals and systems. The course will introduce the concept of realization of discrete-time systems, design of IIR and FIR filters through various techniques, multi-rate digital signal processing and brief introduction of different digital signal processors used in the industries.

Syllabus:

UNIT-1: Analysis of Discrete-time systems

Discrete-time systems: Introduction, Classifications, Properties Linear time invariant systems, linear constant difference equations. Discrete Fourier Series, Discrete Time Fourier Transform (DTFT) and its properties, Inverse DTFT. Discrete Fourier Transform (DFT) and its Properties, Inverse DFT. Fast Fourier Transform, Properties, Types of FFT, N-point Radix-2 FFT, Inverse FFT. Discrete Linear Convolution, Circular Convolution.

UNIT-2: IIR Filter Design

Basics of infinite impulse response (IIR) systems, Linear constant difference equations, Mapping from analog to digital domain systems, Designing by impulse invariant and Bi-linear transformation methods, Design of Butterworth IIR filter, Analog & Digital Frequency transformation. Realization of systems: Basic building blocks, IIR structures: Direct, cascade, parallel, ladder and state space form.

UNIT-3: FIR Filter Design

Basics of finite impulse response (FIR) systems, Linear constant difference equations, Frequency response of linear phase filters, Fourier series method of designing, Designing of FIR filters using windowing techniques: Rectangular, Triangular, Hamming, Hanning and Blackman, windows, Realization of FIR structure: direct, cascade and Linear phase FIR system form.

UNIT-4: Multi-rate Digital Signal Processing

Introduction, Sampling, Sampling rate conversion: decimation and interpolation, Cascading of sampling rate converters, Poly-phase filter structure: Poly-phase decomposition, Multistage Decimator and Interpolators.

UNIT-5: Digital Signal Processors

Introduction, Categories of DSPs, Different DPSs, Selection of DPSs, Applications of DSPs, Elementary idea about the architecture and important instruction sets of TMS320C5416/6713.

Text Books:

1. Digital Signal Processing, Vallavaraj, Salivahanan, Gnanapriya, TMH.

2. Digital Signal Processing, Proakis, Manolakis& Sharma, Pearson Education.

Reference Books:

1. Digital Signal Processing, P. Ramesh Babu, Scitech Publication, India.

2. Discrete Time Signal Processing, Oppenheim & Schafer, Pearson – PHI.

3. Digital Signal Processing, A. Anand Kumar, PHI, Eastern Economy Edition, 2013.

Course Outcomes:

CO	Electrical Engineering Graduates will be able to:
CO1	Understand the application of Fourier and Z-transform with respect to Digital signal processing.
CO2	Comprehend and design IIR filters by different techniques.
CO3	Understand the FIR filter and implement it with window technique.
CO4	Evaluate and design multi-rate digital signal processing systems.
CO5	Apply the concepts of digital signal processing for different applications and understand the fundamentals of digital signal processors.

CO-PO & PSO Correlation:

Course Name : Digital Signal Processing (SOE-B-EE602)											
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1	3	2							3		
CO2	3	2	3						3	2	
CO3	3	2	3						3	2	
CO4	3	2	3						3	2	1
CO5	3	2	3						3	2	1

Note: 1: Low 2: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**VI**
Name of the Course:	**Microprocessor & Microcontroller**	**Course Code:**	**SOE-B-EE603**
Credits:	**3**	**No. of Hours:**	**3 Hrs Per Week**
Max Marks:	**100**		

Course Description:

The purpose of this course is to teach students the fundamentals of different microprocessors and systems. The student will be able to incorporate these concepts into their electronic designs for other courses where control can be achieved via a microprocessor/controller implementation. Topics include Semiconductor memory devices and systems, microcomputer architecture, assembly language programming, I/O programming, I/O interface design, I/O peripheral devices, data communications, and data acquisition systems.

Syllabus:

Unit:1 Microprocessor 8086:
Introduction to 16-bit 8086 microprocessors, architecture of 8086, pin configuration, mode, timing diagram, memory interfacing, interrupts, instruction set of 8086, addressing mode, assembler directives & operations, assembly language programming, subroutine call and returns, concept of stack, stack structure of 8086, timing and delay subroutines.

Unit:2 Input-output interfacing:
PPI 8255 architecture and modes of operation, interfacing keyboard, ADC and DAC interfacing with processor 8086, DMA controller (8257) architecture.

Unit:3 Microcontroller 8051:
Intel family of 8- bit microcontrollers, architecture of 8051, pin description, I/O configuration, interrupts; interrupt structure and interrupt priorities, accessing external memories, addressing modes, instruction set of 8051 and its programming.

Unit:4 Microcontroller 8051 interfacing:
interfacing to ADC and DAC, stepper motor interfacing, timer/ counter functions, 8051 serial communications and its basic modes, Mini project- microcontroller-based industrial automation.

Unit:5 AVR RISC Microcontroller:
Introduction to AVR family microcontroller, ALU, memory access and instruction executions. I/O memory, EEPROM, I/O ports.

Text Books:

1. Microprocessors and Interfacing, Douglas V. Hall, McGraw Hill International Ed. 1992.
2. The 8051 Microcontroller and Embedded Systems, Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin Mackinlay, Prentice Hall; 2 editions, 2005.

References Books:

1. The Intel Microprocessors: 8086/8088, 80186, 80286, 80386 & 80486, Bary B. Brey, Prentice Hall, India 1996.
2. Advanced Microprocessors Peripherals, A K Ray and K M Bhurchandi, 2nd ed., TMH, 2006.

Course Outcomes:

CO	After successful completion of the course, students will be able to:
CO1	Identify detailed s/w and h/w structure of the Microprocessor 8086.
CO2	Analyze the concept of ICs interfacing with Microprocessors.
CO3	Identify detailed s/w and h/w structure of the Microcontrollers 8051.
CO4	Interface advanced peripherals and Memory with Microcontrollers.
CO5	Identify detailed structure of the AVR Microcontroller.

CO-PO & PSO Correlation:

Course Name : Microprocessor & Microcontroller (SOE-B-EE603)											
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1		1							2		
CO2	1								1	2	
CO3			1	1	1	1	1	1		3	
CO4		1								1	1
CO5	2	3			1	1	1	1		1	3

Note: 1: Low 2: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**VI**
Name of the Course:	**Renewable Energy Sources and systems**	**Course Code:**	**SOE-B-EE604**
Credits:	**3**	**No. of Hours:**	**3 Hrs Per Week**
Max Marks:	**100**		

Course Description:

The subject curriculum focuses on the study of fundamentals of operating principle of a range of non-conventional energy resources, materials used, characterization, and key performance characteristics. The technologies looked at will include, Solar energy, Wind, Batteries, Fuel cells, and Geothermal conversion. The advantages and limitations of these technologies in comparison to conventional sources of energy will also be examined.

Syllabus:

UNIT-1: Introduction

Non-Conventional Sources of Energy: An overview, Energy Consumption, Details of Energy usage in each sector, Consequences of Energy Consumption. Renewable Energy Technologies, Energy Usage by Humans: Estimate of Impact on Atmosphere, Conventional Sources of Energy,

UNIT-2: Solar Energy and Applications

The Sun to Earth Transaction, Electromagnetic Radiation: Solar Spectrum, Solar flat plate collector, Solar Concentrator, Solar Energy: Solar Cell, Growing the single crystal and making the p-n junction, Interaction of p-n junction with radiation, Solar cell characteristics and usage, Solar cell construction, Solar Photo-catalysis.

UNIT-3: Wind Energy

Overview, Energy Considerations, Efficiency, Parts and Materials, Design Considerations.

UNIT-4: Geothermal Energy and Biomass

Ocean Thermal Energy: Conversion (OTEC), Geothermal Energy Technological aspects, Biomass Usage and Issues.

UNIT-5: Batteries and Fuel Cells

Basics, Testing and Performance, Lithium ion Batteries, Common Battery Structures and Types, Types of Fuel Cells, Concept to Product, Characterization of Electrochemical Devices, Parts and Assembly, Super-capacitors, Flywheels, Magneto-hydrodynamic Power Generation.

Text Books:

1. Non-conventional Energy Sources: N.K. Bansal, Vikas Publishing House, 2014.
2. Renewable Energy Sources and Emerging Technologies: D.P. Kothari, Prentice Hall, 2nd edition 2011.

Reference Books:

1. Non-conventional energy sources: G.D. Rai, Khanna publisher 2004.
2. Wind Energy Systems, G.L. Johnson Prentice Hall, 2006.
3. Biomass Gasification Principles and Technology, Energy technology review No. 67, - T.B. Read (Noyes Data Corp. , 1981)
4. Biomass Renewable Energy, D.O. Hall and R.P. Overeed, John Wiley and Sons, New York, 1987.

Course Outcomes:

CO	After completion of this course module, students will able to:
CO1	Understand and analyze Solar cell characteristics, usage and construction.
CO2	Get an overall idea about Photo-catalysis.
CO3	Get an overall idea about ocean thermal energy conversion.
CO4	Understand and analyze Magneto-hydrodynamic Power Generation.
CO5	Understand and analyze numeric calculation

CO-PO & PSO Correlation:

Course Name : Renewable Energy Sources and systems (SOE-B-EE604)											
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1	1	2		1		1	2		1	2	
CO2			2		1			1		1	1
CO3	1	3		3		2	3		2		2
CO4		2	2		2	2		1	1	2	
CO5	1	1			2			1			

Note: 1: Low 2: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**VI**
Name of the Course:	**Advance AI and Machine Learning (Professional Elective-I)**	**Course Code:**	**SOE-B-EE605(1)**
Credits:	**3**	**No. of Hours:**	**3 Hrs Per Week**
Max Marks:	**100**		

Course Description:

Machine Learning is the discipline of designing algorithms that allow machines (e.g., a computer) to learn patterns and concepts from data without being explicitly programmed. This course will be an introduction to the design and analysis of Machine Learning algorithms, with examples of real-world applications. This is an introductory course in Machine Learning. Course also deals with some soft computing techniques like Fuzzy logic and genetic algorithms.

Syllabus:

UNIT-1: Introduction to Machine Learning

Basics of Machine Learning, data and tools, Visualization, Applications of Machine Learning, Supervised vs Unsupervised Learning, Python libraries suitable for Machine Learning.

UNIT-2: Regression

Types of Regression Models, Building a Regression model in Python Linear Regression, Non-linear Regression, Model evaluation methods, Logistic regression, Overfitting and complexity, training, validation, test data.

UNIT-3: Classification

Class overview, Class organization, Classification problems, decision boundaries, Linear classifiers, Probability and classification, Bayes optimal decisions, K-Nearest Neighbor, Decision Trees, Logistic Regression, Support Vector Machines (SVM), Model Evaluation

UNIT-4: Fuzzy Logic

Introduction to Fuzzy Logic, Introduction to Crisp Sets and Fuzzy Sets, Basic Fuzzy Set Operation (Union, Intersection, Complement and Other Fuzzy Algebraic Operations) and Approximate Reasoning, Fuzzy Membership Functions, Fuzzy Relations, Fuzzy Propositions, Fuzzy Implications, Different Defuzzification Techniques like CoG, CoA, CoS, Height Methods.

UNIT-5: Genetic Algorithm

Solving Optimization Problems, Basic Concept of Genetic Algorithm and Detail Algorithmic Steps, Adjustment of Free Parameters, GA Operators: Encoding, Selection, Crossover, Mutation, Multi-Objective Optimization, Pareto Optimality.

Text Books:

1. Introduction to Machine Learning with Python, A Guide for Data Scientists by Andreas C. Müller, 1st Edition, O'Reilly Publication.

2. Machine Learning (in Python and R) for Dummies, John Paul Mueller and Luca Massaron, 1st Edition, Learning Made Easy publication.

3. An Introduction to Fuzzy Control: Dimiter Driankov, Hans Hellendoorn, Michael Rein Frank, Springer, Verlag Berlin Heidelberg; 2nd Edition

4. Genetic Algorithms in Search, Optimization and Machine Learning, David E. Goldberg, Addison-Wesley Longman Publishing Co.; 1st Edition

Reference Books:

1. Hal Daumé III, A Course in Machine Learning (CIML), 2017 (freely available online)

2. Kevin Murphy, Machine Learning: A Probabilistic Perspective (MLAPP), MIT Press, 2012.

3. Fuzzy Logic with Engineering Applications: Timothy J. Ross, Wiley; 3rd Edition.

4. Optimization for Engineering Design: Algorithms and Examples: Kalyanmoy Deb, Prentice Hall India Learning Private Limited; 2nd Edition.

Course Outcomes:

CO	By the end of the course, students should be able to:
CO1	Develop an appreciation for what is involved in learning models from data.
CO2	Understand a wide variety of learning algorithms.
CO3	Understand how to evaluate models generated from data.
CO4	Apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

CO-PO & PSO Correlation:

Course Name : Advance AI and Machine Learning (SOE-B-EE605(1))												
	Program Outcomes								PSOs			
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3	4
CO1	2	1	2	3	1	2	2	1	2	4	1	1
CO2	3	2	1	3	1	2	1	3	2	2	3	1
CO3	3	2	3	1	2	1	4	2	2	1	1	2
CO4	3	2	2	2	3	2	3	4	2	2	1	2

Note: 1: Low 2: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**VI**
Name of the Course:	**Computer Networks (Professional Elective- I)**	**Course Code:**	**SOE-B-EE605(2)**
Credits:	**3**	**No. of Hours:**	**3 Hr per week**
Max Marks:	**100**		

Course Description:

The course will embed the understanding of data communication model, different architectures of standard networking suites. The course will emphasize on OSI and IP models' all layers, LAN and WAN technologies, different hardware's and software's protocols for communicating between devices, reliable and connection based communication. The course will also discuss the application layer internet based applications like email, DNS, SMTP, HTTP and discuss their advantages and limitations.

Syllabus:

UNIT-1: Introduction to Data Communication and Physical Layer

Communication System Model, Data Communication Networks, Protocol, Need of Protocol, TCP/IP Protocol Suite, OSI Model, Transmission Modes, Categories of Network, Topologies of Network. Signal Encoding Techniques: Digital to Digital Conversion-Unipolar, Polar: NRZ, RZ, Biphase, Bipolar, Transmission of Digital Data: DTE-DCE Interface, EIA-232D, Null Modem, Modems: Traditional Modem, 56K Modem.

UNIT-2: Data link layer

Design issues, framing, error detection and correction, CRC, Elementary Protocol-stop and wait, Sliding Window, Slip, Data link layer in HDLC, Multiple Access Protocols – Link Layer Addressing, ARP, DHCP, Ethernet, Hubs, Bridges, and Switches. Ring Topology, Physical Ring, Logical Ring.

Medium Access sub layer: ALOHA, MAC addresses, Carrier sense multiple accesses. IEEE 802.X Standard Ethernet, wireless LANS. Bridges

UNIT-3: Network Layer

Forwarding and Routing, Network Service Models, Virtual Circuit and Datagram Networks, Router, Internet Protocol (IP) – IPv4 and IPv6, ICMP, Link State Routing, Distance Vector Routing, Hierarchical, Routing, RIP, OSPF, BGP, Broadcast and Multicast Routing, MPLS, Mobile IP, IPsec.

NIT-4: Transport Layer

Transport Layer Services, Multiplexing and Demultiplexing, UDP, Reliable Data Transfer, Go-Back-N and Selective Repeat. Connection-Oriented Transport: TCP Segment Structure, RTT estimation, Flow Control, Connection Management, Congestion Control, TCP Delay Modeling – SSL and TLS, ISDN services.

UNIT-5: Application Layer

Web and HTTP, FTP, SMTP, DNS, Circuit and Packet switching, Asynchronous Transfer Mode-ATM architecture, Virtual Connection, Identifiers, Cells, Connection Establishment and Release. Switching: VPC switch; ATM Layers: AALs.

Text Books:

1. Data Communications and Networking, Behrouz A. Forouzan, McGraw Hill Education; 4th Edition, 2017
2. Data and Computer Communications, William Stalling, Pearson Education India, 7th Edition, 2016.

Reference Books:

1. Computer Networks, Andrew S Tanenbaum, Pearson Education India, 4th Edition, 2012
2. Engineering Approach to Computer Networks, S.Keshav, Pearson Education India, 2nd Edition, 2002.
3. Understanding communications and Networks, W.A. Shay, 3rd Edition, Cengage Learning Publisher, 2003.

Course Outcomes:

CO	After completing the course, the students will be able to:
CO1	Understand the working of internet based on OSI model and TCP/IP protocol suite.
CO2	Describe the basis and structure of an abstract layered Network protocol model
CO3	Evaluate practical requirements of LAN on the basis of various topologies, signaling techniques and various interfaces.
CO4	Identify and apply basic theorems and formulae of communication
CO5	Analyze the performance of TCP/IP network protocols.

CO-PO & PSO Correlation:

Course Name : Computer Networks (SOE-B-EE605 (2))											
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1	2	3	1	2	3	1	2	2	1	3	3
CO2	3		1	2	2	2	4	1	2	2	1
CO3	1	2	2	1	3	3	3	2	2	1	3
CO4	3	2	2	4	3	1	2	2	2	2	1
CO5	1	3	1	3	1	3	2	2	1	3	2

Note: 1: Low 2: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**VI**
Name of the Course:	**Industrial Automation (Professional Elective- I)**	**Course Code:**	**SOE-B-EE605(3)**
Credits:	**3**	**No. of Hours:**	**3 Hrs Per Week**
Max Marks:	**100**		

Course Description:

The contents aim to develop the knowledge of the student in the field of automation in industries. This will be comprising knowledge of PLC, DCS and SCADA Systems. They will also get familiar with different industrial standard protocols.

Syllabus:

UNIT-1: Control Systems and Automation Strategy

Evolution of instrumentation and control, Role of automation in industries, Benefits of automation, Introduction to automation tools PLC, DCS, SCADA, Hybrid DCS/PLC, Automation strategy evolution, Control system audit, performance criteria, Safety Systems.

UNIT-2: Programmable logic controllers (PLC)

Introduction, architecture, definition of discrete state process control, PLC Vs PC, PLC Vs DCS, relay diagram, ladder diagram, ladder diagram examples, relay sequencers, timers/counters, PLC design, Study of at least one industrial PLC.

UNIT-3: Advance Applications of PLC and SCADA

PLC programming methods as per IEC 61131, PLC applications for batch process using SFC, Analog Control using PLC, PLC interface to SCADA/DCS using communication links (RS232, RS485) and protocols (Modbus ASCII/RTU)

UNIT-4: Instrumentation Standard Protocols

HART Protocol introduction, frame structure, programming, implementation examples, Benefits, Advantages and Limitations. Foundation Fieldbus H1 introduction, structure, programming, FDS configuration, implementation examples, Benefits, Advantages and Limitations, Comparison with other fieldbus standards including Device net, Profibus, Control net, CAN, Industrial Ethernet etc.

UNIT-5: Distributed Control Systems

DCS introduction, functions, advantages and limitations, DCS as an automation tool to support Enterprise Resources Planning, DCS Architecture of different makes, specifications, configuration and programming, functions including database management, reporting, alarm management, communication,

Text Books:

1. Programmable Logic Controllers: Principles and Applications, Webb and Reis, PHI publication 4th edition 1998.
2. Computer Based Process Control, Krishna Kant, PHI publication 2nd edition 2011.

Reference Books:

1. Computer Aided Process Control, S.K.Singh, PHI publication 2004.
2. Introduction to Programmable Logic Controllers, Garry Dunning, Thomson Learning 3rd edition 2005.
3. The Management of Control System: Justification and Technical Auditing, N.E.Battikha, ISA 1992.
4. Distributed Computer Control for Industrial Automation, Poppovik Bhatkar, Dekkar Publications, 1992.

Course Outcomes:

CO	After completing the course, the students will be able to:
CO1	Describe working of various blocks of basic industrial automation system
CO2	Connect the peripherals with the PLC
CO3	Use various PLC functions and develop small PLC programs
CO4	Summarize Distributed control system and SCADA system.
CO5	Understand the concepts of Industrial Robotics, both its social significance and its technical importance in manufacturing automation.

CO-PO & PSO Correlation:

Course Name : Industrial Automation (SOE-B- EE605(3))											
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1	3	2	1	4	1	1	3	2	2	1	1
CO2	3	2	1	2	3	2	2	1	2	1	2
CO3	3	2	2	1	1	1	2	3	1	2	1
CO4	3	2	2	3	2	3	1	2	2	2	3
CO5	1	3	3	2	2	2	3	2	1	2	1

Note: 1: Low 2: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**VI**
Name of the Course:	**Utilization of Electric Energy (Professional Elective- I)**	**Course Code:**	**SOE-B-EE605(4)**
Credits:	**3**	**No. of Hours:**	**3 Hrs Per Week**
Max Marks:	**100**		

Course Description:

This course is exploratory; it will help them to develop some fundamentals of illumination and its classification and electric heating and welding systems. The focus of the course is to impart useful skills on the students in order to enhance their system analysis capability. Hence, the course is designed to provide students with fundamental knowledge on all the varieties of electric drive and their applications to traction systems

Syllabus:

UNIT- 1: Electric Drives:

Type of electric drives, choice of electric drives, starting and running characteristics, speed control, temperature rise, Choice of motor, starting and running characteristics, speed control, temperature rise, particular applications of electric drives, types of industrial loads, continuous, intermittent and variable loads, load equalization.

UNIT- 2: Electric Heating

Electric heating: Introduction, Methods of electric heating, Principle of electric heating, Resistance heating, heating elements and alloys, Causes of failures of heating elements, Advantages and disadvantages of electric heating, Types of electric heating

Arc furnaces- Principle, construction, working and uses, Induction heating- Principle, construction and use.

UNIT- 3: Electric Welding

Electric welding: electric definition, Classification of electrical welding, welding equipment, Principle of arc welding, Qualities of a good weld, welding defects, Resistance welding, Advantages, Classification, Principle and working, Comparison of resistance and arc welding process, A.C. & D.C. welding comparison, TIG and MIG welding.

UNIT- 4: Train Mechanics

Review of existing electric traction systems in India, System of electric traction and track electrification, special features of traction motor, methods of electric braking-plugging, rheostat braking and regenerative braking, mechanics of train movement.

UNIT- 5: Electric Traction:

Tractive effort, power, specific energy consumption for given run, effect of varying acceleration and braking retardation, adhesive weight and braking retardation adhesive weight and coefficient of adhesion, Speed-time curves for different services – trapezoidal and quadrilateral speed time curves.

Text Books:

1. S Sivarnagaraju, D Srilatha, M Balasubbareddy, "Generation and Utilization of Electrical Energy", Pearson Education India, 1st Edition, 2010.

2. Art & Science of Utilization of Electrical Energy, Partab, Dhanpat Rai & Sons.

3. Utilizations of Electric Energy, E Openshaw Taylor, Orient Longman, 1st Edition, 2003.

4. Utilizations of Electric Power and Electric Traction, J.B. Gupta , S.K. Kataruia & Sons, 14 st edition.

Reference Books:

1. Utilization of Electrical Power including Electric drives and Electric traction, N V Suryanarayana, New Age International (P) Limited, Publishers, 1st Edition, 1996.

2. Generation, Distribution and Utilization of electrical Energy, C L Wadhwa, New Age International (P) Limited, 1st Edition, 1997.

3. Art & Science of Utilization of electrical Energy, Partab, Dhanpat Rai &Sons 2nd Edition, 2000.

4. Generation, Distribution and Utilization of electrical Energy, C.L. Wadhwa, New Age International (P) Limited, Publishers, 1997.

Course outcomes:

CO	On completion of this course, the student will be able to accomplish the following competencies:
CO1	Understand the basics of the electric drive system.
CO2	Demonstrate the various heating methods .
CO3	Explain and analyze train mechanics.
CO4	Understanding about the welding system.
CO5	Understand the applications of all basic laws of electricity applicable in industries.

CO-PO & PSO Correlation:

Course Name : Utilization of Electric Energy (SOE-B-EE605(4)											
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1	2						1		2	1	1
CO2	2	2					1		2		
CO3	2	2	2						2	2	1
CO4	2	2	2				1		2	1	1
CO5	2	2	2		2	1		1	2	1	1

Note: 1: Low 2: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**VI**
Name of the Course:	**Electrical Engineering Material (Professional Elective- I)**	**Course Code:**	**SOE-B-EE605(5)**
Credits:	**3**	**No. of Hours:**	**3 Hrs Per Week**
Max Marks:	**100**		

Course Description:

This course is an exploratory, first advance course in engineering materials primarily designed for students in Electrical Engineering discipline. The focus of the course is to impart basics of materials and its behavior in electrical engineering. Hence, the course is designed to provide students with fundamental knowledge on electrical engineering materials. This is one of the foundation courses which are required to understand the concepts of advanced courses.

Syllabus:

UNIT- 1: Conductivity of Metal

Introduction, factors affecting the resistivity of electrical materials, motion of an electron in an electric field, Equation of motion of an electron, current carried by electrons, mobility, energy levels of a molecule, emission of electrons from metals, thermionic emission, photo electric emission, field emission, effect of temperature on electrical conductivity of metals, electrical conducting materials, thermal properties, thermal conductivity of metals, thermoelectric effects

UNIT- 2: Dielectric properties

Introduction, effect of a dielectric on the behavior of a capacitor, polarization, the dielectric constant of monatomic gases, frequency dependence of permittivity, dielectric losses, significance of the loss tangent, dipolar relaxation, frequency and temperature dependence of the dielectric constant, dielectric properties of polymeric system, ionic conductivity in insulators, insulation materials, ferroelectricity, piezoelectricity.

UNIT- 3: Magnetic properties of Materials

Introduction, Classification of magnetic materials, diamagnetism, Para magnetism, ferromagnetism, magnetization curve, the hysteresis loop, factors affecting permeability and hysteresis loss, common magnetic materials, magnetic resonance.

UNIT- 4: Semiconductors

Energy band in solids, conductors, semiconductors and insulators, types of semiconductors, Intrinsic semiconductors, impurity type semiconductor, diffusion, the Einstein relation, hall effect, thermal conductivity of semiconductors, electrical conductivity of doped materials.

UNIT- 5: Measurement of Electrical and Magnetic Properties

Introduction, Conductivity measurement, Dielectric measurement, Magnetic measurement, Measurement of semi-conductor parameters.

Text Books:

1. C. S. Indulkar and S.Thiruvengadam, S, "An introduction to Electrical Engineering Materials" , S. Chand and Company Ltd. Publisher,2006.

2. Kenneth g. Budinski, "Engineering Materials" PHI. Publisher, 2010.

Reference Books:

1. S.P.Seth, "A Course in Electrical Engineering Materials", Dhanpat Rai Publisher,2011 .
2. Technical Teachers Training institute, Madras, "Electrical Engineering Materials", TMH Publisher .

Course outcomes:

CO	On completion of this course, the student will be able to
CO1	Describe various aspects of conductivity of material.
CO2	Apply knowledge about the various dielectric properties of material.
CO3	Recognize the various magnetic properties of material.
CO4	Describe factors affecting properties of material.
CO5	Recognize the properties of semiconductors.

CO-PO & PSO Correlation:

Course Name : Electrical Engineering Material (SOE-B-EE605(5)											
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1	2						1		2	1	1
CO2	2	2					1		2		
CO3	2	2	2						2	2	1
CO4	2	2	2				1		2	1	1
CO5	2	2	2		2	1		1	2	1	1

Note: 1: Low 2: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**VI**
Name of the Course:	**Electrical Drives Lab**	**Course Code:**	**SOE-B-EE606**
Credits:	**2**	**No. of Hours:**	**4 Hr per week**
Max Marks:	**50**		

Course Description:

It consists of performance of different types of ac and dc drives, their suitability for different types of loads and the simulation of these drives.

Syllabus:

List of Experiments:

1. Speed control of separately excited dc motor using single - phase fully controlled bridge converter.
2. Speed control of separately excited dc motor using single - phase half controlled bridge converter.
3. Speed control of separately excited dc motor using single-phase dual converter (Static Ward-Leonard Control).
4. Speed control of separately excited dc motor using chopper.
5. Closed loop control of separately excited dc motor using chopper.
6. Speed control of single phase induction motor using single phase ac voltage controller.
7. Speed control of three phase induction motor using three phase ac voltage controller.
8. Speed control of three phase induction motor using three phase current source inverter.
9. Speed control of three phase induction motor using three phase voltage source inverter.
10. Speed control of three phase slip ring induction motor using static rotor resistance control.
11. Speed control of three phase slip ring induction motor using static Scherbius slip power recovery control scheme.

Simulation Based Experiments:

1. Study of starting transient response of separately excited dc motor.
2. Speed control of separately excited dc motor using single phase fully/half controlled bridge converter in discontinuous and continuous current modes.
3. Speed control of separately excited dc motor using chopper control in motoring and braking modes.
4. Study of starting transient response of three phase induction motor.

5. Speed control of three phase induction motor using:
   (a) V/F control
   (b) Voltage and frequency control

Recommended Books:

1. Electric Drives: An Integrative Approach, Mohan, N., MNPERE 2001.
2. Advanced Electric Drives: Analysis, Control, and Modeling Using Simulink, Mohan, N., MNPERE,2001.
3. Electric Motor & Drives: Modeling, Analysis & Control, Krishnan, R., PHI Pvt. Ltd. 2001.
4. Modern Power Electronics & AC Drives, Bose B.K., PHI Pvt. Ltd., 2001.

Course Outcomes:

CO	At the end of the course, a student will be able to:
CO1	Identify relevant information to supplement the Electric Drives course.
CO2	Set up control strategies to synthesize the voltages in dc and ac motor drives.
CO3	Develop testing and experimental procedures applying basic knowledge in electronics, electrical circuit analysis, electrical machines, microprocessors, and programmable logic controllers.
CO4	Combine the use of computer-based simulation tools relevant to electrical Drives.
CO5	Estimate constraints, uncertainties and risks of the system.

CO-PO & PSO Correlation:

Course Name : Electrical Drives Lab (SOE-B-EE606)											
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1	1	1							2	1	
CO2	3	3							2	1	
CO3	2	2	2						2	2	
CO4	2	3	2						2	2	
CO5	2	2	3						2	2	1

Note: 1: Low 2: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**VI**
Name of the Course:	**Product Development Lab**	**Course Code:**	**SOE-B-EE607**
Credits:	**2**	**No. of Hours:**	**4 Hrs Per Week**
Max Marks:	**50**		

Course Description:

Students will be able to translate a prototype to a useful product. Apply relevant codes and standards during product development. The student will be able to present his results by means of clear technical reports.

Course Outcomes:

CO	**Electrical Engineering Graduates will be able to:**
CO1	Demonstrate the ability to translate the developed prototype/working model to a viable product useful to society/industry.
CO2	Apply the appropriate codes/regulations/standards during product development.
CO3	Write clear and concise technical reports and research articles Module Content Students are expected to translate the developed prototypes / working models into a product which has application to society or industry.

CO-PO & PSO Correlation:

Course Name : Product Development Lab (SOE-B-EE607)											
	Program Outcomes								**PSOs**		
Course Outcomes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**
CO1	**2**	**1**							**2**	**1**	
CO2	**2**	**2**							**2**	**1**	
CO3	**2**	**2**	**2**						**2**	**2**	

Note: 1: Low 2: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**VI**
Name of the Course:	**Microprocessor & Microcontroller Lab**	**Course Code:**	**SOE-B-EE608**
Credits:	**2**	**No. of Hours:**	**4 Hrs Per Week**
Max Marks:	**50**		

Course Description:

This course introduces the assembly language programming of 8086 and 8051 microcontrollers. It gives a practical training of interfacing the peripheral devices with the 8086 microprocessor and microcontrollers. These peripherals are Timers IC, Display, and electrical devices like Motor etc.

List of Experiments:

Microprocessor 8086:

1. To study the architecture diagram of microprocessor 8086 with its general purpose registers.
2. Write an ALP to perform addition, subtraction, multiplication and division on 16-bit data with 8086.
3. Write an ALP to perform logical operations on 16-bit data with 8086.
4. Write an ALP to generate square series from 1 to 20.
5. Write an ALP to generate cube series from 1 to 20.
6. (a) Write an ALP to find the largest number from a block of 15 bytes

   (b) Write an ALP to find the smallest number from a block of 15 bytes
7. Write an ALP to move 10 bytes of data stored in data segment register to extra segment register.
8. (a) Write an ALP to write a program to arrange a data block in ascending order.

   (b) Write an ALP to write a program to arrange a data block in descending order.

Microcontroller 8051 :
8051 Microcontroller programming using Keil Uvision IDE

1. Write an assembly language program to perform arithmetic operations on 8-bit data using 8051 microcontroller.
2. Write an assembly language program to generate square wave using a port.
3. Write a microcontroller 8051 program to get hex data on the range of 00-FFh from port 0 and convert it to decimal.

4. Basic programming of C:

   a) Write an 8051 C program to send values 00 – FF to port P1.
   b) Write an 8051 C program to send hex values for ASCII characters.
   c) Write an 8051 C program to toggle all the bits of P1 continuously.
   d) Write an 8051 C program to send values of –4 to +4 to port P1.

6. a) Write an 8051 C program to toggle bit D0 of the port P1(P1.0) 10,000 times
   b) Write an 8051 C program to toggle bits of P1 continuously forever with some delay.

7. WAP in C a switch is connected to P1.1, monitor the switch & create the following frequency on P1.2: (i) SWITCH == 0, 500Hz (ii) SWITCH == 1, 1000Hz

8. WAP in 'C' to interface LCD with 8051.

9. WAP in 'C' to interface L293D motor Controller with 8051(AT89C51).

Text Books:

1. Advanced Microprocessors & Peripherals, A K Ray and K M Bhurchandi, 2nd ed., TMH, 2006.
2. Microcomputer Systems: 8086/8088 family Architecture, Programming and Design: Liu & Gibson, PHI Publication, 2nd Edition, 2015.
3. Muhammad Ali Mazidi, J G Mazidi, Rolin D, "The Microcontroller 8051 and Embedded systems", Pearson, 2nd Edition, 2013

Course Outcomes:

CO	On completion of this lab course the students will be able to:
CO1	Demonstrate, analyze and design Microprocessor based systems for digital applications.
CO2	Understand and apply the fundamentals of assembly level programming of microprocessors and microcontrollers.
CO3	Work with standard microprocessor real time interfaces including GPIO, serial ports, digital-to-analog converters and analog-to-digital converters.
CO4	Troubleshoot and do interactions between software and hardware teams.
CO5	Analyze abstract problems and apply a combination of hardware and software to address the problem.

CO-PO & PSO Correlation:

Course Name : Microprocessor & Microcontroller Lab (SOE-B-EE608)											
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1					1	1			1		
CO2	1	2	2							1	1
CO3		2	2	1	1				1		
CO4						1	1	1			1
CO5						1	1	1	1	2	

Note: 1: Low 2: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**VI**
Name of the Course:	**Fundamentals of IoT**	**Course Code:**	**SOE-B-EE609**
Credits:	**2**	**No. of Hours:**	**2 Hrs Per Week**
Max Marks:	**50**		

Course Description:

The course will explore various components of Internet of things such as sensors, hardware and internetworking. The course will enable student to understand the basics of Internet of things, different protocols, security issues and different real-world applications as case studies.

Syllabus:

UNIT-1: Internet of Things (IoT)

Vision, Definition, Characteristics of IOT, Conceptual Framework, Architectural view, technology behind IoT, Sources of the IoT, M2M Communication, IoT Examples. Design Principles for Connected Devices: IoT/M2M systems layers and design standardization, communication technologies, data enrichment and consolidation, ease of designing and affordability.

UNIT-2: Hardware for IoT

Sensors, digital sensors, actuators, radio frequency identification (RFID) technology, wireless sensor networks, participatory sensing technology. Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, Raspberry pi, Beagle Bone, Intel Galileo.

UNIT-3: IoT Protocols

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN, Network Layer: IP versions, Constrained Nodes and Constrained Networks, Zigbee, Optimizing IP for IoT: From 6LoWPAN to 6Lo, Supervisory Control and Data Acquisition, Application Layer Protocols: CoAP and MQTT.

UNIT-4: IoT Security Issues

Understanding the risks, Modes of attack - Denial of Service Guessing the credentials, getting access to stored credentials, Man in the middle,sniffing network communication, Port scanning and web crawling, Search features and wildcards, Breaking ciphers, Tools for achieving security: Virtual Private Networks, X.509 certificates and encryption, Authentication of identities, Usernames and passwords, Using message brokers and provisioning servers, Centralization versus decentralization.

UNIT-5: IoT Applications

IOT Case studies: Home Automation - Smart Appliances, Smoke/ Gas Detection, Cities- Smart Parking , Smart Lighting, streetlights: control and monitoring, Smart Road , Health and Lifestyle- Health and fitness monitoring, Retail - Smart Payments.

Text Books:

1. Internet of Things, Raj Kamal, McGraw Hill Education, 1st Edition, 2017
2. Internet of things (A-Hand-on-Approach), Vijay Madisetti and ArshdeepBahga, Orient Blackswan Private Limited - New Delhi 1st Edition, 2015

Reference Books:

1. The Internet of Things: Connecting Objects, Hakima Chaouchi, Wiley publication, 1st Edition, 2013.
2. The Internet of Things key applications and protocols, Olivier Hersent, David Boswarthick, Omar Elloumi, Wiley publication, 2nd Edition, 2012.
3. Learning Internet of Things, Peter Waher, Packt Publishing Limited, 1st Edition, 2015.
4. The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi and Beagle Bone Black, Donald Norris, McGraw Hill Education publication, 1st Edition, 2015.

Course Outcomes:

CO	After completing the course, the students will be able to:
CO1	Understand general concepts of Internet of Things (IoT) to handle IoT projects.
CO2	Recognize various devices, sensors and applications.
CO3	Apply system design concepts to IoT solutions.
CO4	Analyze various IoT architectures solutions for application development.
CO5	Evaluate design issues in IoT applications.

CO-PO & PSO Correlation:

Course Name : Fundamentals of IoT (SOE-B-EE609)											
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1	1	2	2	2	1	1	3	2	1	3	2
CO2	2	3	1	2	1	2	1	3	1	2	3
CO3	3	1	2	2	1	3	3	1	1	2	1
CO4	2	1	1	2	3	2	2	2	1	2	1
CO5	1	1	2	1	1	3	1	1	1	1	1

Note: 1: Low 2: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**VI**
Name of the Course:	**Professional Development**	**Course Code:**	**SOE-B-EE610**
Credits:	**1**	**No. of Hours:**	**1 Hour Per Week**
Max Marks:	**50**		

Course Description:

Employability is a course for engineering students, designed to develop the knowledge and skills necessary to prepare for the career development. Knowledge of the factors involved in these roles is vital for preparing students to make informed and competent decisions regarding career and family life. This course focuses on the development of the transferable skills students need in job and life situation tasks. These skills include: basic academic skills, thinking skills, personal qualities, use of resources, interpersonal skills and using information.

Syllabus:

UNIT-I. Career Exploration

a. Career Clusters

b. Interest Inventory-Career Cruising

c. Career Cruising – My Portfolio

UNIT-II. Finding a Job

a. Job Sources

b. Networking and Personal Contacts

c. Entrepreneurship

UNIT-III. Job Search Skills

a. Resume Writing

b. Letter of Application

c. Job applications d. Interviews e. Professional Dress

UNIT-IV. Employer/Employee Relationships

a. Communication skills b. Transferable work skills

c. Positive work skills

d. Conflict resolution

e. Workplace legal issues

f. Work ethic

UNIT-V. Small Business

a. Small business types

b. Entrepreneurship

c. Business plan

Recommended Text & Reference Books:

1. "Soft Skills" by Hariharan S., S. N.Sundararajan, and S.P.Shanmugapriya, Mjp Publishers

2. "Soft Skills: Know Yourself and Know the World" by Alex

3. "Making Work Work for the Highly Sensitive Person" by Beverly Jaeger, McGraw-Hill Education

4. "Enhancing Soft Skills" by Dipali Biswas, Shroff; First edition

5. "Soft Skills – Enhancing Employability: Connecting Campus with Corporate" by M. S. Rao, I K International Publishing House Pvt. Ltd

6. "Enhancing Employability @ Soft Skills" by Shalini Verma, Pearson Education; First edition

7. "Get your First Job: A companion for getting your first job – A Guide to Employability Skills and Career Planning" by A J Balasubramanian and Dr J Sadakkadulla, Amazon Asia-Pacific Holdings Private Limited

8. "Soft Skills at Work: Technology for Career Success" by Beverly Amer, Course Technology Inc

9. "BEST: Basic Employability Skills Training: Volume 1" by Sally J. Vonada and JoAnn Brunner, Create Space Independent Publishing Platform

10. Personal Transferable Skills in Accounting Education RPD" by Kim Watty and Beverley Jackling, Routledge; 1 edition

11. "How to develop a pleasing personality" by Atul John Rego, Better yourself bools, Mumbai,2006

Course Outcomes:

CO	After completion of the course, students will be able to:
CO1	Explore their values and career choices through individual skill assessments.
CO2	Make realistic employment choices and to identify the steps necessary to achieve a goal.
CO3	Develop and practice self-management skills for the work site.
CO4	Explore and practice basic communication skills.
CO5	Learn skills for discussing and resolving problems on the work site.
CO6	Assess and improve personal grooming.
CO7	Promote safety awareness including rules and procedures on the work site.

CO-PO & PSO Correlation:

Course Name : Professional Development SOE-B-EE610											
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1				2						1	
CO2						2					
CO3				3						1	
CO4				2							2
CO5				2		2		1		1	1
CO6				1			2			2	
CO7								2			1

Note: 1: Low 2: Moderate 3: High

Electrical Engineering

(Detailed Syllabus of B. Tech 7th Semester)

L: Lecture, T: Tutorial, P: Practical, C: Credit

SEMESTER VII

	Subject Code	Board of Study	SUBJECT	Periods per week			Scheme of Examination and Marks				Credit L+(T+P)/2
							PRE		ESE	Total Marks	
				L	T	P	Mid Sem	TA			
1	SOE-B-ME706	EE	**Research Internship /Industry Internship**	0	0	44	0	250	250	500	22
			TOTAL	**0**	**0**	**44**	**0**	**250**	**250**	**500**	**22**
OR											
1	SOE-B-EE701	EE	**High Voltage Engineering**	4	0	0	30	20	50	100	4
2	SOE-B-EE702	EE	**Soft Computing**	4	0	0	30	20	50	100	4
3	SOE-B-EE703	EE	**Professional Elective- II (Annexure-II)**	3	0	0	30	20	50	100	3
4	SOE-B-EE704	EE	**High Voltage Lab**	0	0	4	0	30	20	50	2
5	SOE-B-EE705	EE	**Professional Development**	1	0	0	0	30	20	50	1
			TOTAL	**12**	**0**	**04**	**90**	**120**	**190**	**400**	**14**

L: Lecture T: Tutorial P: Practical ESE: End Semester Examination T.A: Teacher's Assessment. PRE- Progressive Review Examination

Option A: The Students who opted for an Internship in the 7th Semester will have to choose Subjects in the 8th semester.
Option B: The Students who opted for Subjects in the 7th Semester will have to opt for internships in the 8th semester.

***These subjects are to be studied in self-study mode using SWAYAM/NPTEL/Offline**

**** Minor project may be included within the duration**

Professional Elective-II (Annexure-II)

Sr. No	Subject Code	Courses
1.	SOE-B-EE703 (1)	FACTS Controller
2.	SOE-B-EE703 (2)	Image Processing
3.	SOE-B-EE703 (3)	Special Electrical Machines
4.	SOE-B-EE703 (4)	Advanced Control System
5.	SOE-B-EE703 (5)	Advanced Process Control & Instrumentation

Electrical Engineering

(Detailed Syllabus of B. Tech 8th Semester)

L: Lecture, T: Tutorial, P: Practical, C: Credit

SEMESTER VIII

S. No.	Subject Code	Board of Study	SUBJECT	Periods per week			Scheme of Examination and Marks				Credit L+(T+P)/2
				L	T	P	PRE		ESE	Total Marks	
							Mid Sem	TA			
1	SOE-B-EE701	EE	High Voltage Engineering	4	0	0	30	20	50	100	4
2	SOE-B-EE702	EE	Soft Computing	4	0	0	30	20	50	100	4
3	SOE-B-EE703	EE	Professional Elective- II (Annexure-II)	3	0	0	30	20	50	100	3
4	SOE-B-EE704	EE	High Voltage Lab	0	0	4	0	30	20	50	2
5	SOE-B-EE705	EE	Professional Development	1	0	0	0	30	20	50	1
6	SOE-B-EE801	EE	Major Project	0	0	20	0	150	150	300	10
			TOTAL	**12**	**0**	**24**	**90**	**270**	**340**	**700**	**24**
OR											
1	SOE-B-EE706	EE	Research Internship / Industry Internship	0	0	44	0	250	250	500	22
2	SOE-B-EE801	EE	Major Project	0	0	20	0	150	150	300	10
			TOTAL	**0**	**0**	**64**	**0**	**400**	**400**	**800**	**32**

Professional Elective-II (Annexure-II)

L: Lecture T: Tutorial P: Practical ESE: End Semester Examination T.A: Teacher's Assessment. PRE- Progressive Review Examination

Option Chosen	Credit in VII-Sem	Credit in VIII-Sem	Total Credit
Option A	22	24	**46**
Option B	14	32	**46**

Sr. No	Subject Code	Courses
1.	SOE-B-EE703 (1)	FACTS Controller
2.	SOE-B-EE703 (2)	Image Processing
3.	SOE-B-EE703 (3)	Special Electrical Machines
4.	SOE-B-EE703 (4)	Advanced Control System
5.	SOE-B-EE703 (5)	Advanced Process Control & Instrumentation
6.	SOE-B-EE703 (6)	Installation Commissioning Maintenance & Testing of Electrical Equipment

Professional Elective-II (Annexure-II)

Programme:	**B.Tech.**	**Semester :**	**VIII**
Name of the Course:	**High Voltage Engineering**	**Course Code:**	**SOE-B-EE701**
Credits :	**4**	**No of Hours :**	**4 Hrs Per Week**
Max Marks:	**100**		

Course Description:

The course is an advanced course in high voltage technology and electrical insulating materials. It deals with basic gaseous, liquid and solid dielectric breakdown theories. It also contains important experimental methods of high voltage generation and measurement. The course makes the students familiar with various applications where a high voltage field is used.

Syllabus:

UNIT-1: Breakdown in Gases:

Levels of high voltages, necessity of EHV and its limitations, Electrical insulation and dielectrics, Electrical fields – Uniform and non-uniform fields (weekly and extremely), Electric field, intensity/stress, degree of non-uniformity, Types of insulation – gas, liquid, and solids, Types of ionizations – impact, thermal and photo-ionization, Electron avalanche in uniform field, Townsend's first and second Criterion for breakdown, Streamer theory of breakdown, Paschen's law, Discharge in Weakly non-uniform field, Law of similarity of discharge, Discharge in extremely non-uniform field, Partial breakdown corona, Star, streamer and leader types, Corona loss in transmission lines, Methods of reducing corona loss.

UNIT-2: Breakdown in dielectrics:

Breakdown in Liquid Dielectrics:

Types of liquid dielectrics, pure and commercial liquids, Conduction & breakdown in commercial liquids-suspended particle theory, Cavitation and the bubble theory, determination of breakdown strength of transformer oil, Factors affecting dielectric strength of liquids.

Breakdown in Solid Dielectrics:

Breakdown mechanism, Intrinsic breakdown, Electromechanical breakdown, thermal breakdown, breakdown of solid dielectric in practice, Breakdown due to treeing & tracking, breakdown due to the internal discharges.

UNIT-3: Generation of high voltages:

Generation of high D.C. voltages, half wave & full wave rectifier circuits, Van De Graff generators, Electrostatic Generators, Generation of high alternating voltages, cascade transformers, Generation of impulse voltages, Multistage Impulse generator, Marx circuit, Tripping & control of Impulse generators

UNIT-4: Measurement of high Voltages:

Measurement of high D.C. voltage, Measurement of high A.C.& impulse voltages, series Impedance

voltmeter, series capacitance voltmeter capacitance potential dividers & capacitance voltage transformers, Resistance potential dividers, Electrostatic voltmeter, Spark gap for measurement of high D.C., A.C. & impulse voltages, Potential divider for impulse voltage measurements, CRO for impulse voltage measurements.

UNIT-5: High Voltage Testing of Electrical Apparatus:

Test on insulators, Dry & wet flash Over tests & withstand tests, Impulse flash over & withstand voltage test, High voltage tests on cables Impulse testing of transformers.

Non-Destructive Testing: Measurement of dielectric constant & loss factor, High voltage Schering Bridge, Partial Discharge Measurements.

Text Books:

1. High Voltage Engineering: C.L. Wadhwa, New Age International Ltd., 2nd Ed, 2012
2. High Voltage Engineering: M.S. Naidu & V. Kamraju, Tata McGraw Hill, 5th Ed, 2013
3. An Introduction to High Voltage Engineering: Subir Ray, PHI.2013

Reference Books:

1. High voltage Insulation Engineering: Ravindra Arora and Wolfgang Mosch, New Age International. 2008
2. High voltage Engineering: D. V. Razevig and Chaurasia, Khanna Publication, 1989

Course Outcomes:

CO	After completing the course, the students will be able to:
CO1	Describe the various breakdown theories for gaseous dielectric.
CO2	Describe the various breakdown theories for liquid and solid dielectric.
CO3	Describe the generating methods for high DC, AC, and impulse.
CO3	Describe the measuring methods for high DC, AC and impulse.
CO5	Understand the fundamentals of High Voltage Test Techniques

CO-PO & PSO Correlation:

Course Name : High Voltage Engineering									Code: SOE-B-EE701		
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1:	3	3	2						3	1	1
CO2:	2	3	1						3	2	
CO3:	2	3	3						3	2	
CO4:	3	3	3						2	2	
CO5:	3	3	3						2	2	

Note: 1: Low 2: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**VIII**
Name of the Course:	**Soft Computing**	**Course Code:**	**SOE-B-EE702**
Credits :	**4**	**No of Hours :**	**4 Hrs Per Week**
Max Marks:	**100**		

Course Description:

Soft computing is an emerging approach to computing which parallel the remarkable ability of the human mind to reason and learn in an environment of uncertainty and imprecision. Soft computing is based on some biological inspired methodologies such as genetics, evolution, ant's behaviors, particles swarming, human nervous systems, etc. Soft computing provides a solution when we don't have any mathematical modeling of problem solving (i.e., algorithm), need a solution to a complex problem in real time, easy to adapt with changed scenario and can be implemented with parallel computing. It has enormous applications in many application areas such as medical diagnosis, computer vision, handwritten character reconditions, pattern recognition, machine intelligence, weather forecasting, network optimization, VLSI design, etc.

Syllabus:

UNIT-1:

Basics of Soft Computing: Introduction to Soft Computing: Hard Computing, Soft Computing Characteristics, Hard Computing Vs. Soft Computing, Hybrid Computing.

UNIT-2: Fuzzy Logic:

Introduction to Fuzzy Logic, Introduction to Crisp Sets and Fuzzy Sets, Basic Fuzzy Set Operation (Union, Intersection, Complement and Other Fuzzy Algebraic Operations) and Approximate Reasoning, Fuzzy Membership Functions, Fuzzy Relations, Fuzzy Propositions, Fuzzy Implications, Fuzzy Inferences Such as Mamdani Minimum and Larsen Product, Different Defuzzification Techniques like CoG, CoA, CoS, Height Methods.

UNIT-3: Applications of Fuzzy Logic:

Fuzzy Logic Controllers, Architecture of Fuzzy Logic Controllers, Knowledge-Based Control, Fuzzy Knowledge and Rule Bases, Mamdani type and Takagi-Sugeno type Fuzzy Controllers, Fuzzy PI and Fuzzy PD Controllers.

UNIT-4: Genetic Algorithm:

Solving Optimization Problems, Basic Concept of Genetic Algorithm and Detail Algorithmic Steps, Adjustment of Free Parameters, GA Operators: Encoding, GA Operators: Selection, GA Operators: Crossover, GA Operators: Mutation, Multi-Objective Optimization, Pareto Optimality.

UNIT-5: Neural Networks:

Concept of Artificial Neural Networks and Its Basic Mathematical Model, ANN Architecture, Feed-Forward Multilayer Perceptron, Learning and Training The Neural Network, Applications of ANN, Recurrent Neural Networks, Radial Basis Function Network

Text books:

1. An Introduction to Fuzzy Control: Dimiter Driankov, Hans Hellendoorn, Michael Rein Frank, Springer-Verlag Berlin Heidelberg; 2nd Edition.
2. Intelligent Systems and Control: Principles and Applications: Laxmidhar Behera, Indrani Kar, Oxford University Press.
3. Genetic Algorithms in Search, Optimization, and Machine Learning: David E. Goldberg, Addison-Wesley Longman Publishing Co.; 1st Edition
4. Introduction to Artificial Neural Systems: Jacek M. Zurada,Jaico; 1st Edition

Reference books:

1. Fuzzy Logic with Engineering Applications: Timothy J. Ross, Wiley; 3rd Edition
2. Neural Networks and Learning Machines: Simon S. Haykin, Pearson; 3rd Edition
3. Optimization for Engineering Design: Algorithms and Examples: Kalyanmoy Deb, Prentice Hall India Learning Private Limited; 2nd Edition

Course Outcomes:

CO	After completing the course, the students will be able to:
CO1	Understand the difference between hard computing and soft computing.
CO2	Understand fuzzy set theory and can differentiate between crisp and fuzzy sets.
CO3	Learn different applications of fuzzy logic such as fuzzy logic controllers
CO4	Understand the concept of evolutionary optimization techniques such as genetic algorithms.
CO5	Understand the working of artificial neural networks and applications of ANN for problem solving.

CO-PO & PSO Correlation:

Course Name : Soft Computing						**Code: SOE-B-EE702**				
	Program Outcomes								**PSOs**		
Course Outcomes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**
CO1:	**3**	**1**	**1**			**1**			**1**	**1**	**1**
CO2:	**2**	**3**	**2**			**2**			**2**	**2**	
CO3:	**3**	**3**	**3**			**3**			**3**	**3**	
CO4:	**3**	**3**	**3**			**3**			**3**	**3**	
CO5:	**3**	**3**	**3**			**3**			**3**	**3**	

Note: 1: Low 2: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**VIII**
Name of the Course:	**FACTS Controller**	**Course Code:**	**SOE-B-EE703(1)**
Credits :	**4**	**No of Hours :**	**4 Hrs Per Week**
Max Marks:	**100**		

Course Description:

The subject curriculum focuses on the study of fundamentals of FACTs devices, which are important. It also covers the fundamentals of converters. The subject deals with the review of semiconductor devices. It also covers the working principle of voltage source converters, current source converters, STATCOM and basic FACTs controllers. The topics covered in the curriculum are chosen in such a way that the students get a very good idea of the underlying principles of FACTs controller.

Syllabus:

UNIT-1: Introduction

FACTS concepts and general system considerations: Power flow in AC system, transient stability and dynamic stability, basic description of FACTS controllers, brief review of voltage sourced converter and current sourced converter, modeling philosophy

UNIT-2: Shunt Compensation:

Static var compensator (SVC and STATCOM): objectives of shunt compensation, methods of controllable Var Generation, regulation slope, transfer function, V-I and V-Q characteristics, transient stability enhancement, var reserve control, conventional power flow models, shunt variable susceptance model, firing angle model, transient stability model, voltage magnitude control using SVC & STACOM, Application example

UNIT-3: Series Compensation:

Static Series compensators (TCSC and SSSC): objectives of series compensation, improvements of voltage and transient stability, power oscillation damping, sub-synchronous damping, transmittable power and transmittable angle characteristics, control range, conventional power flow models, variable series impedance model, firing angle model, transient stability model, active power flow control using TCSC & SSSC, Application example

UNIT-4: Static Voltage and Phase Regulators:

Objectives of voltage and phase angle regulators, approaches to TCVR and TCPAR, switching converter based voltage and phase angle regulators

UNIT-5: Emerging FACTS Controllers:

Unified power flow controller: Basic operating principles, transmission control, independent real and reactive power flow control, power flow models, transient stability model, control structure, basic control system for P and Q control, dynamic performance, Application example.

Integrated Power Flow Controller (IPFC): Basic operating principles, transmission control, independent real and reactive power flow control. Brief control studies such as Steady state analysis and control, EMTP studies, power oscillation stability analysis and control, transient stability control.

Text Books:

1. Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems: Narain G. Hingorani and Laszlo Gyugyi, IEEE Press.
2. Thyristor-Based FACTS Controllers for Electrical Transmission Systems: R. Mohan Mathur, Rajiv K. Varma, John Wiley & Sons.

Reference Books:

1. Y. H. Songs, A. T. Johns, “Flexible AC Transmission Systems", IEEE Press, 1999
2. E. Acha, “FACTS: modeling and simulation in power networks”, John Wiley & Sons, 2004.

Course Outcomes:

CO	After completing the course, the students will be able to:
CO1	Understand and analyze reactive power control in the transmission line.
CO2	Overall idea about static series and shunt compensators.
CO3	Overall idea about static synchronous series compensators.
CO4	Understand and analyses different emerging FACTs controllers

CO-PO & PSO Correlation:

Course Name : FACTS Controller					**Code: SOE-B-EE703(1)**						
	Program Outcomes								**PSOs**		
Course Outcomes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**
CO1:	**3**	**1**	**1**			**1**			**1**	**1**	**1**
CO2:	**2**	**3**	**2**			**2**			**2**	**2**	
CO3:	**3**	**3**	**3**			**3**			**3**	**3**	
CO4:	**3**	**3**	**3**			**3**			**3**	**3**	
CO5:	**3**	**3**	**3**			**3**			**3**	**3**	

Note:1: Low 2: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**VIII**
Name of the Course:	**Image Processing**	**Course Code:**	**SOE-B-EE703(2)**
Credits :	**4**	**No of Hours :**	**4 Hrs Per Week**
Max Marks:	**100**		

Course Description:

This course will embed the understanding of the fundamentals of digital image processing, and various image transforms, image enhancement techniques, image restoration techniques. This course also will also emphasis on methods of image compression and segmentation used in digital image processing for real-time applications.

Syllabus:

UNIT-1: Digital Image Fundamentals

Introduction, Origin, Steps in Digital Image Processing, Components, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Relationships Between Pixels, Color Models.

UNIT-2: Image Enhancement

Spatial Domain: Gray Level Transformations, Histogram Processing, Basics of Spatial Filtering—Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform, Smoothing and Sharpening Frequency Domain Filters, Ideal, Butterworth and Gaussian Filters.

UNIT-3: Image Restoration and Segmentation

Noise Models, Mean Filters, Order Statistics, Adaptive Filters, Band Reject Filters, Band Pass Filters, Notch Filters, Optimum Notch Filtering, Inverse
Filtering, Wiener Filtering Segmentation: Detection of Discontinuities—Edge Linking and Boundary Detection, Region Based Segmentation, Morphological Processing, Erosion and Dilation.

UNIT-4: Wavelets and Image Compression

Wavelets, Sub-band Coding, Multiresolution Expansions, Compression: Fundamentals, Image Compression Models, Error Free Compression, Variable Length Coding, Bit, Plane Coding, Lossless Predictive Coding, Lossy Compression, Lossy Predictive Coding, Compression Standards.

UNIT-5: Image Representation and Recognition

Boundary Representation, Chain Code, Polygonal Approximation, Signature, Boundary Segments, Boundary Description, Shape Number, Fourier Descriptor, Moments, Regional Descriptors —Topological Feature, Texture, Patterns and Pattern Classes, Recognition Based On Matching.

Text Books

1. Rafael C. Gonzales, Richard E. Woods, "Digital Image Processing", Third Edition, Pearson Education, 2010.
2. Anil Jain K. "Fundamentals of Digital Image Processing", PHI Learning Pvt. Ltd., 2011.

Reference Books:

1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", Third Edition Tata Mc Graw Hill Pvt. Ltd., 2011.
2. Willliam K Pratt, "Digital Image Processing", John Willey, 2002.
3. Malay K. Pakhira, "Digital Image Processing andPattern Recognition", First Edition, PHI Learning Pvt. Ltd., 2011.

Course Outcomes:

CO	After completing the course, the students will be able to:
CO1	Define the fundamental characteristics of digital images.
CO2	Understand the different image processing tools and techniques.
CO3	Apply the image restoration and image enhancement techniques to digital images.
CO4	Analyze the image compression schemes.
CO5	Assess different pattern recognition techniques.

CO-PO & PSO Correlation:

Course Name : Image Processing					Code: SOE-BEE703(2)						
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1:	2								3	1	
CO2:	3	3	2						2	2	
CO3:	3	3	3						3	2	
CO4:	3	3	3						3	2	
CO5:	3	3	3						3	3	

Note: 1: Low 2 : Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**VIII**
Name of the Course:	**Special Electrical Machine**	**Course Code:**	**SOE-B-EE703(3)**
Credits :	**4**	**No of Hours :**	**4 Hrs Per Week**
Max Marks:	**100**		

Course Description:

This course examines the basic theory, characteristics, construction operation and application of special Electrical Machines. It includes the study of stepper motor, switched reluctance motor, Permanent Magnet DC Motor and Brushless Permanent Magnet DC Motor and Single Phase Special Electrical Machines.

Syllabus:

Unit 1:

Stepper Motor: Introduction, Constructional features, Principle of operation, Variable Reluctance Stepper Motor, Permanent Magnet Stepper Motor, Hybrid Stepper Motor, Other Types of Stepper Motor, Torque Equation, Characteristics of Stepper Motor, Open-loop Control of Stepper Motor, Closed-loop Control of Stepper Motor, Applications of Stepper Motor.

Unit 2:

Switched Reluctance Motor (SRM): Construction, Principle of Working, Basics of SRM Analysis, Constraints on Pole Arc and Tooth Arc, Torque Equation and Characteristics, Power Converter Circuits, Control of SRM, Rotor Position Sensors, Current Regulators, Sensor less Control of SRM.

Permanent Magnet DC Motor and Brushless Permanent Magnet DC Motor: Permanent Magnet DC (PMDC) motor, Brushless Permanent Magnet DC (BLDC) Motors

Unit 3:

Permanent Magnet Synchronous Motor (PMSM): Construction, Principle of Operation, EMF Equation, Torque Equation, Phasor Diagram, Circle Diagram, Comparison of Conventional and PMSM, Control of PMSM, Applications.

Synchronous Reluctance Motor (SyRM): Constructional of SyRM, Working, Phasor Diagram, and Torque Equation, Control of SyRM, Advantages and Applications

Unit 4:

Single Phase Special Electrical Machines: AC series Motor, Repulsion Motor, Hysteresis Motor, Single Phase Reluctance Motor, Universal Motor.

Servo Motors: DC Servo Motors, AC Servo Motors

Unit 5:

Linear Electric Machines: Linear Induction Motor, Linear Synchronous Motor, DC Linear Motor, Linear Reluctance Motor, Linear Levitation Machines.

Text Books:

1. K.Venkataratnam, 'Special Electrical Machines', Universities Press (India) Private Limited, 2008.
2. T. Kenjo, 'Stepping Motors and Their Microprocessor Controls', Clarendon Press London, 1984
3. E.G. Janardanan, 'Special electrical machines', PHI learning Private Limited, Delhi, 2014.

References:

1. R.Krishnan, 'Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application', CRC Press, New York, 2001.
2. T. Kenjo and S. Nagamori, 'Permanent Magnet and Brushless DC Motors', Clarendon Press, London, 1988.
3. T.J.E.Miller,'Brushless Permanent-Magnet and Reluctance Motor Drives', Oxford University Press, 1989.
4. R.Srinivasan, 'Special Electrical Machines', Lakshmi Publications, 2013.

Course Outcomes:

CO	After completing the course, the students will be able to:
CO1	Ability to acquire the knowledge on construction and operation of stepper motors.
CO2	Ability to construction, principle of operation, switched reluctance motors.
CO3	Ability to acquire the knowledge on construction and operation of permanent magnet brushless D.C. motors.
CO4	Ability to acquire the knowledge on construction and operation of permanent magnet synchronous motors.
CO5	Ability to select a special Machine for a particular application.

CO-PO & PSO Correlation:

Course Name : Special Electrical Machine Code: SOE-B-EE703(3)											
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1:	3	3	2						3	1	
CO2:	3	3	2						2	2	
CO3:	3	3	2						3	2	
CO4:	3	3	2						3	2	
CO5:	3	3	2						3	3	

Note: 1: Low 2: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**VIII**
Name of the Course:	**Advanced Control System**	**Course Code:**	**SOE-B-EE703(4)**
Credits :	**4**	**No of Hours :**	**4 Hrs Per Week**
Max Marks:	**100**		

Course Description:

This course introduces recently developed and advanced techniques for solving complex control problems. The study presents theory and methodology for analysis and modelling systems and signals and methods for the design and synthesis of feedback controllers. The emphasis of this course will be on robust control and optimal control of dynamical systems

Prerequisite: Review first and higher-order systems, closed and open-loop responses. Type of signals, Response to step, ramp, impulse and sinusoidal signals.

Syllabus

Unit 1: State Variable Analysis and Design

Introduction, the concept of state, state variables and state model, state modeling of linear systems, linearization of state equations. State-space representation using physical variables, phase variables & canonical variables.

Unit 2: Discrete Systems:

Eigenvalues, Eigenvectors, generalized Eigenvectors. Solution of state equation, state transition matrix and its properties, Diagonalization, Solution of State Equations, Concepts of Controllability and Observability

Unit 3: Pole Placement Techniques:

Stability improvements by state feedback, necessary & sufficient conditions for arbitrary pole placement, state regulator design, state observer design, Controllers- P, PI, PID.

Unit 4: Nonlinear systems:

Introduction, the behavior of the nonlinear system, common physical nonlinearity-saturation, friction, backlash, dead zone, relay, multivariable non-linearity. Phase plane method, singular points.

Unit 5: Stability analysis of nonlinear systems:

Nonlinear system stability, limit cycles, construction of phase trajectories. Lyapunov Stability Definitions, Lyapunov Stability Theorems, Lyapunov Functions for Nonlinear Systems.

Reference Books:

1. Ogata. Modern Control Engineering. Fifth edition, Prentice Hall of India, 2009.
2. Franklin and Powell. Feedback Control of Dynamics Systems. Addison-Wesley.
3. Di Stefano. Feedback Control Systems. Schaum's Outline Series, McGraw Hill, 1967
4. Luenberger. Introduction to Dynamic Systems. Wiley. 1979
5. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", Eleventh Edition, Prentice-Hall, Pearson Education, 2008.

Course Outcomes:

CO	After learning the course, the students should be able to:
CO1	Define and explain the basic properties of multivariable linear systems such as controllability, observability, and transfer functions.
CO2	Derive linear-quadratic optimal controllers for scalar systems, and evaluate how design parameters influence the closed-loop system properties.
CO3	Explain and discuss the basic principles behind model-predictive control, including how the design parameters influence the closed-loop performance.
CO4	Design and assess model-predictive controllers for real-world dynamical systems.
CO5	Describe and evaluate nonlinear dynamical systems and apply linearization techniques when appropriate

CO-PO & PSO Correlation:

Course Name: Advanced Control System					Code: SOE-B-EE703(4)						
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1:		3		1	2	2		3	2	1	3
CO2:	1	1	2			2		1		2	2
CO3:		3	3			2	3		2		3
CO4:	2	1		4	3		1	2		3	3
CO5:	2	3		1		1	2		2	1	

Note: 1: Low 2: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**VIII**
Name of the Course:	**Advanced Process Control and Instrumentation**	**Course Code:**	**SOE-B-EE703(5)**
Credits :	**4**	**No of Hours :**	**4 Hrs Per Week**
Max Marks:	**100**		

Course Description:

Expose students to the advanced control methods used in industries and research. This course prepares the student to take up such challenges in a suitable profession.

Prerequisite: Review first and higher-order systems, closed and open-loop responses. Type of signals, Response to step, ramp, impulse and sinusoidal signals. Transient Response.

Syllabus

Unit 1: Sensors

Types of sensors, Principles of sensors, calibration techniques for sensors, Displacement, Position and Motion Sensors, Force, Torque, Tactile Sensors, Strain Gauges, Pressure Flow and Temperature Sensors.

Unit 2: Optical Instrumentation:

Fiber optic sensors -Intrinsic & extrinsic type -Characteristics and laser generation- Types of lasers- Laser for measurement of distance and length – velocity - acceleration – Calculation of power requirements of laser for material processing.

Unit 3: Industrial Standards:

RS – 232- RS – 485 - ISO-OSI model – EIA 232 interface standard – EIA 485 interface standard – EIA 422 interface standard - 20mA current loop – Serial interface converters -Modbus- Data Highway- HART Protocols, Field bus, Profibus.

Unit 4: PID Control:

Purpose of PID controllers, implementation in Industry PID tuning, tuning methods such as Ziegler-Nichols/Cohen-Coon with lambda-tuning, Velocity and positional form of discrete PID, Cascade control, Smith predictors, Relative Gain Array.

Unit 5: Advanced Process Control

Model Predictive Control, Real-time optimization - linear and nonlinear programming - particle swarm optimization - genetic algorithm.

Unit 6: Smart Instrumentation:

Introduction to Intelligent sensors – smart sensors for temperature and pressure – Smart transmitters for measurement of differential pressure, flow and temperature- self-diagnosis and remote calibration features.

References

1. Alexander D Khazan, "Transducers and their elements:Design and application‖", PTR Prentice Hall, 1994.
2. G Madhusudhana Rao, "Advanced Process control and Instrumentation", InSc International Publications, Bengaluru.
3. Pavel Ripka and Alois Tipek, "Modern sensors handbook" Instrumentation and measurement series, ISTE Ltd., 2007
4. Thomas E. Marlin, "Process Control", McGraw-Hill International Edition.
5. B.G. Liptak, "Handbook of Instrumentation: Process Control"
6. Les A. Kane, "Handbook of Advanced Process Control Systems and Instrumentation" Springer

Course Outcomes:

CO	After learning the course, the students should be able to:
CO1	General concepts of measurement systems, static and dynamic characteristics, errors, standards and calibration.
CO2	Understand the usage of Transducers and sensors in industrial applications.
CO3	To know various tuning methods for the PID controllers
CO4	Understand the national and international safety standards relevant to process control and instrumentation applications.
CO5	By designing the intelligent sensors with advanced tuning methods, the student may get the skill of translating mathematical ideas into physical systems.

CO-PO & PSO Correlation:

Course Name: Advanced Process Control and Instrumentation									Code: SOE-B-EE703(5)		
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1:	2	3		1	2			3	2	1	
CO2:		1	2			2		1	3	2	2
CO3:	3		3	2			3		2	3	
CO4:	2	1		4	3		1	2	2	3	3
CO5:	2	3		1		1	2		2	1	

Note: 1: Low 2: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**VIII**
Name of the Course:	**Installation Commissioning Maintenance & Testing of Electrical Equipment**	**Course Code:**	**SOE-B-EE703(6)**
Credits :	**4**	**No of Hours :**	**4 Hrs Per Week**
Max Marks:	**100**		

Course Description:

Introduction to testing and maintenance strategies, DC and AC testing of insulation of electrical equipment, Testing, commissioning, and maintenance of rotating machines, Testing, commissioning and maintenance of transformer, Troubleshooting of Electrical equipment.

Syllabus

UNIT -1: Overview of Site Management, Electrical Safety

Introduction to Site activities; Civil works, Erection, Testing & Commissioning, Operation and Maintenance, Type and Scope of Maintenance, Advantages of programmed preventive maintenance, Safety management, Electrical shocks, Recommended safety precautions against electrical shocks in LV and HV installations, Safety procedure during commissioning.

UNIT -2: Transformer I.M.T.

Important steps in maintenance of power transformer, maintenance schedule for attended and unattended transformer, causes of troubles and failure of power transformer, Dispatch and shipping, inspection, storage, procedure of filling oil in transformer tank, drying out, various commissioning tests on a power transformer, typical maintenance schedule for transformer up to 1000 KVA and above 1000 KVA, transformer oil filtration.

UNIT -3: Rotating Machines I.M.T.

Standard designation for cooling and degree of protection, Installation and commissioning of induction motor and rotating machines, drying out of electrical rotating machines, insulation resistance measurements, Mechanical maintenance of rotating machines, Care, servicing and maintenance of motor, Troubles, causes, remedies and protective devices during respective abnormal condition in low voltage induction motor, Testing of induction motors.

UNIT -4: Earthing

Introduction and and importance of earthing , Step potential and touch potential , Factors affecting earthing resistance, Methods of earthing , Substation and transmission tower earthing , transformer neutral earthing.

UNIT -5: Hotline Maintenance

Meaning and advantages of hot-line maintenance. Special type non conducting materials used for preparing tools for Hot line maintenance, Tools, Various types of Hot- line operations, safety during Hot line maintenance.

Text Books:

1. Testing, commissioning, operation and maintenance of Electrical equipments –

   S. Rao, 6th Edn. Khanna Publishers.

2. Installation, commissioning & maintenance of Electrical Equipments - Tarlok Singh, S.K. Katariya & Sons

Reference Books:

1. Installation maintenance and testing vol. I & II B.V.S. Rao
2. Electrical Power Equipment maintenance & testing - Paul Gill, CRC Press
3. Electrical Equipment Handbook: Trouble Shooting & Maintenance- Philip Kiameh, Mc Graw Hill.

Course Outcomes:

CO	After learning the course, the students should be able to:
CO1	Undertake installation, commissioning and maintenance of various electric equipment.
CO2	Prepare maintenance schedule of different equipments & machines
CO3	Prepare troubleshooting chart for various electric equipments, machines and domestic appliances
CO4	Prepare procedure of different types of earthings for different types of electrical installations
CO5	Familiar about electric safety regulations and rules during maintenance

CO-PO & PSO Correlation:

Course Name: Installation Commissioning Maintenance & Testing of Electrical Equipment
Code: SOE-B-EE703(6)

	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1:	2	3		1	2			3	2	1	
CO2:		1	2			2		1	3	2	2
CO3:	3		3	2			3		2	3	
CO4:	2	1		4	3		1	2	2	3	3
CO5:	2	3		1		1	2		2	1	

Note: 1: Low 2: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**VIII**
Name of the Course:	**High Voltage Lab**	**Course Code:**	**SOE-B-EE704**
Credits :	**4**	**No of Hours :**	**4 Hrs Per Week**
Max Marks:	**100**		

Course Description:

The lab is an advanced course in high voltage technology and electrical insulating materials. It also contains important experimental methods of high voltage generation and measurement. It deals with various power system components, its testing and calibration.

Syllabus:

List of Experiments (To be performed minimum 10 experiments)

1. To calibrate the voltmeter of the high voltage control panel with the help of standard sphere gap.
2. To determine the corona starting voltage for

a. Rod-plane gap

b. Rod-sphere gap

3. To study and determine breakdown strength of cable (11 kV)
4. Study and determination of breakdown voltage of rod and rod gap
5. To test “one minute withstand voltage” of transformer oil
6. To test power frequency breakdown strength of solid insulating materials

a. Paper

b. Presspan

c. Bakelite

7. To determine flash over voltage of 11 kV Disc insulation.
8. To find the string Efficiency of a string of 11 kV insulator disc.
9. To study impulse generators and obtain standard impulse voltage waves.
10. To study critical Flashover of a Sphere Gap using Impulse voltage generator. (Virtual Lab based)
11. To study the functioning of Voltage Doubler. (Virtual Lab based)
12. To study 3-Stage Cockroft Walton Voltage Multiplier. (Virtual Lab based)

Text Books:

1. High Voltage Engineering: C.L. Wadhwa, New Age International Ltd., 2nd Ed, 2012
2. High Voltage Engineering: M.S. Naidu & V. Kamaraju, Tata McGraw Hill, 5th Ed, 2013
3. An Introduction to High Voltage Engineering: Subir Ray, PHI.2013

Reference Books:

1. High voltage Insulation Engineering: Ravindra Arora and Wolfgang Mosch, New Age International. 2008

2. High voltage Engineering: D. V. Razevig and Chaurasia, Khanna Publication, 1989

Course Outcomes:

CO	At the end of the course, the students will be able to:
CO1	Calibrate the high voltage voltmeter
CO2	Understand the corona effect in high voltage systems
CO3	Determine the dielectric strength of various insulating materials
CO4	Understand and familiar with high voltage impulse generations
CO5	Understand the insulator flashover phenomenon, string efficiency, voltage doubler as well as voltage multiplier

CO-PO & PSO Correlation:

Course Name: High Voltage Lab				Code: SOE-B-EE704						
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6			1	2	
CO1:	3	3	2						3	1	
CO2:	3	3	1						3	3	
CO3:	2	3	3						3	2	
CO4:	3	2	3						2	2	
CO5:	3	3	3						3	3	

Note: 1: Low 2: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**VIII**
Name of the Course:	**Professional Development**	**Course Code:**	**SOE-B-EE705**
Credits :	**1**	**No of Hours :**	**1 Hr Per Week**
Max Marks:	**50**		

Course Description:

Today in the present world, society and organization can be developed that follow a process among the people of organization as an instrument in order to get new styles in proceeding, production and services and effective decision making and the comparison of organization with dynamic environment and competitive market which this process is beds for the developed employment skill. Entrepreneur and Knowledge Management Course aims to provide students with scientific and practical knowledge about entrepreneurship and knowledge management as well as the skills to turn such knowledge into practice. The learning outcomes are therefore designed to help the student acquire perspectives, skills and experiences necessary to take on an entrepreneurial role in future positions and activities. Knowledge Management may provide the experiences of knowledge and experts. This function will create new abilities; increase the performance and the new innovation.

Syllabus:

UNIT -1:

Entrepreneurship, Definition, Role and expectations, Entrepreneurial styles and types, Characteristics of the Entrepreneur, Functions of an Entrepreneur, Promotion of Entrepreneurship, Role of Socio-Cultural, Economic and Political Environment, Growth of Entrepreneurship in Pre and Post-independence era, Constraints for the Growth of Entrepreneurial Culture.

UNIT -2:

Entrepreneurial Motivation Theories, Entrepreneurial Competencies, Developing Competencies, Role of Entrepreneur, Development Programs, Assistance Programme for Small Scale UNITs, Institutional Framework, Role of SSI Sector in the Economy, SSI UNITs, Failure, Causes and Preventive Measures, Turnaround Strategies.

UNIT -3:

Identification of Business Opportunity, Preparation of Feasibility Report, Financial and Technical Evaluation, Project Formulation, Common Errors in Project Formulation, Specimen Project Report, Ownership Structures, Proprietorship, Partnership, Company, Co-operative, Franchise.

UNIT -4:

Corporate Entrepreneurship (Intrapreneurship), Concepts, Need, Strategies, Corporate Practices, Select Cases, Dynamics of Competition, Plans for Survival and Growth.

UNIT -5:

Women Entrepreneurship, Need, Growth of women Entrepreneurship, Problems faced by Women Entrepreneurs, Development of women Entrepreneurship, Entrepreneurship in Informal Sector, Rural Entrepreneurship, Entrepreneurship in Sectors like Agriculture, Tourism, health case, Transport and allied services.

Text Books:

1. Peter Drucker, "Innovation and Entrepreneurship", Taylor and Francis, 2014.
2. Donald L. Sexton & Raymond W.Smilor , "The art and Science of Entrepreneurship", Ballinger pub. Co., 2008.
3. Clifford M. Baumback & Joseph R. Mancuso, "Entrepreneurship and Venture Management", Prentice hall, 1975.

Reference Books:

1. Dan Steinhoff & John F. Burgess, "Small business management – fundamentals", McGraw hill.
2. Small industries service institute (sisi), madras publication: guidelines to entrepreneurs for starting a small scale industry.

Course Outcomes:

CO	At the end of the course, the students will be able to:
CO1	Students are expected to understand Entrepreneurship and importance of Innovation
CO2	Students are expected to know about different business opportunities and how to pursue them
CO3	Students are expected to understand Importance of women entrepreneurship and empowerment

CO-PO & PSO Correlation:

Course Name: Professional Development (SOE-B-EE705)											
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1	1	1	2								1
CO2	1			1	2	1				1	
CO3							1	1			

Note: 1: Low 2: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**VIII**
Name of the Course:	**Major Project**	**Course Code:**	**SOE-B-EE801**
Credits :	**10**	**No of Hours :**	**10 Hrs Per Week**
Max Marks:	**100**		

Course Description:

The project work can be an investigative analysis of a technical problem in the relevant area, planning and/or design project, experimental project or computer application based project on any of the topics. Each project group will submit project synopsis by the end of eighth semester. Project evaluation committee consisting of three or four faculty members specialized in the various fields shall study the feasibility of each project work before giving consent.

Syllabus:

Project work is of duration of one semesters and is expected to be completed in the eighth semester. Each student group consisting of not more than four members is expected to design and develop a complete system or make an investigative analysis of a technical problem in the relevant area. The project batches are expected to fix their topics, complete preliminary studies like literature survey, field measurements etc. in the seventh semester.

Students shall study the topic of project work and define problem statements. The student shall evolve design and/or do experimental study and/or fabricate engineered devices to obtain a solution to the identified problem. The student shall prepare a report and shall present a seminar on the basis of work done at the end of semester.

Course Outcomes:

CO	At the end of the course, the students will be able to:
CO1	Gain in-depth knowledge and use adequate methods in the major subject/field of study.
CO2	Create, analyze and critically evaluate different technical/research solutions.
CO3	Clearly present and discuss the conclusions as well as the knowledge and arguments that form the basis for these findings.
CO4	Identify the issues that must be addressed within the framework of the specific dissertation in order to take into consideration
CO5	apply principles of ethics and standards, skill of presentation and communication techniques.

CO-PO & PSO Correlation:

Course Name: Major Project					**Code: SOE-B-EE801**						
	Program Outcomes								**PSOs**		
Course Outcomes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	
CO1:	**3**	**2**	**2**	**2**		**2**	**2**	**2**	**3**	**2**	
CO2:	**3**	**2**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**3**	
CO3:	**1**	**2**	**1**	**3**	**2**			**1**	**1**	**3**	
CO4:	**1**	**1**	**1**		**1**		**3**	**2**	**1**	**2**	
CO5:	**3**		**3**	**2**		**3**		**1**	**1**	**3**	

Note: 1: Low 2: Moderate 3: High