OP JINDAL UNIVERSITY
Raigarh-Chhattisgarh

UNIVERSITY OF STEEL TECHNOLOGY AND MANAGEMENT

Scheme and Syllabus
of
B. Tech.
(01UG060)

Department of
Electrical Engineering
School of Engineering
2020-2024

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 Specific Outcomes 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	BOS	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-FY101	Math	Mathematics- I	4	1	0	30	20	50	100	5
2	SOE-B-FY102	Chemistry	Engineering Chemistry	3	0	0	30	20	50	100	3
3	SOE-B-FY103	Physics	Physics- I	3	0	0	30	20	50	100	3
4	SOE-B-FY104	CSE	Basic Computing	3	2	0	30	20	50	100	4
5	SOE-B-FY105	Mech	Engineering Graphics	2	2	0	30	20	50	100	3
6	SOE-B-FY106	EE	Basic Electrical & Electronics Engineering	3	0	0	30	20	50	100	3
7	SOE-B-FY107	EE	Basic Electrical & Electronics Engineering Lab	0	0	2	-	30	20	50	1
8	SOE-B-FY108	Chemistry	Engineering Chemistry Lab	0	0	2	-	30	20	50	1
9	SOE-B-FY109	Humanities	Spoken English Communication	0	0	2	-	30	20	50	1
TOTAL				**18**	**05**	**06**	**180**	**210**	**360**	**750**	**24**

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

*** End Semester Examination**

****Teacher Assessment**

***** Progress Review Examination**

Programme:	**B.Tech.**	**Semester :**	**I**
Name of the Course:	**Mathematics-I**	**Course Code:**	**SOE-B-FY101**
Credits :	**5**	**No of Hours :**	**5 Hrs. Per Week**
Max Marks:	**100**		

Course Description:

Find the Rank and Inverse of matrix by using Elementary Transformations. Solve systems of linear equations (homogeneous & non-homogeneous), Eigen values and Eigen vectors of matrix. Find the nth derivative by using Leibmitz's, Taylor's and Maclaurin's Theorem. Differentiation of functions having more than one variable. Integration of functions having nth power, double and triple integral and applications. Gradient, divergence and curl, line integral, Surface integral and Volume integral. Relation between line integral, Surface integral and Volume integral.

Syllabus

UNIT-1: Linear Algebra

Matrix algebra, Elementary transformations; Inverse of a matrix; Rank of matrix; Systems of linear equations (homogeneous & non-homogeneous); Eigen values and Eigen vectors; Cayley-Hamilton theorem; Applications of matrices in Engineering.

UNIT-2: Differential Calculus

Successive differentiation; Leibnitz's theorem; Taylor's and Maclaurin's series; Radius of curvature; Curve tracing.

UNIT-3: Multivariable Calculus

Limits, continuity and differentiability of function of several variables; Partial derivatives; Maxima and minima of function of two or more variables; Method of Lagrange's multipliers; Differentiation under integral sign

UNIT-4: Integral Calculus

Reduction formulae; Double and triple integrals; Change of order of integrations; Beta and Gamma functions; Applications to area and volume

UNIT-5: Vector Calculus

Scalar and vector point functions; Gradient, divergence and curl; Properties of gradient, divergence and curl; Line integral; Surface integral; Volume integral; Green's theorem in a plane; Gauss's Divergence theorem; Stoke's theorem.

Text Books:

1. Advanced Engineering. Mathematics by Erwin Kreyszig (8th edition) – John Wiley & Sons.
2. Higher Engineering. Mathematics by B. S. Grewal (38th edition)-Khanna Publishers.
3. Applied mathematics for Engineers & Physicists by Louis A. Pipes – Mc Graw Hill.
4. Advanced Engineering Mathematics by R. K. Jain & S. R. K. Iyengar – Narosa Publishing House.

Reference Books:

1. Peter V. O'Neil, Advance Engineering Mathematics, Thomson (Cengage) Learning, 2007.
2. Maurice D. Weir, Joel Hass, Frank R. Giordano, Thomas, Calculus, Eleventh Edition, Pearson.
3. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
4. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
5. Ray Wylie C and Louis C Barret, Advanced Engineering Mathematics, Tata Mc-Graw-Hill; Sixth Edition.
6. P. Sivaramakrishna Das and C. Vijayakumari, Engineering Mathematics, 1st Edition, Pearson India Education Services Pvt. Ltd.

Course Outcomes:

CO	After completing the course, the students will be able to:
CO1	Find Rank and Inverse of matrix by using Elementary Transformations and Solve systems of linear equations
CO2	Understand applications in Engineering Problems
CO3	Understand Successive Differentiation, Leibmitz's Theorem for nth derivative of two functions.
CO4	Understand Taylor's and Maclaurin's Theorem and tracing of curves.
CO5	Understand Limits, continuity and differentiability of function of several variables.
CO6	Understand Partial derivatives, Maxima and minima of function of two or more variables.
CO7	Understand Reduction formulae, Double and triple integrals, Change of order of integrations. Beta and Gamma functions; Applications to area and volume.
CO8	Understand Beta and Gamma functions, Applications to area and volume.

CO9	Understand Gradient, divergence and curl and Properties of gradient, divergence and curl.
CO10	Understand Line integral, Surface integral, Volume integral, Green's theorem in a plane; Gauss's Divergence theorem; Stoke's theorem.

CO-PO Correlation:

Course Name: Mathematics-I								**Code:SOE-B-FY101**
Course Outcome	**Program Outcome**							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
CO1	2	2		1	2		2	1
CO2	2					1		2
CO3	1		1		1		1	
CO4	1				2			
CO5	1	2	2	2			2	1
CO6	1				2	2		
CO7	1	1	1					1
CO8	1		1			1	2	
CO9	2			1	1			1
CO10	1		1		1		1	

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

Programme:	**B.Tech.**	**Semester :**	**I**
Name of the Course:	**Engineering Chemistry**	**Course Code:**	**SOE-B-FY102**
Credits :	**3**	**No of Hours :**	**3 Hrs Per Week**
Max Marks:	**100**		

Course Description:

This course aims at giving students theoretical understanding about the basic concepts of Chemistry and to acquire the skills required for an engineer. Reaction rates and factors that influence the reactions and the importance & utility related to it is introduced. The importance of water in industrial usage, significance of corrosion control to protect the structures, polymers and their usage as an important material to be studied. The students will gain knowledge about fuel, characteristics and ranking.

Syllabus:

UNIT-1 Reaction Kinetics

Factors affecting rate of reaction (reactant concentrations, temperature, physical states and surface areas, solvent and catalyst); Rate of reaction, mathematical expression, units, instantaneous & average rate; Rate Law-Differential & Integrated Rate law, order and molecularity, determination of rate law- Differential, Integral, Half-life, Initial rate & graphical method, rate constants (up to second order with one reactant only); Half-lives and radioactive decay kinetics (carbon dating); Collision model of reaction kinetics, activation energy, Arrhenius equation; Catalysis.

UNIT-2 Corrosion Chemistry

Corrosion fundamentals (causes, consequences & driving force); Theories of Corrosion: Dry/ Chemical Corrosion & Wet/ Electrochemical corrosion; Forms of corrosion- Galvanic, Concentration Cell / Differential aeration, wire-fence, waterline, pitting, crevice, stress corrosion, corrosion fatigue, microbial & soil corrosion; Factors affecting corrosion: nature of the metal & corroding environment: Corrosion Control- Proper design, materials selection, protective coatings, use of inhibitors, modifying/ alteration of environment, cathodic protection (sacrificial anodic & impressed current cathodic).

UNIT-3 Water Chemistry

Introduction, sources of water, impurities present in water & their effect, requirement of boiler feed water; Alkalinity – types & determination (including numerical problems); Hardness - definition, types, determination; Water softening process- Lime and Soda,

Zeolite & Ion Exchange Process (including numerical problems); Boiler problems (causes & removal) - sludge and scale, caustic embrittlement, boiler corrosion, priming and foaming; Conditioning of boiler feed water (carbonate, phosphate, colloidal & calgon conditioning).

UNIT-4 Fuels Chemistry

Introduction (definition & classification, characteristics, combustion); Calorific value (HCV & LCV) & its determination - by Dulong's formula & Bomb Calorimeter (principle & working); Coal, ranking & analysis - proximate & ultimate analysis and their importance in ranking; Coke, importance as fuel, manufacturing & carbonization- high temp & low temp carbonization.

Unit-5 Polymer Chemistry

Fundamentals (nomenclature, degree of polymerization, monomer units & classification), Polymerization- Addition, Condensation & Co-polymerization; glass transition temperature, tacticity & Ziegler-Natta catalyst; Preparation, properties, and technical application of major polymers (polyethylene, PVC, Teflon, Nylon 6,6, Bakelite); Introduction to Resin, Types of Resins, Thermoplastic & thermosetting Resin, Industrial applications of resin; Elastomers, natural rubber & vulcanization process.

Textbooks:

1. Engineering Chemistry by P.C. Jain & Monica Jain, 2008
2. A textbook of Engineering Chemistry by Dara, S.S. & Umare, S.S., S Chand, 2013
3. Engineering Chemistry by Palanna O.G., Mc Graw Hill Edu., 2017

Reference Books:

1. Chemistry in Engineering and Technology (Vol-2) by J. C. Kuriacose, J. Rajaram (Tata McGraw Hill).
2. Engineering Chemistry by M.M. Uppal, Revised by S.C. Bhatia (Khanna Publishers).
3. Corrosion for Science and Engineering, Trethewey and Chamberlain, 2nd Edition, Pearson Education 1998
4. Corrosion Engineering, Fontana, 3rd Edition, McGraw Hill, 1986
5. Corrosion Engineering, Roberge, McGraw Hill, 2008
6. Principles of Chemistry, Laidler, K.J., Harcourt, Brace & World, New York, 1966
7. Physical Chemistry, Moore, W.J., Prentice-Hall, 1962
8. Inorganic Chemistry, Moeller, T., John Wiley, 1982

Course Outcomes:

CO	**After completing the course, the students will be able to:**
CO1	Demonstrate an understanding of scientific facts and concepts, scientific methods and techniques, scientific terminology, and methods of presenting scientific information
CO2	Apply and use scientific facts and concepts, scientific methods and techniques, scientific terminology to communicate effectively and apply appropriate methods to present scientific information
CO3	Facilitate the application of chemical principles in engineering and technology for future technopreneurs and researchers

CO-PO Correlation:

Course Name: Engineering Chemistry								**Code:SOE-B-FY102**
	Program Outcome							
Course Outcomes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
CO1	**2**	**1**						
CO2	**1**	**2**						
CO3		**1**	**1**					

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

Programme:	**B.Tech.**	**Semester :**	**I**
Name of the Course:	**Physics-I**	**Course Code:**	**SOE-B-FY103**
Credits :	**3**	**No of Hours :**	**3 Hrs Per Week**
Max Marks:	**100**		

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 Physics-I course is basically fundamentals of electronics, theory and applications of laser, concepts of Newton's law of motion, parameter of Mechanics, interference of light, good conditions for interference and its engineering applications. The purpose of studying Physics-I 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-1: Solid State Theory

Formation of energy bands in metals, Classification of solids on the basis of energy band diagram, Conductivity of Semiconductors, mobility in conductor & semiconductor.

UNIT-2: 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-3: Lasers

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

UNIT-4: General Mechanics

Central and non-central forces, Inverse square force, Potential energy function F = -grad V, equipotential surfaces and meaning of gradient. Conservative and non- conservative forces, Conservation laws of energy & momentum, Harmonic oscillator, damped harmonic motion forced oscillations.

UNIT-5: Interference of light

Superposition of Waves, Conditions for Interference, Methods of formation of coherent sources, Theory of Interference, Fresnel's Biprism, Newton's ring, Diffraction grating, Rayleigh's criterion of resolution, Engineering applications of Interference phenomenon.

Text Books:

- Beiser, Perspectives in Modern Physics, McGraw Hill, 1969.
- Lengyel, Introduction to Laser Physics, Wiley Interscience 1971.
- E. Siegman, An Introduction to Laser and Masers, McGraw Hill 1971.
- S. H. Patil, Elements of Modern Physics, Tata McGraw Hill, 1989.

Reference Books:

- A.K. Ghatak and S. Loknathan, Quantum Mechanics, Theory and Applications, McMillan India, 1984.
- Michael Sayer & Abhai Mansingh, "Measurement, Instrumentation and experiment design in physics and engineering", Prentice Hall of India Pvt. Ltd., New Delhi – 110 001, 2003.
- P. Malvino, "Electronic Principles", Tata McGraw-Hill, 1979.
- H. V. Malmstadt, "Electronics for Scientists", New York : W. A. Benjamin, 1962.
- J. W. Goodman, An Introduction of Fourier Optics, McGraw Hill,N.Y., 1968.

Course Outcomes:

CO	After completing the course, the students will be able to:
CO1	Understand basics of Solid State Physics.
CO2	Know the fundamental principles of semiconductors
CO3	Understand the interference from wave optics concepts and know its applications.
CO4	Acquire knowledge and understanding of fundamental principles of modern physics relevant to problems of Electrical and Electronics Engineering

CO-PO Correlation:

Course Name: Physics-I					Code: SOE-B-FY103			
Course Outcomes	Program Outcomes							
	1	2	3	4	5	6	7	8
CO1	2	2	1					
CO2	2	2	2					
CO3	2	2	1					
CO4	2	2	2					

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

Programme:	**B.Tech.**	**Semester :**	**I**
Name of the Course:	**Basic Computing**	**Course Code:**	**SOE-B-FY104**
Credits :	**4**	**No of Hours :**	**4 Hrs Per Week**
Max Marks:	**100**		

Course Description:

This course will expose students to developments in computer technology and understand the working of a computer system. It will introduce end-user computing and build problem solving skills by using C programming.

Course Outcomes:

CO	After completing the course, the students will be able to:
CO1	Makes students gain a broad perspective about the uses of computers in engineering industry.
CO2	Develops basic understanding of computers, the concept of algorithm and algorithmic thinking.
CO3	Develops the ability to analyze a problem, develop an algorithm to solve it.
CO4	Develops the use of the C programming language to problem solving and develops the basic concepts and terminology of programming in general.
CO5	Introduces the more advanced features of the C language for implementation in diverse platforms.

Syllabus:

UNIT-1 Introduction to Computers

Basic Concepts, Evolution, Computer Organization, Peripheral Devices, Software – System Software, Application Software, Computer Languages – Low Level, Machine Level and High Level Languages, Compiler and Assembler, Microprocessors, Memory, Technological Trends. Algorithms and Flow Chart: Algorithm and its characteristics, flowchart, Algorithm involving Decisions and Loops, Problem solving methods. Pseudo code, top down & bottom up approaches of program design.

UNIT-2 II Introduction to C

History of C, Features of C Language, Structure of a C program, Basic Input Output Execution of C Program- Compiling, Linking, debugging, and running a program. Variables, Constants and Operators: C character set – Tokens, Constants Keywords, identifiers, and Variables. Data types – Data type Qualifiers, Declaration of variables, Arithmetic, Logical, Assignment, Relational, Increment and Decrement, Conditional, Bit wise, Special Operator, Precedence and Associativity

UNIT-3 Looping and Functions

Branching & Looping: Introduction – Simple if statement, if-else, else-if ladder, nested if-else, Switch statement, go to statement. Loops - while, do-while, for loop, nested loops infinite loops Functions: Introduction to functions – Declaration, definition and calling of function, Function arguments and return value, scope and lifetime of variables call by value, call by reference. Storage classes. Recursion. Library functions

UNIT-4 Arrays and Pointers

Arrays: Declaration and initialization of one dimensional, two dimensional and character arrays, accessing and manipulating array elements, array applications - matrix operations, searching, sorting. String manipulations. Pointers: Pointers concepts, pointers and function arguments, pointer arithmetic

UNIT-5 Structures and File Handling Structure

Structure declaration, definition, initialization and accessing. Structure Assignment, Nested Structure, Structures and Functions, Structures and arrays. File Handling: Concept of a file – Data Organization, reading, writing, manipulating and troubleshooting, file types, file opening modes.

Textbooks

1. “Let us C” by Yashvant Kanetkar, BPB Publications.
2. Raja Raman V., "Fundamental of Computers" (4th edition.), Prentice Hall of India, New Delhi.

Reference Books

1. “C Programming Language” by B. W. Kernighan & D.M. Ritchie.
2. “Programming with C (SCHAUM’s Outlines Series)” by Byron Gottfried.

CO-PO Correlation:

Course Name: Basic Computing								**Code: SOE-B-FY104**
Course Outcomes	**Program Outcomes**							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
CO1	**2**			**1**	**3**			
CO2	**1**		**2**	**2**				
CO3	**3**		**1**	**1**	**2**		**2**	
CO4	**2**			**1**				
CO5		**1**			**1**		**2**	**3**

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

Programme:	**B.Tech.**	**Semester :**	**I**
Name of the Course:	**Engineering Graphics**	**Course Code:**	**SOE-B-FY105**
Credits :	**3**	**No of Hours :**	**3 Hrs Per 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.

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 Auto CAD (only for Term Work)

Isometric Projection

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

Text books:

1. N. D. Bhatt and V.M. Panchal, Engineering Drawing, Plane and Solid Geometry, Charotor Publication House, Anand, Gujarat, India.
2. Dhaanjay A. Jolhe, Engineering Drawing with an Introduction to Auto CAD, Tata Megraw- hill Publishing Co. Ltd, New Delhi, India.
3. Basant Agrawal and C.M. Agrawal, Engineering Drawing, Tata Megraw-hill Publishing Co. Ltd, New Delhi, India.
4. K. L. Narayana and P.L. Kannaiah, Engineering Drawing, Second Edition, Scitech Publications (India) Pvt. Ltd. Chennai.
5. K. C. John, Engineering Graphics for Degree, PHI Learning Pvt. Ltd. New Delhi, 2009
6. A. R. Bapat, Engineering Graphics, Allied Publications, New Delhi, India.
7. D. N. Johle, Engineering Drawing, S. Chand and Company Ltd., New Delhi, India.

Reference Books:

1. W. J. Luzadder, Fundamental of Engineering Drawing, Prentice Hall of India.
2. Basudeb Bhattacharyya, Machine Drawing Include Auto CAD Supplements, Oxford University Press, India.
3. French and Vierck, Graphic Science, Mc- Graw Hill international
4. K. Venugopal, Engineering Drawing and Graphics, New Age Publication.
5. R. K. Dhawan, Engineering Drawing, S. Chand and Company Ltd., New Delhi, India.
6. N. B. Shaha and B. C. Rana, Engineering Drawing, Person Education.
7. C. Jensen, J. D. Helsel and D. R. Short, Engineering Drawing and Design, Tata Megraw-hill Publishing Co. Ltd, New Delhi, India.
8. T. Jeyaproovan, Engineering Drawing and Graphics by using Auto CAD, Vikas Publication house, Pvt. Ltd. New Delhi, India.
9. M. L. Dhabhade, Engineering Graphics, Association of technical Authors, Pune

India.
10. B. V. R. Gupta, M. Raja Roy, Engineering Drawing, I. K. International Pvt. Ltd, India.
11. R. K. Dhawan, Engineering Drawing, S. Chand and Company Ltd., New Delhi, India.

Course Outcomes:

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

CO-PO Correlation:

Course Name: Engineering Graphics								Code: SOE-B-FY105
Course Outcomes	Program Outcomes							
	1	2	3	4	5	6	7	8
CO1	3		2	3	3			
CO2	3		2		2		1	
CO3		3		3		2		
CO4	3		2		2			2
CO5		2		3		2		

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

Programme:	**B.Tech.**	**Semester :**	**I**
Name of the Course:	**Basic Electrical and Electronics**	**Course Code:**	**SOE-B-FY106**
Credits :	**3**	**No of Hours :**	**3 Hrs Per Week**
Max Marks:	**100**		

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 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.

Course Outcomes:

CO	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

CO-PO Correlation:

Course Name: Basic Electrical & Electronics Engineering								**Code: SOE-B-FY106**
Course Outcomes	**Program Outcomes**							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
CO1	**2**		**2**			**2**		
CO2		**3**	**2**					
CO3	**3**	**3**			**1**		**1**	
CO4	**3**	**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-FY107**
Credits :	**1**	**No of Hours :**	**2 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. 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.

Syllabus:

List of Experiments:

1. Study of Electrical Safety precautions.
2. Study of CRO, DSO, Function Generator, Multimeter, Power supply.
3. To verify KCL and KVL.
4. To verify Thevenin's and Norton's Theorem.
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 VI 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 /Machine/Software required: Different types of meters, resistors, DC supply, variance, transformers, rheostat. Some experiments can be done by MATLAB.

CO-PO 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**		**1**		**2**		
CO2	**3**		**2**		**1**		**2**	
CO3		**3**						**2**

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

Programme:	**B.Tech.**	**Semester :**	**I**
Name of the Course:	**Engineering Chemistry Lab**	**Course Code:**	**SOE-B-FY108**
Credits :	**1**	**No of Hours :**	**2 Hr Per Week**
Max Marks:	**50**		

Course Description:

This Engineering Chemistry Laboratory is common to first year branches of UG Engineering. The course enables students to

- Apply and use knowledge, methods and techniques for analysis
- Develop an ability to analyze, evaluate and synthesize scientific information
- Develop experimental and investigative scientific skills

List of Experiments

1. Determination of type and extent of Alkalinity in the given sample of water using hydrochloric acid solution (acid-base titration)
2. Determination of chloride ion content in a given water sample by Mohr's method (AgNO3, Cl- titration)
3. Determination of the Dissolved Oxygen in a given water sample by Wrinkler's method using Std. Sodium thiosuphate solution (iodometric titration)
4. Determination of temporary & permanent hardness in water sample by EDTA method (complexometric titration)
5. Determination of order and rate law expression of acid decomposition of thiosulfate ion solution (kinetics study)
6. Determination of the concentration of unknown solution of an electrolyte by conductivity measurement (using data loggers with conductivity probe and drop counters)
7. Determination of equivalence point and concentration of acid by pH measurement (using data loggers with pH probe and drop counters)
8. Demonstration of different types of Corrosion of metals
9. Kinetics ICT Exercise: Determination of order and rate constant of reaction using a spreadsheet and graphical techniques
10. Acid & Base ICT Exercise: Determination of equivalence point and concentration of acid (or base) using spreadsheet and graphical techniques.

Text Books:

1. Laboratory manual on Engineering Chemistry by Dr. Sudha Rani (S. Chand and Company).
2. A Textbook on Experiments and Calculations in Engineering Chemistry by S.S. Dara (Dhanapat Rai Publishing Company Pvt. Ltd.).
3. Experimental in General Chemistry; C.N.R. Rao & U. C. Agrawal, East–West Press.

Reference Books:

1. Advance Practical Chemistry, by ILPC, Wilkinson G., Murrillo, C.A. and Bochmann, Wiley.
2. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
3. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.
4. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.Text Book of Chemical Science by F.W. Billmeyer, John Wiley & sons, 1994.
5. Vogel's Texbook of Quantitative Chemical Analysis (Latest ed.), Revised by G.H. Jeffery, J. Bassett, J. Mendham & R.C. Denney.
6. Applied Chemistry: Theory and Practice (Latest ed.), by O.P. Vermani and A. K. Narula.

Course Outcomes (CO):

CO	After completing the course, the students will be able to:
CO1	Understand the use of instruments, sensors and methods for analyzing various parameters
CO2	Collect, process and analyze data using ICT tools

CO-PO Correlation:

Course Name : Engineering Chemistry Lab								Code: SOE-B-FY108
Course Outcomes	Program Outcome							
	1	2	3	4	5	6	7	8
CO1	2	2						
CO2	1	1						

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

Programme:	**B.Tech.**	**Semester :**	**I**
Name of the Course:	**Spoken English Communication**	**Course Code:**	**SOE-B-FY109**
Credits :	**1**	**No of Hours :**	**2 Hr Per Week**
Max Marks:	**50**		

Course Description

This course examines the process of spoken communication in English language with an emphasis to develop fluency in it. Through individual and group activities, students work on improving pronunciation, practice conversation strategies and delivering oral presentation.

Syllabus

UNIT-1 Basics of Communication

Introduction to Communication, Types of Communication, Barriers to Communication, Listening Skill.

UNIT-2 Grammar in Use

Sentence Structures, Determiners and Preposition, Modals in Conversational Usage, , Voice, Punctuation.

UNIT-3 Oral Communication

Speaking: An Overview, Combating Stage Fright, Describing Objects/Situations/People, Delivering Just-a-minute Sessions, Dialog delivery, one to one conversation.

UNIT-4 Body Language

Body Language - the role of body postures, movements, gestures, facial expressions, dress and make up in effective communication, conduct while facing interviews,

UNIT-5 Professional Presentation

Presentation, Power point Presentation, Group Discussion, Role Plays, Delivering Different Types of Speeches.

Texts Books:

1. A Communicative Grammar of English by Geoffrey N. Leech and Jan Svartvik, Longman
2. Technical Communication for Engineers by Shalini Verma, Vikas Publishing House.
3. A Practical Course in Spoken English by Gangal J.K, Prentice Hall India Learning Private Limited.

Reference Books:

1. English for Technical Communication (With CD) by Aysha Viswamohan, McGraw Hill Education.
2. Comprehensive English Grammar by Madan Sood, Goodwill Publishing House.
3. Spoken English by Alison Reid, Goodwill Publishing House.
4. All about Words: An Adult Approach to Vocabulary Building by Nurnberg, M and M. Rosenblum, W.R. Goyal Publishers & Distributors.
5. High School English Grammar and Composition by Wren & Martin , S Chand Publication

Course Outcome

CO	After completing the course, the students will be able to:
CO1	Reduce anxiety by recognizing and using communication strategies.
CO2	Apply principles of effective and ethical speaking during conversation at the various situations.
CO3	Formulate the speech according to the purpose, audience and time constraints
CO4	To recognize and use effectively non-verbal clues in communication
CO5	Give an effective presentation.

CO-PO Correlation:

Course Name : Spoken English Communication								Code: SOE-B-FY109
Course Outcomes	Program Outcomes							
	1	2	3	4	5	6	7	8
CO1	2	1		1				
CO2	3		2			1		
CO3		2		2			3	
CO4	3	1						
CO5				1				2

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

Electrical Engineering

(Detailed Syllabus of 2nd Semester)

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

SEMESTER II

S. N.	Subject/Course Code	BOS	SUBJECT/COURSE	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-FY201	Maths	Mathematics- II	4	1	0	30	20	50	100	5
2	SOE-B-FY202	Physics	Physics- II	2	0	0	15	10	25	50	2
3	SOE-B-FY204	Civil	Basics of Civil Engineering	3	0	0	30	20	50	100	3
4	SOE-B-FY205	Mech	Engineering Mechanics	3	0	2	30	20	50	100	4
5	SOE-B-FY207	Chemistry	Environmental Studies	1	0	2	15	10	25	50	2
6	SOE-B-FY208	CSE	Introduction to Artificial Intelligence	2	0	2	30	20	50	100	3
7	SOE-B-FY203	Physics	Physics-II Lab	0	0	2	-	30	20	50	1
8	SOE-B-FY206	Mech	Workshop Practice	0	0	2	-	30	20	50	1
9	SOE-B-FY209	Humanities	Written English Communication	1	0	2	-	30	20	50	1
TOTAL				**16**	**01**	**12**	**150**	**190**	**310**	**650**	**22**

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

Programme:	**B.Tech.**	**Semester :**	**II**
Name of the Course:	**Mathematics-II**	**Course Code:**	**SOE-B-FY201**
Credits :	**5**	**No of Hours :**	**5 Hr Per Week**
Max Marks:	**100**		

Course Description:

Learning Objective 1. Evaluate first order differential equations including separable, homogeneous, exact, and linear. 2. Show existence and uniqueness of solutions. 3. Solve second order and higher order linear differential equations. 4. Create and analyze mathematical models using higher order differential equations to solve application problems such as harmonic oscillator and circuits. 5. Solve differential equations using variation of parameters 6. Solve linear systems of ordinary differential equations**.**

Syllabus:

UNIT-1 Ordinary Differential Equation of First order

Review of ordinary differential equation of first order; nonlinear differential equation of first order and their applications to engineering problems (viz. Simple electrical circuits, Heat conduction problem, Rate of decay of radio-active material, Chemical reactions and solutions, etc.).

UNIT-2 Differential Equation of Higher order

Linear differential equations of higher order with constant coefficients; Method of variation of parameters; Cauchy's & Legendre's linear equations; simultaneous linear equations with constant coefficients; Applications to engineering problems.

UNIT-3 Partial Differential Equation

Formation of parti bhial differential equation; Linear partial differential equation of first order; Standard forms; Charpit's method; Homogeneous linear partial differential equations with constant coefficients; Non-homogeneous linear partial differential equations.

UNIT-4 Fourier series

Euler's Formula; Functions having points of discontinuity; Change of interval; Even and odd functions; Half range series; Harmonic analysis.

UNIT-5 Application of Partial Differential Equation

Method of separation of variables; Solution of heat equation; Wave equation; Laplace equation & Poisson's equation

Text Books:

1. Advanced Engineering. Mathematics by Erwin Kreyszig (8th edition) – John Wiley & Sons.
2. Higher Engineering. Mathematics by B. S. Grewal (38th edition)-Khanna Publishers.
3. Higher Engineering Mathematics by B. V. Rammana-Tata Mc Graw Hill.
4. Advance Engineering Mathematics by R. R. Greenberg- Pearson Publication.
5. Ordinary and Partial Differential Equations by MD Rai Singhania-S. Chand & Sons.

Reference Books:

1. Peter V. O'Neil, Advance Engineering Mathematics, Thomson (Cengage) Learning, 2007.
2. Maurice D. Weir, Joel Hass, Frank R. Giordano, Thomas, Calculus, Eleventh Edition, Pearson.
3. D. Poole, Linear Algebra : A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
4. Veerarajan T., Engineering Mathematics for first year, Tata Mc Graw-Hill, New Delhi, 2008.
5. P. Sivaramakrishna Das and C. Vijayakumari, Engineering Mathematics, 1st Edition, Pearson India Education Services Pvt. Ltd

Course Outcomes:

CO	After completing the course, the students will be able to:
CO1	Understand ordinary differential equation.
CO2	Understand applications in Engineering Problems
CO3	Understand higher order differential equation with constant coefficient.
CO4	Understand simultaneous linear equations with constant coefficients.
CO5	Understand Linear partial differential equation of first order.
CO6	Understand Non-homogeneous linear partial differential equations
CO7	Understand Euler's Formula, Functions having points of discontinuity Understand Fourier series, Linear and quasi linear equations
CO8	Understand Harmonic analysis.

CO9	Understand Method of separation of variables; Solution of heat equation;
CO10	Understand Wave equation; Laplace equation & Poisson's equation

CO-PO Correlation:

Course Name: Mathematics-II					**Code:SOE-B-FY201**			
Course Outcomes	**Program Outcomes:**							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
CO1	**2**	**2**				**1**		
CO2	**1**	**2**	**1**			**2**		
CO3	**1**	**2**	**1**			**3**		
CO4	**1**	**2**	**1**			**2**		
CO5	**1**	**2**	**1**			**3**		
CO6	**1**	**2**	**1**			**2**		
CO7	**1**	**2**	**1**			**3**		
CO8	**1**	**2**	**1**			**3**		
CO9	**1**	**2**	**1**			**2**		
CO10	**1**	**2**	**1**			**3**		

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

Programme:	**B.Tech.**	**Semester :**	**II**
Name of the Course:	**Physics-II**	**Course Code:**	**SOE-B-FY202**
Credits :	**2**	**No of Hours :**	**2 Hrs. Per 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 Physics-II course is basically fundamentals of X-rays, its characteristics, its production method and uses, basics of nuclear energy and nuclear reactor, concepts of relativity its applications, 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 Physics-II is to develop the basic knowledge on the development and time-to-time applications of physics in diverse field.

Syllabus:

UNIT-1 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-2: The Theory of Relativity

Frame of reference, Galileo's Transformations, Michelson-Morley experiment and its negative result, Einstein's theory of relativity (postulates), Lorentz Transformation, Time dilation, Length contraction, Twin's Paradox, Doppler's effect, Addition of Velocities, Relativistic mass- Variation of Mass with Velocity, Equivalence of mass and energy.

UNIT-3: 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 nonconducting medium. Gradient, divergence, and curl of scalar and vector fields, Formulation and solving the engineering problems on electromagnetism.

UNIT-4: 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.

UNIT-5: Origin of Universe

Various interpretations about the origin, Big Bang Theory, Large Hadron Collider (LHC) experiment, Hawkins theory about the universe.

Texts Books:

- Beiser, Perspectives in Modern Physics, McGraw Hill, 1969.
- M.A. Preston and R.K. Bhaduri, Structure of the nucleus, Addison- Wesley, 1975.
- M.K. Pal, Theory of Nuclear Structure, Affiliated East West Press, 1982.
- S. H. Patil, Elements of Modern Physics, Tata McGraw Hill, 1989.

Reference Books:

- A.K. Ghatak and S. Loknathan, Quantum Mechanics, Theory and Applications, McMillan India, 1984.
- Michael Sayer & Abhai Mansingh, "Measurement, Instrumentation and experiment design in physics and engineering", Prentice Hall of India Pvt. Ltd., New Delhi – 110 001, 2003.
- P. Sivaramakrishna Das and C. Vijayakumari, Engineering Mathematics, 1st Edition, Pearson India Education Services Pvt. Ltd.

Course Outcomes:

CO	After completing the course, the students will be able to:
CO1	Acquire knowledge of Atomic and Nuclear physics and explore their technological applications in diverse fields.
CO2	Acquire knowledge of basic principles of Relativity and be able to differentiate between classical and quantum mechanics.
CO3	Knowledge of propagation of electromagnetic energy through transmission lines and the design of propagation medium based on the requirements.
CO4	Gain basic knowledge of quantum mechanics and the origin of the Universe.

CO-PO Correlation:

Course Name: Physics-II							**Code: SOE-B-FY202**	
	Program Outcomes							
Course Outcomes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
CO1	**2**	**2**	**2**					
CO2	**2**	**2**	**2**					
CO3	**2**	**2**	**2**					
CO4	**2**	**2**	**2**					

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

Programme:	**B.Tech.**	**Semester :**	**II**
Name of the Course:	**Basics of Civil Engineering**	**Course Code:**	**SOE-B-FY204**
Credits :	**3**	**No of Hours :**	**3 Hrs. Per Week**
Max Marks:	**100**		

Course Description:

Civil Engineering as a profession; General introduction to history of civil engineering; types and classification of buildings; setting out of buildings; building materials- various types of bricks, various types of cements, natural and fly ash aggregates, cement mortar and concrete, TMT and structural steel; Overview of foundation engineering; Introduction to traffic and transportation engineering; Case studies of some advance technologies in civil engineering.

Syllabus:

UNIT-1: Civil Engineering Materials

Masonry Materials: Types and characteristics of burnt clay and fly ash bricks, AAC blocks, paver blocks; various bonds in masonry.

Cement: Raw materials, Initial and final setting times, types and manufacturing process of cements.

Aggregate: Coarse and fine aggregates and their characteristics.

Steel: Difference among cast-iron, wrought iron, steel, mild steel, tor-steel and 550D grade of steel.

Mortar and Concrete: Proportions of cement mortar and concrete and their characteristics, self- healing concrete.

Activity: Industrial visit to any one of following (student will submit visit report)

1. Brick manufacturing plant
2. Cement manufacturing plant
3. Steel rolling mill.

UNIT-2: Building Plans

Components of residential, industrial, commercial and public buildings. Concepts of smart buildings and smart city.

Activity: Study of architectural principles of any one in following (student will submit a report)

1. Central jail building

2. Church
3. Auditorium
4. Industrial building
5. Power station
6. Software technology park
7. Naya Raipur development authority, smart city

UNIT-3

Basic concepts of transportation and traffic engineering, signage and signals. Kinetic roadway and walk ways, automation in tunnelling and bridge construction.

Activity: Case study any one of following (student will submit a report)

1. Warli Bandra sea link
2. Britain France chunnel
3. Pumbam bridge

UNIT-4: Civil Engineering Foundations

Various types of foundations for high rise building, bridges, dams, roads.

Activity: Case study of any one of following (student will submit a report)

1. Burj Khalifa,
2. Petronas towers
3. Statue of unity
4. Swaminarayan temple of the Bochasanwasi in Dubai
5. Flipkart headquarters at Bangalore

UNIT-5: Advance Technologies in Civil Engineering

Modular construction, cloud collaboration, supply chain management in civil engineering. Introduction to software in civil engineering, photovoltaic glassing, augmented and virtual reality in civil engineering. Overview of total station and application of drones in civil engineering.

Activity: Any one case study in (student will submit a report)

1. Cloud collaboration in civil engineering,
2. Supply chain management in civil engineering,
3. Software application in civil engineering
4. Application of drones in civil engineering

Text Books:

1. Chen,W.F. and Liew, J.Y.R., The Civil Engineering Handbook, 2nd Ed., CRC Press, Taylors and Francis, (2002).
2. Kandya A.A., Elements of Civil Engineering, Charotar Publishing House, (2015).

Reference Books:

1. Gopi, S., Basic Civil Engineering, 1st Ed., Pearson Publishers, (2009).
2. Ahuja, T.D. and Birdi, G.S., Civil Engineering (Building Construction), 8th Ed., Rajsons Publications Pvt. Ltd., (2018).
3. Relevant BIS codes and CPWD Manuals.

Course Outcomes:

CO	After completing the course, the students will be able to:
CO1	Explain the importance of civil engineering in the infrastructural development of the society.
CO2	Illustrate the types, uses and properties of various civil engineering materials, foundations, traffic and plans of civil engineering structures.
CO3	Understand the latest technologies in the construction of different civil engineering structures.

CO-PO Correlation:

Course Name: Basics of Civil Engineering								Code: SOE-B-FY204
	Program Outcomes							
Course Outcomes	1	2	3	4	5	6	7	8
CO1	3		2			1		1
CO2	3					1		
CO3	3	3	2			1		1

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

Programme:	**B.Tech.**	**Semester :**	**II**
Name of the Course:	**Engineering Mechanics**	**Course Code:**	**SOE-B-FY205**
Credits :	**4**	**No of Hours :**	**4 Hrs. Per Week**
Max Marks:	**100**		

Course Description:

This course helps in understanding the various types and systems of forces. Resolution and addition of forces. It helps to apply the condition of equilibrium in various force systems. It also helps in understanding the friction, centroid, and center of gravity etc. At last, it helps in understanding the concept of kinetics of rigid body and energy principle.

Syllabus:

UNIT-1: Force and Force Systems

Definitions of mechanics, statics, dynamics, characteristics of a force, principle of transmissibility, Composition and resolution of forces, moment of forces.
System of Coplanar forces: Introduction to coplanar & non-coplanar force system. Forces and their components. Moment of the force about a point, couple.
Resultant of coplanar force system: Resultant of concurrent forces, parallel forces, non-concurrent non-parallel system of forces. Varignon's theorem.

UNIT-II: Equilibrium of Force Systems

Equilibrium of coplanar force system: Meaning of equilibrium, free body diagrams, equilibrium of concurrent, parallel and non-concurrent non-parallel (general) system of forces. Types of supports, determination of reactions at supports for various types of determinate beams.
Analysis of pin jointed frame / truss: Perfect truss, Imperfect truss, Analysis of truss by method of joints and method of sections.

UNIT-III: Friction

Definition of friction, force of friction, Limiting frictional force, coefficient of friction, angle of friction, angle of repose, relation between angle of friction and coefficient of friction. Cone of friction, types of friction, laws of friction, advantages and disadvantages of friction. Equilibrium of bodies on level plane, external force applied on horizontal and inclined up and down. Equilibrium of bodies on inclined plane external forces is applied parallel to the plane, horizontal and inclined to inclined plane.

UNIT-IV: Centroid, Centre of Gravity and Moment of Inertia

Centroid: Definition, centroid of basic geometrical figures such as square, rectangle, triangle, circle, semicircle and quarter circle. Centroid of composite figure.
Centre of Gravity: CG of simple solids such as cylinder, sphere, hemisphere. Cone, cube, and rectangular block. Centre of gravity of composite solids.

Moment of inertia: of plane areas, parallel axis theorem. Introduction to polar moment of inertia, product of inertia and mass moment of inertia. Problems on moment of inertia of composite areas.

UNIT-V: Dynamic Equilibrium

Kinetics of particles: Newton's laws of motion, D' Alembert's principle, equation of dynamic equilibrium linear motion, curvilinear motion. Kinetics of rigid bodies,D' Alembert's principle for bodies under rotational motion about a fixed axis.

Energy principles: Work done by a force, potential and kinetic energy, power, work energy equation, principle of conservation of energy.

Text Books:

1. Engineering Mechanics (Statics and Dynamics) by A.K. Tayal, Umesh Pub., 14th Ed, 2011
2. Engineering Mechanics by K.L. Kumar, Tata McGraw Hill, 4th Ed, 2017
3. Engineering Mechanics (Statics and Dynamics) by D.S. Kumar, S K Kataria & sons, 4th Ed, 2013.

Reference Books

1. Engineering Mechanics (Statics and Dynamics): R.C. Hibbeler, Pearson, 11Ed, 2009
2. Engineering Mechanics: Meriam and Kreige, John Wiley and sons, 7th Ed, 2012
3. Engineering Mechanics by Beer & Johnson, Tata McGraw Hill, 2007.
4. Engineering Mechanics by Shames, Prentice Hall, India.2005

Course Outcomes:

CO	After completing the course, the students will be able to:
CO1	Understand various force systems and apply various concepts to solve problems related to force.
CO2	Understand the different structures like Frame, Trusses, and structures.
CO3	Understand the role of friction and its industrial applications.
CO4	Understand and apply the concept of kinetics and energy principles.

CO-PO Correlation:

Course Name: Engineering Mechanics			Code: SOE-B-FY205					
Course Outcomes	Program Outcomes							
	1	2	3	4	5	6	7	8
CO1	2		1					1
CO2	2		1					1
CO3	2		1					1
CO4	2		1					1

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

Programme:	**B.Tech.**	**Semester :**	**II**
Name of the Course:	**Environmental Studies**	**Course Code:**	**SOE-B-FY207**
Credits :	**2**	**No of Hours :**	**2 Hrs. Per Week**
Max Marks:	**50**		

Course Description:

The course will empower the undergraduate students by helping them to Gain in-depth knowledge on natural processes and resources that sustain life. Understand the consequences of human actions on the web of life and quality of human 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 the future ones. Adopt sustainability as a practice in life, society, and industry.

Syllabus

Unit I: Ecology and Bio-Diversity

Ecology, Environment & Ecosystem, Biotic & Abiotic Components; Structure & functions of Ecosystem, Productivity, Decomposition, Energy Flow, Nutrient cycling, Food Chain & Food Web, Ecological Pyramids; Ecological succession; Bio-diversity: Concept, Importance, and Threats & Conservation

Unit II: Environment and Natural Resources

Earth's Environment: Atmosphere, Lithosphere, Hydrosphere & Biosphere, functions and related problems; Environmental degradation and its causes; Natural resources, Renewable and Non- renewable Resources & associated problems; Study of major Resources on Earth (overview): Forest, Water, Mineral, Food, Energy and Land.

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; Stratospheric Ozone & its Depletion; Lapse rate & Temperature Inversion; Ambient Air Quality standard; Air pollution Control Techniques for Gaseous and Particulate air pollutants & equipment used.

Unit IV: Water Pollution & Soil Pollution

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

Soil formation, composition & profile; Sources of Soil pollution & effect; Solid Waste Management: Objective, Process & Disposal Techniques.

Unit V: Sustainability & Social issues and Environment

Concept of Sustainable Development (SD), models, indicators and principles of Sustainability. Water conservation- Rain water harvesting, Watershed management. Population Growth, variation among nations, Population explosion, Family Welfare Programme; Environment and human health

Text Books:

1. Kurian Joseph & R. Nagendran, "Essentials of Environmental Studies", 1st Edition, Pearson Education, 2004.
2. A. K. Dey “Environmental Chemistry” New Age International Publishers..
3. Smriti Srivastava. “Environment & Ecology” S.K. Kataria & Sons, New Delhi.

References Books:

1. Keerthinarayana & Daniel Yesudian, "Environmental Science and Engineering", 1st Edition, Hi-Tech publications, 2004.
2. Erach Bharucha, “A Text Book for Environmental Studies”, Text Book of University Grants Commission, 2004.
3. Peavy, H.S., D.R. Rowe & T. George, “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.).

Course Outcomes (CO)

CO	After completing the course, the students will be able to:
CO1	Gain in-depth knowledge on natural processes and resources that sustain life.
CO2	Understand the consequences of human actions on the web of life and quality of human life.
CO3	Develop critical thinking for shaping strategies for environmental protection, conservation of biodiversity, environmental equity, and sustainable development.
CO4	Acquire values and attitudes towards understanding complex environmental- economic-social challenges, and active participation in solving current environmental problems and preventing the future ones.
CO5	Adopt sustainability as a practice in life, society, and industry.

CO-PO Correlation:

Course Name: Environmental studies								Code:SOE-B-FY207
Course Outcomes	Program Outcome							
	1	2	3	4	5	6	7	8
CO1	1						1	
CO2							1	1
CO3	1		1			1		1
CO4				1				1
CO5			1			1		1

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

Programme:	**B.Tech.**	**Semester :**	**II**
Name of the Course:	**Introduction to Artificial Intelligence**	**Course Code:**	**SOE-B-FY208**
Credits :	**3**	**No of Hours :**	**3 Hrs. Per Week**
Max Marks:	**100**		

Course Description:

In this course, students will study the most fundamental knowledge for understanding AI. The course will introduce some basic search algorithms for problem solving, Computing methods like Hard computing & soft computing, various soft computing approaches for learning through neural network. Hands-on with Python programming will enable students to develop AI applications.

Syllabus:

UNIT-1 Overview and search techniques

Introduction to AI, AI Definition, Philosophy of AI, Related Fields: Robotics, Machine Learning, Data Science, Deep Learning, Applications: Self Driving Cars, Content Recommendation System, Video/Image processing.AI problem Solving and Games, A* Search.

UNIT-2 Machine Learning and Knowledge Representation Odds and Probability:

Why probability matters, Various examples like card playing, Dice, Uncertainty in real life like train ticket confirmation. How to deal with uncertainty, Odds and Expected outcomes, Bayes Rule, Prior and Posterior odds: Basic Principles. Application areas of Bayes classification. Knowledge representation in AI, Types of Knowledge in AI

UNIT-3 Advanced Topics in Machine Learning DATA PREPARATION:

Validation, Dimensionality, Missing, Values, Dimensionality, Encoding, Basics of confusion matrix Classification in Machine Learning, MNIST Data set identification, Supervised, Unsupervised and Reinforced Learning.

UNIT-4 Introduction to Artificial Neural Network Neural Network Basics

Elements of Neural Network, Why Develop Artificial Neural Networks: Modelling Key features, How Neural networks are Built: Weights and Input, Activation and Output: Identity Function, Step function, Sigmoid Function. Perceptron, Neural Network, Neural Network classifier. Advanced Neural network techniques: Convolutional Neural Network, Generative adversarial networks (GANs), Deep Learning: It's application on data processing.

UNIT-5 Application and Case Studies in AI Case study:

Auto Driving Cars, Smart Home and IoT Applications, Robotics, Mine Detections, Medical Diagnosis, Applications in multiple domains. Smart City, Implications of AI, Predicting the Future and Social Implications

Text Books:

1. Introduction to Artificial Intelligence and Expert Systems by Dan W. Patterson, Prentice Hall of India.
2. Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis and applications by S. Rajashekran and G.A. Vijayalakshmi, Prentice Hall of India.
3. Python Programming Fundamentals by Nischay Kumar Hegde, Educreation Publishing.
4. A Textbook of Discrete Mathematics by Swapan Kumar Sarkar, S. Chand Publishing.
5. Discrete Mathematics and its Applications by Kenneth H. Rosen, McGraw-Hill Publication.

Reference Books:

1. Robert J. Schalkoff, "Artificial Neural Networks", McGraw-Hill International Editions, 1997.
2. Principles of Artificial Intelligence by Nils J. Nilsson, Narosa Publishing house.
3. Introduction to Artificial Neural Network by Jacek M. Zurada, West Publishing Company.

Course Outcomes:

CO	After completing the course, the students will be able to:
CO1	Understand the basics of Artificial Intelligence.
CO2	Understand the overview of problem solving through search methods.
CO3	Understand the difference between Hard and Soft computing approaches.
CO4	Understand basic Neural network structure and activation functions.
CO5	Understand how to implement the AI concepts using Python programming.

CO-PO & PSO Correlation:

Course Name: Introduction to Artificial Intelligence Code:SOE-B-FY208								
	Program Outcomes							
Course Outcomes	1	2	3	4	5	6	7	8
CO1	2				3		2	1
CO2	1			2				2
CO3	3			1		2		
CO4		1	2		3			
CO5	3		1	2				3

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

Programme:	**B.Tech.**	**Semester :**	**II**
Name of the Course:	**Physics-II Lab**	**Course Code:**	**SOE-B-FY203**
Credits :	**1**	**No of Hours :**	**2 Hrs. Per Week**
Max Marks:	**50**		

Course Description:

This course deals with practical knowledge of basic physics including mechanics, optics and electronics.

Syllabus:

At least ten experiments are to be performed by each student from the following list.

1. Determination of wavelength of given light by Newton's ring method.
2. Determination of grating element of diffraction grating using He-Ne laser source.
3. Determination of NA (Numerical Aperture) of an optical fiber.
4. Determination of e/m by Thomson method.
5. Determination of AC frequency using Sonometer.
6. Determination of energy gap of semiconductor diode.
7. To study solar cell characteristics.
8. To study the characteristics of PN junction diode.
9. To determine the divergence of laser beam.
10. To study the Hall effect.
11. To study the transistor characteristics in CE mode.
12. Determination of wavelength of He-Ne laser using diffraction grating.

Course Outcomes:

CO	After completing the course, the students will be able to:
CO1	Gain practical knowledge of mechanics
CO2	Acquire hands-on experience of optics experiments using laser.
CO3	Gain knowledge of measuring moment of inertia of fly wheel, acceleration due to gravity, frequency of AC signal, and viscosity of different liquids.

CO-PO Correlation:

Course Name: Physics-II Lab				Code:SOE-B-FY203				
	Program Outcomes							
Course Outcomes	1	2	3	4	5	6	7	8
CO1	2		2		3		1	
CO2		2		1		2		3
CO3	2		2		2	1		2

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

Programme:	**B.Tech.**	**Semester :**	**II**
Name of the Course:	**Workshop Practice**	**Course Code:**	**SOE-B-FY206**
Credits :	**1**	**No of Hours :**	**2 Hrs. Per Week**
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 experiment

1. Study of electrical safety precautions. Study and 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 part of Electric motor & Transformer.
6. Design and fabrication of DC Power supply.
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 help of electric arc welding.
14. To Prepare a Lap-Joint with 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 Correlation:

Course Name: Workshop Practice								**Code: SOE-B-FY206**
Course Outcome	**Program Outcome**							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
CO1	**3**	**3**	**1**	**0**	**0**	**1**	**0**	**0**
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:	**Written English Communication**	**Course Code:**	**SOE-B-FY209**
Credits :	**2**	**No of Hours :**	**2 Hrs. Per Week**
Max Marks:	**50**		

Course Description

The purpose of the course is to acquire accuracy and clarity in written communication. It helps to develop written text of varying lengths and styles that communicate effectively accurately and appropriately across various situations**.**

UNIT-1 Basics of Writing

An introduction to writing: Definition, Characteristics of effective writing, Principles of writings(7C's), Modes of Writing: Narrative, Descriptive, Argumentative, Expository.

UNIT-2 Grammar in Use

Sentence structure, Subject-Verb concord, Tenses, Voice, Narration, Identifying common errors in writings, Précis writings, Paragraph writings.

UNIT-3 Letter Writing

Types of letters, Elements of letters, Styles of letter writing, Basics of official correspondence, Preparation of Resume and Job application, Quotation, Order, Complaint letter.

UNIT-4 Report Writing

Characteristics of good report, Elements of report, Preparation and writings of report, Use of illustrations in reports, Preparation of Bibliography and References.

UNIT-5 Corporate Writing

Notice, Agenda and Minutes Writing techniques, Tenders, Advertising, Sales Letter

Texts Books:

1. A Communicative Grammar of English by Geoffrey N. Leech and Jan Svartvik, Longman
2. Effective Technical Communication- M.Ashraf Rizvi Tata McGraw Hill Company limited New Delhi.
3. Developing Communication Skills- Krishna Mohan and Meera Banerjee, Mc Millan India Ltd, New Delhi

Reference Books:

1. Introduction to Communication studies- John Fisk, RotledgeLondon
2. Writing Technical Papers- D.H.Menzel, H.M.Jonest. Mc GrawHill New Delhi.
3. A Remedial English Grammar for Foreign Students- F.T.Wood Mc Millan India Ltd.
4. Living English Structure- W. Stannard Allen, Orient Longman London Fourth edition.
5. Technical Communication for Engineers by Shalini Verma, Vikas Publishing House.

Course Outcome

CO	After completing the course, the students will be able to:
CO1	Communicate by writing clearly and precisely without errors
CO2	Draft various business correspondence in correct styles and format
CO3	To prepare various forms of the report
CO4	Know the principles of effective written communication
CO5	Develop advance corporate writing skills

CO-PO & PSO Correlation:

Course Name: Written English Communication								Code:SOE-B-FY209
	Program Outcomes							
Course Outcomes	1	2	3	4	5	6	7	8
CO1	1			2	1	1	1	
CO2				3	2	1	1	
CO3	1		1	2	2	1		
CO4				2	1			
CO5				3	2	2	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	3	0	0	30	20	50	100	3
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	3	0	0	30	20	50	100	3
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	2	0	30	20	50	1
10	SOE-B-EE309	EE	MATLAB Programming and Simulation	0	0	4	0	30	20	50	2
11	SOE-B-CE305	Civil	Disaster Management	1	0	0					1
Total				**16**	**0**	**18**	**150**	**250**	**350**	**750**	**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:	**3**	**No. of Hours:**	**3 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 the behavior of sinusoidal and non-sinusoidal waveforms.
CO2	Analyze the circuit graphically.
CO3	Analyze circuits with ideal, independent, and controlled (voltage and current) sources.
CO4	Identify poles and zeros in circuit transfer functions; Plots s-domain expression as a function of σ and ω.
CO5	Analyze the transient circuits and network analysis.
CO6	Analyze balanced and unbalanced three phase circuits.
CO7	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	2	1			1				2	1	1
CO2	1	2							1		
CO3	1	1				1				1	
CO4	1	1				1			2	1	
CO5	1	1				1			1		
CO6	1	1							1		
CO7						2					1

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

OP JINDAL UNIVERSITY

OP Jindal Knowledge Park, Punjipatra, Raigarh-496109

Department of Electrical Engineering

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	Explain the underlying physics and principles of operation of p-n junction diodes, rectifiers, bipolar junction transistors (BJTs), and MOS field effect transistors (MOSFETs).
CO2	Design practical circuits using p-n diodes, BJTs, and MOSFETs, including analog amplifiers.
CO3	Explain, and compare, and contrast the input, output, and gain characteristics of bipolar junction transistor (BJT), FET and MOSFETs.
CO4	Understand the limitations of the various device models, identify the appropriate model for a given problem or situation, and justify the selection.

CO5	Evaluate the critical parameters which influence the functions of the electronic devices as diode, BJT, JFET and MOSFET.
CO6	Compare the parameters of amplifiers for different configurations.
CO7	Design simple devices and circuits to meet stated operating specifications.

CO-PO & PSO Correlation:

Course Name : Electronic Devices and Circuits **Code:SOE-B-EE302**

	Program Outcomes								PSOs		
Course Outcomes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**
CO1	**3**	**1**	**2**						**3**	**1**	**1**
CO2	**2**	**2**	**2**					**1**	**2**	**2**	
CO3	**3**	**1**							**2**		
CO4	**1**		**2**						**1**	**1**	
CO5	**2**	**2**							**2**	**1**	
CO6	**2**	**2**	**2**						**1**		
CO7	**2**	**2**	**3**						**2**	**2**	**2**

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:	**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 Transformers and rotating electrical machines. It includes the study of transformers, direct current motors, direct current generators.

Course Objectives:

The course will enable the student to:

1. Understand principle of energy conversion and torque production in single and multi-excited machine.

2. Realize the principle of single phase transformer, its equivalent circuit, parameter determination, performance analysis, testing, parallel operation and its applications.

3. Make them understand principle of three phase transformer, performance analysis, parallel operation and its applications.

4. Know constructional features, working principle, its operational constraints, various tests and applications of direct current electrical generators.

5. Know that how torque is produced, starting mechanism, speed control method, performance analysis, testing and application of direct current motor.

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: Electrical Transformer- I

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 3: Electrical Transformer- II

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.

Unit 4: DC Machines-I

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 5: DC Machines-II

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.

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	Recognize the various components, its performance analysis, several testing procedures, parallel operation criterion and proper application of single phase transformer.
CO3	Identify various types of three phase transformer, its performance analysis, necessary condition for parallel operation and its applications according to requirement.
CO4	Be familiar with constructional features, its operational limitation and proper capacity selection of direct current generators.
CO5	Know various types of starters, limitation of speed control methods, efficiency and application of direct current motor.

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
CO1	3		1		1				3	1	
CO2		2		1		2				2	
CO3		1									2
CO4			2		2					1	
CO5										1	

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.

Syllabus:

Unit 1: Laplace Transform

Definition, Transform of elementary functions, Properties of Laplace transform, Transform of derivatives & integrals, Multiplication by t, Division by t, Inverse Laplace Transform, Convolution theorem, Unit step function, Unit impulse function, Periodic function, Application to solution of ordinary differential equations.

Unit 2: Solution of Algebraic and Transcendental equation

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

Unit 3: Interpolation, Numerical Differentiation and Integration

Finite Differences: forward, backward, central and differences, Interpolation Formulae based on forward, backward, central differences, Lagrange's Interpolation formula, Newton Divided difference interpolation formula, Numerical Differentiation using Forward, Backward and Central Difference Formulae, Numerical Integration by Trapezoidal rule, Simpson's rules.

Unit 4: Numerical Solution of ODE

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

Unit 5: Probability and Statistics

Discrete Random variables, Discrete probability Distribution, Discrete probability distribution function; Continuous Random variables, Continuous probability distribution, Continuous probability distribution function, Expectation, Variance, Standard deviation, Moments, Moments generating function, Coefficient of skewness and coefficient of kurtosis, Binomial, Poisson, Normal and exponential distributions.

Text Books:

1. Dr. B.S. Grewal, "Numerical Methods in Engineering and Science", Khanna Publishers, 2009.
2. M.K. Jain, S. R. K. Iyengar & R. K. Jain, "Numerical Methods for Scientific and Engineering Computation", Wiley Eastern Limited, 2014.
3. B.S. Grewal, "Higher Engineering Mathematics", 38th edition, Khanna Publishers, 1965.

Recommended Books:

1. Erwin Kreyszig, "Advanced Engineering. Mathematics", 8th edition, John Wiley & Sons, 1998.
2. B. V. Rammana, "Higher Engineering Mathematics" Tata Mc Graw Hill, 2006.
3. Dr. B.S. Grewal, "Numerical Methods in Engineering and Science", Khanna Publishers, 2009.
4. M.K. Jain, S. R. K. Iyengar & R. K. Jain, "Numerical Methods for Scientific and Engineering Computation", Wiley Eastern Limited, 2014.
5. K. Shankar Rao, "Numerical Methods for Scientists and Engineers", Prentice Hall of India, 2007.
6. S. S. Sastry, "Numerical Methods", Prentice Hall Inc. India, 2012.
7. N G Das, "Statistical Methods" Tata McGraw Hill, 2008.
8. S C Gupta, "Fundamentals of Statistics" Himalaya Publishing House, 2018.
9. Irwin Miller Marylees Miller, "John E. Freund's Mathematical Statistics with Applications", Eighth Edition, Pearson Publication, 2013.

Course Outcomes:

CO	After completion of the course, students will be able to:
CO1	Numerically estimate the roots of algebraic and transcendental equations.
CO2	Solve the system of linear algebraic equations by direct and iterative methods.
CO3	Approximate the tabulated function by a polynomial
CO4	Find the derivatives and integrals of a tabulated function.
CO5	Obtain the numerical solution of Ordinary Differential Equations.
CO6	Use the mathematical concepts of Discrete and Continuous Probability Distributions to formulate and solve the real life problems.

** Application of Unit III is: A student can find the distance, time, velocity, acceleration like physical quantity. Also a student can predict or approximately find some missing value by using given data.

CO-PO & PSO Correlation:

Course Name : Engineering Mathematics-III									**Code:SOE-B-MA303**		
	Program Outcomes								**PSOs**		
Course Outcomes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**
CO1	**3**	**2**	**1**			**2**			**2**	**1**	
CO2	**3**	**2**		**1**		**2**			**2**		**1**
CO3	**2**	**1**		**1**		**2**			**2**	**1**	
CO4	**1**	**1**		**1**		**1**			**1**	**1**	**1**
CO5	**3**	**2**		**1**		**1**	**2**		**1**	**1**	
CO6	**3**	**2**		**1**		**3**	**3**		**2**	**1**	

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

OP JINDAL UNIVERSITY

OP Jindal Knowledge Park, Punjipatra, Raigarh-496109

Department of Electrical Engineering

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 Hrs 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.

Syllabus:

List of Experiments:

1. Verify Thevenin's Theorem.
2. Verify Norton's Theorem.
3. Verify Maximum Power Transfer Theorem.
4. Verify Superposition and Reciprocity Theorems.
5. Verification 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 circuits.
9. Analyze the charging and discharging of an R-C & R-L circuit with oscilloscope and Compute the time constant from the tabulated data and determine the rise time graphically.
10. Determination of Impedance (Z), and Admittance (Y) parameters of Two-port networks.
11. Determination of Hybrid and Transmission parameters of Two-port networks.
12. Generation of periodic, exponential, sinusoidal, damped sinusoidal, step, impulse, and ramp signals using MATLAB.

13. Representation of Poles and Zeros in s-plane, determination of partial fraction expansion in s-domain and cascade connection of second-order systems using MATLAB.

14. Determination of Laplace Transform, different time domain functions, and Inverse Laplace Transformation using MATLAB.

15. Spectrum analysis of different signals.

Equipment /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.
CO6	Synthesize waveforms using step, ramp and impulse functions.

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**		**1**
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**	
CO6	**1**	**1**	**1**							**1**	

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 Hrs 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 characteristics of a semiconductor p-n junction diode and to find cut-in voltage, reverse resistance, static resistance and dynamic resistance.

2. To draw the characteristics of a zener diode and to find cut-in voltage, reverse resistance, static resistance and dynamic resistance.

3. Find and evaluate the desired waveform by using waveform shaping circuits i.e. clipper and clamper.

4. Study the half wave and full wave rectifier circuit and measure different performance parameters.

5. To design a- full wave rectifier and determine the ripple factor and efficiency with and without filter.

6. To design a Zener regulator circuit and to find the regulation characteristics.

7. Plotting input and output characteristics and calculation of parameters of a transistor in common base configuration.

8. Plotting input and output characteristics and calculation of parameters of a transistor in common emitter configuration.

9. Plotting input and output characteristics and calculation of parameters of a transistor in common collector configuration.

10. To draw the load line and find Q-point of a transistor amplifier under CE configuration.

11. Transistor biasing circuit: Measurement of operating point (Ic and Vce) for

i. Fixed bias circuit.
ii. Potential divider biasing circuit.

12. To plot the FET V-I characteristics and its transfer curve.

13. To plot the MOSFET V-I characteristics and its transfer curve.

14. To study Emitter follower circuit & measurement of voltage gain and plotting of frequency response Curve.

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, e.g., resistors, sources, inductors, capacitors, diodes and transistors.
CO2	Become adept at using various methods of circuit analysis, including simplified methods such as Series-parallel reductions, voltage and current dividers, and the node method.
CO3	Understand the characteristics of diodes, BJT and FETs.
CO4	Design best in class biasing circuits for analog application.
CO5	Develop the capability to analyze and design simple circuits containing non-linear elements such as transistors using the concepts of load lines, operating points and incremental analysis.

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	
CO2	2	2	1						1	2	
CO3	2								1		
CO4	2	2	1						2	2	
CO5	2	1	1						2	2	

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

Programme:	**B.Tech.**	**Semester :**	**III**
Name of the Course:	**Electrical Machines - I Lab**	**Course Code:**	**SOE-B-EE307**
Credits:	**2**	**No. of Hours:**	**4 Hrs Per Week**
Max Marks:	**50**		

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. To determine the Transformation ratio of a single phase transformer.
2. To determine the voltage regulation of a single phase transformer operating at different power factors.
3. To perform the open & short circuit test of single phase transformer for finding its parameters.
4. To determine the efficiency of a single phase transformer under different loading condition.
5. To perform parallel operation of two single phase transformer and sharing of load.
6. To perform Back to Back test on two single phase transformer.
7. To perform 3- phase to 2- phase conversion (Scott connection).
8. To study 3-phase transformer with different connections and vector groups.
9. To perform the reversal of D.C. Shunt Motor.
10. To determine the armature & field winding resistance of D.C machine by voltmeter/ammeter method.
11. To determine the magnetization or Open circuit characteristics of a D.C machine.
12. To perform load test on D.C shunt generator.

13. To perform Swinburne's test on a D.C machine & calculation of its efficiency at full load operating condition.

14. To study three point and four point motor starters.

15. Speed control of D.C. shunt motor by:
    i) Varying field current with armature voltage kept constant.
    ii) Varying armature voltage with field current kept constant.

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:	**1**	**No. of Hours:**	**2 Hrs 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

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OP Jindal Knowledge Park, Punjipatra, Raigarh-496109

Department of Electrical Engineering

Programme:	**B.Tech.**	**Semester :**	**III**
Name of the Course:	**MATLAB programming and Simulation**	**Course Code:**	**SOE-B-EE309**
Credits:	**2**	**No. of Hours:**	**4 Hrs Per Week**
Max Marks:	**50**		

Course Description:

MATLAB is a software package for high-performance numerical computation and visualization. It provides an interactive environment with hundreds of built in functions for technical computation, graphics and animation. Best of all, it also provides easy extensibility with its own high-level programming language. The name MATLAB stands for MATrix LABoratory.

Syllabus:
List of Experiments:

1. Introduction to MATLAB and its basic commands.
2. Introduction to basic features of plots.
3. Determine the root of a polynomial.
4. Study of matrix arithmetic.
5. Solution of differential equation using 4th order runge - kutta method.
6. Determination of time response of an RLC circuit.
7. Determine resonant frequency of series R-L-C circuit.
8. To measure Current, Power, Voltage and Power Factor of series R-L-C Circuit.
9. Step, Ramp and impulse response of transfer function.
10. Generation of single and three phase sinusoidal waveform.
11. PWM based waveform generation.
12. Single phase uncontrolled half wave rectifier using R and RL load
13. Study Single phase uncontrolled full wave rectifier using R and RL load.
14. Three phase uncontrolled full wave rectifier using R and RL load

Reference Books & Manuals:

1. Rudra Pratap "Getting Started with MATLAB", Oxford University Press, 2002.

Equipment's/Machine/Software required:

All experiments can be done by MATLAB.

Course Outcomes:

CO	After completing the course, the students will be able to:
CO1	Understand some important commands and command input assistance features.
CO2	Knowing useful built-in functions to handle matrix and arrays.
CO3	Exploring interactive plotting environments through plotting tools.
CO4	Understand fundamentals of MATLAB programming, opening and running a file.
CO5	Know creating and masking a subsystem, running the simulation and observing the dynamic variables.

CO-PO & PSO Correlation:

Course Name : MATLAB programming and Simulation									**Code: SOE-B-EE309**	
	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**	
CO4	**2**	**3**	**2**						**2**	**2**	
CO5	**2**	**2**	**2**						**2**	**2**	**1**

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

Programme:	**B.Tech.**	**Semester :**	**III**
Name of the Course:	**Disaster Management**	**Course Code:**	**SOE-B-CE305**
Credits:	**1**	**No. of Hours:**	**2 Hour Per Week**
Max Marks:	**50**		

Course Description:

Taking this course will help you prepare a fully functional disaster preparedness plan, to include packing lists, a communication plan, a financial plan, and even a technology plan. If you live in areas where tornados, hurricanes, earthquakes, or other disasters are common, this is the course for you. In addition, this course will cover topics that help you understand what the benefits a safe room can provide for your safety. Even for those not in these areas, this course still provides insight into what to do for man-made disasters such as terrorist attacks, chemical spills, and fires. Don't wait until disaster strikes, strike first and get prepared.

Syllabus:

Unit I: Understanding Disasters

Understanding the Concepts and definitions of Disaster, Hazard, Vulnerability, Risk, Capacity, Disaster and Development, and disaster management.

Unit II: Types, Trends, Causes, Consequences and Control of Disasters

Geological Disasters (earthquakes, landslides, tsunami, mining); Hydro-Meteorological Disasters (floods, cyclones, lightning, thunder-storms, hail storms, avalanches, droughts, cold and heat waves) Biological Disasters (epidemics, pest attacks, forest fire); Technological Disasters (chemical, industrial, radiological, nuclear) and Manmade Disasters (building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemicals and biological disasters) Global Disaster Trends, Emerging Risks of Disasters, Climate Change and Urban Disasters

Unit III: Disaster Management Cycle and Framework

Disaster Management Cycle, Paradigm Shift in Disaster Management, Pre-Disaster: Risk Assessment and Analysis, Risk Mapping, zonation and Micro zonation, Prevention and Mitigation of Disasters, Early Warning System, Preparedness, Capacity Development; Awareness During Disaster, Evacuation, Disaster Communication, Search and Rescue, Emergency Operation Centre, Incident Command System, Relief and Rehabilitation, Post-disaster, Damage and Needs Assessment, Restoration of Critical Infrastructure, Early Recovery, Reconstruction and Redevelopment; IDNDR, Yokohama Strategy, Hyogo Framework of Action

Unit IV: Disaster Management in India

Disaster Profile of India, Mega Disasters of India and Lessons Learnt, Disaster Management Act 2005, Institutional and Financial Mechanism National Policy on Disaster Management, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national), Non-Government and Inter-Governmental Agencies

Unit V: Applications of Science and Technology for Disaster Management

Geo-informatics in Disaster Management (RS, GIS, GPS and RS), Disaster Communication System (Early Warning and Its Dissemination), Land Use Planning and Development Regulations, Disaster Safe Designs and Constructions, Structural and Non Structural Mitigation of Disasters, S&T Institutions for Disaster Management in India.

Text Books:

1. Singhal J.P., "Disaster Management", Laxmi Publications, 2010.
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012.
3. Gupta Anil K, Sreeja S. Nair, "Environmental Knowledge for Disaster Risk Management", NIDM, New Delhi, 2011.
4. Kapur Anu, "Vulnerable India: A Geographical Study of Disasters", IIAS and Sage Publishers, New Delhi, 2010.

Course Outcome:

CO	After completing the course, the students will be able to:
CO1	Differentiate the types of disasters, causes and their impact on environment and society
CO2	Assess vulnerability and various methods of risk reduction measures as well as mitigation.
CO3	Draw the hazard and vulnerability profile of India, Scenarios in the Indian context, Disaster damage assessment and management.

CO-PO & PSO Correlation:

Course Name : Disaster Management Code:SOE-B-CE305											
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1	3		3		2		2		1		2
CO2	3	1		3	2		2	3		2	2
CO3		2		3		3		3		2	

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

OP JINDAL UNIVERSITY

OP Jindal Knowledge Park, Punjipatra, Raigarh-496109

Department of Electrical Engineering

Electrical Engineering

(Scheme of B.Tech 4th Semester)

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

SEMESTER IV

S. No.	Subject /Course Code	BOS	SUBJECT/ COURSE	Periods per week			Scheme of Examination and Marks				Credits L+(T+P)/2
				L	T	P	PRE** Mid Sem	PRE** TA	ESE*	Total Marks	
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-EE409	EE	Power System Computer Aided Design Lab	0	0	2	0	30	20	50	1
10	SOE-B-EE410	EE	Introduction to PYTHON	0	0	2	0	15	10	25	1
11	SOE-B-EE411	Humanities	Professional Development	1	0	0	0	15	10	25	1
				16	**1**	**16**	**150**	**250**	**350**	**750**	**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:

Thermal Power generation: Working Principle, Main Features of Boilers, Steam Turbines, Auxiliaries, Coal Preparation, Ash Handling and Layout of Thermal Power Station.

Hydro Power Stations: Hydrology, Hydrographs, Flow Duration & Mass Curve, Main Types of Dams, Turbines & Generators, Pumped Storage Plant.

Nuclear power Generation: Principles of Nuclear Power Generation, Main Parts of Nuclear Power Plants, Types of Reactors, Nuclear Waste Hazards & Disposal.

Introduction to Various Renewable Energy Sources (Wind, Solar, Geothermal Only).

UNIT-2: Inductance and Capacitance of Transmission Lines:

Line Constant Calculations: Introduction to Per Unit System and Calculation for Transmission System. Magnetic Flux Density, Inductors and Inductance Magnetic Field Intensity Due to Long Current Carrying Conductors, Inductance of Two Wire Transmission Line, Flux Linkages with One Conductor in a Group of Conductors, Transposition of Power Lines, Composite Conductors, Inductance of Composite Conductors, Inductance of Double Circuit Three Phase Line, Concept of GMD, Bundled Conductors, Skin and Proximity Effect. 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 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:

Power System – I	**Code:SOE-B-EE401**										
	Program Outcomes								**PSOs**		
Course Outcomes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**
CO1	**1**		**3**		**2**			**3**		**2**	**2**
CO2		**1**							**1**		
CO3	**1**		**3**							**2**	
CO4		**1**			**1**			**1**	**3**		
CO5	**1**		**2**		**3**			**1**		**1**	
CO6		**2**			**1**				**2**		
CO7	**1**		**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-1: Digital Logic and Boolean Algebra

Representation of numbers, binary codes, Gray code, error-detecting and error-correcting codes, registers, binary logic, basic logic gates. Boolean operations, Boolean functions, algebraic manipulations, minterms and maxterms, sum-of-products and product-of-sum representations, realization of Boolean functions using NAND/NOR gates. Karnaugh map, don't-care conditions, prime implicants, Quine–McCluskey technique.

UNIT-2: Combinational Circuits

Adder, subtractor, multiplier, comparator, decoders, encoders, multiplexers, demultiplexers, Read Only Memory, Programmable Logic Arrays, Programmable Array Logic, Implementation of Combinatorial Logic using these devices.

UNIT-3: Sequential Circuits-I

Introduction, Clocks, latches, S-R Flip-flops, JK flip-flop, D flip-flop, T flip-flop, master slave flip-flop. Flip-flop excitation table, Interconversion of flip-flop, Classification of sequential circuits.

UNIT-4: Sequential Circuits-II

Registers and shift registers, sequential adders, binary and BCD ripple counters, synchronous counters, Finite-state model, Mealy and Moore machines, state minimization.

UNIT-5: Logic Families and converters

Transistors as switches, Various Logic Families like RTL, DTL, TTL and ECL, I2L, working and their characteristics, MOS and CMOS devices, TTL CMOS Interfacing, IEEE/ANSI representation of Logic Families, 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	After completing the course, the students will be able to:
CO1	Analyze different types of digital electronics circuits to simplify the circuits design using various boolean algebra and logical methods.
CO2	Design different types of digital electronic circuits for particular operation to improve performance and efficiency.
CO3	Apply the fundamental knowledge of analog and digital electronics to get different types analog to digitized signal and vice-versa converters in the real world with different changing circumstances.
CO4	Assess the nomenclature and technology in the area of digital devices and apply the devices in different types of real world applications for societal benefits.

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	3	1				1		1			
CO2	2	3					1		2	3	
CO3							1	1		2	
CO4	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:	**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, resolution, sensitivity, relative error, absolute error, types of error; Standards, Classification: deflecting, control and damping torques; Permanent magnet moving coil, moving iron, Electrodynamometer, Thermal and Electrostatic instruments, their errors and remedies; Concept of multi range instruments.

Unit 2: Instrument Transformers and Potentiometer

Principle, construction, testing and errors of Current Transformer and Potential Transformer; Principle and operation of D.C. Crompton's potentiometer, standardization; Measurement of unknown resistance, current, voltage; AC Potentiometer: Polar and coordinate type's standardization, application.

Unit 3: Measurement of Power and Energy

Single phase dynamometer wattmeter, LPF and UPF, Double element and three element dynamometer wattmeter, Expression for deflecting and controlling torques, range extension of wattmeter, Measurement of active and reactive powers in balanced and unbalanced systems. Single phase induction type energy meter, errors and compensation; test by phantom loading, three phase energy meter and maximum demand meter.

Unit 4: DC and AC bridges

Methods of measuring low, medium and high resistance, sensitivity of wheatstone bridge; Carey-Foster bridge and Kelvin's double bridge for measuring low resistance; measurement of high resistance: loss of charge method; Measurement of Inductance: Maxwell's bridge, Hay's bridge, Anderson's bridge, Owen's bridge; Measurement of capacitance: De-sauty's bridge, Wein's bridge, Schering Bridge.

Unit 5: Electronics Instruments and measurement

Electronic potentiometer, Instrumentation Amplifier. Review of basic CRO circuit, Probes, Oscilloscope control. Measurement of voltage, frequency, and phase using a CRO. Multimeter Digital Storage Oscilloscope (DSO), Current and Voltage Probes, Function Generators, 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	Measure the electrical quantities.
CO2	Calibrate and extend the range of measuring instruments.
CO3	Measure resistance, inductance and capacitance.
CO4	Properly utilize the electrical and electronics measuring instruments.

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
CO1		1				1		1			
CO2	2			2			1		2	3	
CO3							1	1		2	
CO4	1	2	1		1	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

Vector Relation in rectangular, cylindrical, spherical and general curvilinear coordinate system, 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 divergence theorem, Maxwell's first equation, potential differences for different configurations

UNIT-3: Capacitance & Dielectrics

Capacitor properties and boundary conditions, the method of images, nature of dielectric materials, boundary conditions for perfect dielectric materials, Poisson's and Laplace's equation and their solution, Current and current density, Continuity equation.

UNIT-4: Static Magnetic Field

Magnetic field vector: Magnetic field intensity, flux density & magnetization, Bio-Savart's law, Ampere's law, Helmholtz's theorem, Magnetic scalar and vector potential, Stokes theorem, magnetic flux density, Derivation of Steady magnetic field Laws, 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

Fundamental relations for Electrostatic and Magnetostatic fields, Faraday's law for Electromagnetic Induction, Maxwell's field equations, electromagnetic radiation,

Uniform plane wave in free space, standing wave ratio, Poynting Theorem and Poynting vector, skin effect, EM Boundary condition.

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

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

OP JINDAL UNIVERSITY

OP Jindal Knowledge Park, Punjipatra, Raigarh-496109

Department of Electrical Engineering

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. Visit local substation
11. Design first element-Bus, transmission line, generator, load, and transformer.

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									Course Code :		(SOE-B-EE406)
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1	2	1			1				2		
CO2		3			1						
CO3									1	2	1
CO4			3	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. Verification and interpretation of truth tables for AND, OR, NOT NAND, NOR and Exclusive OR (EX-OR) and Exclusive NOR(EX-NOR) gates
2. Realization of logic functions with the help of NAND or NOR gates.
3. Construction of half adder and full adder using XOR and NAND gates and verification of its operation
4. 4-bit adder- subtractor circuit.
5. To Construct a Circuit of 4 -Bit Parity Checker & Verify its truth table.
6. To Design a Comparator Circuit & Verify its truth table.
7. Verification of truth table for encoder and decoder.
8. Verification of truth table Mux and De-Mux.
9. Verification of truth table for positive edge triggered, negative edge triggered, level triggered flip-flops.
10. Construction of a 4 bit SISO, SIPO, PISO, PIPO shift registers using JK/D flip flops and verification of their operation.
11. Construction and testing of a 4-bit ring counter
12. Design 4-bit Asynchronous Counter
13. Verification of truth table for any one universal shift register
14. To construct and test 4/8-bit D/A Converter

15. To construct and test 4/8 bit A/D Converter

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										Course Code : (SOE-B-EE407)	
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1	2	1									
CO2					1				1		
CO3							1			2	1
CO4	1		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 and Power Factor of series R-L-C Circuit.
2. To measure R and L of a Chock Coil.
3. To measure Power in Three Phase Circuitry by Two Wattmeter Method.
4. To measure 3 - phase reactive power by using single wattmeter method.
5. Calibration of Energy meter.
6. Calibration of LPF 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.

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 Course Code : (SOE-B-EE408)											
	Program Outcomes								**PSOs**		
Course Outcomes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**
CO1		**1**			**2**				**2**		
CO2		**3**			**1**					**2**	
CO3									**1**		**1**
CO4			**2**	**1**							
CO5	**1**		**1**			**1**			**3**		**1**

Note: 1: Low 2: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**IV**
Name of the Course:	**Power System Computer Aided Design Lab**	**Course Code:**	**SOE-B-EE409**
Credits:	**1**	**No. of Hours:**	**2 Hour Per Week**
Max Marks:	**50**		

Course Description:

This course covers the fundamentals applicable to the study of electromagnetic transients in electrical networks. A number of application areas such as AC transients, fault and protection, transformer saturation, wind power, FACTS, power quality, as well as other power system topics are discussed with practical examples serving to illustrate the subjects. Several case studies will be applied in detail to highlight practical situations encountered by engineers.

Syllabus:

List of Experiments:

1. Intro to PSCAD/EMTDC and learn the usage of PSCAD/EMTDC in modeling of ac circuits and plotting of results.
2. Understanding reactive power and power factor in single-phase and three-phase circuits.
3. Obtaining Parameters of a HV/EHV Transmission Line and Modeling it in PSCAD/EMTDC
4. To understand the operating principle of 12-pulse converters used in HVDC transmission systems.
5. To understand the operating principle of 12-pulse inverters used in HVDC transmission systems.
6. To obtain the current harmonics drawn by power electronics interface in EMTDC/PSCAD.
7. To obtain the effect of sudden short-circuit on a synchronous generator output using EMTDC/PSCAD
8. To study the effect of real and reactive powers on bus voltages.
9. Understanding the operation of a Thyristor Controlled Reactor (TCR) using EMTDC/PSCAD

10. Switching Over-Voltages and Modeling of Surge Arresters using EMTDC/PSCAD.

11. Design of MHO relay characteristic using EMTDC/PSCAD.

12. Design of renewable energy sources (wind and solar) using EMTDC/PSACD.

Equipment /Machine/Software Required:

EMTDC/PSCAD and MATLAB/SIMULINK software

Reference Manuals:

1. EMTP Reference Manual, H. Dommel, Bonneville Power Administration 1986.

2. Introduction to EMTDC/PSCAD V3, Manitoba HVDC Research Centre Inc., Canada, 2000.

Course Outcomes:

CO	Student completing the course will be able to:
CO1	Students familiar with EMTDC/PSCAD simulation software.
CO2	Students will be able to design basic power system components.
CO3	Students able to perform various power electronics converter.
CO4	Students will be able to simulate HVDC transmission components.
CO5	Students will able to design and perform simulation power system integrated with FACTS controller and renewable energy sources.

CO-PO & PSO Correlation:

Course Name : Power System Computer Aided Design Lab Course Code : (SOE-B-EE409)											
	Program Outcomes								**PSOs**		
Course Outcomes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**
CO1	**1**		**1**						**2**		**1**
CO2		**2**								**3**	
CO3				**3**	**1**						
CO4	**1**		**1**			**3**			**2**		
CO5	**2**			**2**			**1**	**1**			

Note: 1: Low 2: Moderate 3: High

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Programme:	**B.Tech.**	**Semester :**	**IV**
Name of the Course:	**Introduction to Python**	**Course Code:**	**SOE-B-EE410**
Credits:	**1**	**No. of Hours:**	**2 Hour Per Week**
Max Marks:	**25**		

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.

Course Objectives:

The subject aims to provide the student with: -

1. Familiarizing with the python programming fundamentals.
2. Understanding the role of computation for problem solving problems.
3. The ability to learn the semantics and tools for the python programming language.
4. Application of python programming to the advanced field of machine learning.

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									Course Code : (SOE-B-EE410)		
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1		1									
CO2			2							1	
CO3		1								2	
CO4									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 Course Code : (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

OP JINDAL UNIVERSITY

OP Jindal Knowledge Park, Punjipatra, Raigarh-496109

Department of Electrical Engineering

OPJU
UNIVERSITY OF STEEL TECHNOLOGY AND MANAGEMENT

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 Marks				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	Analog Electronics	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	Analog Electronics Lab	0	0	4	0	30	20	50	2
9	SOE-B-EE509	Electric Vehicles	1	0	2	0	30	20	50	2
10	SOE-B-EE510	Industrial Training Presentation	0	0	1	0	30	20	50	1
TOTAL			**16**	**0**	**15**	**150**	**250**	**350**	**750**	**24**

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

Power in single phase AC circuits, Complex power, Complex power balance, Complex power flow, Balanced Three Phase Circuits, Star connected loads, Delta connected loads, Delta-star transformation, Per phase analysis, Balanced three phase power, One line and impedance diagram, Per unit system, Per unit representation of transformer, Per unit impedance diagram of power system, Examples – per unit system and impedance diagram, Synchronous machine, Power factor and power control, Salient pole synchronous generator, Operating chart of a synchronous generator, Representation of loads

Symmetrical Components: Symmetrical component transformation, Phase shift in star-delta transformers, Sequence impedances of transmission lines, Sequence - impedances and networks of synchronous machines, Sequence impedances and networks of transformers, Construction of sequence networks of a power system, Examples.

Un-Symmetrical Components: Introduction, Symmetrical component analysis of unsymmetrical faults, Single line to ground fault, Line to line fault, Double line to ground fault, Open conductor faults.

UNIT-2: Power Flow Analysis

Network model formulation, formation of Y-bus, load flow problem, Gauss-Siedel method, Newton-Raphson method, Decoupled load flow studies, comparison of load flow methods, numerical.

UNIT- 3: Economic Operation of Power System

Statement of economic dispatch problem, input and output characteristics of thermal plant, incremental cost curve, optimal operation of thermal units without and with transmission loses (no derivation of transmission loss coefficients), base point and participation factors method, statement of unit commitment (UC) problem, constraints on UC problem, solution of UC problem using priority list, special aspects of short term and long term hydro thermal problems.

UNIT-4: Power System Frequency and Voltage Control

Load Frequency Control: Load Frequency Control (LFC) of single area system, static and dynamic analysis of uncontrolled and controlled cases, LFC of two area system, tie line modelling, block diagram representation of two area system, static and dynamic analysis, tie line with frequency bias control.
Automatic Voltage Regulator: Generation and absorption of reactive power, basics of reactive power control, Automatic Voltage Regulator (AVR), brushless AC excitation system, block diagram representation of AVR loop.

UNIT-5: Power System Stability

Steady state stability, transient stability, equal area criteria, swing equation, multi machine stability concept, Ned of computer control of power systems-concept of energy control centers and functions, PMU, system monitoring, data acquisition and controls, System hardware configurations, SCADA and EMS functions.

Text Books:

1. Modern Power System Analysis, D.P. Kothari and I.J. Nagrath, Tata McGraw Hill, 4^{th} 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, 1 st Edition, 2008.

4. Power System Stability, E.W. Kimbark, Wiley, Vol. I, II and III, 2007.

5. 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	Prepare the model of transmission line, generator and transformer of power system for single line diagram representation and per unit quantity calculation
CO2	Understand the techniques to control power flows, frequency and voltage.
CO3	Analyze symmetrical and unsymmetrical faults in power system
CO4	Learn the power system stability and economic operation as a system operator.
CO5	To understand process industrial power system control through SCADA.
CO6	To understand the voltage control methods used in industry.

CO-PO & PSO Correlation:

Course Name : Power System – II									Course Code : (SOE-B-EE502)		
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1		2	1							2	
CO2	3				1	2	2		2		2
CO3		2	1							1	
CO4	3				3			1	1		1
CO5		3	3				1			3	
CO6	3				1			2	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: Three Phase Induction Motor

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, double cage induction motors, cogging and crawling, synchronous induction motor.

UNIT-2: Starting and Speed Control of Three Phase 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, slip power recovery scheme, braking of three phase induction motor: plugging, dynamic braking and regenerative braking.

UNIT-3: Synchronous Generator

Constructional details, winding factor, EMF equation, synchronous reactance, armature reaction, voltage regulation, EMF, MMF, ZPF and A.S.A method, steady state power-angle characteristics, phasor diagrams of non-salient pole synchronous generator connected to infinite bus, synchronizing and parallel operation, synchronizing torque, Effect of change in excitation and mechanical input, slip test, open circuit and short circuit test, short circuit transients and its efficiency.

UNIT-4: Synchronous motor

Principle of operation, torque equation, starting of synchronous motor, V and inverted V curves, power input and power developed equations, operation on infinite bus bars, current loci for constant power input, constant excitation and constant power developed, hunting, damper windings, synchronous condenser.

UNIT-5: Single phase induction motors and special machines

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, shaded pole induction motor, linear induction motor, repulsion motor, hysteresis motor, AC series motor, servo motors, stepper motors, introduction to magnetic levitation systems, BLDC 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, 4th Edition 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 construction, operation and performance of three phase squirrel cage and slip ring induction motors that will help to use specific motor as per industrial requirement.
CO2	Select appropriate starter and speed control techniques of three phase induction for various applications of three phase induction motor on the basis of proper requirement and cost involved for domestic or industrial application.
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 for power industry.
CO4	Understand the construction, operation, starting, speed control and performance of synchronous motor in various industrial operating conditions is used as either as a constant speed motor in industry or as a synchronous condenser in power sector.
CO5	Understand the construction, operation, starting, speed control and performance of single phase induction motor along with special electrical machines, which is required as a home appliance or in industries such as industrial fans, blowers, pumps, machine tools, power tools, turbines, compressors, alternators, ships, rolling mills, paper mills, movers, and other special applications.

CO-PO & PSO Correlation:

Course Name: Electrical Machine-II									**Course Code : (SOE-BE-503)**		
	Program Outcomes								**PSOs**		
Course Outcomes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**
CO1		**2**		**1**			**2**		**3**		**3**
CO2	**2**		**1**		**2**	**1**		**1**			
CO3		**2**		**1**			**3**			**2**	**1**
CO4	**1**		**2**		**3**	**2**		**3**			
CO5		**3**					**1**		**2**	**1**	

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 to Control Systems

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 and Control Hardware

Differential equations and their transfer functions, Block diagram algebra, Representation by Signal flow graph, Reduction using mason's gain formula. Transfer functions of Translational and Rotational mechanical systems and its Impulse Response.

Transfer Function Representation: Transfer Function of DC Servo motor, AC Servo motor, Synchro transmitter and Receiver, Block diagram representation of systems considering electrical systems as examples.

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: Rauth-hurwitz criterion, Root Locus techniques: introduction, root loci theory, application to system stability studies, illustration of the effect of addition of a zero and a pole.

UNIT-4: Frequency Domain Analysis

Introduction, polar plots, Nyquist stability criterion, frequency domain indices (gain margin, phase margin, bandwidth), Bode plots, application of Bode plots, Nichols charts, application of Nichols charts.

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, Eigen-9values, Eigen-Vector, 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									Course Code : (SOE-B-EE504)		
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1			1		2				3		
CO2	3			2			2			1	
CO3		1	3			1			2		1
CO4	1				1			3		2	
CO5		3					1		1		2
CO6	2		1		2					3	
CO7		2						2			
CO8	3			3		2			2	1	

Note: 1: Low 2: Moderate 3: High

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

Course Description:

Analog electronics course has the design and applications of operational amplifiers and other important analog ICs. It introduces basic Op-Amp concepts, its internal design and applications of Op-Amp IC in electronics designs. Much attention is given to basic Op-Amp configurations, linear and non-linear applications of Op-Amp and active filter synthesis. It also deals with oscillators, waveform generators and data converters and Regulator IC with their applications in electronics design.

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 2015.

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

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

Course Outcomes:

CO	Electrical Engineering Graduates will be able to:
CO1	Identify different configurations of Op-Amp.
CO2	Analyze the parameters of Op-Amp and observe the frequency response of operational-amplifier.
CO3	Understand & demonstrate different applications based on operational-amplifier.
CO4	Understand analog multiplier and PLL & demonstrate different applications based on it.
CO5	Differentiate A/D and D/A converter, understand their types and analyze their applications.
CO6	Demonstrate the applications of waveform generators, timers and voltage regulators.
CO7	Show improved ability to look into industrial problem with an understanding and importance for designing analog circuits.

CO-PO & PSO Correlation:

Course Name : Analog Electronics									Course Code : (SOE-B-EE505)		
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1	1		2				3				1
CO2		1		1					1		
CO3	2	2				1		1		1	3
CO4			2						2		
CO5	1				1				2	1	
CO6		1						1			1
CO7			1	1					1		

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.
1. 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.

Equipment/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									**Course Code : (SOE-B-EE506)**		
	Program Outcomes								**PSOs**		
Course Outcomes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**
CO1		**2**		**2**		**2**			**3**		**2**
CO2	**1**		**3**		**1**			**1**		**1**	
CO3				**3**			**1**		**1**		**3**
CO4	**2**		**2**					**2**		**2**	
CO5		**1**			**2**		**3**		**2**		**1**

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 Hrs 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: (Minimum 10 Experiments):

1. 1. Study and plot the V-I characteristics of a SCR.
2. Transfer characteristics study of a MOSFET.
3. To study and plot the drain characteristics of an IGBT.
4. Analysis and plot of V-I characteristics of a TRIAC.
5. Testing and design of single-phase half-wave controlled rectifier for R/RL Load.
6. To design and study of single-phase full-wave controlled rectifier for R/RL Load.
7. Test the performance of three-phase half-wave controlled rectifier for R load and measure load voltage.
8. Test the performance of single phase series inverter with R/RL loads.
9. Study of single Phase parallel inverter with R/RL loads.
10. Test the performance of three-phase full-wave controlled rectifier for R load.
11. Design and testing of DC-DC buck converter.
12. Design and testing of DC-DC boost converter.
13. Simulation of buck boost converter circuit.
14. Simulation of three phase VSI for 180°/120° mode of conduction
15. Simulation of single-phase step down cyclo-converter for R and RL.

Equipment/Machine/Software required: Equipment/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									Course Code : (SOE-B-EE507)		
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1	2								2		
CO2		2								1	2
CO3	1		2						3		

Note: 1: Low 2: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**V**
Name of the Course:	**Analog Electronics Lab**	**Course Code:**	**SOE-B-EE508**
Credits:	**2**	**No. of Hours:**	**4 Hrs 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.

Syllabus:

List of Experiments: (Minimum 10 Experiments):

1. To design an inverting amplifier using Op-Amp and study its frequency response.
2. To design a non-inverting amplifier using Op-Amp and study its frequency response.
3. To design a circuit of summing amplifier using Op-Amp.
4. To design a differential amplifier using Op-Amp and find its CMRR.
5. To determine SVRR and slew rate of an Op-Amp.
6. To design a Bistable multivibrator circuit and to draw its output waveform.
7. To design a Monostable multivibrator circuit and to draw its output waveform.
8. To design an Astable multivibrator circuit and to draw its output waveform.
9. To design and study a diode clamper circuit using Op-Amp.
10. To design and study diode series and shunt clipper using Op-Amp.
11. To measure the input impedance of a voltage follower using Op-Amp.

12.To design and study comparator circuit using Op-Amp.

13.To analyze the characteristics of PLL & describe its application as frequency multiplier

14.To understand & demonstrate phase shift and Wien bridge oscillator-using Op-Amp

15.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

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									Course Code : (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											1
CO3	3								2	1	
CO4			2								3

Note: 1: Low 2: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**V**
Name of the Course:	**Electric Vehicle**	**Course Code:**	**SOE-B-EE509**
Credits:	**2**	**No. of Hours:**	**4 Hrs Per Week**
Max Marks:	**50**		

Course Description:

This course introduces the fundamental concepts, principles, analysis and design of hybrid Electric vehicles.

Course Objectives:

Students will learn to do the following:

1. Comparative study of conventional and electric vehicles performance. Hybrid electric vehicles and its impact on environment.

2. Analysis of various hybrid vehicle configurations and its performance. Interpretation of the electric components used in hybrid and electric vehicles.

3. Design and Selection of sizing the drive systems.

4. Selection of proper energy storage systems for vehicle applications.

5. 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						Course Code : (SOE-B-EE509)				
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1	3		1				2		3		3
CO2	1	2		2		1		2		1	
CO3	1		2			1	3		1		1
CO4		1			3	2		3		3	
CO5	2		3				1		2		2

Note: 1: Low 2: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**V**
Name of the Course:	**Industrial Training Presentation**	**Course Code:**	**SOE-B-EE510**
Credits:	**1**	**No. of Hours:**	**1 Hour Per Week**
Max Marks:	**50**		

Course Description:

Industrial Training Presentation gives the students an exposure towards current industrial practices related to the theoretical knowledge being taught at the classes. Industrial visits provide an excellent opportunity to interact with industries and know more about industrial environment. Industrial visits are arranged for the students for Industrial realities and related professionalism related to Industry.

With an objective of providing students functional opportunity in different sectors. Industrial visit helps to combine theoretical knowledge with industrial knowledge. Industrial realities are opened to the students through industrial visits

Course Objectives:

1. To prepare industry oriented engineers with an ability to adapt and progress in a rapidly changing field.

2. Well-rounded individuals who both understand the principles and can undertake the practice of the Industrial areas.

3. Able to operate as effective engineers or scientists in metallurgical and materials Industries academia. equipment/machine or related fields with respect to advanced level.

Syllabus:

The student has to give a review presentation of comprehensive design/experimental project on a selected topic and Industrial Report preparation and submission.

Course Outcomes:

CO	At the end of this course the student will be able to:
CO1	Know how the basic principles of the industrial equipment/ machines.
CO2	Solve and analyze a problem from an industry/institute.
CO3	Select and redesign a problem.
CO4	Solve the problem through experiments to reach the sustainable solution.
CO5	Explain and demonstrate the solution developed

CO-PO & PSO Correlation:

Course Name: Industrial Training Presentation Course Code : SOE-B-EE510											
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1	1					3		1	2	2	
CO2	2	2	2		1	1			1	1	
CO3			1		2	1			1		
CO4			2	1	1	2			1		
CO5			1		1		2				3

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/Course Code	SUBJECT/COURSE	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-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	Digital Signal Processing 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									Course Code : (SOE-B-EE601)		
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1				1		2			2		
CO2		1					2			1	
CO3	1		2					1	1		1
CO4		3			1		3			2	
CO5	2		1						3		2
CO6		2			2	1		2		3	
CO7	3			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 time domain and frequency domain analysis tools.
CO3	Obtain the basic knowledge of FIR and IIR filters and its design.
CO4	Evaluate and design multi-rate digital signal processing systems.
CO5	Apply the concepts of digital signal processing for different applications.
CO6	Implement different algorithms in the field of image processing, video processing, speech processing etc. for industry application.

CO-PO & PSO Correlation:

Course Name : Digital Signal Processing									**Course Code : (SOE-B-EE602)**		
	Program Outcomes								**PSOs**		
Course Outcomes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**
CO1			**2**		**1**			**2**	**3**		**1**
CO2	**2**	**2**				**2**				**1**	
CO3				**2**			**2**		**1**		**3**
CO4	**3**	**1**			**3**			**1**		**2**	
CO5			**1**				**3**		**2**		
CO6	**1**	**3**			**2**	**1**				**3**	

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: Fundamental of Computer Systems

Building blocks of the Digital computer, CPU functions, Control Unit, Memory organisations, History of Microprocessors. Introduction to RISC and CISC Processor.
8086 Processor: Architecture, Addressing Modes, Instruction set. Min & Max mode of operation, Assembler Directives and Operators; Programming of microprocessor 8086.

UNIT-2: System Bus Structure and Interfacing

Basic 8086/8088 system bus architecture, Minimum mode Configuration, Maximum mode configuration; memory interfacing with 8086/8088 in minimum and maximum mode; System Bus Timings, Bus Standards. Interrupts of microprocessor 8086.

UNIT-3: Interfacing Devices
Programmable interrupt controller (PIC) 8259, Programmable DMA Controller (8257). 8-bit ADC and DAC, Programming for Interfacing of 8253/8254, 8255, ADC and DAC with 8086.
UNIT-4: Microcontrollers

Basics of microcontrollers. Intel-8051 Architecture, Hardware description, Memory organization, Addressing Modes. SFRs.

UNIT-5: Programming the 8051

Instruction set, Assembly language programming, structure and interrupt priorities, Interfacing with external devices. Programming in Embedded C.
Mini project- microcontroller-based industrial automation

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 a detailed s/w and h/w structure of the Microprocessor
CO2	Distinguish and analyze the properties of Microprocessors and Microcontrollers.
CO3	Develop algorithm/program of the microprocessors and microcontrollers for a particular task.
CO4	Interface advanced microprocessor with external peripherals and Memory.
CO5	Able to design complex control systems by using microcontrollers and microprocessors.

CO-PO & PSO Correlation:

Course Name: Microprocessor & Microcontroller Course Code : (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

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

UNIT-2: Solar Energy and Applications

The Sun to Earth Transaction, The Solar Energy Budget, Electromagnetic Radiation: Solar Spectrum, Solar flat plate collector, Solar Concentrator, Solar Energy: The Semiconductor, the p-n junction, 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, Fuel Processing for PEM Fuel Cells, Fuel Cells: Concept to Product, Characterization of Electrochemical Devices, Fuel Cells: 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 overall idea about Photo-catalysis.
CO3	Get overall idea about ocean thermal energy conversion.
CO4	Understand and analyze Magneto-hydrodynamic Power Generation.

CO-PO & PSO Correlation:

Course Name : Renewable Energy Sources and systems Course Code : (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				3		2	3		2		2
CO4		2	2		2	2		1	1	2	

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 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, Fuzzy Inferences Such as Mamdani Minimum and Larsen Product, 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, GA Operators: Selection, GA Operators: Crossover, GA Operators: 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 Course Code : (SOE-B-EE605(1))											
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1	1		3		2		1			2	3
CO2		2				1			2		
CO3	3			2				1		1	
CO4		2				2			3		1

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 Hrs 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.

UNIT-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.
CO6	Comprehend various inter-networking devices and formation of Headers of TCP/IP.
CO7	Design wired or wireless computer network infrastructure as per the industrial requirement.

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		1			2						2
CO2	3			3		1		2	2		
CO3		2					3			1	
CO4	3		2					2	2	2	1
CO5			1			2					
CO6	2				3		2		1		
CO7		2				1		1		1	3

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, third party interface, control, display etc. Enhanced functionsviz. Advance Process Control, Batch application, Historical Data Management, OPC support, Security and Access Control etc.

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

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 an 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 motor, starting and running characteristics, speed control, temperature rise, Type of electric drives, 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 & Welding

Electric heating: Advantages and methods of electric heating, resistance heating induction heating and dielectric heating. Electric welding: resistance and arc welding, electric welding equipment, comparison between AC and Welding.

UNIT- 3: Illumination

Illumination: Introduction, terms used in illumination, laws of illumination, polar curves, photometry, integrating sphere. Sources of light: Discharge lamps, MV and SV lamps, comparison between tungsten filament lamps and fluorescent tubes, basic principles of light control, types and design of lighting and flood lighting. Discharge lamps, MV and SV lamps comparison between tungsten filament lamps and fluorescent tubes, Basic principles of light control, Types and design of lighting and flood lighting.

UNIT- 4: Train Mechanics

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

UNIT- 5: Electric Traction

Calculations of 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. System of electric traction and track electrification. Review of existing electric traction systems in India. Special features of traction motor, methods of electric braking-plugging rheostatic braking and regenerative braking.

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.

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 electric traction system.
CO2	Demonstrate the various heating and welding system.
CO3	Explain and analyze train mechanics.
CO4	Understanding about illumination system.
CO5	Understand the electric traction system.
CO6	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			2			1			1	
CO2		2				3			2		
CO3	2		2		1		2			2	
CO4		2							1		1
CO5			1		2		3			1	
CO6	2					1			3		3

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:

To impart knowledge in the field of material science and their applications in electrical engineering.

Syllabus:

Unit-1: Conducting Materials

Elementary Materials Science Concepts: Bonding and types of solids, Crystalline state and their defects, Review of metallic conduction on the basis of free electron theory, conducting materials properties, Variation of conductivity with temperature and composition, Material for brushes of electrical machines, lamp filaments, fuses and solder etc.

Unit -2: Magnetic Materials

Origin of permanent magnetic dipoles, Classification of magnetic materials -Curie-Weiss law Properties and application of iron, Alloys of iron- Hard and Soft magnetic materials, Ferrites magnetic materials used in electrical machines, instruments and relays.

Unit-3: Dielectrics Insulating Materials

Dielectric, Polarization under static fields, Electronic ionic and dipolar polarizations, Behavior of dielectrics in alternating fields, Factors influencing dielectric strength and capacitor materials, Insulating materials, Complex dielectric constant and dielectric loss, Inorganic materials (mica, glass, porcelain, asbestos), Organic materials (paper, rubber, cotton silk fiber, wood, plastics and bakelite), Resins and varnishes, Liquid insulators (transformer oil), Gaseous insulators (air, SF6 and nitrogen) and ageing of insulators.

Unit-4: Semiconductor Materials

Mechanism of conduction in semiconductors, Density of carriers in intrinsic semiconductors, Energy gap, Types of semiconductors, Compound semiconductors, Basic ideas of amorphous and organic semiconductors.

Unit-5: Materials for Special Applications

Basic Concept, Types characteristics and applications solar energy materials, Photo thermal conversion, Solar selective coatings for enhanced solar thermal energy collection, Photovoltaic conversion, Solar cells (Silicon, Cadmium sulphide and Gallium Arsenic), Organic solar cells.
Modern Techniques for Materials Studies: Optical microscopy, Electron microscopy,

Photoelectron spectroscopy, Atomic absorption spectroscopy, Introduction to biomaterials and

nanomaterials.

Text Book:

1. Electrical Engineering Materials: A.J. Dekker, Prentice Hall of India, 1970.

2. Electrical Engineering Material Science: G K Mithal, Khanna Publishers, 2nd edition, 1991.

References Books:

1. Materials Science and Engineerin An Introduction: William D. Callister and David G. Rethwisch, Wiley, 9th edition, 2013.

2. Applied Solar Energy An Introduction: A.B Meinal and M. P. Meinal, Addison-Wesley Educational Publishers Inc, 1976.

3. An Introduction to electrical Engineering Materials: O.S Indulkar and S. Thiruvegadam, S Chand & Company, 4th Edition, 2006.

4. A Course in Electrical Engineering Materials: S.P Seth and P. V. Gupta, Dhanpath Rai publication, 3rd edition, 2011.

Course Outcomes:

CO	At the end of this course the student will be able to:
CO1	Understand the characteristics and application of conducting materials.
CO2	Give details, classify and uses of magnetic materials in instruments and machines.
CO3	Recognize insulators and their behavior in static and alternating fields as well as its application in industries.
CO4	Understand the characteristics and applications of semiconducting materials in semiconductor devices.
CO5	Describe the materials used for special application like solar energy materials and superconducting materials as well as will gain knowledge in the modern techniques for material studies.
CO6	Apply their knowledge in selecting conductor material, insulating material as per the prescribed voltage and current.

CO-PO & PSO Correlation:

Course Name : Electrical Engineering Material Course Code : (SOE-B-EE605(5))											
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1		1			2						2
CO2	3			3		1		2	2		
CO3		2					3			1	
CO4	3		2					2	2	2	1
CO5			1			2					
CO6	2				3		2		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 Hrs 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.

(A) Hardware Based Experiments:

1. To study speed control of separately excited dc motor by varying armature voltage using single- phase fully controlled bridge converter.

2. To study speed control of separately excited dc motor by varying armature voltage using single phase half controlled bridge converter.

3. To study speed control of separately excited dc motor using single-phase dual converter (Static Ward-Leonard Control).

4. To study speed control of separately excited dc motor using MOSFET/IGBT chopper.

5. To study closed loop control of separately excited dc motor.

6. To study speed control of single phase induction motor using single phase ac voltage controller.

7. To study speed control of three phase induction motor using three phase ac voltage controller.

8. To study speed control of three phase induction motor using three phase current source inverter.

9. To study speed control of three phase induction motor using three phase voltage source inverter.

10. To study speed control of three phase slip ring induction motor using static rotor resistance control using rectifier and chopper.

11. Tostudyspeedcontrolofthreephaseslipringinductionmotorusingstaticscherbiusslippower recovery control scheme.

Simulation Based Experiments using MATLAB or any other software)

1. To study starting transient response of separately excited dc motor.

2. To study speed control of separately excited dc motor using single phase fully/half controlled bridge converter in discontinuous and continuous current modes.

3. To study speed control of separately excited dc motor using chopper control in motoring and braking modes.

4. To study starting transient response of three phase induction motor.

5. To study speed control of three phase induction motor using:
    a. Constant V/F control
    b. Constant 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									Course Code : (SOE-B-EE606)		
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1	1									1	
CO2		3							2		1
CO3	2		2							2	
CO4		1							1		
CO5	3		3							1	

Note: 1: Low 2: Moderate 3: High

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

Course Description:

The course is an experimental laboratory that explores the design and implementation of different digital signal processing techniques for discrete-time systems such as signal generation, DFT, FFT, design of IIR and FIR filters through various techniques. The programs shall be implemented in software using MATLAB/Python programming.

Syllabus:

List of Experiments:

1. To write a program to generate continuous-time signals like unit step, unit ramp, sinusoidal, sinc functions and perform various operations such as addition, multiplication, scaling, shifting, and folding.

2. To write a program to generate discrete-time signals like unit step, unit ramp, sinusoidal, sinc functions and perform various operations such as addition, multiplication, scaling, shifting, and folding.

3. To write a program to generate sampling of a continuous signal and its frequency spectrum.

4. To write a program to compute DFT for a given sequence.

5. To write a program to compute for N-point FFT algorithm.

6. To write a program to compute linear convolution of two given sequences.

7. To write a program to compute cross correlation and auto correlation of two given sequences.

8. To write aprogram to design low pass filter using non-recursive structure.

9. To write aprogram to design high pass filter using non-recursive structure.

10. To write a program to compute power spectrum of a given signal.

11. To write a program to design band pass filter (bpf) & band stop filter (bsf) using non-recursive structures.

12. To write a program to implement Decimation Process and vary (decrease) the sampling rate.

13. To write a program to implement Interpolation Process and vary (increase) the sampling rate.

14. Study of architecture of DSP chips – TMS320C6x and its instructions.

Equipment/Software required:

Python with essential components, MATLAB with Tool boxes, DSP Processor kit, Digital Storage CRO, Spectrum.

Reference Books& Manuals:

1. MATLAB: An introduction with applications- Amos Gilat – Willey Publication

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

3. Think DSP: Digital Signal Processing in Python - Allen B. Downey – O'Reily

Course Outcomes:

CO	Electrical Engineering Graduates will be able to:
CO1	Learn basic knowledge about the generation of different kinds of signals.
CO2	Interpret different signal transformation techniques.
CO3	Determine the characteristics of the IIR and FIR filters.
CO4	Identify the DSP processors and its architecture.
CO5	Apply the concepts of digital signal processing for different applications.
CO6	Implement different algorithms such as FFT and multirate digital signal processing for industry application.

CO-PO & PSO Correlation:

Course Name : Digital Signal Processing Lab									**Course Code : (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**	
CO4	**2**	**3**	**2**						**2**	**2**	
CO5	**2**	**2**	**3**						**2**	**2**	**1**
CO6	**2**	**2**							**2**	**2**	**1**

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.

Syllabus:

Microprocessor 8086:

1. Write an ALP to perform arithmetic and logical operation on 8-bit data with 8086.
2. To find the largest number & smallest number from a block of 10 bytes on 8086
3. A block of 200-signed bytes is present in memory from address BA: EA add all the positive bytes and store 8-bit signed result in memory after this block.
4. To write a program to convert an 8-bit BCD number into its equivalent binary.
5. To write program to input a 4-bit BCD number, look up the seven-segment code for this number and output to the display.
6. Write a Program to rotate the Stepper motor in Clock-Wise direction (8 steps).
7. Study and Design Interfacing of ADC and DAC to 8086

Microcontroller 8051:

1. Write an assembly language program to add, subtract, multiply, divide 16-bit data by Atmel 8051 microcontroller.
2. Write an assembly language program to generate 10 KHz frequency using interrupts on P1.2.

3. Design an interfacing circuit and write the c code to interface of 16 x 2 LCD.
4. Study of implementation of DC Motor control using PWM method.

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 Course Code : (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.

Course Objectives:

The subject aims to provide the students with: -

1. Understanding the concepts of internet of things.
2. Acquiring the knowledge of the architectural components and platforms of IoT ecosystem.
3. Designing appropriate access technology and protocol as per the application requirement.
4. Learning the various security issues of IoT architecture.
5. Understanding of design and implementation issues of IoT circuits and solutions.

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, Routing over Low Power and Lossy Networks, Application Transport Methods: 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									Course Code : (SOE-B-EE609)		
	Program Outcomes								PSOs		
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3
CO1	1	2			1				3		2
CO2	2		1								
CO3		1	2						1	2	1
CO4		1	1							2	
CO5		1	2	1	1		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.

Course Objectives:

The objectives of this course are:

1. Analyzing interest, aptitudes and skills to make informed career goals.
2. Using job shadowing to research careers of interest and identify career preferences.
3. Demonstrating job seeking and job keeping skills to gain immediate or future employment.
4. Identify entrepreneurial characteristics and skills.

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
				L	T	P	PRE		ESE	Total Marks	
							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

Professional Elective-II (Annexure-II)

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**

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**

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

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 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**		**2**		**1**		**2**		**1**	
CO2:	**2**		**1**		**2**		**2**		**3**		**1**
CO3:		**2**		**1**		**3**		**2**		**3**	
CO4:	**3**		**3**				**1**		**1**		**2**
CO5:		**1**			**3**					**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:	**1**		**3**		**2**	**1**		**2**	**1**		**1**
CO2:		**1**		**1**						**2**	
CO3:	**3**		**2**			**3**	**2**		**3**		
CO4:		**2**			**1**			**3**		**1**	
CO5:	**3**		**1**			**2**			**3**		

Note: 1: Low 2: Moderate 3: High

Programme:	**B.Tech.**	**Semester :**	**VII/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 one. 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 controller. 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.

Course Objectives:

1. Explain the working principle of series and shunt compensators.
2. Explain the working principle and application of SVCs and VAR generations.
3. Analyze and compare static synchronous series compensators.
4. Compare the different type of static series compensators.
5. Overall idea on 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”, IEE Press, 1999

2. E. Acha, “FACTS: modelling 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 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:		**1**				**1**		**3**	**1**		**1**
CO2:	**2**		**2**				**2**			**2**	
CO3:		**3**				**3**		**1**	**3**		
CO4:	**3**		**3**				**1**			**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**		**1**			**2**		**1**		**2**	
CO2:	**1**			**3**			**2**		**1**		**1**
CO3:		**2**			**3**			**2**		**1**	
CO4:	**3**		**3**			**1**					**2**
CO5:				**1**			**3**		**2**		

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

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
Pre Requisite: 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 modelling 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: I
Introduction, the behavior of the nonlinear system, common physical non-linearity-saturation, friction, backlash, dead zone, relay, multivariable non-linearity. Phase plane method, singular points, nonlinear system stability, limit cycles, construction of phase trajectories. Lyapunov Stability Definitions, Lyapunov Stability Theorems, Lyapunov Functions for Nonlinear Systems.

References

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	
CO2:	1		2			2		1		2	2
CO3:		1	3			2	3		2		
CO4:	2			4	3		1	2		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.

Pre Requisite: 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 applicationǁ", 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**	
CO2:		**1**	**2**			**2**		**1**	**3**		**2**
CO3:	**3**		**3**	**2**			**3**			**3**	
CO4:	**1**	**1**			**3**		**1**	**2**	**2**		**3**
CO5:	**2**	**3**		**1**		**1**	**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 :	**2**	**No of Hours :**	**4 Hrs Per Week**
Max Marks:	**50**		

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 generator and obtain standard impulse voltage wave.
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. 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	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	7	8	1	2	3
CO1:	1	3								1	
CO2:	2		1						3		1
CO3:										2	
CO4:	3		2						2		
CO5:		1								3	

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 :**	**20 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. Student shall study the topic of project work and define problem statement. The student shall evolve design and/or do experimental study and/or fabricate engineered device to obtain 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**	**3**
CO1:	**3**		**1**	**2**		**2**		**2**			
CO2:		**2**		**1**		**1**	**2**			**3**	
CO3:					**2**				**1**		**3**
CO4:	**1**		**1**		**1**		**1**			**2**	
CO5:	**2**	**1**		**2**		**3**		**1**	**1**		**1**

Note: 1: Low 2: Moderate 3: High

Program:	**B.Tech.**	**Semester:**	**VII/VIII**
Name of the Course:	**Professional Development**	**Course Code:**	**SOE-B-EE705**
Credits:	**1**	**No of Hours:**	**1 Hrs/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 knowledge and experts. This function will create new abilities; increase the performance and the new innovation.

Course Outcomes:

CO	At the end of the course, the students will be able to
CO1	To provide an integrative and holistic understanding of the nature of entrepreneurship.
CO2	To make students understand the criticality of entrepreneurship survival, growth and sustainability.
CO3	To make students learn the factors that contribute to entrepreneurship success and failure.
CO4	To make students learn the role of creativity, knowledge and learning processes in entrepreneurship.
CO5	To make students learn the knowledge management.

Syllabus:

UNIT- I

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- II

Entrepreneurial Motivation Theories - Entrepreneurial Competencies – Developing Competencies – Role of Entrepreneur. Development Programs – Assistance Programme for Small Scale UNIT-s – Institutional Framework – Role of SSI Sector in the Economy – SSI

UNIT-s – Failure, Causes and Preventive Measures – Turnaround Strategies.

UNIT- III

Identification of Business OpportUNIT-y – 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- IV

Corporate Entrepreneurship (Intrapreneurship) – Concepts – Need – Strategies - Corporate Practices – Select Cases – Dynamics of Competition – Plans for Survival and Growth.

UNIT- V

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. Innovation and entrepreneurship, Drucker P F. (2004), Heinemann. REFERENCES
2. Entrepreneurship and venture management, Baumback M. C & Mancuso R J., (1987), Prentice Hall.

Reference Books:

1. Small business management, Dan S, ISBN 13: 9780070611481, McGraw Hill
2. Guidelines to entrepreneurs for starting a small-scale industry, Small Industries Service Institute (SISI), Madras Publication

CO-PO & PSO Correlation:

Course Name: Professional Development (SOE-B-EE705)											
	Program outcome								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