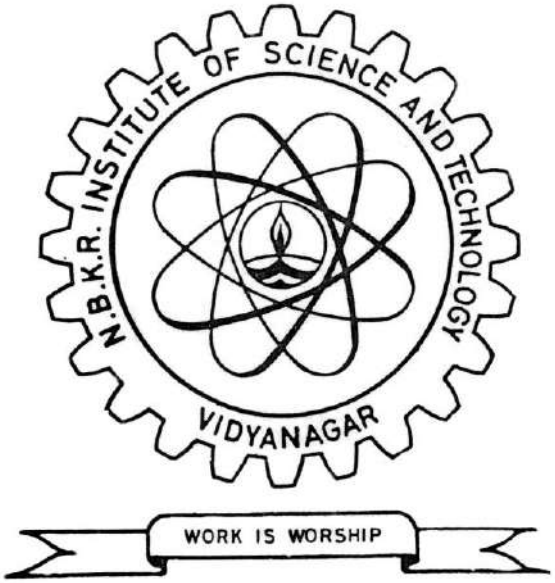
N.B.K.R. INSTITUTE OF SCIENCE & TECHNOLOGY

(AUTONOMOUS)
COLLEGE WITH POTENTIAL FOR EXCELLENCE (CPE)
Affiliated to JNTUA, Anantapuramu
Re-Accredited by NAAC with 'A' Grade
B.Tech. Courses Re- Accredited by NBA under TIER-I



SYLLABUS

I B.TECH.
I & II Semesters

ELECTRICAL AND ELECTRONICS ENGINEERING

(With effect from the batch admitted in the academic year 2020-2021)

VIDYANAGAR - 524413
SPSR Nellore-Dist.Andhra Pradesh

www.nbkrist.org

Vision and Mission of the Institute

Vision:

To emerge as a comprehensive Institute that provides quality technical education and research thereby building up a precious human resource for the industry and society.

Mission:

- To provide a learner-centered environment that challenges individuals to actively participate in the education process.
- To empower the faculty to excel in teaching while engaging in research, creativity and public service.
- To develop effective learning skills enabling students to pick up critical thinking thus crafting them professionally fit and ethically strong.
- To reach out industries, schools and public agencies to partner and share human and academic resources.

Vision and Mission of the Department

Vision:

To impart quality education and research with professional values & ethics to cater the industrial and societal needs.

Mission:

- To enhance student's skills by implementing modern curriculum through collaborative industry institute interaction.
- To provide with modern tools to enhance innovative research.
- To create human resources in electrical engineering to contribute to the nations development and improve the quality of life.
- Imbibe values and ethics for a holistic engineering professional practice.

PROGRAM EDUCATIONAL OBJECTIVES

PEO1: To inculcate basic knowledge in Humanities and Sciences, Fundamentals of Computer Programming besides essential knowledge of electrical and electronics engineering.

PEO2: To apply the principles, concepts and skills of Electrical and Electronics Engineering for research and development.

PEO3: To imbibe professional values, ethics, leadership, teamwork through co-curricular and extracurricular activities for personality development and for effective engineering practice.

PEO4: Engage in continuing professional growth.

PROGRAMME OUTCOMES (POs)

An Engineering Graduate will be able to:

PO1: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

NBKR INSTITUTE OF SCIENCE & TECHNOLOGY:: VIDYANAGAR (AUTONOMOUS)
(AFFILIATED TO JNTUA :: ANANTAPUR)
SPSR NELLORE DIST
I YEAR OF FOUR YEAR B.TECH DEGREE COURSE – I SEMESTER
ELECTRICAL AND ELECTRONICS ENGINEERING
SCHEME OF INSTRUCTION AND EVALUATION
(With effect from the academic year 2020-2021)

S.No	Course Code	Course Title	Instruction Hours/Week			Credits	Evaluation									
							Sessional Test-1			Sessional Test-2			Total Sessional Marks (Max. 40)	End Semester Examination		Maximum Total Marks
		THEORY	L	T	D/ P		Test-1 (2 Hr)	Assign-1	Max. Marks	Test-2 (2 Hr)	Assign-2	Max. Marks		Duration In Hours	Max. Marks	100
1	20SH1101	Communicative English*	3	-	-	3	34	6	40	34	6	40	0.8*Best of Two + 0.2*Least of Two	3	60	100
2	20SH1102	Applied Physics#	3		-	3	34	6	40	34	6	40		3	60	100
3	20SH1105	Engineering Mathematics-I*	3	-	-	3	34	6	40	34	6	40		3	60	100
4	20CS1101	Programming for Problem Solving*	3	-	-	3	34	6	40	34	6	40		3	60	100
5	20EE1101	Basic Electrical Sciences	3	-	-	3	34	6	40	34	6	40		3	60	100
		PRACTICALS														
6	20ME11P2	Engineering Workshop lab#	-	-	3	1.5	-		-	-		-	Day to Day Evaluation and a test (40 Marks)	3	60	100
7	20CS11P1	Programming for Problem Solving Lab*	-	-	3	1.5	-		-	-				3	60	100
8	20SH11P2	Applied Physics Lab#	-	-	3	1.5	-		-	-		-		3	60	100
		TOTAL				**19.5**										
9		Induction program	3 WEEKS													

(***:** Common to all; #: Common EEE,CSE,IT & AI&DS, $: Common to ECE & EEE)

20SH1101-Communicative English

(Common to All Branches)

Course Category:	Basic Sciences	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Basic Level of LSRW Skills	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected:	
	1. To develop basic writing skills in English. 2. To achieve specific linguistic and communicative competence. 3. To acquire relevant skills and make use of them effectively in practical working context. 4. To inculcate the habit of reading and make aware of appropriate reading strategies. 5. To learn writing paragraphs effectively with unity and coherence. 6. To learn writing of simple and analytical essays.	
Course Outcomes	On successful completion of this course, the students will be able to:	
	CO1	Identify activity-based learning methods to ensure that they would be engaged in use of language.
	CO2	Demonstrate effective listening skills for better comprehension of academic lectures and English spoken by the native speakers.
	CO3	Apply knowledge of grammatical structures and vocabulary and encourage their appropriate usage in speaking and writing.
	CO4	Contrast graphic elements used in academic texts and produce a coherent paragraph construing a figure/graph/chart/table
	CO5	Evaluate reading/listening texts and to write summaries based on global comprehension of these texts.
	CO6	Develop appropriate reading strategies of comprehension in various academic texts and authentic materials and comprehend, discuss and respond to academic texts orally and in writing.
Course Content	**UNIT-I** **Lesson: On the Conduct of Life: William Hazlitt** **Writing:** Paragraph Writing: Sentence Structures- use of phrases and clauses in sentences - importance of proper punctuation- creating coherence- beginnings and endings of paragraphs - introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph **Grammar:** Content words and Function words: Word Forms: Verbs, Nouns, Adjectives and Adverbs; Nouns: Countable and Uncountable; singular and plural; Basic Sentence Structures; Simple Question form - Wh-questions; Word Order in Sentences **Vocabulary :** Word Formation - Suffixes	

Course Content	**UNIT-II** **Lesson: The Brook: Alfred Tennyson** **Writing:** Descriptions: Nature and style of sensible writing - Describing - Defining -Classifying- Providing examples and evidence - Writing introduction and conclusion **Grammar:** Cohesive devices - Linkers, Sign posts and transition signals; Use of Articles and Zero Article, Prepositions, **Vocabulary:** Word Formation- Prefixes **UNIT-III** **Lesson: The Death Trap: Saki** **Writing:** Drafting of Public Speech**:** Introduction - Structure - Content- Informing facts- Conclusion **Grammar:** Pronoun-Agreement, Subject-Verb Agreement **Vocabulary:** Synonyms **UNIT-IV** **Lesson: Innovation: Muhammad Yunus** **Writing:** Information Transfer: describe, compare, contrast, and identify significance/trends based on information provided in figures/charts/graphs/tables. **Grammar:** Quantifying expressions - Adjectives and Adverbs; Comparing and Contrasting; Degrees of Comparison **Vocabulary:** Antonyms **UNIT-V** **Lesson: Politics and the English Language: George Orwell** **Writing:** Letter Writing: Official Letters and E-mail letters **Grammar:** Verbs - Tenses - Active Voice and Passive Voice, Question Tags, Reported Speech **Vocabulary:** One - Word Substitutes **UNIT –VI** **Reading:** Comprehension: Different Reading Strategies - Skimming - Scanning - Inferring, Predicting and responding to content - Guessing from context and vocabulary extension. **Writing:** Essay writing: Writing structured essays on specific topics - introducing the issue - analyzing and arguing - creating coherence usage of proper punctuation - importance of conclusion **Grammar :** Editing short texts - identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement) **Vocabulary:** Common Abbreviations
Text Books & Reference Books:	**TEXT BOOK:** 1**.**Language and Life: A Skills Approach- I Edition 2018, Orient Black Swan **REFERENCE BOOKS:** 1. Bailey, Stephen. Academic writing: A hand book for international students. Routledge, 2014. 2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking, Heinley ELT; 2nd Edition, 2018. 3. Skilful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational. 4.Raymond Murphy's English Grammar in Use Fourth Edition (2012) E-book 5.Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.
e-resources:	www.englishclub.com www.easyworldofenglish.com www.languageguide.org/english www.bbc.co.uk/learningenglish www.eslpod.com/index.html www.myenglishpages.com

20SH1102-APPLIED PHYSICS

(Common to EEE, CSE, IT & AI&DS**)**

Course Category:	Basic Science	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Fundamental concepts of Physics	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	Students undergoing this course are expected to	
	1. Learn various phenomena exhibited by light and describe the characteristics, construction & working of lasers along with applications in Science & Technology. 2. Acquire knowledge of crystal systems & their analysis using X-rays and concepts of ultrasonics. 3. Apply principles of quantum mechanics to various atomic phenomena and understand the electrical behaviour of solids. 4. Explain and provide the knowledge about semiconductors and their use in electronic devices. 5. Learn basic properties of dielectric &magnetic materials and their uses in Science & Technology. 6. Learn the behaviour of super conductors, nanomaterials, quantum phenomena and the limitations of basic physical laws.	
Course Outcomes:	Upon successful completion of the course, the student will be able to:	
	CO1	Understand the utilization of laser technology in various disciplines.
	CO2	Understand the structure of crystalline solids and their applications in x-ray diffraction.
	CO3	Able to understand the basic concepts of quantum physics applicable to solids.
	CO4	To know the properties of semiconductor materials by projecting the view of energy bands.
	CO5	Understand the concepts of polarization& magnetization and also applications of dielectric& magnetic materials in various disciplines.
	CO6	Basic ideas about superconductors and nanomaterials with their uses in various fields of Science & Technology

Course Content:	**UNIT-I:Wave optics & Lasers** **Wave optics**: Introduction (Interference of light) - Interference of light by wave front splitting (Young's double slit experiment) and amplitude splitting (Newton rings) – Fraunhoffer diffraction from a single slit, double slit - Diffraction grating (qualitative). **Lasers**: Spontaneous & stimulated emission of radiation - Population inversion– Properties of lasers (mono-chromacity, coherence, directionality, brightness) – Types of lasers: solid state (Nd-YAG), gas (He–Ne) – Applications of lasers in science, engineering & medicine. **UNIT-II: Crystallography, X-ray diffraction & Ultrasonics** **Crystallography**: Introduction – Space lattice – Unit cell – Lattice parameters – Bravais lattice – Crystal systems – Packing fractions of S.C., B.C.C., F.C.C. – Planes in crystal : Miller indices – Inter planar spacing in cubic crystals– Bragg's law of diffraction – X-ray diffraction techniques: Laue method – Powder method (Debye – Scherrer method). Ultrasonics: Introduction-Properties and detection-Production of ultrasonics using Piezo electric method-Applications of ultrasonics. **UNIT-III: Introduction to quantum mechanics &Electron theory** **Introduction to quantum mechanics** : Wave nature of particles (de-Broglie hypothesis) – Uncertainty principle – Schrodinger time independent wave equation - Significance of wave function (Born interpretation) – Solution of stationary state Schrodinger equation for one dimensional problems (particle in a box). **Free electron theory:** Introduction (classical & quantum: postulates, success& drawbacks) – Fermi–Dirac distribution function and its temperature dependence – Fermi level – Density of states (qualitative) –Kronig–Penny model (non mathematical treatment) - Origin of energy bands– Classification into conductors, semiconductors & insulators. **UNIT-IV: Semiconductor physics & Semiconductor devices** **Semiconductor physics**: Intrinsic Semiconductors – Intrinsic conductivity – P&N type semiconductors - Variation of Fermi level with temperature– Drift & diffusion –Einstein relation – Hall effect and its applications. **Semiconductor devices:** Formation of P-N junction – V-I Characteristics of P-N junction diode (forward & reverse bias)– Direct & indirect band gap semiconductors – Light emitting diodes, photo detectors & solar cells (construction, working, materials & applications) **UNIT-V:Dielectrics & Magnetic properties** **Dielectric properties**: Basic definitions – Electronic, ionic and orientation polarizations (qualitative) – Internal field in solid dielectrics – Clausius – Mossotti equation – Ferroelectricity – Applications of dielectrics. **Magnetic properties:** Introduction and basic definitions (B, M, H & χ) – Origin of magnetic moment – Classification of magnetic materials into dia, para, ferro,anti ferro&ferri magnetics – Hysteresis – Soft & hard magnetic materials – Applications of magnetic materials . **UNIT VI: Superconductors and Nanomaterials :** **Superconductors:** Introduction – Effect of temperature and magnetic field – Meissner effect – Types of superconductors (type I & II) – BCS theory –DC & AC Josephson effects (qualitative) – Applications of superconductors **Nanomaterials:** Introduction – Significance of nano scale – Types ofnanomaterials – Properties of nanomaterials: physical, mechanical, magnetic and optical – Synthesis of nanomaterials: top down-Ball milling, bottom up – Chemical vapour deposition – Applications of nanomaterials
Text Books & Reference Books	**TEXT BOOKS:** 1.Engineering Physics by P.K.Palanisamy, Scitech Publications (2nd edition). 2. Engineering Physics by S.Maninaidu, Pearson (2009). 3. Applied Physics by K.Thyagarajan, McGraw Hill (2019). **REFERENCE BOOKS:** 1.Solid State Physics, by C.Kittel, Wiley India PVT Limited (2007) 2. Solid State Physics by S.O.Pillai, New Age International Publishers (2018). 3. Engineering Physics by R.K.Gaur and S.L.Gupta, Dhanpatrai Publications(2012)

20SH1105-ENGINEERING MATHEMATICS –I

(Common to all branches**)**

Course Category:	Basic Sciences	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre -requisite:	Intermediate Mathematics	**Sessional Evaluation:** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	To make the student learn about 1. The concepts of Newton's law of cooling, Law of natural growth and decay. 2. Solving higher order differential equations with RHS of different types by using analytical techniques. 3. The concepts of first shifting theorem, Change of scale property, Laplace transformation of multiplied by t and division by t and transformation of derivatives and integrals. 4. The application of Solutions of Ordinary Differential Equations. 5. The basic concepts of Matrices. 6. Taylor's and Maclaurin's series, Maxima and Minima of the functions of two and three variables.	
Course Outcomes:	After completing the course the student will be able to	
	CO1	Attains skills in solving first order differential equations and its applications.
	CO2	Acquire knowledge in solving higher order differential equations by using various types.
	CO3	Acquire basic knowledge in Laplace transforms and their applications.
	CO4	Develop analytical skills in solving the Ordinary Differential Equations by using the Laplace transform technique.
	CO5	Understand effectively the analyzation of the Rank of the matrix, Consistency of system of linear equations, Eigen values and Eigen vectors.
	CO6	Attains skills in analyzing the Taylor's and Maclaurin's series and Maxima and Minima of the functions of two and three variables.
Course Content:	**UNIT - I** **First order Differential Equations**: Differential Equations of first order and first degree – exact, linear and Bernoulli. Applications to Newton's law of cooling, Law of natural growth and decay. **UNIT - II** **Higher order Differential Equations:** Homogeneous linear differential equations of second and higher order with constant coefficients with R.H.S. of the type e^{ax}, $\sin ax$ or $\cos ax$, x^n, e^{ax} V and $x^n v(x)$. **UNIT - III** **Laplace Transformation:** Laplace Transformations of standard functions, First shifting theorem, Change of scale property, Laplace transformation of multiple by t and division by t, Transformation of derivatives and integrals. **UNIT - IV** **Inverse Laplace Transformation:** Inverse transforms, Method of partial fractions, Shifting property, Inverse Laplace transform of a multiple by s and division by s, Inverse Laplace transform of derivatives and integrals, Convolution theorem. Application to Solutions of Ordinary Differential Equations.	

	UNIT - V **Matrices:** Rank of Matrix by Echelon form, System of homogenous and non-homogenous linear equations, Eigen values and Eigen vectors and their properties. UNIT - VI **Differential Calculus:** Taylor's and Maclaurin's series , Maxima and Minima of function of two variables and Lagrangian method of multipliers with three variables only.
Textbooks: & Reference Books:	**TEXTBOOKS:** 1. Higher Engineering Mathematics - B.S.Grewal, Kanna Publishers, New Delhi. 2. Engineering Mathematics - B.V. Ramana, Tata McGraw-Hill Education Pvt. Ltd, New Delhi. **REFERENCE BOOKS:** 1. Higher Engineering Mathematics - H.K. Dass, Er. Rajnish Verma, S.Chand Publication, New Delhi. 2. Advanced Engineering Mathematics - N.P. Bali & M. Goyal, Lakshmi Publishers, New Delhi. 3. Advanced Engineering Mathematics - Erwin Kreyszig, Wiley, India

20CS1101-PROGRAMMING FOR PROBLEM SOLVING

(Common to all branches)

Course category:	Program Core	**Credits:**	3
Course Type:	Theory	**Lecture–Tutorial –Practical:**	3-0-0
Pre-requisite:	Knowledge on computer fundamentals and basic mathematics	**Sessional Evaluation:** **Univ. Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to:	
	1. Learn the procedure how to develop algorithms, representations and programming development steps 2. Learn the basic building blocks of C language. 3. Usage of C constructs (arrays, structures, pointers and file management) to develop various programs 4. Create better awareness how effectively utilize the concepts of C for application development	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Learn the fundamentals of programming development, structure of C and basic data types
	CO2	Find the usage of operators in expression evaluation and construction of I/O Statements.
	CO3	Acquire knowledge on various control structures to develop simple programs
	CO4	Explore the concept of arrays, strings and its effective utilization
	CO5	Understand the concepts of Pointers and Functions for exploring the dynamic memory usage
	CO6	Explore the basics of Structures, Unions, File operations and supporting implementations
Course Content	**UNIT– I** **INTRODUCTION:** Algorithms, Flowcharts, Program development steps. **FUNDAMENTALS OF C:** History, Structure of a C program, Programming rules and execution. Character set, Delimiters, C keywords, Identifiers, Constants, Variables, Rules for defining Variables, Data types, Declaration and Initialization of Variables. **UNIT– II** **OPERATORS AND EXPRESSIONS:** Introduction, Operator Precedence and Associativity, Operator Types **INPUT AND OUTPUT IN C:** Formatted and Unformatted functions, Commonly used library functions. **UNIT– III** **DECISION STATEMENTS:** Introduction, Types of If statements, switch statement, break, continue, goto. **ITERATIVESTATEMENTS**: while, do-while and for loops.	

	UNIT-IV **ARRAYS**: Definitions, Initialization, Characteristics of an array, Array Categories. **STRINGS:** Declaration and Initialization of strings, String handling functions. **STORAGE CLASSES**: Automatic, External, Static and Register Variables. **UNIT-V** **POINTERS:** Fundamentals, Declaration and initialization of Pointers, Arithmetic Operations, Pointers and Arrays. **FUNCTIONS:** Definition, Function Proto types, Types of functions, Call by Value and Call by Reference, Recursion. **UNIT-VI** **STRUCTURES:** Definition, Declaration and Initialization of Structures. **UNIONS:** Definition, Declaration and Initialization of Union. **FILES:** Introduction, File Types, Basic operations on Files, File I/O, Command Line Arguments.
Text Books & Reference Books	**TEXTBOOKS:** 1. Programming with ANSI & TURBO C by Ashok N.Kamthane, PearsonEducation2007 **REFERENCEBOOKS:** 1. A Book on C by AlKelley/IraPohl, Fourth Edition,Addison-Wesley.1999 2. Let Us C by Yashavant Kanetkar, BPB Publications. 3. Programming in ANSIC by Balaguruswamy 6th Edition, Tata McGraw Hill Education,2012.

20EE1101 - BASIC ELECTRICAL SCIENCES

(EEE)

Course Category:	Professional core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Fundamental concepts of Electricity and electromagnetic induction.	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	Students undergoing this course are expected to learn:	
	1. Basic characteristics of R, L, C parameters and network reduction techniques. 2. The concept of form factor, Crest factor ,j notation and power triangle 3. The concept of series and parallel connection of R, L & C elements with sinusoidal Excitation and also graph theory concepts 4. Concepts of application of KCL and KVL. 5. Concept of inductance & mutual inductance, Dot convention and coefficient of coupling. 6. Concept of Series , parallel resonance and current locus diagrams	
Course Outcomes:	After completing the course the student will be able to	
	CO1	Find the equivalent resistance by using network reduction Techniques.
	CO2	Calculate average, RMS, form factor & crest factor for a given periodic waveform and determine the real power, reactive power& power factor.
	CO3	Determine steady state response for a given circuit and understand the concepts of graph theory.
	CO4	Understand and apply nodal and mesh analysis for the given circuit.
	CO5	Perform the calculation of coefficient of coupling (K) and equivalent inductance for a given coupled coil.
	CO6	Accomplish the computation of Quality factor, band width and current locus diagram for a given electrical circuit.
Course Content:	**UNIT- I** **Concept of Electric Circuits**: Introduction, Active and passive elements, V-I Characteristics of R, L and C elements, Ideal & Practical Sources, Source Transformation, Kirchhoff's laws, Network reduction techniques, Star-Delta transformation. **UNIT – II** **Fundamentals of AC circuits:** R.M.S, Average values , form factor and crest factor for different periodic wave forms, Sinusoidal Alternating Quantities - Phase and Phase Difference, Complex and Polar Forms Of Representations, j-Notation. Concept of Reactance, Impedance, Susceptance and Admittance. Concept of Active and reactive power, power factor –power triangle, Examples. **UNIT – III** **Single Phase AC Circuits:** Steady state Analysis of R, L and C elements (in series, parallel and series parallel combinations) – with sinusoidal Excitation - Phasor diagrams- Examples. **Graph Theory:** Network topology, Cut set and Tie set matrices – Incident matrices – Problems.	

	UNIT – IV **Analysis of Electrical Circuits:** Mesh and Nodal analysis of DC and AC circuits concept of super mesh and Super node with only independent sources. **UNIT – V** **Coupled Coils**: Faraday's Laws of Electromagnetic Induction, Concept of Self and Mutual Inductance, Dot Convention in coupled coils, Equivalent inductance of series and parallel connection coupled coils, Coefficient of Coupling. **UNIT – VI** **Resonance:** Series and parallel Resonance, Half power frequencies, Bandwidth and Q factor, Relation between half power frequencies - Bandwidth - Quality factor. **Locus Diagrams:** Locus diagrams of Series and parallel combinations of R-L, R-C with variation of parameters.
Text Books & Reference Books:	**TEXT BOOKS:** 1. "Engineering Circuit Analysis", by Hayt & Kemmerly, Fourth edition, TMH publishers 2. "Network Analysis", by M.E Van Valkenburg, Third edition, PHI learning private Limited, 2006. 3."Fundamentals of Electric circuits", by Charles k Alexander, Mathew N O Sadiku, Tata McGraw Hill Education private Limited, sixth edition,2017. **REFERENCE BOOKS:** 1. "Circuits & Networks", by A.Sudhakar and Shyam Mohan , Fifth edition(2015),TMH 2. "Circuit Theory", by A.Chakrabarti, DhanpatRai publishers, sixth edition 2014. 3. "Circuits & Systems", by Dr K.M.Soni, S.K.Kataria & sons Publication, Eleventh edition, Reprint 2016.
E-Resources:	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

20ME11P2- ENGINEERING WORKSHOP LABORATORY

(Common to EEE, CSE, IT and AI&DS)

Course Category	Engineering Science	**Credits**	1.5
Course type	Practical	**Lecture- Tutorial-Practical**	0-0-3
Pre-requisite:	No Prerequisite	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	Students undergoing this course are expected to learn: 1. The usage of work shop tools and prepare the models in the trades such as carpentry, fitting, sheet metal & foundry. 2. The usage of wiring tools and to execute house wiring connections. 3. To demonstrate the usage of tools of welding, black smithy and machine tools.	
Course Outcomes:	After completing the course the student will be able to:	
	CO1	Identify, Distinguish and Choose the tools of various trades (carpentry, fitting, sheet metal, foundry, wiring, welding, black smithy and machine tools).
	CO2	Demonstrate and Describe the usage of tools of various trades (carpentry, fitting, sheet metal, foundry, wiring, welding, black smithy and machine tools).
	CO3	Documenting the procedure adopted while preparing the model.
Course Content:	1. **Carpentry**: Half Lap, Mortise and Tenon and Bridle joint. 2. **Fitting:** Square, V, half round and dovetail fittings 3. **Tin-Smithy:** Tray, cylinder, hopper, cone 4. **House-wiring:** One lamp controlled by one switch, Two lamps (bulbs) controlled by two switches independently, Stair- case connection, Two lamps controlled by one switch in series, Two lamps controlled by on switch in parallel and Water pump connected with single phase starter. 5. **Foundry**: single-piece pattern and Two- piece pattern **TRADES FOR DEMONSTRATION:** 6. Machine Tools 7. Welding 8. Black Smithy	
Text Books:	**Text Books** 1. Engineering Work shop practice for JNTU, V. Ramesh Babu, VRB Publishers Pvt. Ltd,2009 2. Work shop Manual / P.Kannaiah/ K.L.Narayana/ Sci Tech Publishers,2004 3. Engineering Practices Lab Manual, Jeyapoovan, Saravana Pandian, Vikas publishers,2007.	

20CS11P1-PROGRAMMING FOR PROBLEM SOLVING LABORATORY

(Common to all branches)

Course category:	Professional Core	**Credits:**	1.5
Course Type:	Practical	**Lecture-Tutorial-Practice:**	0 -0 -3
Pre-requisite:	Basic mathematical knowledge to solve problems and computer fundamentals	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected:	
	To learn the C programming constructs and their implementation	
Course Outcomes	Upon successful completion of the course, the students will be able:	
	CO1	To solve problems using C-programming concepts
Course Content	**LISTOFEXPERIMENTS** 1. To evaluate expressions. 2. To implement if constructs. 3. To implement Switch statement. 4. To demonstrate alliterative statements. 5. To implement Arrays. 6. To implement operations on Strings without using Library functions. 7. To implement arithmetic operations using pointers. 8. Implement both recursive and non-recursive functions. 9. Demonstrate parameter passing techniques. 10. To implement Structures. 11. To implement basic File operations.	
Text Books & Reference Books	**Text Books:** 1.Programming with ANSI & TURBO C by Ashok N.Kamthane, Pearson Education 2007 **REFERENCEBOOKS:** 1. A Book on C by AlKelley/IraPohl, Fourth Edition,Addison-Wesley.1999 2. Let Us C by Yashavant Kanetkar, BPB Publications 3. Programming in ANSI C by Balaguruswamy 6th Edition, Tata McGraw Hill Education,2012	

20SH11P2 - APPLIED PHYSICS LABORATORY

(Common to EEE, CSE,IT & AI&DS**)**

Course Category:	Basic Science	**Credits:**	1.5
Course Type:	Practical	**Lecture-Tutorial-Practical:**	0-0-3
Pre-requisite:	Fundamental concepts of physics	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	To provide student to learn about some important experimental techniques in physics with knowledge in theoretical aspects so that they can excel in that particular field.
Course Outcomes	1. These experiments in the laboratory are helpful in exploring important concepts of physics through involvement in the experiments by applying theoretical knowledge. 2. It helps to recognize where the ideas of the students agree with those accepted by physics and where they do not.
Course Content	Minimum of 8 experiments to be conducted out of the following **LIST OF EXPERIMENTS** 1. Determination of rigidity modulus of a wire material – Torsional pendulum. 2. Melde's experiment – Transverse & longitudinal modes. 3. Resonance in LCR circuit. 4. Magnetic field along the axis of a coil (Stewart – Gee's Method). 5. Study of characteristics of LED. 6. Newton rings. 7. Wedge method. 8. Diffraction grating - Wavelength of given source. 9. Dispersive power of prism material using spectrometer. 10. P-N- junction diode characteristics. 11. Evaluation of Numerical Aperture of given optical fiber. 12. Energy gap of a P-N junction diode material. 13. Transistor characteristics. 14. Solar cell characteristics. 15. Logic gates.

NBKR INSTITUTE OF SCIENCE & TECHNOLOGY:: VIDYANAGAR (AUTONOMOUS)
(AFFILIATED TO JNTUA:: ANANTAPUR)
SPSR NELLORE DIST
I YEAR OF FOUR YEAR B.TECH DEGREE COURSE – II SEMESTER
ELECTRICAL AND ELECTRONICS ENGINEERING
SCHEME OF INSTRUCTION AND EVALUATION
(With effect from the academic year 2020-2021)

S.No	Course Code	Course Title	Instruction Hours/Week			Credits	Evaluation									
							Sessional Test-1			Sessional Test-2			Total Sessional Marks (Max. 40)	End Semester Examination		Maximum Total Marks
		THEORY	L	T	D/P		Test-1 (2 Hr)	Assign-1	Max. Marks	Test-2 (2 Hr)	Assign-2	Max. Marks		Duration In Hours	Max. Marks	100
1	20SH1204	Engineering Mathematics –II*	3	-	-	3	34	6	40	34	6	40	0.8*Best of Two + 0.2*Least of Two	3	60	100
2	20SH1203	Applied Chemistry#	3	-	-	3	34	6	40	34	6	40		3	60	100
3	20EE1201	Circuits &Networks	3	-	-	3	34	6	40	34	6	40		3	60	100
4	20CS1201	Python Programming	3	-	-	3	34	6	40	34	6	40		3	60	100
		PRACTICALS														
5	20ME12P1	Computer Aided Engineering Drawing Lab#	-	-	6	3	-		-	-		-	Day to Day Evaluation and a test (40 Marks)	3	60	100
6	20SH12P4	Applied Chemistry Laboratory	-	-	3	1.5	-		-	-		-		3	60	100
7	20CS12P2	Python Programming Laboratory	-	-	3	1.5	-		-	-		-		3	60	100
8	20SH12P1	English Language Lab#			3	1.5										
		TOTAL				**19.5**										

(***:** Common to all; **#**: Common EEE,CSE,IT & AI&DS, $: Common to ECE & EEE)

20SH1204-ENGINEERING MATHEMATICS –II

(Common to all branches)

Course Category:	Basic Sciences	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre – requisite:	Intermediate Mathematics	**Sessional Evaluation:**	40
		External Evaluation:	60
		Total Marks:	100

Course Objectives:	To make the student learn about	
	1. The concepts of Double integrals, Areas and Volumes 2. The basic concepts of Triple integrals and its volume, Beta and Gamma functions. 3. The Gradient, Divergence and Curl operators, Solenoidal and Irrotational vectors. 4. The basic concepts of Vector Integration. 5. The determination of Fourier coefficients, Fourier series, Even and Odd Functions and Change of intervals. 6. The concepts of Fourier Transforms.	
Course Outcomes:	After completing the course the student will be able to	
	CO1	Attains skills in analyzing the Double integrals also its Areas and Volumes.
	CO2	Understand effectively in analyzing the Triple integrals, Beta and Gamma functions
	CO3	Acquire knowledge in analyzing the Curl, Divergence and Gradient operators, Solenoidal and Irrotational vectors with their applications.
	CO4	Attains skills in analyzing the applications of Green's, Stoke's and Gauss-divergence theorems.
	CO5	Develop analytical skills in solving the problems involving Fourier Series.
	CO6	Understand effectively Fourier Sine and Cosine integral, Fourier Transforms, Fourier Sine and Cosine transforms.
Course Content	**UNIT - I** **Double integrals:** Double integrals - Change of order of integration - Change to polar coordinates - Area and Volumes by double integration. **UNIT - II** **Tripple integrals and Special functions:** Evaluation of triple integrals, Volume by triple integral. Beta and Gamma functions and their properties, Relation between Beta and Gamma functions. **UNIT - III** **Vector Differentiation:** Scalar and vector point function, Vector operator Del, Del applied to scalar point function, Gradient, Divergence, Curl, Solenoidal and Irrotational vectors. **UNIT - IV** **Vector Integration:** Line integral-circulation-work done, Surface integrals – flux, Green's theorem in the plain (Without proof), Stoke's theorem (Without proof), Volume integral, Gauss-divergence theorem (without proof).	

	UNIT-V **Fourier Series:** Determination of Fourier coefficients - Fourier series - Even and Odd functions - Change of intervals (0,2l). **UNIT-VI** **Fourier Transforms:** Fourier Integral Theorem (Without proof)-Fourier Sine and Cosine integral - Fourier integral in complex form - Fourier Transforms - Fourier Sine and Cosine transforms.
Textbooks: & Reference Books:	**TEXTBOOKS:** 1. Higher Engineering Mathematics - B.S.Grewal, Khanna Publishers, New Delhi. 2. Engineering Mathematics - B.V. Ramana, Tata McGraw-Hill Education Pvt. Ltd, New Delhi.
	REFERENCE BOOKS: 1.Higher Engineering Mathematics - H.K. Dass, Er. Rajnish Verma, S.Chand Publication, New Delhi. 2.Advanced Engineering Mathematics - N.P. Bali & M. Goyal, Lakshmi Publishers, New Delhi. 3.Advanced Engineering Mathematics - Erwin Kreyszig, Wiley, India

20SH1203-APPLIED CHEMISTRY

(Common to EEE, CSE, IT and AI&DS)

Course Category:	Basic science	**Credits**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Fundamental concepts of Chemistry	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	To make the student learn about 1.To familiarize engineering chemistry and its applications 2.To train the students on the principles and applications of electrochemistry and polymers 3.To introduce modern engineering materials, semiconductors and nanomaterials	
Course Outcomes:	On successful completion of this course student will be able to:	
	CO1	Explain the calculation of bond order of O2 and CO molecules
	CO2	Illustrate the band theory of solids for conductors, semiconductors and insulators
	CO3	Apply Nernst equation for calculating electrode and cell potentials
	CO4	Demonstrate the factors affecting corrosion and corrosion prevention methods
	CO5	Discuss the different types of polymers and their applications
	CO6	Understand the types of calorific value

Course content:

UNIT I: STRUCTURE AND BONDING MODELS:

Planck's quantum theory, dual nature of matter, Schrodinger equation, significance of Ψ and Ψ^2, applications to hydrogen, molecular orbital theory – bonding in homo- and hetero nuclear diatomic molecules – energy level diagrams of N_2, O2, CO and NO, π-molecular orbitals of butadiene and benzene, calculation of bond order.

UNIT II: MODERN ENGINEERING MATERIALS

i). Understanding of materials: Crystal field theory – salient features – splitting in octahedral, tetrahedral and square planar geometry. Properties of coordination compounds- oxidation state, coordination number, magnetic properties and colour.

ii). Semiconductor materials, superconductors- basic concept, band diagrams for conductors, semiconductors and insulators, effect of doping on band structures.

iii). Nanochemistry: Introduction, classification of nanometerials, properties and applications of fullerenes, carbon nanotubes and graphene nano-particles.

UNIT III: ELECTRO CHEMISTRY AND APPLICATIONS

Introduction to Electro chemistry, Electrode potential, Nernst equation, reference electrodes (Calomel electrode and glass electrode), electrochemical cell, cell potential calculations and numerical problems .Batteries-

Primary cells – Zinc-air battery.

Secondary cells – lead acid and lithium ion batteries-working of the batteries including cell reactions.

Fuel cells- hydrogen-oxygen fuel cell– working of the cell.

Potentiometry – potentiometric titration (redox reaction).

Conductometry – concept of conductivity- Specific, equivalent & molar conductance and cell constant, conductivity cell, conductometric titrations (acid-base titrations).

P^Hmetry-Basic concepts and applications.

	UNIT IV: SCIENCE OF CORROSION Introduction to corrosion, definition, types of corrosion, Mechanism of corrosion- metal oxide formation by dry corrosion, Pilling Bedworth ratios and uses and electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, Factors affecting the corrosion, prevention methods of corrosion- Cathodic protection (Sacrificial anodic protection and Impressed current cathodic protection) and Metallic coatings -electroplating and electro less plating. **UNIT V: POLYMER SCIENCE AND TECHNOLOGY** Introduction to polymers, Polymerisation and Types of polymerisation (addition, condensation and co-polymerisation), Poly dispersibity index-Measurement of average molecular weight of polymer. Plastomers -Thermoplastics and Thermo setting plastics, Preparation, properties and applications of PVC, Bakelite, Urea-Formaldehyde and Nylons. Elastomers – Preparation, properties and applications of Buna S, Buna N and Thiokol **UNIT VI:FUEL TECHONOLOGY** Chemical fuels – Introduction, classification, characteristics of a good fuel, calorific value, determination of calorific value (Bomb and Boy's gas calorimeters), numerical problems based on calorific value. **Solid Fuels–** Types, ranking of coal and Analysis of coal (Proximate and Ultimate analysis). **Liquid Fuels -**Refining of petroleum, knocking and anti-knock agents, Octane and Cetane numbers. **Gaseous Fuels-**L.P.G, Water gas, producer gas and Flue gas analysis by Orsat's apparatus.
Text Books & References	**TEXT BOOKS:** 1. Jain and Jain, Engineering Chemistry, 16 Ed., DhanpatRai Publishers, 2013. 2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10 Ed., Oxford University Press, 2010. **REFERENCE BOOKS:** 1. K N Jayaveera, G V Subba Reddy and C Rama Chandraiah, Engineering Chemistry 1 Ed. McGraw Hill Education (India) Pvt Ltd, New Delhi 2016 2. J. D. Lee, Concise Inorganic Chemistry, 5 Ed., Oxford University Press, 2008. 3. Dr. S.S. Dara and Dr S.S Umare, A Text book of Engineering Chemistry, 1 Ed., Chand & Company Ltd., 2000. 4. K Sesha Maheswaramma and Mridula Chugh, Engineering Chemistry, 1 Ed., Pearson India Education Services Pvt. Ltd, 2016.

20EE1201-CIRCUITS & NETWORKS

(EEE)

Course Category:	Professional core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Concepts of Basic electrical sciences, Calculus & Laplace Transforms.	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	Students undergoing this course are expected to learn: 1. Network theorems and their applications 2. The analysis of three phase balanced & unbalanced circuits 3. Transient response of RL, RC, RLC series circuit for DC excitation. 4. Transient response of RL, RC, RLC series circuit for AC excitation 5. The two port network parameters for the given network. 6. Necessary conditions for driving point function & transfer function	
Course Outcomes:	After completing the course the student will be able to	
	CO1	Apply suitable theorems for a given circuit.
	CO2	Analyze three phase balanced & unbalanced circuits and also calculation of power for a given circuit.
	CO3	Find the time constant and transient response of a given circuit with and without D.C excitation.
	CO4	Determine the time constant and transient response of a given circuit with and without A.C excitation.
	CO5	Evaluate the two port network parameters for the given network.
	CO6	Draw the pole- zero plot and obtain the time domain response for a given transfer function.
Course Content:	**UNIT- I** **Network Theorems:** Superposition, Reciprocity, Thevenin's and Norton's theorems, Maximum power transfer theorem, Millman's theorem and Compensation theorem. Application of these theorems to DC and AC Excitations **UNIT – II** **Three phase A.C circuits:** Advantages of three phase systems - Phase sequence - Star and Delta connection-Relation between line and phase voltages & currents in balanced systems-Analysis of balanced three phase circuits-measurement of power in Balanced and unbalanced three phase systems. Analysis of three phase Unbalanced circuits-Loop method -Star Delta Transformation Technique. **UNIT – III** **D.C Transient Analysis:** Transient response of R-L, R-C & R-L-C circuits for DC excitations initial conditions-Time constants -solution using Differential equation & Laplace transform methods. **UNIT – IV** **A.C Transient Analysis :** Transient response of R-L, R-C & R-L-C circuits for sinusoidal excitations-initial condition-time constants - Solution using Differential Equation & Laplace transform methods - Transformed circuits - Transient response of R-L, R-C& R-L-C circuits for other types of signals(step, impulse) using Laplace transform methods.	

	UNIT – V **Two port Network Parameters** - Open circuit parameters – Short circuit parameters – Transmission parameters - Hybrid parameters – Inter-relationships of different parameters-Interconnections of two port networks –Condition for reciprocity and symmetry of networks with different two port parameters - Terminated two port networks. **UNIT – VI** **Network Functions :** Single port &multi port networks - Immittance functions of two port networks – Necessary conditions for driving point functions & transfer function – Complex frequencies – Poles and zeros – Time domain response from pole zero plots – Restrictions on pole-zero locations.
Text Books & Reference Books:	**TEXT BOOKS:** 1. "Engineering Circuit Analysis", by Hayt & Kemmerly, 2nd Edition,TMH publishers 2. "Network Analysis", by M.E Van Valkenburg, Third Edition, PHI learning private Limited, 2006. 3. "Fundamentals of Electric circuits", by Charles k Alexander, Mathew N O Sadiku, Tata McGraw Hill Education private Limited, 6th Edition,2017. **REFERENCE BOOKS:** 1. "Circuits & Networks", by A.Sudhakar and Shyam Mohan, 5th Edition(2015),TMH 2. "Circuit Theory", by A.Chakrabarti, DhanpatRai publishers, 6th Edition 2014. 3. "Circuits & Systems", by Dr K.M.Soni, S.K.Kataria& sons Publication(2014).
E-Resources:	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

20CS1201 PYTHON PROGRAMMING

Course Category:	Professional Core	**Credits:**	3
Course Type:	Theory	**Lecture – Tutorial – Practical:**	3-0-0
Pre-requisite:	Basic mathematical knowledge to solve problems and programming	**Sessional Evaluation:** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objective	Students undergoing this course are expected: • To learn the fundamentals of Python constructs. • To develop various simple programs using Python. • To define Python functions, exceptions and various other features. • To explore features of object oriented concepts.	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Learn the basic building blocks of Python
	CO2	Understand the flow of execution, exception handling mechanism and functions for application development
	CO3	Study Strings, Lists and their applications
	CO4	Acquire knowledge in the concepts of Dictionaries, Tuples, and Sets.
	CO5	Comprehend the rules to construct regular expressions, and apply them to text to search for patterns and make changes.
	CO6	Understand Object-oriented programming paradigm in controlling the access of data and reducing the duplication of code by employing code reusability techniques.
Course Content	**UNIT-I** **Why Python:** Thrust areas of Python, Open Source Software **Python Basics**: Identifiers, Keyword, Statements and Expressions, variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input and Writing Output, Type Conversions, type() function and "is" operator, Dynamic and Strongly Typed Language **UNIT-II** **Control Flow Statements**: if and nested if, for, while Continue and Break statements, Catching Exceptions **Functions:** Built-in Functions, Commonly Used Modules, Function Definition and Calling the function, The return statement and void function, scope and lifetime of variables, Default Parameters, Keyword Arguments, Variable number of arguments with *args and **kwargs, command line arguments	

	UNIT-III **Strings:** Creating and Storing Strings, Basic String Operations, Access characters by Index, Slicing and Joining of Strings, String Methods and Formatting Strings **Lists:** Creating Lists, List operations, indexing and Slicing, Built-in Functions, List Methods, del() vs pop() **UNIT-IV** **Dictionaries:** Creation, accessing and modifying key-value pairs, built-in functions used on dictionaries, dictionary methods, del statement **Tuples and Sets**: Creation of Tuples, Basic Tuple Operations, Indexing and Slicing in Tuples, Built-in functions, Relationship among Tuples, Lists and Dictionaries, Tuple Methods, aggregation with zip(), Sets, Set Methods and Frozen sets **UNIT-V** **Files**: Types, Creating, Reading Text data and methods used for it, Manipulating Binary and CSV files, pickling (serialization of objects), os and os.path modules. **Regular Expression Operations**: Using Special Characters, Regular Expression Methods, Named Groups in Python Regular Expression and Regular Expression with glob Module. **UNIT-VI** **Object-Oriented Programming:** Classes and Objects and Creating them, The Constructor Method, Classes with Multiple Objects, Class Attributes versus Data Attributes, Encapsulation, Inheritance, Polymorphism.
Text Books & References:	**Text Book(s):** 1. Gowri shankar. S, Veena.A, "Introduction to Python Programming",CRC Press, Taylor and Francis group,2019. **Reference Books:** 1. Brian Heinold, A Practical Introduction to Python Programming. 2. April Speigh, Bite-Size Python: An Introduction to Python Programming. Kenneth A. Lambert, Fundamentals of python - Data structures. 3. Mark Summer field, Programming in python 3. 4. Yaswanth Kanetkar, Aditya Kanetkar, Let Us Python, BPB Publications, 2020
E-Resources	1. https://nptel.ac.in/courses 2. https://freevideolectures.com/university/iitm 3. https://wiki.python.org/moin/PythonBooks

20ME12P1-COMPUTER AIDED ENGINEERING DRAWING LABORATORY

(Common to EEE, CSE, IT and AI&DS)

Course Category:	Engineering Science	**Credits:**	3
Course type:	Practical	**Lecture- Tutorial-Practical:**	0-0-6
Pre-requisite:	Geometrical Construction	**Sessional Evaluation:**	40
		External Exam Evaluation:	60
		Total Marks:	100

Course Objectives	Students undergoing this course are expected:	
	❖ To enable the students with various concepts like dimensioning, construction of conic sections, polygons, cycloids and involutes. ❖ To impart and inculcate proper understanding of AutoCAD fundamentals. ❖ To apply the knowledge of AutoCAD for the projections of points, lines and solids. ❖ To know about sections and developments of solids. ❖ To improve the visualization skills with isometric projections.	
Course Outcomes	At the end of the course, the student will be able to	
	CO1	Understand the conventions and methods of engineering drawings
	CO2	Sketch the solutions to the problems on projection of points, lines, planes and solids
	CO3	Demonstrate orthographic and Isometric principles
	CO4	Understand and apply the knowledge of engineering drawing in modern CAD tools.
Course Content	**INTRODUCTION TO CAD SOFTWARE:** **Introduction:** Importance of Computer Aided Drawing, software tool environment, drawing size and scale, main menu, tool bar and menus, co-ordinate system, drafting settings. **Creation and Editing:** Points, Lines, Poly lines, Polygons, Splines, circle, ellipse, text, move, copy, off-set, pan, mirror, rotate, trim, extend, break, chamfer, fillet, curves, block, layers, line representations, dimensioning and hatching. **GEOMETRICAL CONSTRUCTIONS, AND CONIC SECTIONS:** Importance of Drawing, Drawing Instruments, Sheet layout, BIS Conventions, Types of lines, Lettering, and dimensioning methods. **Geometrical Constructions:** Regular Polygons. **Conic Sections:** Introduction, Construction of Ellipse, Parabola and Hyperbola using Eccentricity method and Rectangular/ Oblong methods, Rectangular hyperbola. **SPECIAL CURVES:** Construction of Cycloidal curves – Cycloid, Epi-cycloid and Hypo- cycloid. Involutes – Involutes of circle and polygons. **PROJECTIONS OF POINTS AND LINES:** **Projections of Points:** Principles of projections, Planes of projection, Points in four quadrants. **Projections of Lines:** Line inclined to both the principal planes (first angle projection only). **PROJECTIONS OF PLANES:** **Projections of Planes:** Plane (triangle, square, rectangle, pentagon, hexagon and circular) inclined to both the principal planes. **PROJECTIONS OF SOLIDS:** **Projections of Solids:** Solids such as Prisms, Pyramids, Cylinders and Cones inclined to both the principal plane. **SECTIONS OF SOLIDS:** Solids such as Prisms, Pyramids, Cylinders and Cones resting on their bases on HP.	

	DEVELOPMENT OF SURFACES. Lateral surfaces of solids such as Prisms, Pyramids, Cylinders and Cones (cut by a plane inclined to HP). **ISOMETRIC VIEWS AND PROJECTIONS:** Isometric views of planes and solids. Isometric scale, Isometric Projections of simple objects**.** **ORTHO GRAPHIC PROJECTIONS:** Conversion of Pictorial views into Orthographic Views.
Text Books & Reference Books	**TEXT BOOKS:** 1. Engineering Drawing, N.D. Bhat / Charotar Publishing House,. Gujarat, 53rd edition, 2014. 2. AutoCAD 2013 For Engineers and Designers, Sham Tickoo, Dream tech Press, 2013. **REFERENCE BOOKS:** 1. Engineering Drawing And Graphics + Autocad, Venugopal K, New Age International Pvt.Ltd. New Delhi, 2007. 2. Engineering Graphics with Auto CAD, D.M. Kulkarni, A.P. Rastogi and A.K. Sarkar, PHI Learning Private Limited, Revised Edition, August 2010. 3. Engineering Drawing and Graphics Using Autocad, T Jeyapoovan, Vikas Publishing House, 3rd Edition, 2010. 4. A Textbook on Engineering Drawing, P. Kannaiah, K. L. Narayana, K. Venkata Reddy, Radiant Publishing House, 2012.

20SH12P4-APPLIED CHEMISTRY LABORATORY

(Common to EEE, CSE, IT & AI&DS)

Course Category:	Basic science	**Credits:**	1.5
Course Type:	Practical	**Lecture-Tutorial-Practical:**	0-0-3
Pre-requisite:	Fundamental concepts of Chemistry	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to learn :	
	The main objective is to provide students to learn about experimental techniques in chemistry with knowledge in theoretical aspects so that they can excel in that particular field.	
Course Outcomes	At the end of the course, the student will be able to	
	CO1	Determine the cell constant and conductance of solutions
	CO2	Prepare advanced polymer materials
Course Content	Minimum of 8 experiments to be completed out of the following: **LIST OF EXPERIMENTS** 1. Determination of cell constant and conductance of solutions 2. Conductometric titration of strong acid Vs strong base 3. Conductometric titration of weak acid Vs strong base 4. Determination of pH of unknown solution 5. Potentiometry - determination of redox potentials and emfs 6. Determination of Strength of an acid in Pb-Acid battery 7. Preparation of a polymer-Bakelite 8. Estimation of ferrous iron by Dichrometry 9. Estimation of Mangneous by Colorimetry 10. Determination of viscosity of oils with Redwood viscometer 1&2 11. Determination of Flash and Fire point 12. Preparation of Nanomaterials by precipitation method	
Text Books	**TEXT BOOKS:** 1.Mendham J et al, Vogel's text books of quantitative chemical analysis, 5 Ed., Pearson publications, 2012. 2.KN Jayaveera, Subbareddy & Chandra sekhar , Chemistry lab manual, 1 Ed., SM Enterprises, Hyderabad, 2014 3.Chatwal & Anand , Instrumental methods of chemical analysis, 2 Ed., Himalaya publications, 2006.	

20CS12P2 –PYTHON PROGRAMMING LABORATORY

Course Category:	Professional Core	**Credits:**	1.5
Course Type:	Practical	**Lecture – Tutorial – Practical:**	0-0-3
Pre-requisite:	Fundamentals of Computers and basic Mathematics	**Sessional Evaluation:** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	• Students undergoing this course are expected: • To learn and practice the fundamental blocks of Python Programming
Course Outcomes	• After completing the course, the student will be able to Gain knowledge on Python programming
Course Content	1. Check whether the given year is leap year or not. 2. Compute GCD of two numbers using python. 3. Check whether the given number is palindrome. 4. Find all prime numbers within a given range. 5. Print 'n' terms of Fibonacci series using recursion 6. Implement matrix multiplication. 7. Demonstrate use of slicing in string. 8. Build an application using lists & list methods. 9. Demonstrate use Dictionary& related functions. 10. Implement a program to show usage of tuples, sets & their methods. 11. Demonstrate read and write from a file. 12. Write a program to copy a file. 13. Demonstrate working of classes and objects. 14. Write a program to demonstrate constructors. 15. Write a program to demonstrate inheritance.
Text Books & References:	**Text Book(s):** 1.Gowri shankar. S, Veena.A, "Introduction to Python Programming", CRC Press, Taylor and Francis group, 2019. 2.Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2011, Cengage Learning, ISBN: 978-1111822705 **Reference Books:** 1.Martin C.Brown, "The Complete Reference: Python", McGraw-Hill, 2018. 2. Kenneth A. Lambert, B.L. Juneja, "Fundamentals of Python", CENGAGE, 2015. 2.R. Nageswara Rao, "Core Python Programming", 2nd edition, Dream tech Press, 2019
e-Resources	1.https://Wiki.python.org/moin/Web Programming Books 2.https://realpython.com/tutorials/web-dev/ 3.https://nptel.ac.in/courses 4.https://freevideolecture.com/university/iitm

20SH12P1-ENGLISH LANGUAGE LABORATORY

(Common to EEE, CSE, IT & AI&DS)

Course Category:	Basic Sciences	**Credits:**	1.5
Course Type:	Practical	**Lecture-Tutorial-Practical:**	0-0-3
Pre-requisite:	Basic Level of LSRW skills	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected:
	The main objective is to prepare the students to improve their communicative ability in English with emphasis on LSRW skills and enable them to communicate effectively in different socio- cultural and professional contexts.
Course Outcomes	After completing the course, the student will be able to
	These activities practiced in the laboratory are helpful in comprehending the important language aspects which are useful for the real-life situations. These are also helpful in enhancing the language competency and communicative level of students.
Course Content	**LIST OF ACTIVITIES** **1. Listening Skills** • Listening for Identifying key terms, understanding concepts • Listening for specific information • Listening for global comprehension and summarizing • Listening to short audio texts and answering a series of questions. **2. Common Everyday Conversations:** (Asking and answering general questions on familiar topics such as home, family, work, studies and interests) • Expressions in various situations • Making requests and seeking permissions • Interrupting and apologizing • Role plays / Situational dialogues **3. Communication at Work Place:** • Introducing oneself and others • Ice Breaking Activity and JAM Session • Greetings • Taking leave **4. Debates &Group Discussions** • Discussion in pairs/ small groups on specific topics • Short structured talks • Reporting/ summarizing **5. Presentations (Oral presentation, PPT & Poster presentation):** • Pre-planning • Non verbal communication • Formal oral presentations on topics from academic contexts **6. Giving directions** **REFERENCE BOOKS:** 1. A Manual for English Language Laboratories: Dr. D. Sudha Rani, Pearson publications 2. https://www.talkenglish.com/ 3.www.esl-lab.com 4.www.englishmedialab.com 5.www.englishinteractive.net

NBKR INSTITUTE OF SCIENCE &TECHNOLOGY:: VIDYANAGAR (AUTONOMOUS)
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II YEAR OF FOUR YEAR B.TECH DEGREE COURSE – I SEMESTER
ELECTRICAL AND ELECTRONICS ENGINEERING
SCHEME OF INSTRUCTION AND EVALUATION
(With effect from the academic year 2021-2022)
(For the batch admitted in the academic year 2020-2021)

S.No	Course Code	Course Title	Instruction Hours/Week			Credits	Evaluation									
							Sessional Test-1			Sessional Test-2			Total Sessional Marks (Max. 40)	End Semester Examination		Maximum Total Marks
		THEORY	L	T	D/ P		Test-1 (2 Hr)	Assign-1	Max. Marks	Test-2 (2 Hr)	Assign-2	Max. Marks		Duration In Hours	Max. Marks	100
1	20SH2101	Engineering Mathematics – III#	3	-	-	3	34	6	40	34	6	40	0.8*Best of Two + 0.2*Least of Two	3	60	100
2	20EC2105	Analog & Digital Electronics	3	-	-	3	34	6	40	34	6	40		3	60	100
3	20EC2103	Signals & Systems$	3	-	-	3	34	6	40	34	6	40		3	60	100
4	20EE2101	Electromagnetic fields	3	-	-	3	34	6	40	34	6	40		3	60	100
5	20EE2102	Electro Mechanical Energy Conversion-I	3	-	-	3	34	6	40	34	6	40		3	60	100
6	20SH2102	Universal Human Values	3	-	-	3	34	6	40	34	6	40		3	60	100
7	20EE21SC	Electrical workshop	1	-	2	2	-	-	-	-	-	-	Day to Day Evaluation and a test (40 Marks)	3	60	100
		PRACTICALS														
8	20EC21P4	Analog & Digital Electronics lab	-	-	3	1.5	-		-	-		-	Day to Day Evaluation and a test (40 Marks)	3	60	100
9	20EE21P1	Electrical Circuits & Simulation Lab	-	-	3	1.5								3	60	100
10	20EE21P2	Electro Mechanical Energy Conversion-I lab	-	-	3	1.5	-		-	-		-		3	60	100
		MANDATORY														
11	20MC2102	Managerial Economics and Financial Accounting $	3	-	-	-	34	6	40	34	6	40	0.8*Best of Two + 0.2*Least of Two	3	60	100
		TOTAL				**24.5**										

(***:** Common to all; **#**: Common to CE,ECE& EEE; $: Common to ECE&EEE; **@** : Common to CE,EEE,ECE, CSE&IT)

20SH2101-ENGINEERING MATHEMATICS–III

(Common to CE, ME, EEE&ECE)

Course Category:	Basic Sciences	**Credits:**	3
Course Type:	Theory	**Lecture –Tutorial –Practical:**	2-1-0
Pre-requisite:	Intermediate Mathematics	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	To make the student learn about:	
	1. The basic concepts of numerical solutions of simultaneous linear and non-linear algebraic equations. 2. The numerical methods to solve Ordinary Differential Equations by using Taylor's series method, Picard's method, Euler's and Modified Euler's Methods and Runge-Kutta methods of 2^{nd}and4^{th}order. 3. The concepts of Cauchy - Riemann equations, Construction of Analytic function, Line integral, Cauchy's theorem and Cauchy's integral formula. 4. The concepts of Residues. 5. The Properties of Z- Transforms, shifting properties, initial value and final value theorems and the applications of difference equations. 6. Foundation of the probability and statistical methods.	
Course Outcomes:	Upon successful completion of the course, the students will able to:	
	CO1	Have a sound knowledge in analyzing the simultaneous linear and non-linear algebraic equations by various numerical methods.
	CO2	Understand effectively the significance numerical methods to solve Ordinary Differential Equations.
	CO3	Understand effectively the significance of differentiability for complex Functions and be familiar with the Cauchy-Riemann equations and also Cauchy's integral formula.
	CO4	Compute the Taylor and Laurent expansions of simple functions, determining The nature of the singularities and calculating residues.
	CO5	Attains skills in analyzing the Z-Transforms and their applications.
	CO6	Have a well-founded knowledge of standard distributions(Binomial, Poisson And Normal distributions) which can describe real life phenomena.

Course Content:	**UNIT-I** **Solution of Simultaneous Linear and Non-linear Algebraic Equations:** Iteration method, Gauss Jordon method, Gauss Elimination with Pivotal condensation method, Triangular Factorization method, Gauss-Seidal method and Newton- Raphson method **UNIT-II** **Numerical Solution of Ordinary Differential Equations:** Solution by Taylor's Series, Picard's Method of Successive Approximations, Euler's Methods and Runge-Kutta Method of 2^{nd} order and 4^{th} order. **UNIT-III** **Complex Analysis:** Analytical functions, Cauchy - Riemann equations, Construction of Analytic function, Complex integration - Line integral, Cauchy's theorem, Cauchy's integral formula and Generalized Cauchy's integral formula. **UNIT-IV** **Residues**: Taylor's theorem and Laurent's theorem (without proof),Singularities, Poles, Residues, Residue theorem and Evaluation of real definite integrals. **UNIT-V** **Z-Transforms:** Z-Transform of some standard functions, Properties of Z-Transforms, Shifting Properties, Initial value theorem and final value theorem, Inverse Z-Transform, Convolution theorem, Inversion by partial fractions and Applications to difference equations. **UNIT-VI** **Probability and Statistics**: Introduction, Random variables, Discrete and Continuous distributions, Binomial distribution, Poisson distribution and Normal distribution.
Text Books & Reference Books:	**TEXTBOOKS:** 1. Higher Engineering Mathematics-B.S.Grewal, Khanna Publishers, NewDelhi. 2.Engineering Mathematics -B.V.Ramana, Tata Mc Graw-Hill Education Pvt. Ltd, New Delhi. 3.Advanced Engineering Mathematics- Erwin Kreyszig, Wiley,India **REFERENCEBOOKS:** 1.Higher Engineering Mathematics-H.K.Dass, Er.Rajnish Verma, S. Chand Publication, New Delhi. 2.Engineering Mathematics-III- Dr.T.K.V.Iyengar, Dr.B.Krishna Gandhi, S.Ranganatham, Dr.M.V.S.S.N.Prasad, S.Chand Publication, NewDelhi 3.Special functions and complex variables (Engineering Mathematics-III)–Shahnaz Bathul, PHI, New Delhi.
e-Resources	1.https://nptel.ac.in/courses2.https://freevideolectures.com/university/iit m

20EC2105– ANALOG & DIGITAL ELECTRONICS
(EEE)

Course Category:	Professional core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	2-1-0
Pre-requisite:	Basic knowledge of semiconductor physics.	**Sessional Evaluation :** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	Students undergoing this course are expected to learn: 1. Design rectifiers & filters circuits and BJT biasing circuits and its applications.. 2. The working of FET and MOSFET. 3. The constructional features and operation of FET amplifier & feedback amplifier. 4. The Digital electronics fundamentals and examine the structure of various number systems. 5. The analysis and design of various combinational and synchronous sequential circuits. 6. The concept of various counters and Registers.	
Course Outcomes:	Upon successful completion of the course, the student will able to:	
	CO1	Design rectifiers & filters circuits and BJT biasing circuits and its applications.
	CO2	Understand the working of FET and MOSFET.
	CO3	Distinguish the constructional features and operation of FET amplifier & feedback amplifier.
	CO4	Understand the fundamental concepts and techniques used in digital electronics and examine the structure of various number systems.
	CO5	Understand analysis and design of various combinational and synchronous sequential circuits.
	CO6	Understand concept of various counters and Registers..
Course Content:	**UNIT-I** **Diode Rectifiers:** Half wave and full wave rectifiers, Analysis of filters (C, L, LC. and CLC) used with Full wave rectifier. **Bipolar Junction Transistor:** BJT biasing schemes, Small signal analysis of single stage BJT amplifiers, Comparison of CE, CB and CC amplifiers, Approximate model analysis, Effects of coupling and bypass capacitors on low frequency response. **UNIT – II** **Field Effect Transistor:** Introduction, Construction & Operation of N-Channel JFET, Characteristic Parameters, Saturation Drain Current, Slope of the Transfer Characteristic at I_{DSS}, Comparison of JFET and BJT, Applications, MOSFET, Enhancement MOSFET, Depletion MOSFET, Comparison of MOSFET and JFET. **UNIT –III** **FET Amplifiers:** FET biasing schemes, Small signal model, Analysis of CS, CD and CG amplifiers, High frequency response. **Feedback Amplifiers:** Feedback concept, Classification, Effect of negative feedback on gain, Stability, Noise, Distortion, Bandwidth, Input and Output resistances. Different types of feedback circuits without analysis.	

	UNIT – IV **DIGITAL FUNDAMENTALS:** Number Systems-Decimal, Binary, Octal, Hexadecimal, Binary Arithmetic – Addition, subtraction, multiplication, division. Conversion of number systems. Binary Codes, BCD, Excess3, Gray, Error correcting and detecting code, Alphanumeric codes. **BOOLEAN THEOREMS AND LOGIC GATES:** Boolean theorems, Logic gates, Universal gates, Sum of products and product of sums, Minterms and Maxterms, Karnaugh map Minimization. **UNIT – V** **COMBINATIONAL LOGIC CIRCUIT DESIGN:** Design of Half and Full Adders, Half and Full Subtractors, Binary Parallel Adder, BCD Adder, Multiplexer, Demultiplexer, Decoder, Encoder**.** **SYNCHRONOUS SEQUENTIAL CIRCUITS:** Flip flops – SR, JK, T, D, Master/Slave FF, operation and excitation tables, Triggering of Flip flops, Analysis and design of clocked sequential circuits. **UNIT – VI** **REGISTERS AND COUNTERS:** Design of Counters, Ripple Counters, Ring and Johnson Counters, Shift registers, Universal Shift Register.
Text Books & Reference Books:	**TEXT BOOKS:** 1. "Electronic devices and circuits", by Mottershed, PHI. 2."Electronic Devices & Circuits", by Jacob Millman & Christos C. Halkias, McGraw- Hilll 3. "Digital design", by Morris Mano, Pearson Education Asia. 4."Fundamentals of logic design", by Roth & Charles, 2nd Edition, West Publishing Company, 1979. **REFERENCE BOOKS:** 1."Electronic Devices and circuits", by S. Salivahanan, N. Suresh Kumar, McGraw- Hill 2."Electronic devices and circuits" , by Boylestad, Louis Nashelsky, 9ed.., 2008 PE. 3."Fundamentals of logic circuits", by A. Anand Kumar, PHI Learning. 4."Digital logic - applications and design", by Jon M, Yarbrough, Thomson -Brooks India edition.
e-Resources:	https://nptel.ac.in/courses https://iete-elan.ac.in https://freevideolectures.com/university/iitm

20EC2103– SIGNALS AND SYSTEMS

(Common to ECE & EEE)

Course category:	Professional core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	2 - 1 - 0
Pre-requisite:	Knowledge of vectors, Trigonometry, Differentiation & Integration	**Sessional Evaluation :** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	Students undergoing this course are expected to learn:	
	1. The different types of Continuous Time Signals. 2. The Fourier series for periodic signals. 3. The Fourier Transform of various signals. 4. The analysis of different types of Continuous Time Systems. 5. The mathematical background of Discrete Time Signals and Systems. 6. The Fourier Transform of discrete time signals and systems.	
Course Outcomes:	Upon successful completion of the course, the students will be able to:	
	CO1	Define the signals and systems with examples.
	CO2	Find the Fourier series of various Periodic signals.
	CO3	Analyze the signal in frequency domain by applying FT and its properties.
	CO4	Establish the inter connections of LTI systems.
	CO5	Know the operations on discrete time signals and its transformations.
	CO6	Solve the difference equation and attain the solution using DTFT.
Course Content:	**UNIT-I** **SIGNAL ANALYSIS**: Analogy between Vectors and Signals, Orthogonal Signal Space, Signal approximation using Orthogonal functions, Mean Square Error, Closed or complete set of Orthogonal functions, Orthogonality in Complex functions, continuous discrete Exponential and Sinusoidal signals, Concepts of Impulse function, Unit Step function, Signum function. Operations on signals. **UNIT-II** **FOURIER SERIES**: Representation of Fourier series, Properties of Fourier Series, Dirichlet's conditions, Trigonometric Fourier Series and Exponential Fourier Series, Complex Fourier spectrum. **UNIT III** **FOURIER TRANSFORMS**: Deriving Fourier Transform from Fourier Series, Fourier Transform of arbitrary signal, Fourier Transform of standard signals, Fourier Transform of Periodic Signals, Properties of Fourier Transform, Fourier Transforms involving Impulse function and Signum function, Introduction to Hilbert Transform.	

	UNIT-IV **SAMPLING**: Sampling theorem – Graphical and analytical proof for Band Limited Signals, Types of Sampling – Impulse Sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, Effect of under sampling – Aliasing, Introduction to Band Pass sampling. **UNIT-V** **SIGNAL TRANSMISSION THROUGH LINEAR SYSTEMS**: Linear System, Convolution, Impulse response, Response of a Linear System, Linear Time Invariant (LTI) System, Linear Time Variant (LTV) System, Transfer function of a LTI system, Filter characteristics of Linear Systems, Distortion less transmission through a system, Signal bandwidth, System bandwidth, Ideal LPF, HPF and BPF characteristics, Causality and Paley-Wiener criterion for physical realization, Relationship between Bandwidth and Rise time. **UNIT-VI** **DISCRETE TIME SIGNALS AND SYSTEMS**: Linear Shift Invariant(LSI) system – Stability – Causality – Convolution and Correlation –Linear constant coefficient difference equation – Impulse response -Definition of Discrete Time Fourier Transform – Properties – Transfer function – System analysis using DTFT.
Text Books & Reference Books:	**TEXT BOOKS:** 1. "Signals and Systems", by A.V. Oppenheim, A.S. Willsky and S.H. Nawab, 2nd Ed., Pearson New international Edition-2014 2. "Principles of Linear Systems and Signals", B. P. Lathi, 2009, 2nd Ed, Oxford. 3. "Signals and Systems", by P.Ramesh Babu, Scitech Publications (India),4th edition 2010 **REFERENCE BOOKS:** 1. "Signals & Systems", by Simon Haykin and Van Veen, Wiley, 2 Ed.-2018 2. "Signals and Systems", by A.Rama Krishna Rao – 2008, TMH, reprint 2014 3. "Fundamentals of Signals and Systems", by Michel J. Robert, 2017, MGH International Edition.
e-Resources	1. https://nptel.ac.in/courses 2. https://iete-elan.ac.in 3. https://freevideolectures.com/university/iit

20EE2101-ELECTROMAGNETIC FIELDS

Course Category:	Professional core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Knowledge of vector analysis, co-ordinate system, vector calculus, differentiation of scalars and vectors.	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	Students undergoing this course are expected to learn :	
	1. The Electrostatics and Magneto statics concepts. 2. Calculate electric field and potential using Gauss's law. 3. The boundary conditions of dielectrics. 4. The Maxwell's equations and EM wave Characteristics . 5. The magnetic forces and torque produced by currents in magnetic field. 6. The time varying fields and ability to calculate the induced EMF.	
Course Outcomes:	After completing the course the student will be able to	
	CO1	Determine electric force and electric field intensity.
	CO2	Calculate electric field and potential using Gauss's law.
	CO3	Analyse current densities and boundary conditions of dielectrics.
	CO4	Demonstrate magnetic field intensity due to current, the application of ampere's law and the Maxwell's second and third equations.
	CO5	Estimate the magnetic forces and torque produced by currents in magnetic field.
	CO6	Gain knowledge on time varying fields and ability to calculate the induced EMF.
Course Content:	**UNIT – I** **Electrostatic Fields-I:** Vector Analysis-Cartesian-Cylindrical-Spherical Co-Ordinate systems, Coulomb's law, Electric Field Intensity(EFI)– EFI due to a infinite line charge- infinite sheet of charge-circular disc charge-Circular ring of charge, Electric flux density. **UNIT – II** **Electrostatic Fields-II:** Gauss's law-Gauss's law in point form, Application of Gauss's Law-point charge-infinite line charge-co axial cable-infinite sheet of charge-spherical shell of charge-uniformly charged sphere, Laplace's and Poisson's equations, Electrostatic potential, Potential gradient, Energy stored in Electric field, Capacitance– Capacitance of parallel plates – Coaxial Capacitor - Spherical Capacitor – Composite parallel plate capacitor. **UNIT-III** **Conductors and Dielectrics:** Current and current density, Conductors – properties of conductor- Ohm's Law-Resistance-Power dissipation - Joule's Law, Dielectrics- Properties of Dielectrics - Polarization – mathematical expression for polarization- Dipole Moment, Torque on an Electric dipole in an electric field, Boundary conditions-Conductor and Dielectric – Dielectric and Dielectric boundary conditions, Continuity equation.	

	UNIT – IV **Magneto Static Fields:** Static magnetic fields – Biot-Savart's law – Magnetic Field Intensity (MFI) – MFI due to a straight current carrying filament – center of the circular conductor-circular loop, Ampere's circuital law, Ampere's circuital law in point form, Applications of Ampere's circuital law- MFI due to infinite straight long conductor- MFI due to co axial cable- MFI due to infinite sheet of current, Magnetic vector potential, Lorentz force law. **UNIT – V** **Magnetic Field in Materials:** Dipole moment, Torque, Boundary conditions, Magnetic circuits, Inductance- Solenoid- Toroid- Co axial cable, Energy stored in Magnetic field. **UNIT –VI** **Maxwell's Equations:** Faraday's law-Motional and transformer induced E.M.F., Maxwell's equations, Faraday's law, Faraday's law in point form, Displacement current, Wave equation and its general solution for free space conditions.
Text Books & Reference Books:	**TEXT BOOKS:** 1. "Engineering Electromagnetics", by William H. Hayt& John. A. Buck Mc.Graw-Hill Companies, 7th Editon.2006 . 2. "Electromagnetic Fields", by Sadiku, Oxford Publications, 3rd Editon.2007. 3. "Field Theory",by K.A.Gangadhar & PM Ramanathan Khanna Publishers New Delhi, 2005, 5th Edition. **REFERENCE BOOKS:** 1. "Electromagnetics", by Joseph A.Edminister, McGraw-Hill 4th Edition, 2014. 2. "Electromagnetic waves & Radiating system", by Edward C.Jordan and keith G.Balmain, Prentics-Hall of India Pvt. Ltd. 3. "Engineering electromagnetics: Theory and Problems and Applications", by J.P Tewari, Khanna Publishers,2003.
e-Resources:	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

20EE2102-ELECTRO MECHANICAL ENERGY CONVERSION -I

(EEE)

Course Category:	Professional core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Faraday's laws and fundamental concepts of Electrical circuits.	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	To make the student learn about:	
	1.The conversion principle of electrical and mechanical energy. 2.The working principle of Generator and its winding diagrams. 3. The performance characteristics of DC machines & parallel operation of DC generator. 4. The working principle and performance characteristics of DC Motor. 5. The losses and efficiency of DC Machines. 6. Different performance tests on DC machines.	
Course Outcomes	After completing the course the student will be able to	
	CO1	Understand the basics of electromechanical energy conversion.
	CO2	Empathize the working principle of Generator and its winding diagrams.
	CO3	Identify the suitable DC generator for specific applications.
	CO4	Ascertain the suitable DC motor for specific applications.
	CO5	Evaluate the efficiency of DC machine and analyse the parallel operation of DC generators.
	CO6	Conduct different tests on DC machines.
Course Content	**UNIT- I** **Introduction:**- Principle of Electromechanical Energy Conversion- Right hand thumb rule-Fleming's right hand rule- Fleming's left hand rule-Faraday's law of Electro Magnetic Induction-Construction of DC machine. Simple DC Generator working Principle–operation-action of commutator. **UNIT – II** **Types of DC Generators and Armature reaction:** Types of Armature windings–lap and wave winding-winding drawings-Problems–Generated EMF equation- Armature reaction-Demagnetising and cross magnetizing conductors-effects of Armature reaction and compensating Methods-Problems. Types- series, shunt, compound DC generator **UNIT – III** **Characteristics of DC Generators:** Characteristics of different types of generators– critical field resistance and critical speed – applications – Problems - commutation - methods of improving commutation - compensating winding. **Parallel operation of DC generators**: Parallel operation of DC shunt, series and compound Generators- Problems.	

	UNIT – IV **DC Motors:** Working principle–importance of back EMF –Types of DC motors–series, shunt, compound motors-Torque and Power developed by armature–performance characteristics of DC motors–Applications & Problems. **UNIT – V** **Speed control, starting of DC motors:** Speed control of DC series & shunt motors–Problems-Starting of DC motors- Constructional details of 3-Point and 4-Point starters –problems. **Losses and efficiency of DC machine**: Various losses in DC machine and efficiency, power flow analysis- condition for maximum Efficiency-Problems. **UNIT – VI** **Testing of DC machines** :Brake test-Swinburne's test-Hopkinson's test – Field's test-Retardation test-Separation of iron and friction Losses-Problems.
Text Books & Reference Books	**TEXT BOOKS:** 1. "Theory and performance of Electrical machines", by J.B Gupta - SK Kataria publishers,2013. 2. "Principles of Electrical Machines", by VK Mehta, Rohit Mehta – S.Chand,2006. 3. "Electrical machines", by I.J. Nagarath and D.P. Kothari 4th Edition, Tata McGraw Hill. **REFERENCE BOOKS:** 1. "Electrical Machinery", by P.S Bimbhra - Khanna publishers, 2011. 2. "Performance of DC machines", by M.G. Say, Second Edition, CBS Publishers. 3. "A Textbook of Electrical Technology: Volume 2, AC and DC Machines", by Theraja B. L, Theraja A.K. S. Chand,2006.
E-Resources	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

20SH2102-UNIVERSAL HUMAN VALUES

(Common to CIVIL, EEE, MECH & ECE)

Course Category:	Human Values Courses	Credits:	3
Course Type:	Theory	Lecture -Tutorial-Practical:	3-0-0
Pre – requisite:	SIP-Universal Human Values 1 (desirable)	Sessional Evaluation:	40
		External Evaluation:	60
		Total Marks:	100

Course Objectives:	Students undergoing this course are expected: 1. Development of a holistic perspective based on self-exploration about human being, family, society and nature/existence. 2. Developing clear understanding of the harmony in the human being, family, society and nature/existence. 3. Strengthening of self-reflection. 4. Development of commitment and courage to act. 5. Know about appropriate management patterns with harmony.	
Course Outcomes:	After completing the course, the student will be able to	
	CO1	Understand more about of themselves, and their surroundings (family, society, nature);
	CO2	Become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
	CO3	Develop as a socially and ecologically responsible engineers
	CO4	Justify the need for universal human values and harmonious existence
	CO5	Relate human values with human relationship and human society
	CO6	Apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.
Course Content:	**UNIT-I** **Introduction to Value Education**:Universal Human Values- I - Self-Exploration - content and process; 'Natural Acceptance' and Experiential Validation - Self-exploration - Continuous Happiness and Prosperity - Basic Human Aspirations - Current scenario - Method to fulfill the above human aspirations- Understanding and living in harmony at various levels. **UNIT-II** **Understanding Harmony in the Human Being - Harmony in Myself:** Human being as a co-existence of the sentient 'I' and the material'Body' - The needs, happiness and physical facility - The Body as an instrument of 'I' - The characteristics and activities of 'I' and harmony in 'I' - The harmony of I with the Body **UNIT-III** **Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship:** Values in human relationship; meaning of Justice; Trust and Respect; Difference between intention and competence; the other salient values in relationship - the harmony in the society: Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals - Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.	

	UNIT-IV **Understanding Harmony in the Nature and Existence - Whole existence as Coexistence:** The harmony in the Nature - Interconnectedness and mutual fulfillment among the four orders of nature- Recyclability and self-regulation in nature - Understanding Existence as Co-existence of mutually interacting units in all-pervasive space - Holistic perception of harmony at all levels of existence. **UNIT-V** **Implications of the above Holistic Understanding of Harmony on Professional Ethics:**Natural acceptance of human values - Definitiveness of Ethical Human Conduct - Basic for Humanistic Education - Humanistic Constitution and Humanistic Universal Order - Competence in professional ethics: Professional competence – People-friendly and eco-friendly production systems - Appropriate technologies and management patterns for above production systems. **UNIT-VI** **Case studies and Strategy:** Case studies of typical holistic technologies, management models and production systems - Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations.
Text book: & Reference Books:	**Text book:** 1.A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1 **Reference Books:** 1.Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2 2. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999. 3. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004. 4. The Story of Stuff (Book). 5. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi 6. Small is Beautiful - E. F Schumacher. 7. Slow is Beautiful - Cecile Andrews 8. Economy of Permanence - J C Kumarappa 9. Bharat Mein Angreji Raj - PanditSunderlal 10. Rediscovering India - by Dharampal 11. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi 12. India Wins Freedom - Maulana Abdul Kalam Azad 13. Vivekananda - Romain Rolland (English) 14. Gandhi - Romain Rolland (English)
E-Resources	1. https://www.youtube.com/channel/UCo8MpJB_aaVwB4LWLAx6AhQ 2. https://aktu.ac.in/hvpe 3. http://www.storyofstuff.com 4. https://fdp-si.aicte-india.org/download.php#1

20EE21SC-ELECTRICAL WORKSHOP

Course Category:	Professional core	**Credits:**	2
Course Type:	Skill oriented (Theory & Practical)	**Lecture-Tutorial-Practical:**	1-0-2
Pre-requisite:	Knowledge	**Sessional Evaluation:**	40
		External Exam Evaluation:	60
		Total Marks:	100

Course Objectives:	Students undergoing this course are expected to learn :	
	1. The concepts and importance of Electrical tools and PPE. 2. About staircase and Go-down house wiring connections. 3. Residential house wiring connections 4. The importance of electrical safety. 5. About dismantling and assembling of different electrical appliances 6. Various types of Batteries and their applications	
Course Outcomes:	After completing the course the student will be able to	
	CO1	Identify different types of instruments and the utilization of PPE.
	CO2	Perform wiring for staircase and go-down applications
	CO3	Perform wiring for residential houses
	CO4	Learn safety measures against electrical shocks
	CO5	Self-repair all electrical appliances
	CO6	Identify the health of the battery
Course Content:	**UNIT – I** **Electrical Tools, Instruments and Electrical Symbols:** Introduction of Different types of Electrical tools, Instruments and explain their function. Different types of electrical symbols. **Experiments:** Physical Demonstration of usage of different types of electrical tools & Instruments. **Personal Protective Equipment:** Hierarchy of controls as it relates to personal protective equipment. Different types of personal protective equipment utilized in general industry. Personal protective equipment training requirements. **Experiments:** Physical Demonstration of usage of different types of PPE. **UNIT – II** **House wiring 1:** House wiring materials and their selection, House wiring **Experiments:** 1. Control a Light Bulb by a Single Way or One-way Switch 2. Switch board containing at least two switches, one fan regulator and one 5A plug point 3. Staircase wiring and Go-down Wiring 4. Fluorescent Tube Light	

	UNIT-III **House wiring 2:** **Experiments:** 5. Residential House Wiring Using Fuse, Switch, Indicator, Lamp and Energy Meter. 6. Ceiling Fan Connection with Regulator, Switch and Capacitor. 7. Inverter connection diagram. Install Inverter and Battery at Home. **UNIT – IV** **Electrical Safety:** Static Electrical safety rules, Electrical Shock –causes for electric shock, Preventive measures to electric shock, Earthing. **Experiments:** 1.Demonstration of CPR 2.Earthing demonstration and field visit 3.Measurement of earth resistance **UNIT – V** **House hold Electrical appliances:** Dismantling and assembling of different electrical appliances (steam iron box, electric geyser, Table fan and Ceiling fan. **Experiments:** 1.Dismantling and assembling of steam iron box 2.Dismantling and assembling of an electric geyser 3.Dismantling and assembling of Table fan 4.Dismantling and assembling of Ceiling fan **UNIT –VI** **Batteries and their applications**: Different types of batteries and their applications, Working of lead acid battery, Charging of the battery. **Experiments:** 1. Physical demonstration of battery 2. Testing of lead acid battery 3. Charging of lead acid battery
Text Books & Reference Books:	**TEXT BOOKS:**1. A Textbook of Electrical Workshop Practices by Umesh Rathore, Naresh Kumar Sharma, S.K. Kataria & Sons,1st Edition, Paper back January 2019. **REFERENCE BOOKS:**1. Electrical Engineering Handbook, second Edition, New Age International publishers.
e-Resources:	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

20MC2102-Managerial Economics and Financial Accounting

(Common to EEE & ECE)

Course Category:	Humanities	**Credits**	0
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Nil	**Sessional Evaluation:** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to learn:	
	1. The concept and nature of Managerial Economics and its relationship with other disciplines and also to understand the Concept of Demand and Demand forecasting, Production function, Input Output relationship, Cost-Output relationship and Cost-Volume-Profit Analysis. 2. The nature of markets, methods of Pricing in the different market structures and to know the different forms of Business organization 3. The preparation of Financial Statements and use of Capital Budgeting techniques to evaluate Capital Budgeting proposals.	
Course Outcomes	Upon successful completion of the course , the students will be able to:	
	CO1	Adopt the Managerial Economic concepts for decision making and forward planning. Also know law of demand and its exceptions, to use different forecasting methods for predicting demand for various products and services.
	CO2	Know the role of various cost concepts in managerial decisions and the managerial uses of production function and to compute breakeven point to illustrate the various uses of breakeven analysis.
	CO3	Understand how to determine price and output decisions under various market structures.
	CO4	Know in brief formalities to be fulfilled to start a business organization.
	CO5	Adopt the principles of accounting to record, classify and summarize various transactions in books of accounts for preparation of final accounts.
	CO6	Apply capital budgeting techniques in evaluating various long term investment opportunities.

Course Content	**UNIT – I** **Introduction to Managerial Economics and demand Analysis**: Definition of Managerial Economics –Scope of Managerial Economics and its relationship with other disciplines. Concept of Demand, Types of Demand, Determinants of Demand- Demand schedule- Demand curve- Law of Demand and its limitations- Elasticity of Demand: Types and significance. **UNIT – II** **Production & Cost Analysis**: Production Function- Isoquants and Isocosts- Cobb-Douglas Production function- Law of variable Proportions- Laws of Returns-Internal and External Economies of Scale. Cost Analysis: Cost concepts- Break-even Analysis. **UNIT – III** **Theory of Pricing:** Types of competition and Markets- Features of Perfect competition, Monopoly and Monopolistic Competition- Price-Output Determination in case of Perfect Competition and Monopoly. Pricing: Objectives and Policies of Pricing. Methods of Pricing. **UNIT – IV** **Types of Business Organizations and Banking System:** Sole proprietorship-partnership - Joint Stock Company – Shares and debentures. **Banking System**: Central bank- Commercial banks and their functions- Impact of technology in banking sector. **UNIT – V** **Financial Accounting:** Accounting principles- Double-Entry system of Accounting- Rules for maintaining Books of Accounts- Journal- Posting to Ledger- Preparation of Trial Balance- Preparation of Final Accounts (with simple adjustments). **UNIT-VI** **Capital and capital budgeting**: Capital and its significance- Types of Capital- Sources of raising capital. Capital Budgeting: features of capital budgeting proposals- Methods of Capital Budgeting: Payback Method, Accounting Rate of Return (ARR) and Net Present Value Method and Internal Rate of Return (IRR) (simple problems).
Text Books and Reference Books	**TEXT BOOKS:** 1. Varshney & Maheswari: Managerial Economics, S. Chand Publishers 2. Business Organisations: C.B.Gupta , S.Chand Publishers 3. Managerial Economics and Financial Accounting: A.R.Arya Sri, Tata McGraw Hills publishers. **REFERENCE BOOKS:** 1. Economic Analysis: S.Sankaran, Margham Publications. 2. S.N.Maheswari& S.K. Maheswari, Financial Accounting, Vikas Publishers. 3. S. A. Siddiqui& A. S. Siddiqui, Managerial Economics & Financial Analysis, New age International Space Publications. 4 M. Sugunatha Reddy: Managerial Economics and Financial Analysis, Research India Publication, New Delhi.

20EC21P4 – ANALOG & DIGITAL ELECTRONICS LAB

(EEE)

Course Category:	Professional Core	**Credits:**	1
Course Type:	Laboratory	**Lecture-Tutorial- Practice:**	0 - 0 - 2
Pre-requisite:	Basic Electrical Sciences and Electronic Devices	**Sessional Evaluation:** **External Evaluation :** **Total Marks:**	40 60 100

Course Objectives:	Students undergoing this course are expected to learn:	
	1. The V-I characteristics of various semiconductor devices. 2. The design & analysis of the rectifiers (With & Without filters). 3. The response of the RC coupled amplifier & feedback practically. 4. The realization of logic gates using NAND and NOR Gates 5. About the full adder and full subtractor operation & the operation of decoder and expression using decoder 6. About the multiplexer and expression using MUX.	
Course Outcomes:	Upon successful completion of the course, the students will be able to:	
	CO1	Plot the characteristics of various semiconductor devices and Transistors experimentally.
	CO2	Design &analyse the rectifiers (With & Without filters).
	CO3	Calculate the frequency response of the RC coupled amplifier & understand the performance of feedback amplifiers practically.
	CO4	Understand the realization of logic gates using NAND and NOR Gates
	CO5	Understand the full adder, full subtractor operation & operation of decoder and expression using decoder.
	CO6	Understand about the multiplexer and MUX & design and analysis of various combinational circuits and sequential circuits.
Course Content:	Minimum of 10 experiments to be completed out of the following: **LIST OF EXPERIMENTS** 1.P-N Junction Diode Characteristics 2. Zener Diode Characteristics 3. Bi-Polar Junction Transistor Characteristics (CE Configuration) 4. Junction Field Effect Transistor Characteristics 5. Uni-Junction Transistor Characteristics 6. a) Full Wave Rectifier without Filters b) Full Wave Rectifier with LC Filter 7. R-C Coupled Amplifier 8. FET Amplifier 9. Current Series Feedback Amplifier (With & Without feedback) 10. Realization of all logic gates using NAND and NOR Gates 11. Full Adder and Full Subtractor 12. Decoder & Implement Expression using Decoder 13. Multiplexer & Implement Expression using MUX 14. Divide by N-Ripple Counter.	

20EE21P1-ELECTRICAL CIRCUITS AND SIMULATION LAB

Course Category:	Professional core	**Credits:**	1.5
Course Type:	Laboratory	**Lecture-Tutorial-Practical:**	0-0-3
Pre-requisite:	Basic concepts of Ohm's Law, Kirchhoff's Laws. Basic knowledge of Network Theorems	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	Students undergoing this course are expected to learn :	
	1. The design and analysis of basic electric circuits. 2. The network theorems. 3. The measurement of power and resonating condition in AC circuits. 4. The two port network parameters experimentally. 5. To Plot the locus diagram 6. The verification of electrical circuit theorems using MATLAB software	
Course Outcomes:	After completing the course the student will be able to:	
	CO1	Analyse the electric circuits experimentally.
	CO2	Verify the network theorems.
	CO3	Measure the power in single phase AC circuit and resonating condition in RLC series circuit.
	CO4	Evaluate the two port network parameters experimentally.
	CO5	Analyse and plot the locus diagram of the given circuit experimentally.
	CO6	Acquire skills of using MATLAB software for electrical circuit studies.
Course Content:	Minimum of 10 experiments to be conducted out of the following: **List of Experiments** 1. Verification of Kirchhoff's current law and Kirchhoff's voltage law using hardware and simulation 2. Verification of Super position theorem using hardware and simulation 3. Verification of Reciprocity theorem using hardware and simulation 4. Verification of Maximum Power Transfer theorem using hardware and simulation 5. Verification of Thevenin's theorem using hardware and simulation 6. Verification of Norton's theorem using hardware and simulation 7. Resonance in series RLC circuit using hardware and simulation 8. Locus diagram of RC series circuit using hardware and simulation 9. Measurement of time constant and rise time in RC series circuit using hardware and simulation 10. Average value, RMS value, Form Factor, Peak Factor of sinusoidal wave, Square wave using hardware and simulation 11. Determination of two port network parameters using hardware and simulation 12. Measurement of power and power factor using hardware and simulation	

20EE21P2-ELECTRO MECHANICAL ENERGY CONVERSION-I LAB

Course Category:	Professional core	**Credits:**	1.5
Course Type:	Laboratory	**Lecture-Tutorial-Practical:**	0-0-3
Pre-requisite:	Basic concepts of Electro Magnetics, Knowledge of DC machines is required.	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	Students undergoing this course are expected to learn :	
	1. The test performance of DC machines. 2. To perform load tests on DC Generators. 3. The load testing methods to obtain the performance of DC motors 4. The speed control methods of DC motors 5. To separate the losses in a DC motor. 6. The assessment of DC machines.	
Course Outcomes:	After completing the course the student will be able to	
	CO1	Test the performance of DC machines.
	CO2	Perform load tests on DC Generators.
	CO3	Conduct load tests on DC motors.
	CO4	Design to Control the speed of DC motor.
	CO5	Distinguish to separate the losses in a DC motor.
	CO6	Analyse the assessment of DC machines.
Course Content:	Minimum of 10 experiments to be conducted out of the following: **List of Experiments** 1. Magnetization characteristics of DC shunt Generator 2. Load Test on DC shunt Generator 3. Load Test on DC Compound Generator 4. Swinburne's Test 5. Brake Test on DC Shunt Motor 6. Brake Test on DC Series Motor 7. Brake test on a DC Compound Motor 8. Speed Control of DC Shunt Motor 9. Hopkinson's Test 10. Field Test on DC Series Machines 11. Separation of Losses of DC Shunt Motor 12. Retardation Test	

NBKR INSTITUTE OF SCIENCE & TECHNOLOGY:: VIDYANAGAR (AUTONOMOUS)
(AFFILIATED TO JNTUA:: ANANTAPUR)
SPSR NELLORE DIST
II YEAR OF FOUR YEAR B.TECH DEGREE COURSE – II SEMESTER
ELECTRICAL AND ELECTRONICS ENGINEERING
SCHEME OF INSTRUCTION AND EVALUATION
(With effect from the academic year 2021-2022)
(For the batch admitted in the academic year 2020-2021)

S.No	Course Code	Course Title	Instruction Hours/Week			Credits	Evaluation									
							Sessional Test-1			Sessional Test-2			Total Sessional Marks (Max. 40)	End Semester Examination		Maximum Total Marks
		THEORY	L	T	D/P		Test-1 (2 Hr)	Assign-1	Max. Marks	Test-2 (2 Hr)	Assign-2	Max. Marks		Duration In Hours	Max. Marks	100
1	20SH2202	Modern Linear algebra	3	-	-	3	34	6	40	34	6	40	0.8*Best of Two + 0.2*Least of Two	3	60	100
2	20CS2205	Object Oriented Programming Through JAVA	3	-	-	3	34	6	40	34	6	40		3	60	100
3	20EE2201	Electro Mechanical Energy Conversion-II	3	-	-	3	34	6	40	34	6	40		3	60	100
4	20EE2202	Power Electronics	3	-	-	3	34	6	40	34	6	40		3	60	100
5	20EE2203	Power systems-I	3	-	-	3	34	6	40	34	6	40		3	60	100
6	20EE22SC	Basics of PV system Installation	1	-	2	2							Day to Day Evaluation and a test (40 Marks)	3	60	100
		PRACTICALS														
7	20EE22P1	IoT Lab	-	-	3	1.5	-		-	-		-	Day to Day Evaluation and a test (40 Marks)	3	60	100
8	20EE22P2	Power Electronics & simulation Lab	-	-	3	1.5	-		-	-		-		3	60	100
9	20CS22P4	Object Oriented Programming Through JAVA Lab	-	-	3	1.5	-		-	-		-		3	60	100
		MANDATORY														
10	20MC2201	Environmental science#	3	-	-	-	34	6	40	34	6	40	0.8*Best of Two + 0.2*Least of Two	3	60	100
		TOTAL				**21.5**										

(***:** Common to all; **#**: Common to CE, ME, ECE & EEE; $: Common to ECE&EEE; **@** : Common to EEE, ECE,CE&ME)

20SH2202 – MODERN LINEAR ALGEBRA

Course Category:	Basic Science	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Intermediate Mathematics	**Sessional Evaluation:** **Univ. Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	1. To learn handling of linear system of equations using matrix as a tool. 2. Learn the basic concepts of linear algebra to illustrate its power and utility through applications to computer science and Engineering. 3. To visualize of vectors in n-space which is useful in representing data 4. Apply the concepts of vector spaces, linear transformations, matrices and inner product spaces in engineering. 5. Solve problems in inner product spaces& Gram Schmidt orthogonal process. 6. To introduce matrix decompositions methods that reduce a matrix into constituent parts which make.	
Course Outcomes	At the end of this course the students are expected to understand	
	CO1	The abstract concepts of matrices and system of linear equations using decomposition methods
	CO2	The basic notion of vector spaces and subspaces
	CO3	Apply the concept of vector spaces using linear transforms which is used in computer graphics and inner product spaces
	CO4	Applications of inner product spaces in cryptography
	CO5	Use of wavelet in image processing. Theory of vector space in representing data.
	CO6	Matrix operations in solving system of linear equations. Matrix decomposition in solving system of equations.
Course Content	**UNIT – I** **Matrices :** Cayley-Hamilton theorem, diagonalization of matrices and its computation, eigenvalue decomposition of matrices, computation of powers of diagonalizable matrices. **UNIT – II** **Vector Spaces:** Vector Spaces, Subspaces- Definition and Examples, Linear independence of vectors, Bases and dimension, Linear Span, Field-Definition **UNIT – III** **Linear Transformations and applications:** Linear transformations – Basic properties-invertible linear transformation - matrices of linear transformations - vector space of linear transformations – change of bases – similarity - Kernel and range, properties	

	UNIT-IV **Vector space in R^n :** System of linear equations, row space, Column space and null space. relation between rank and nullity, consistency theorem, basis from a spanning set and independent set. **UNIT-V** **Inner Product Spaces:** Dot products and inner products – the lengths and angles of vectors – matrix representations of inner products- Cauchy-Schwarz inequality - Gram-Schmidt orthogonalisation. **UNIT-VI** **Matrix Factorization:** LU decomposition, QR Decomposition and Projection - orthogonal projections
Text Books & References Books	**TEXT BOOKS:** 1. Introduction to Linear Algebra, 5th Edition, Gilbert Strang, 2. Gilbert Strang Linear Algebra and It's Applications, 4th edition, Cengage Learning. 3. Stephen Boyd, Lieven Vandenberghe, Introduction to Applied Linear Algebra: Vectors, Matrices,and Least Squares, Cambridge University Press, 2018 4.W. Keith Nicholson, Linear Algebra with applications, 4th edition, McGraw-Hill, 2002. **REFERENCE BOOKS:** 1. Higher Engineering Mathematics - H.K. Dass, Er. RajnishVerma, S. Chand Publication, New Delhi. 2. Engineering Mathematics -III - Dr.T.K.V. Iyengar, Dr.B. Krishna Gandhi, S. Ranganatham, Dr.M.V.S.S.N. Prasad, S. Chand Publication, New Delhi 3.Special functions and complex variables (Engineering Mathematics-III) – Shahnaz Bathul, PHI, New Delhi.

20CS2205 - OBJECT ORIENTED PROGRAMMING THROUGH JAVA
(EEE)

Course Category:	Program Core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Basic knowledge of programming.	**Sessional Evaluation:** **Univ. Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	• Acquire knowledge on basics of Java • Learn the fundamental constructs of string handling functions in Java • Gain knowledge of using inheritance and packages • Explore the knowledge to create Graphical User Interfaces by using event handling mechanisms. • Learn the exception handling mechanisms.	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Understand the basic concepts of Java and control statements.
	CO2	Acquire the knowledge of Classes and Methods
	CO3	Conceptualize the techniques of inheritance and String handling functions.
	CO4	Understand Interfaces and packages in java.
	CO5	Know the Exception Handling mechanisms and thread Programs.
	CO6	Understand the concept of Event Handling mechanisms and its applicability.
Course Content	**UNIT-I** **Java Basics:** Buzz words, Data types, Variables and Arrays **Operators:** Arithmetic, Bitwise, Relational, Boolean, Assignment, Ternary, Precedence and Associativity. **Control statements:** Selection, Iteration and Jump statements **UNIT-II** **Classes:** Fundamentals, Assigning Object Reference Variables, Constructors, Garbage collection. **Methods:** Overloading of Methods, Passing Objects as Parameters, Argument Passing, Returning Objects, Recursion, Access Control, Static, Final, Variable-length Arguments. **UNIT-III** **String Handling:** Constructors, length(), Special String Operations, Character Extraction, String Comparison – equals(), equalsIgnoreCase(), startsWith(), endsWith(), Deep Vs Shallow comparisons, String Buffer – constructors, length(), capacity(), reverse() and replace(). **Inheritance:** Basics, use of super keyword, Method overriding, Dynamic method dispatch, Using final with Inheritance.	

	UNIT-IV **Interfaces:** Definitions and Implementations, Nested and Applying Interfaces, Variables in interfaces, Extending interfaces, Default and Static Interface Methods. **Packages:** Basics, Member Access, Importing Packages. **UNIT-V** **Exception Handling:** Fundamentals, Types, Uncaught Exceptions, Usage of try and catch clauses, Multiple catch clauses, throw, throws and finally keywords. **UNIT-VI** **Event Handling:** Delegation Event Model, Event Classes, KeyEvent Class, Listener Interfaces, Handling Mouse Events, usage of delegation model, Adapter Classes, Inner Classes.
Text Books & References Books	**TEXT BOOKS:** 1. Java: The Complete Reference, 10th Edition, Herbert Schildt TMH. **REFERENCE BOOKS:** 1. Understanding Object-oriented Programming with Java, Timothy Budd, Addison Wesley. 2. Object-Oriented Programming and Java, Danny Poo, Derek Kiong, Swarnalatha Ashok, Second Edition, Springer. 3. Object-Oriented Programming using Java, Simon Kendal, Simon Kendal & Ventus Publication Aps.
E-Resources	1. https://nptel.ac.in/courses 2. https://freevideolectures.com/university/iitm

20EE2201-ELECTROMECHANICAL ENERGY CONVERSION - II
(EEE)

Course Category:	Professional core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Fundamentals of energy conversion and three phase connections	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to learn: 1. The basic fundamentals related to the principle, construction and operation and testing of a transformer 2. To measure the performance of a transformer by conducting transformer tests. 3. Learn the important concepts related to different poly-phase transformer connections. 4. The principle, construction and operation of Induction Motor. 5. The performance and characteristics of an Induction motor using different tests. 6. The speed control techniques of an Induction Motor and the principles of double cage motor and Induction generator.	
Course Outcomes	After completing the course the student will be able to	
	CO1	Acquire the knowledge of principle, construction, operation and testing of a transformer
	CO2	Understand the working of transformer under no load, loaded conditions and analyse the equivalent circuit of a transformer.
	CO3	Identify different connections of a poly-phase transformer.
	CO4	Demonstrate the principle, construction and operation of Induction Motor.
	CO5	Assess the performance and characteristics of an Induction motor using different testing methods.
	CO6	Analyse the speed control techniques of an Induction Motor and understand the principles of double cage motor and Induction generator.
Course Content	**UNIT-I** **1- ϕ Transformers:** Constructional details - Principle of operation – EMF Equation -Ideal transformer - Leakage flux - Phasor diagram of ideal and practical transformer on no load and loaded condition. **Autotransformer:** Principle-saving of copper - realization of two winding transformer as auto-transformer. **UNIT-II** **Testing of 1-ϕ Transformers:** Pre-determination of performance from OC and SC tests - Equivalent circuit - determination of parameters of equivalent circuit – Losses, efficiency and regulation – Sumpner's test - separation of hysteresis and eddy current losses -Parallel operation of transformers - equal and unequal voltage ratios- load sharing. **UNIT-III** **Poly-phase transformers:** Poly-phase connections – Star/Delta, Delta/Star, Star/Star, Delta/Delta, Star/zigzag Star, Delta/zigzag Star connections and their Phasor diagrams - Scott connection - Open Delta connection - Testing of three phase transformers (Ratio test, Transformer vector group test, Polarity test and magnetic balance test).	

	UNIT-IV **3-ϕ Induction motor:** Constructional details – types - production of rotating magnetic field -principle of operation - Torque equation - Starting and maximum torques - Maximum output - Slip for maximum output - Torque-slip characteristic - losses and efficiency - phasor diagram - Equivalent circuit. **UNIT-V** **Testing and starting of 3-ϕ Induction motor:** No load and blocked rotor tests - determination of equivalent circuit parameters, Brake test, Pre-determination of performance from no load and blocked rotor tests - circle diagram - Auto transformer, star delta and rotor resistance starters. **UNIT-VI** **Speed control of Induction motors:** Pole changing - cascade connection - injection of EMF into rotor circuit - introduction to V/f control of three phase Induction motor. **Double cage induction motor**: Construction theory - equivalent circuit - characteristics and applications - Induction generator - Theory, construction, operation, equivalent circuit and applications.
Text Books & Reference Books	**TEXT BOOKS:** 1. "Theory and performance of Electrical machines", by J.B Gupta, SK Kataria publishers, 2013 Reprint. 2. "Electrical Machines", by Ashfaq Hussain ,Dhanpat Rai & Co, 3rd Edition,2016. 3. "Principles of Electrical Machines" by V.K Mehta, Rohit Mehta – S.Chand, Reprint Edition 2006. **REFERENCE BOOKS:** 1. "Electrical Machinery", by Dr. P.S Bimbhra, Khanna publishers,2011. 2. "Electrical Machines" by I.J.Nagarath and D.P.Kothari 4th Edition, Tata McGraw-Hill, 2010. 3. "Performance & Design of Alternating Current machines" by M. G. Say, CBS publishers, 2012.
E-Resources	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

20EE2202 – POWER ELECTRONICS
(EEE)

Course Category:	Professional core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Electrical circuit theory, differential &integral calculus.	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	Students undergoing this course are expected to learn:	
	1. About characteristics, specifications, commutation methods and protection of thyristor. 2. About phase controlled converters with their applications. 3. The harmonics presence in source current and THD calculation of phase controlled converters. 4. The choppers with their control techniques and its applications. 5. The inverters with their control techniques and applications. 6. The A.C voltage controllers and cyclo-converters with their applications.	
Course Outcomes:	After completing the course the student will be able to	
	CO1	Understand the characteristics, specifications, protection and commutation methods of thyristor.
	CO2	Analyze single phase controlled rectifiers.
	CO3	Demonstrate three phase controlled rectifiers.
	CO4	Assess and apply the concepts of D.C-D.C converters in steady state operation.
	CO5	Explain the operation of inverters and voltage control techniques.
	CO6	Gain knowledge on the operation of single phase A.C voltage controllers and single phase cyclo-converters.
Course Content:	**UNIT-I** **Thyristors:** Silicon controlled rectifier (SCR's)- basic theory of operation of SCR-two transistor analogy- static and dynamic characteristics of SCR-turn on methods - gate characteristics- firing circuits for thyristor- series and parallel operation of SCRs- protection of SCR-snubber circuit- ratings of SCRs - commutation methods. **UNIT-II** **Phase controlled rectifiers:** Phase control technique, single phase half wave Converters with R & RL loads-single phase full wave converters-Midpoint-full controlled bridge-Half controlled bridge converters with R, RL loads-effect of freewheeling diode- effect of source inductance. **UNIT-III** **Three phase controlled rectifiers:** Three pulse and six pulse converters - midpoint and bridge connections, average load voltage with R and RL loads - effect of source inductance - presence of harmonics in source current -THD calculation.	

	UNIT-IV **Choppers:** Step-down and step-up chopper-control strategy– Introduction to types of choppers-A, B, C, D and E -Switched mode regulators- Buck, Boost, Buck- Boost regulator, Introduction to Resonant Converters, Applications-Battery operated vehicles. **UNIT-V** **Inverters:** Single phase and three phase voltage source inverters (both 120^0 mode and 180^0 mode)– Voltage& harmonic control-PWM techniques: Multiple PWM, Sinusoidal PWM, modified sinusoidal PWM – Introduction to space vector modulation –Current source inverter, **UNIT-VI** **AC voltage controller:** Single phase two SCR's in anti-parallel - with R and RL loads- derivation of RMS load voltage- current and power factor. TRIAC and its characteristics. **Cyclo-converters**: Single phase midpoint and bridge configuration cycle-converters with R and RL loads (step up and step down).
Text books **&** **Reference books:**	**Text books :** 1. *"*Power electronics: circuits, devices and applications*",* by M.H. Rashid, Pearson Education, PHI Third Edition, New Delhi 2004. 2. "Power electronics", by P.S. Bimbra, Khanna Publishers, third Edition, 2003. 3. "Power electronics", by MD Singh and Khanchandani, Second Edition, TMH Publishes. **Reference books:** 1. *"*Power electronics for technology", by Ashfaq Ahmed Pearson Education, Indian reprint, 2003. 2. "Power electronics: converters, applications and design", by Ned Mohan, Tore.M.Undeland, William. P. Robbins, John Wiley and sons, third Edition, 2003. 3. "Elements of power electronics", by Philip T. Krein, Oxford University Press, 2004 Edition.
e-Resources	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

20EE2203-POWER SYSTEMS-I

(EEE)

Course Category:	Professional core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Basic concepts of machines, renewable and non renewable sources.	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	Students undergoing this course are expected to learn:	
	1. The concepts of the electrical power generation by Themal power stations. 2. The concepts of the electrical power generation by Hydro power stations. 3. The concepts of the electrical power generation by Nuclear power stations. 4. The economic aspects of power generation. 5. The calculation of various Transmission line parameters. 6.The various factors governing performance of transmission lines.	
Course Outcomes:	After completing the course the student will be able to:	
	CO1	Understand the operation of various components involved in thermal power plant.
	CO2	Demonstrate the operation, construction and design of various components of hydro power plant.
	CO3	Explain the operation, construction, safety and design of various components of nuclear power plant.
	CO4	Evaluate tariffs by different methods and economical aspects of power generation.
	CO5	Calculate the various Transmission line parameters.
	CO6	Understand various effects governing performance of transmission lines.

Course Content:

UNIT-I

Thermal Power Stations (TPS): Introduction - Selection of site for TPS -block diagram of Thermal Power Station - showing paths of coal - steam - water - air - ash and flue gases.

Brief description of TPS components: Economisers - Boilers - types of Boilers - Super heaters - steam Turbines-Impulse & Reaction type- Condensers - Jet and surface types of Condensers - Electrostatic precipitator - Chimney and Cooling towers - Advantages & disadvantages of TPS - TPS in India.

UNIT-II

Hydro-Electric Power Plants: Introduction - Selection of site for Hydro – electric Power plants - classification of Hydro - electric plants - Layout of Hydro Electric Power plant - working principle - Description of main components - types of turbines –Pelton - Francis & Kaplan turbines - Pumped storage plant - Advantages and disadvantages of hydro power plant .

UNIT –III

Nuclear Power Stations: Introduction - Nuclear Fission and Chain reaction - Principle of operation of Nuclear power plant - Nuclear Reactor components and their functions : Moderators - Control rods - Reflectors and Coolants- Radiation hazards: Shielding and Safety precautions - Types of Nuclear reactors and their brief description - Pressurised Water Reactor (PWR), Boiling Water Reactor (BWR) and Fast Breeder Reactor - Merits and demerits of Nuclear Power Plant.

	UNIT –IV **Economic Aspects of power generation:** Load curve - load duration and integrated load duration curve - number and size of generator units- Connected load - Maximum demand - Load Factor - Demand Factor- Diversity Factor - Plant use factor - Plant Capacity Factor - Utilization Factor- Power Factor - causes of low power factor - Numerical problems. **Cost of Electrical Energy:** Cost of generation and their division into fixed, semi fixed and running costs. Tariff - Objectives of tariff - flat rate - block rate - two part - three part and power factor tariff methods - Numerical problems. **UNIT-V** **Transmission Line Parameters:** Inductance and capacitance, Calculation of Transmission line Resistance, Inductance and Capacitance of single phase and three phase lines with symmetrical and unsymmetrical spacing, bundled conductor, effect of earth on capacitance. **UNIT-VI** **Various factors governing the performance of Transmission line:** Skin and Proximity effects, Ferranti effect, Charging Current. **Corona**: Description of the phenomenon, Factors affecting corona, critical voltages and power loss, Radio Interference.
Text Books & Reference Books:	**TEXT BOOKS:** 1. "A course in electrical Power", by J.B.Gupta S.K. kataria& sons, 11th Edition (Reprint 2014). 2. "Generation of Electrical Energy", by B.R Gupta-S.Chand Publications, 6th Edition (Reprint 2014). 3. "Electrical power system", by C.L Wadhwa-New age International, 6th Edition. **REFERENCE BOOKS:** 1. "Generation, Distribution and Utilization of Electrical Energy", by C.L Wadhwa- New age International Pvt 2015. 2. "Power System Engineering", by I.J Nagarath& D.P Kothari, TMH Publications, 2nd Edition. 3. "A Course in Power Plant Engineering", by Subhash C. Arora, S.Domkundwar, DhanpatRai.
e-Resources:	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

20EE22S1-BASICS OF PV SYSTEM INSTALLATION

Course category:	Professional core	**Credits:**	2
Course Type:	Skill oriented course	**Lecture - Tutorial - Practical:**	1 - 0 - 2
Pre-requisite:	Electrical circuits	**Sessional Evaluation :**	40
		Univ.Exam Evaluation:	60
		Total Marks:	100

Course Objectives	Students undergoing this course are expected to learn:	
	1.The basics of electricity related to photo-voltaics. 2.The different types of protective clothing and equipment 3.About the functions of the system components 4.The requirements for photovoltaic system installation on different surfaces 5.Installation of photovoltaic system components and systems 6.About the procedure for maintaining different PV system components.	
Course Outcomes	Upon successful completion of the course , the students will be able to:	
	CO1	Explain the basics of electricity related to photo-voltaics
	CO2	Identify the different types of protective clothing and equipment
	CO3	Explain the functions of the system components
	CO4	Understand and explain the requirements for photovoltaic system installation on different surfaces
	CO5	Install photovoltaic system components and systems
	CO6	Outline the procedure for maintaining different PV system components
Course Content	**UNIT-I** **Introduction to solar photo-voltaics:** The photovoltaic effect , Photovoltaic technology and solar cells, Photovoltaic system configuration, Applications for solar photovoltaic systems **UNIT-II** **Workplace safety and first aid:** Risks and hazards, Site safety, Personnel safety, Working at rooftops and facades, Fire hazards, First aid. **UNIT III** **Components and electrical connections:** Basics of Solar photovoltaic modules, Inverters, Batteries, Charge controllers, Protective measures, Sizing a PV system. **UNIT-IV** **Site preparations:** Taking measurements, Shade analysis, Orientation of photovoltaic modules, Installation surfaces, Planning work schedules. **UNIT-V** **Installing a solar photovoltaic system:** Required tools and equipment, Installing the photovoltaic array, Installing the battery bank, Installing the charge controller, Installing the inverter, Connecting the system components, Commissioning, PV panel earthing**.** **UNIT-VI** **Maintenance and troubleshooting:** Maintenance of solar panels, Troubleshooting PV system.	

Text Books & Reference Books	**TEXT BOOKS:** 1. Photovoltaic design and installation for dummies, Wiley Publishing Inc. 2. Planning and installing photovoltaic systems:A guide for installers ,engineers and architects Earth scan **REFERENCE BOOKS:** 1. Solar photovoltaic systems technical training manual • UNESCO 2. Renewable energy resources • John Tidwell and Tony Weir.
E- Resources	1. www.mfs.fireextinguishers.co.uk 2. https://hespv.ca/solar-resources/solar-installer-tools/solar-training-videos 3. https://www.solarenergy.org/online/

20MC2201 - ENVIRONMENTAL SCIENCE

(Common to CE, ME, EEE & ECE)

Course Category:	Basic Sciences	**Credits:**	0
Course Type:	Theory	**Lecture-Tutorial-Practical:**	2-0-0
Prerequisite:	Basic idea on environment, Environmental pollution causes, effects and control measures.	**Sessional Evaluation:** **Univ. Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	• To know the importance of Environmental Sciences and understand the various components of environment. • To know the value of natural resources and need to protect them. • To know the value of biodiversity and it`s conservation methods. • To describe advanced methods to solve problems related to environmental pollution. • To understand the social issues and provide plans to minimize the problems. • To articulate various environmental acts in order to protect the environment.	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Know the importance of Environmental sciences and understand the various components of environment.
	CO2	Understand the value of natural resources
	CO3	Summarize the function of ecosystem, values of biodiversity and conservation.
	CO4	Identify how the environment is polluted and suggest the mitigation measures.
	CO5	Understand the environmental problems in India and way to minimize the effects.
	CO6	Categorize the environmental protection laws in our country and role of information technology in environment protection.
Course Content	**UNIT-I** **Fundamentals of Environmental Science:** Introduction, Definition, Scope and Importance of environmental science - Various components of environment – Atmosphere, lithosphere, hydrosphere and biosphere – Multidisciplinary nature of environmental science-public awareness. **UNIT-II** **Natural Resources:**Introduction- Classification of Natural resources. **Forest Resources:** Importance of Forests, over-exploitation of forest resources-Deforestation-causes, effects and control methods. **Water Resources:** Use and over-utilization of surface and ground water – Dams -Benefits and problems-conflicts over water. **Energy Resources:** Renewable and non-renewable energy sources. Need to use of alternate energy sources, Impact of energy use on environment. **Land Resources:** Importance, Land degradation, Soil erosion and desertification.	

	UNIT-III **Ecosystem and Bio-diversity** **Ecosystem:** Definition, types, structure of ecosystem (biotic and abiotic components) and functions of an Ecosystem – Energy flow, Food chains, food web, ecological pyramids and Ecological succession. **Bio-diversity and its Conservation:** Definition - Genetic, Species and Ecosystem diversity- value of biodiversity - Hotspots of biodiversity in India - Threats to biodiversity – conservation of biodiversity (In-situ and Ex-situ conservation). **UNIT-IV** **Environmental Pollution:** Introduction, Causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution and nuclear hazards. **Solid Waste Management:** sources, effects of Municipal solid waste, Industrial solid waste and management of solid waste. **Disaster Management:** Floods, Droughts, earthquakes and cyclones. **UNIT-V** **Social Issues and The Environment:** From unsustainable to sustainable development, urban problems related to energy, water conservation, rainwater harvesting and water shed management. **Climate Change-** Global warming, Acid rain and Ozone layer depletion. **Environmental Acts:** Water (Prevention and control of pollution) Act-Air (Prevention and control of pollution) Act – Wildlife protection Act and Forest conservation Act **UNIT-VI** **Human Population and Environment:** Population growth, variation among nations and population Explosion- Role of information technology in environment and human health. **Case Studies:** Silent valley project, Madhura Oil Refinery and Taj Mahal, Kolleru Lake Aquaculture and Fluorosis in Andhra Pradesh **Field Work:** Visit to a Local Area having river/Forest/grass land/hill/mountain to document environmental assets. Study of common plants, insects and birds.
Text Books & References Books	**TEXT BOOKS:** 1. Environmental Studies by E. Bharucha (2003), University Publishing Company, New Delhi. 2. "Environmental science" by Anubha Kaushik and C.P .Kaushik.(2016), New age International Private Limited. 3. "Environmental science and Engineering" by P.Anandan and R.K. Kumaravelan.(2009), Scitech Publishers. 4. Environmental Studies by K.V.S.G.Murali Krishna(2015), Savera Publishing House **REFERENCE BOOKS:** 1. "Introduction to Environmental science" by Y. Anjaneyulu. 2. "Environmental studies" by Dr.B.S. Chauhan. 3. "Environmental science" by M. Chandrasekhar. 4. Environmental Studies by P.N,Palini swamy, P.Manikandan, A.Geeta and K.Manjula Rani, Pearson Education, Chennai.
E-Resources	1. https://nptel.ac.in/courses 2. https://freevideolectures.com/university/iitm

20EE22P1-IoT Lab

Course Category:	Professional core	**Credits:**	1.5
Course Type:	Laboratory	**Lecture-Tutorial-Practical:**	0-0-3
Pre-requisite:	C-Programming &basic electrical concepts	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	Students undergoing this course are expected to learn:	
	1. The basic knowledge of Arduino kit. 2. To measure different parameters using Arduino. 3. Various applications of Arduino. 4. To interface different sensors with Arduino kit 5. The basic programming knowledge on Arduino kit 6. The interfacing of different types of sensors to Arduino kit.	
Course Outcomes:	After completing the course the student will be able to	
	CO1	Understand voltage, current, temperature and pressure circuitry using Arduino kit.
	CO2	Apply appropriate techniques for position error detection.
	CO3	Analyse the different sensors using Arduino kit.
	CO4	Evaluate physical quantity using sensors and Arduino kit.
	CO5	Demonstrate the basic programming on Arduino kit
	CO6	Design to interface different types of sensors to Arduino kit
Course Content:	Minimum of 10 experiments to be conducted out of the following: **List of Experiments** 1. Voltage and Current Detection Circuitry. 2. Temperature and Pressure Detection Circuitry. 3. Water flow and Level Detection Circuitry. 4. Position Indication (LVDT, Pot). 5. Proximity sensors (inductive). 6. Distance (Ultrasonic) sensor. 7. Light sensor. 8. Humidity sensor. 9. Rainfall and Soil moisture Sensor.. 10. Accelerometer sensor. 11.Motion sensor 12.Wave generation 13.Speed control of DC motor with Arduino	
e-reference	http://mct.asu.edu.eg/uploads/1/4/0/8/14081679/lab1.pdf http://www.dissidents.com/resources/LaboratoryManualForEmbeddedControllers.pdf	

20EE22P2-POWER ELECTRONICS& SIMULATIONLAB

Course Category:	Professional core	**Credits:**	1.5
Course Type:	Laboratory	**Lecture-Tutorial-Practical:**	0-0-3
Pre-requisite:	Power Electronics	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	To make the student learn about:	
	1.The design of triggering circuits of SCR. 2. The commutation circuits of SCR. 3. The characteristics of SCR, TRIAC, IGBT and MOSFET. 4. The performance of various converters. 5. The chopper circuits. 6. The induction motor drive.	
Course Outcomes:	After completing the course the student will be able to	
	CO1	Analyze the Thyristor turn-on by R,RC,UJT triggering experimentally.
	CO2	Verify the power rectification from 1- Φ A.C to D.C.
	CO3	Verify the power conversion from 1- Φ A.C to A.C.
	CO4	Analyze the forced commutation of thyristor.
	CO5	Verify the power conversion from DC to1-ph A.C .
	CO6	Analyze the performance of induction motor by controllers.
Course Content:	Minimum of 10 experiments to be conducted out of the following: **List of Experiments** 1) V-I characteristics of SCR, MOSFET & IGBT. 2) Power control with SCR using R & RC triggering. 3) Power control with SCR using UJT triggering. 4) Thyristor forced commutation Techniques. 5) Series inverter 6) Parallel inverter. 7)Morgan's chopper 8) Simulation of single phase half wave and full wave converter. 9) Simulation of power control with TRIAC & DIAC. 10) Simulation of speed control of single phase Induction motor. 11) Simulation of D.C Jones chopper. 12) Simulation of 1-Ø to 1- Ø Cyclo converter. 13) Simulation of semi and full wave converters. 14) Simulation of 1-Φ A.C voltage controller	

20CS22P4 - OBJECT ORIENTED PROGRAMMING THROUGH JAVA LABORATORY
(EEE)

Course Category:	Program Core	**Credits:**	1.5
Course Type:	Practical	**Lecture-Tutorial-Practical:**	0-0-3
Pre-requisite:	Basic knowledge of programming fundamentals.	**Sessional Evaluation:** **Univ. Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	• To strengthen the ability to identify and apply the suitable object-oriented concept for the given real-world problems. • To learn skills to create the applications in java.
Course Outcomes	After the completion of this lab, the students will be able to develop various applications using core concepts of Java.
Course Content	1. Write a Java program a. To demonstrate blocks of code in java b. For matrix multiplication (Read input from the user) 2. Write a Java program to create class called Box. a. Create objects of type Box and assign values to the side. Find and print the volume of each box objects created. b. Create overloaded constructors and return the volume of the Box from a method. 3. Write a Java program a. To create a multi-level hierarchy using the Box class 4. Write a Java program a. To create Abstract classes and use the created abstract class b. To prevent overriding of methods. 5. Write a Java program that demonstrates a. Multiple catch clauses. b. Nested try statements 6. Write a Java program that describes the exception handling mechanism. 7. Write a Java program to implement event handling.
Reference Books	**Reference Books:** 1. Java: The Complete Reference, 10th Edition, Herbert Schildt TMH, Indian Edition. 2. An introduction to java programming and object-oriented application development, R A Johson-Thomson.

NBKR INSTITUTE OF SCIENCE &TECHNOLOGY:: VIDYANAGAR (AUTONOMOUS)
(AFFILIATED TO JNTUA :: ANANTAPUR)
SPSR NELLORE DIST
III YEAR OF FOUR YEAR B.TECH DEGREE COURSE – I SEMESTER
ELECTRICAL AND ELECTRONICS ENGINEERING
SCHEME OF INSTRUCTION AND EVALUATION
(With effect from the academic year 2022-2023)
(For the batch admitted in the academic year 2020-2021)

S.No	Course Code	Course Title	Instruction Hours/Week			Credits	Evaluation									
							Sessional Test-1			Sessional Test-2			Total Sessional Marks (Max. 40)	End Semester Examination		Maximum Total Marks
		THEORY	L	T	D/P		Test-1 (2 Hr)	Assign-1	Max. Marks	Test-2 (2 Hr)	Assign-2	Max. Marks		Duration In Hours	Max. Marks	100
1	20EE3101	Control Systems	3	-	-	3	34	6	40	34	6	40	0.8*Best of Two + 0.2*Least of Two	3	60	100
2	20EE3102	EMEC-III	3	-	-	3	34	6	40	34	6	40		3	60	100
3	20EE3103	Power Systems-II	3	-	-	3	34	6	40	34	6	40		3	60	100
4		**Professional Elective -1 (PE-I)**	3	-	-	3	34	6	40	34	6	40		3	60	100
5		**Open Elective-1(OE-I)**	3	-	-	3	34	6	40	34	6	40		3	60	100
6	20SH31SC	Communication & Soft skills @	1	-	2	2	-	-	-	-	-	-	Day to Day Evaluation and a test (40 Marks)	3	60	100
		PRACTICALS														
7	20EE31P1	Control Systems & Simulation Lab	-	-	3	1.5	-		-	-		-	Day to Day Evaluation and a test (40 Marks)	3	60	100
8	20EE31P2	EMEC-II Lab	-	-	3	1.5								3	60	100
		MANDATORY														
9	20MC3101	Entrepreneurship@	3	-	-	-	34	6	40	34	6	40	0.8*Best of Two + 0.2*Least of Two	3	60	100
10	20EE31IS	Summer Internship (Community Service Project)				1.5							Internal Evaluation (40 Marks)	External evaluation (60 Marks)		100
		TOTAL				**21.5**										

(***:** Common to all; **#**: Common to CE,ECE& EEE; ******: Common to EEE & CSE , $: Common to ECE&EEE; **@** : Common to CSE,IT, AI&DS & EEE)

20EE3101-CONTROL SYSTEMS

Course Category:	Professional core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Basic knowledge of differentiation, integration and Laplace transform techniques.	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	Students undergoing this course are expected to learn :	
	1. The various types of control systems and methods to obtain transfer function. 2. The mathematical models of physical systems. 3. The time domain response and evaluate stability of control system using different techniques. 4. The frequency domain techniques to assess the system performance. 5. The different types of compensators for linear systems. 6. The state variable representation of physical systems	
Course Outcomes:	Upon successful completion of the course , the students will be able to:	
	CO1	Understand the various types of control systems and methods to obtain transfer function.
	CO2	Develop mathematical models of physical systems.
	CO3	Determine the time domain response and evaluate stability of control system using different techniques.
	CO4	Apply frequency domain techniques to assess the system performance.
	CO5	Design the different types of compensators for linear systems.
	CO6	Derive the state space model of a given physical system and solve the state equations.
Course Content:	**UNIT-I** **Introduction to classical control systems:** Open loop and closed loop control systems, types of feedback, feedback and its effects, Transfer functions, Block diagram reduction techniques, signal flow graphs. **UNIT-II** **Mathematical modeling of physical systems:** Mathematical modeling and transfer functions of electrical, mechanical and electro-mechanical elements, DC servo motors, two-phase AC servo motors, synchros. **UNIT-III** **Time domain analysis:** Introduction, standard test signals, time response specifications, steady state error constants. **Stability of control systems:** Routh - Hurwitz criterion, Root locus construction, rules for the construction of root loci, introduction to P, PI and PID controllers. **UNIT-IV** **Frequency domain analysis:** Introduction, frequency domain specifications, Polar plots, Bode plots, Nyquist stability criterion.	

	UNIT-V **Design of compensators:** Introduction, need for compensators, lag, lead and lead-lag compensators design in frequency domain. **UNIT-VI** **State Space analysis of continuous systems:** Concepts of state, state variables and state model, derivation of state models from block diagrams, Solution of State equations for Homogeneous and Non homogeneous systems (Derivation only), State Transition Matrix and it's properties, concepts of Controllability and Observability.
Text books & Reference books:	**TEXT BOOKS:** 1. "Control system engineering", by I.J.Nagrath and M.Gopal, 6th Edition, New Age International (P) Ltd. 2. "Control systems", by A.Nagoorkani, 2nd Edition, RBA publishers. 3. "Control systems", by A.Anand kumar, 2nd Edition, PHI publishers. **REFERENCE BOOKS:** 1. "Automatic control systems", by B.C.Kuo, 7thEdition, PHI publishers. 2. "Discrete time control systems", by K.Ogata, PHI Publishers. 3. "Control systems engineering", by Norman S Nise, Wiley, 2000.
e-Resources:	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

20EE3102- ELECTROMECHANICAL ENERGY CONVERSION – III

(EEE)

Course Category:	Professional core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Basic electrical sciences, Electromechanical energy conversion-I & II	**Sessional Evaluation:** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	To make the student learn about:	
	1. The construction and working of different types of alternators. 2.The voltage regulation of synchronous generators using different methods. 3. The theory of salient pole machines. 4. The concept of parallel operation of alternators. 5. The comparison between the characteristics of different types of electrical machines and performing various tests on the machines. 6. The various types of electrical machines.	
Course Outcomes:	After completing the course the student will be able to:	
	CO1	Understand the construction and working of different types of alternators.
	CO2	Determine the voltage regulation using different experimental methods and theoretical analysis.
	CO3	Understand the characteristics of synchronous generators.
	CO4	Understand the principles of synchronization and parallel operation under different operating conditions.
	CO5	Analyse the working and performance of synchronous motor.
	CO6	Understand the construction, operation and starting methods of single phase induction motors and stepper Motor.

Course Content:

UNIT-I

Synchronous generators: Construction, types of alternators, armature windings, EMF equation, armature reaction, leakage flux, synchronous reactance, equivalent circuit, phasor diagram.

UNIT-II

Voltage regulation of synchronous generators: Voltage regulation, pre-determination of regulation by synchronous impedance, ampere turn and Potier triangle methods, SCR and its importance.

UNIT-III

Theory of salient pole machines: Two reaction theory, phasor diagram, determination of X_d and Xq from slip test- expression for power output of cylindrical and salient pole alternators, power angle characteristics.

UNIT-IV

Parallel operation of alternators: Conditions for parallel operation, synchronization, load sharing, synchronizing power, operation on infinite bus bar, effect of change of excitation, effect of change of mechanical input, excitation systems.

	UNIT-V **Synchronous motor:** Theory of operation, phasor diagrams, variation of current and power factor with excitation, hunting and its suppression, determination of V and inverted V curves, methods of starting. **UNIT-VI** **Single phase induction motors:** Principle of operation, double revolving field theory, cross field theory, equivalent circuit, determination of equivalent parameters, starting methods, split phase motors, shaded pole motor, repulsion motor, universal motor and Stepper motor.
Text books & Reference books:	**Text books:** 1."Theory and performance of electrical machines", by J.B Gupta, SK Kataria& sons,3rd Edition,2013. 2."Electrical machines", by Ashfaq Hussain, Dhanpatrai& co (P) Ltd,7th Edition. **Reference books:** 1."Electrical machinery", by Dr. P.S Bimbhra, Khanna publishers. 2."Electrical machines", by I.J.Nagarath and D.P.Kothari, 5th Edition, Tata McGraw-Hill.
e-Resources:	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

20EE3103-POWER SYSTEMS-II

Course Category:	Professional core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Generation of electric power, Circuits and Networks	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	Students undergoing this course are expected to learn :	
	1. The classification of and performance calculation of over head transmission lines. 2. The fundamental concepts of AC & DC electrical power distribution. 3.The various types of underground cables and the methods of grading of Underground cables. 4. The transients and travelling wave phenomenon on transmission lines. 5. The objective of power system earthing and methods of earthing. 6. The different types of insulators, methods of equalising the potential across the string of insulators and mechanical design of over head transmission lines.	
Course Outcomes:	After completing the course the student will be able to	
	CO1	Understand the classification and performance calculation of over head transmission lines.
	CO2	Design and evaluate the performance of D.C and A.C distribution.
	CO3	Acquire the knowledge on underground cables and methods grading of underground cables.
	CO4	The transients and travelling wave phenomenon on transmission lines.
	CO5	Understand the objective of power system earthing and methods of earthing.
	CO6	Gain knowledge about the different types of insulators, methods of equalizing the potential across the string of insulators and also mechanical design of over head transmission lines.
Course Content:	**UNIT- I** **Performance of transmission lines**: Representation of lines, Short transmission lines, Medium transmission lines, Nominal pie and T representation of long lines by distributed parameters, Equivalent T and Pie representation of long transmission lines, Evaluation of ABCD parameters of long lines. **UNIT –II** **DC & AC Distribution :** Comparison of single Phase , 3-phase three wire and 3- phase four wire system, Types of primary distribution systems, Types of Secondary distribution systems, DC distribution fed at one end and at both ends(Concentrated loads), AC distribution fed at one end and at both ends(Concentrated loads), Kelvin's law - limitation of Kelvin's law - Numerical problems. **UNIT-III** **Underground Cables**: Types of Cables, Construction, classification of cables, parameters of single core cable, Grading of cables, Capacitance grading, Inter-sheath grading, Capacitance of three core belted cable.	

	UNIT-IV **Power system transients:** Introduction, Circuit closing transients, Recovery transient due to removal of a short circuit, Travelling waves on transmission line, Surge impedance and wave velocity, Specification of travelling waves, Reflections and refractions of waves, Different types of terminations, Forked line, Successive reflections, Bewley's Lattice diagram, Attenuation and distortion. **UNIT-V** **Power system earthing:** Objectives, definitions, Tolerable limits of body currents, Soil resistivity, Earth resistance, Tolerable Step and touch voltages, Neutral earthing, Ungrounded and effectively grounded system, Resistance, Reactance, Arc suppression coil earthing and grounding transformers. Arcing grounds, protection against arcing grounds. **UNIT –VI** **Mechanical design of Overhead Transmission Line:** Calculation of sag for equal and unequal supports, loading on the conductors in an overhead line, variation of sag with load and temperature, stringing chart. **Overhead Line Insulators:** Introduction, Types of Insulators, potential distribution over a string of insulators, Methods of equalizing the potential, string efficiency.
Text Books & Reference Books:	**TEXT BOOKS:** 1. "Electrical power systems", by C.L.Wadhwa, New Age International (P) Limited, 6th Edition, Reprint 2014. 2. "Power system analysis and Design", by B.R.Gupta S.chand company Pvt. Ltd New Delhi, Reprint-2015. **REFERENCE BOOKS:** 1."Power System Engineering", by I.J Nagarath and D.P Kothari, TMH Publications. 2."A course in power systems", by J.B.Gupta, S.K.Kataria & sons, Reprint-2016.
e-Resources:	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

S.No	PROFESSIONAL ELECTIVE-I (3)
1	Industrial electrical systems **(20EE31E1)**
2	High voltage Engineering **(20EE31E2)**
3	Pulse & Digital Circuits **(20EE31E3)**
4	Wind & Solar Energy systems **(20EE31E4)**

20EE31E1-INDUSTRIAL ELECTRICAL SYSTEMS

(EEE)

Course Category:	Professional Elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Electric power systems	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	Students undergoing this course are expected to learn:	
	1. About electrical system components. 2. The different types of residential and commercial wiring systems. 3. The concepts of refrigeration, air conditioning and heating of buildings. 4. About the industrial loads, SLD cable and switchgear selection, KVAR calculations, types of compensation, PCC and MCC panels. 5. The DG, UPS systems, elevators, battery banks, sizing and selection. 6. The basics of PLC, control system design – SCADA system for distribution automation of industrial electrical systems.	
Course Outcomes:	After completing the course the student will be able to:	
	CO1	Explain the electrical wiring system components and single line diagram
	CO2	Understand the electrical wiring systems for residential and commercial consumers, sizing of wire and protection devices
	CO3	Analyze the concepts of refrigeration, air conditioning and heating of buildings
	CO4	Enumerate various components of industrial electrical systems
	CO5	Design and select the proper size of various electrical system components
	CO6	Demonstrate the role in automation and PLC based control system design
Course Content:	**UNIT-I** **Electrical system components:** LT system wiring components, selection of cables- wires- switches- distribution box- metering system- tariff structure- protection components-fuse-MCB- MCCB-ELCB-inverse current characteristics- symbols- single line diagram of a wiring system- contactor- isolator- relays- MPCB- electrical shock and electrical safety practices. **UNIT-II** **Residential and commercial electrical systems:** Types of residential and commercial wiring systems- general rules and guidelines for installation- load calculation and sizing of wire- rating of main switch-distribution board and protection devices- earthing system calculations- requirements of commercial installation-deciding lighting scheme and number of lamps-earthing of commercial installation-selection and sizing of components.	

Course Content:	**UNIT-III** **Refrigeration**: Refrigeration cycle- different refrigeration systems- domestic refrigerator & different types of water coolers- control of temperature- protection of motors- simple heat load and motor calculations. **Air-conditioning**: Function of complete air conditioning system- types of air conditioning system- types of compressor motor- cool storage - estimation of tonnage capacity and motor power. **Heating of buildings**: Types of heating equipment used for space heating, calculation of rating of electrical equipment. **UNIT- IV** **Industrial electrical systems I:**HT connection- industrial substation- transformer selection- industrial loads- motors- starting of motors- SLD- cable and switchgear selection- lightning protection-, earthing design- power factor correction- kVAR calculations- type of compensation- Introduction to PCC- MCC panels- specifications of LT breakers- MCB and other LT panel components. **UNIT-V** **Industrial electrical systems II:** DG systems- UPS systems- electrical systems for the elevators- battery banks- sizing the DG- UPS and battery banks- selection of UPS and battery banks. **UNIT-VI** **Industrial electrical system automation:** Study of basic PLC- role in automation- advantages of process automation- PLC based control system design- panel metering and introduction to SCADA system for distribution automation.
Text books & Reference books:	**Text books:** 1. "Electrical wiring, estimating &costing", by S. L. Uppal and G.C. Grag, Khanna publishers, 2008. 2. "Electrical design, estimating &costing", by K.B. Raina, New Age International, 2007. 3. "Electrical estimating and costing", by S. Singh and R. D. Singh, DhanpatRai and Co., 1997. **Reference books:** 1. "Residential commercial and industrial systems", by H. Joshi, McGraw Hill Education, 2008. 2."Course in electric power", by M.L.Soni, P.V. Gupta, U.S.Bhatnagar, DhanapatRai& sons publication.
e-Resources	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

20EE31E2-HIGH VOLTAGE ENGINEERING

(EEE)

Course Category:	Professional Elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Electrical Measurements	**Sessional Evaluation:** **Univ. Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	Students undergoing this course are expected to learn :	
	1. The different types of high voltage generation. 2. About different types of impulse voltage and current generation. 3.About different methods of high voltages and currents 4. The high voltage testing methods and propose suitable testing instruments. 5. About different insulation parameters. 6.The detailed analysis of breakdown occurs in gaseous, liquids and solid dielectric.	
	After completing the course the student will able to:	
Course Outcomes:	**CO1**	Understand different types of high voltage generation.
	CO2	Demonstrate different types of impulse voltage and current generation
	CO3	Explore different methods of high voltages and currents.
	CO4	Explain high voltage testing methods and propose Suitable testing instruments.
	CO5	Design different insulation parameters.
	CO6	Enumerate the behaviour of gas, liquid and solids when they are used as insulation.
Course Content:	**UNIT –I** **Generation of high voltages:** Half wave rectifier circuit, cockroft-walton voltage multiplier circuit, electrostatic generator, generation of high A.C voltages by cascaded transformer, series resonant circuit. **UNIT-II** **Generation of impulse voltages and currents:** Definitions, impulse voltage generator circuits-single stage generator circuits, multiple impulse generator circuits, triggering and synchronization of the impulse generator, impulse current generator. **UNIT-III** **Measurement of high voltages and currents**: Introduction, sphere gap, uniform field spark gap, rod gap, electrostatic voltmeter, Chubb-Fortescue method, measurement of high D.C, A.C and impulse currents. **UNIT-IV** **High voltage testing of electrical equipment:** Testing of overhead line insulator, testing of cables, testing of bushings, testing of power capacitor, testing of power transformer, testing of circuit breaker.	

	UNIT-V **Non-destructive insulation techniques:** Measurement of resistivity, measurement of dielectric constant and loss factor, high voltage Schering bridge measurement of large capacitances, partial discharges. **UNIT-VI** **Breakdown mechanism:** Gases, liquid and solid insulating materials, mechanism of breakdown of gases, townsend's first ionization coefficient, townsend's second ionization coefficient, townsend's breakdown mechanism, paschen's law, principles of breakdown of solid and liquid dielectrics **.**
Text books & Reference books:	**Text books:** 1."High voltage engineering", by C.L.Wadhwa, New Age International publishers 2."High voltage engineering", by M. S.Naidu&Kamaraju, 3rd Edition, Tata Mc-Graw- Hill Publishers. **Reference books:** 1."High voltage Engineering Fundamentals", by E.Kuffel & W.S.Zaengl, Second Edition, Newens publishers. 2. "An introduction to high voltage Engineering", by Subir Ray, PHI Learning Pvt. Ltd
e-Resources	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

20EE31E3 – PULSE AND DIGITAL CIRCUITS

Course category:	Professional Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 0 - 0
Pre-requisite:	Knowledge in active & passive components and mathematical representation of different waves.	**Sessional Evaluation :** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to understand:	
	1. Design of wave shaping circuits. 2. Functioning of Switching Circuits. 3. Concept of multi-vibrators. 4. Principle and operation of time base generators. 5. various Power Amplifiers and their operation 6. LC tuned amplifiers.	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Design RC circuits for triggering
	CO2	Understand Switching circuits (BJT Inverter, NMOS, PMOS and CMOS switching circuits)
	CO3	Design a Multi-vibrator and Schmitt trigger
	CO4	Analyse Voltage/ Current Sweep Circuits
	CO5	Categorize Power Amplifiers and understand the essence
	CO6	Understand principle and operation of a Tuned amplifiers
Course Content	**UNIT-I** **WAVE SHAPING CIRCUITS**: Types of waveforms, RC low pass and high pass circuits, rise time, tilt. **UNIT-II** **REVIEW OF SWITCHING CIRCUITS**: Diode as a switch,BJT as a switch and switching times, Diode clippers and clampers. **UNIT-III** **MULTIVIBRATORS:** Analysis and Design of Bistable, Monostable, Astable Multivibrators and Schmitt trigger using transistors, triggering methods. **UNIT-IV** **TIME BASE GENERATORS:** RC sweep circuits, constant current Miller and Bootstrap time base generators using BJT's and UJT relaxation oscillator.	

	UNIT-V **TUNED AMPLIFIERS:** Introduction, Q-factor, small signal tuned amplifiers, effect of cascading single tuned amplifier on bandwidth and stagger-tuned amplifiers. **UNIT-VI** **POWER AMPLIFIERS:** Classification of Power Amplifiers, Class-A, Transformer coupled Class-A, cross over distortion, Class-B push-pull amplifier, Distortions in amplifiers.
Text Books & Reference Books	**TEXT BOOKS:** 1. "Pulse & Digital switching waveforms" by J. Milliman& H. Taub McGraw-Hill, 3rd edition 2017. 2. Millman and Halkias,"Integrated Electronics", McGraw-Hill Co 2nd Ed, 2017. **REFERENCE BOOKS:** 1. Solid State Pulse Circuits, by David A. Bell, PHI.4th edition 2008. 2. Boylestad, Louis Nashelsky "Electronic devices and circuits" 11th ed., 2012 PH.
E-Resources	1. http://nptel.ac.in/cources 2. https:// iete-elan.ac.in 3. https://freevideolectures.com/university/iit

20EE31E4-WIND & SOLAR ENERGY SYSTEMS

(EEE)

Course Category:	Professional Elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-practical:**	3-0-0
Pre-requisites:	Generation of electric power, Power Electronics	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	Students undergoing this course are expected to learn: 1.The history and basic concepts of wind power generation 2.The wind generator technologies 3.About the solar resources 4.The design of solar photovoltaic power generating units in various modes. 5. The methods of solar thermal power generation. 6. About interconnected grid issues.	
Course Outcomes:	After completing the course the student will be able to:	
	CO1	Understand concepts of wind power generation
	CO2	Demonstrate the basic aspects of wind energy topologies.
	CO3	Gain knowledge on working principle of solar energy systems.
	CO4	Carry out basic design of solar energy system (Photovoltaic).
	CO5	Acquire the knowledge about the different technologies used to harness solar energy depending on the temperature of operation.
	CO6	Enumerate the electronic devices developed for the integration of renewable energies and different challenges faced in power quality during network integration.
Course Content:	**UNIT-I** **Introduction to wind power:** History of wind power, wind physics, Betz limit, tip speed ratio, stall and pitch control, wind speed statistics, probability distributions, wind speed and power. **UNIT-II** **Wind generator topologies:** Review of modern wind turbine technologies, fixed and variable speed wind turbines, induction generators, doubly-fed induction generators and their characteristics, permanent magnet synchronous generators, power electronics converters. **UNIT-III** **The solar resource:** Introduction, solar radiation spectra, solar geometry, earth sun angles, observer sun angles, solar day length, estimation of solar energy availability. **UNIT-IV** **Solar photovoltaic:** Amorphous, Mono Crystalline, Polycrystalline, V-I characteristics of a PV cell, PV module, PV array, Solar Power Plant, maximum power point tracking (MPPT) algorithms.	

	UNIT-V **Solar thermal power generation:** Technologies, parabolic trough, central receivers, parabolic dish, fresnel, solar pond. **UNIT-VI** **Network integration issues:** Overview of grid code technical requirements, fault ride through for wind farms, real and reactive power regulation, voltage and frequency operating limits, solar PV and wind farm behaviour during grid disturbances, power quality issues.
Text books & Reference books:	**Text books:** 1. "Wind power in power systems", by T. Ackermann, John Wiley and Sons Ltd., 2005. 2."Renewable and efficient electric power systems", by G. M. Masters, John Wiley and Sons, 2004. 3."Solar energy: principles of thermal collection and storage", by S. P. Sukhatme, McGraw Hill, 1984. **Reference books:** 1."Grid integration of wind energy conversion systems", by H. Siegfried and R. Waddington, John Wiley and Sons Ltd., 2006. 2."Renewable Energy Applications", by G. N. Tiwari and M. K. Ghosal, Narosa Publications, 2004. 3."Solar Engineering of Thermal Processes", by J. A. Duffie and W. A. Beckman, John Wiley & Sons, 1991.
e-Resources	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

S.No	OPEN ELECTIVE-I (3)
1	Data Base Management Systems (20CS31O2)
2	Object Oriented Programming Through JAVA (20CS31O4)
3	Embedded Systems (20EC31O4)
4	Fundamentals of Data structures (20CS31O1)

20CS31O2 - DATABASE MANAGEMENT SYSTEMS

Course Category:	Open Elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Knowledge of basic computer programming, Basic mathematical concepts such as sets, functions etc. Students must have taken the introductory course in computer programming	**Sessional Evaluation:** **Univ. Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	• Understand the areas of databases and composition of queries using Structured Query Language • To study various database design models for building applications • Evaluate a business situation while designing a database system	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Identify basic concepts that explores the applications and architectures of database systems.
	CO2	Recognize the Relational Model and the Relational Algebraic operations.
	CO3	Write basic SQL queries.
	CO4	Apply Normalization and construct complex SQL queries.
	CO5	Recognize the basic concepts of transaction & concurrency control techniques.
	CO6	Demonstrate the Security issues of database.
Course Content	**UNIT-I** **Introduction to Databases**: Characteristics of a Database, Advantages, A brief history of database applications, When not to use DBMS. **Overview of Database languages and architectures**: Data models, Schemas and Instances, Three-schema architecture, Data independence, Centralized and Client/Server Architecture for DBMS, Classification of DBMS**.** **UNIT-II** **Data Modeling Using (ER) Model**: High level conceptual data models, Entity types, Entity sets, Attributes, Keys, Relationship types, Weak entity types, ER diagrams, Naming conventions and Design Issues. **Basic Relational Model**: Relational model concepts, Constraints and Relational Database Schemas, Update Operations, Transactions and Dealing with Constraint Violations.	

	UNIT-III **Formal Relational Languages:** Unary relational operations, relational algebra operations, binary relational operations. **Basic SQL:**Data definition and types, specifying constraints, Basic Retrieval Queries, INSERT, UPDATE, DELTE. **UNIT-IV** **Functional Dependencies and Normalization**: Design Guidelines for Relation Schemas,Functional dependencies, First,2nd and 3rd normal forms, Boyce-Codd normal form, Multivalued dependencies (4th normal form), Join dependencies (5th normal form. **UNIT-V** **Introduction to Transaction:**Transaction Processing**,**Transaction and System Concepts, Desirable Properties of Transactions, Characterizing Schedules Based on Recoverability. **UNIT-VI** **Database Security:** Security Issues, Discretionary Access Control based on Granting and Revoking Privileges, Mandatory Access Control and Role Based Access Control for Multilevel Security.
Text Books & References Books	**TEXT BOOKS:** 1. RamezElmasri, and Shamkant B Navathe, Database Systems, 6th edition, Pearson Education,2011 **REFERENCE BOOKS:** 1. Silberschatz A, Korth H F, and Sudarshan S, Database System Concepts, 5th edition, McGraw-Hill, 2006. 2. Ramakrishnan R, and Gehrke J, Database Management Systems, 3rd edition, McGraw-Hill, 2003.
E-Resources	1. https://docs.ccsu.edu/curriculumsheets/ChadTest.pdf 2. https://nptel.ac.in/courses 3. https://freevideolectures.com/university/iitm

20CS31O4 - OBJECT ORIENTED PROGRAMMING THROUGH JAVA

Course Category:	Open Elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Basic knowledge of programming.	**Sessional Evaluation:** **Univ. Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	• Acquire knowledge on basics of Java • Learn the fundamental constructs of string handling functions in Java • Gain knowledge of using inheritance and packages • Explore the knowledge to create Graphical User Interfaces by using event handling mechanisms. • Learn the exception handling mechanisms.	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Understand the basic concepts of Java and control statements.
	CO2	Acquire the knowledge of Classes and Methods
	CO3	Conceptualize the techniques of inheritance and String handling functions.
	CO4	Understand Interfaces and packages in java.
	CO5	Know the Exception Handling mechanisms and thread Programs.
	CO6	Understand the concept of Event Handling mechanisms and its applicability.
Course Content	**UNIT-I** **Java Basics:** Buzz words, Data types, Variables and Arrays **Operators:** Arithmetic, Bitwise, Relational, Boolean, Assignment, Ternary, Precedence and Associativity. **Control statements:** Selection, Iteration and Jump statements **UNIT-II** **Classes:** Fundamentals, Assigning Object Reference Variables, Constructors, Garbage collection. **Methods:** Overloading of Methods, Passing Objects as Parameters, Argument Passing, Returning Objects, Recursion, Access Control, Static, Final, Variable-length Arguments.	

	UNIT-III **String Handling:** Constructors, length(), Special String Operations, Character Extraction, String Comparison – equals(), equalsIgnoreCase(), startsWith(), endsWith(), Deep Vs Shallow comparisons, String Buffer – constructors, length(), capacity(), reverse() and replace(). **Inheritance:** Basics, use of super keyword, Method overriding, Dynamic method dispatch, Using final with Inheritance. **UNIT-IV** **Interfaces:** Definitions and Implementations, Nested and Applying Interfaces, Variables in interfaces, Extending interfaces, Default and Static Interface Methods. **Packages:** Basics, Member Access, Importing Packages. **UNIT-V** **Exception Handling:** Fundamentals, Types, Uncaught Exceptions, Usage of try and catch clauses, Multiple catch clauses, throw, throws and finally keywords. **UNIT-VI** **Event Handling:** Delegation Event Model, Event Classes, KeyEvent Class, Listener Interfaces, Handling Mouse Events, usage of delegation model, Adapter Classes, Inner Classes.
Text Books & References Books	**TEXT BOOKS:** 1. Java: The Complete Reference, 10th Edition, Herbert Schildt TMH. **REFERENCE BOOKS:** 1. Understanding Object-oriented Programming with Java, Timothy Budd, Addison Wesley. 2. Object-Oriented Programming and Java, Danny Poo, Derek Kiong, Swarnalatha Ashok, Second Edition, Springer. 3. Object-Oriented Programming using Java, Simon Kendal, Simon Kendal &Ventus Publication Aps.
E-Resources	1. https://nptel.ac.in/courses 2. https://freevideolectures.com/university/iitm

20EC31O4-EMBEDDED SYSTEMS

Course category:	Open Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 0 - 0
Prerequisite:	Digital Electronics, Microprocessors, Microcontrollers.	**Sessional Evaluation :** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to understand:	
	1. The basic idea regarding the nature of embedded systems 2. The hardware aspects of modern Microcontrollers. 3. Basic Microcontroller Programming. 4. Serial Communication Protocols. 5. Learning to control Analog devices in Embedded Systems. 6. IOT working principles.	
Course Outcomes	Upon successful completion of the course , the students will be able to:	
	CO1	Highly competitive on the national and international job market, both in the industry as high - skilled expert. After studies, the students will be able to make a career as e.g., engineers, project leaders, system architects, programmers or researchers in the fields of e.g., automotive industry, robotics, telecom, industrial process control, consumer electronics etc
	CO2	Able to acquire knowledge and understand fundamental embedded systems design paradigms, architectures, possibilities and challenges, with respect to both software and hardware.
	CO3	Able to analyze a system both as whole and in the included parts, to understand how these parts interact in the functionality and properties of the system.
	CO4	Able to practically apply gained theoretical knowledge in order to design, analyse and implement embedded systems, e.g. integrating embedded subsystems and applications in building a fully functional autonomous robot.
	CO5	Apply formal method, testing, verification, validation and simulation techniques and tools in order to engineer reliable and safe embedded systems.
	CO6	Demonstrate a deeper understanding of the electronics and physical principles used for embedded biomedical measuring systems.
	UNIT-I **INTRODUCTION TO EMBEDDED SYSTEMS:** Embedded system overview and applications, features and architecture considerations-ROM, RAM, timers, data and address bus, Memory and I/O interfacing concepts, memory mapped I/O. CISC vs RISC design philosophy, Von-Neumann Vs Harvard architecture, instruction set, instruction formats, and various addressing modes of 32-bit. Fixed point and floating point arithmetic operations.	

Course Content	**UNIT – II** **INTRODUCTION TO ADVANCED MICROCONTROLLERS:** Introduction ARM architecture and Cortex – M series, Introduction to the Tiva family viz. TM4C123x & **TM4C129x** and its targeted applications, Tiva block diagram, address space, on-chip peripherals (analog and digital) Register sets, Addressing modes and instruction set basics. **UNIT – III** **MICROCONTROLLER FUNDAMENTALS FOR BASIC PROGRAMMING:** I/O pin multiplexing, pull up/down registers, GPIO control, Memory Mapped Peripherals, programming System registers, Watchdog Timer, need of low power for embedded systems, System Clocks and control, Hibernation Module on Tiva, Active vs Standby current consumption. Introduction to Interrupts, Interrupt vector table, interrupt programming. **UNIT – IV** **TIMERS, PWM AND MIXED SIGNALS PROCESSING:** Timer, Basic Timer, Real Time Clock (RTC), Timing generation and measurements, Analog interfacing and data acquisition: ADC, Analog Comparators, DMA, Motion Control Peripherals: PWM Module & Quadrature Encoder Interface (QEI). **UNIT – V** **COMMUNICATION PROTOCOLS AND INTERFACING WITH EXTERNAL DEVICES:** Synchronous/Asynchronous interfaces (like UART, SPI, I2C, USB), serial communication basics, baud rate concepts, Interfacing digital and analog external device, I2C protocol, SPI protocol & UART protocol. Implementing and programming I2C, SPI & UART, CAN & USB interfaces. **UNIT-VI** **EMBEDDED NETWORKING AND INTERNET OF THINGS:** Embedded Networking fundamentals, Ethernet, TCP/IP introduction IoT overview and architecture, Overview of wireless sensor networks and design examples. Various wireless protocols and its applications: NFC, ZigBee, Bluetooth, Bluetooth Low Energy, Wi-Fi.
Text Books and Reference Books	**TEXT BOOKS :** 1. Shibu K.V.: Introduction to Embedded Systems, Tata McGraw Hill, 2009 2. Tim Wilmshurst: An introduction to the design of small-scale embedded systems, Palgrave, 2001. **REFERENCE BOOKS :** 1.Device data sheets of ARM/PSoC/MSP430
E-Resources	nptel.ac.in/courses/117105079/

20CS31O1 - FUNDAMENTALS OF DATA STRUCTURES

Course Category:	Open Elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Knowledge in programming languages.	**Sessional Evaluation:** **Univ. Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	• Master the implementation of linked data structures such as linked lists and binary trees. • Familiar with advanced data structures such as balanced search trees and priority queues. • Familiar with several sorting algorithms including quick sort, and merge sort. • Familiar with some graph traversals like DFS, BFS.	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Understand concepts of Data Structures and Learn sorting & searching techniques.
	CO2	Implement stacks and queues using arrays.
	CO3	Gain knowledge in Linked lists and types.
	CO4	Understand the concepts of Binary trees, Binary search trees and Graphs.
	CO5	Explore the basics of balanced search trees - AVL trees, Splay trees.
	CO6	Acquire knowledge in B-Trees and Hash tables.
Course Content	**UNIT-I** **Introduction to Data Structures:** Primitive, non-primitive, Linear, non-linear **Searching:** Linear Search and Binary Search. **Sorting Techniques:** Bubble Sort, Selection Sort, Quick sort, Merge sort, Insertion Sort, Sorting Efficiency. **UNIT-II** **Stacks:** Introduction, Stack operations, Implementation of Stacks using Arrays **Applications:** Conversion from Infix to Postfix notation, Evaluation of Postfix Expression **Queues**: Introduction, operations on Queues, Circular Queues, Priority Queues, Double Ended Queues (deques).	

	UNIT-III **Linked Lists:** Introduction, Linked List Operations, **Types:** Singly, Doubly and Circularly Linked Lists. **Applications:** Stacks and Queues implementation using linked list. **UNIT-IV** **Tree**: Definition, Representation. **Binary Tree**: Definition and Properties, Representation, Tree traversals. **Binary Search Tree**: Definition and Properties, applications. **Graphs:** Introduction, Basic terminologies, Representation, Graph traversals. **UNIT-V** **Balanced Search Trees:** AVL trees: Definition, operations. **Red-Black Trees:** Definition, Representation and operations. **UNIT-VI** **B-Trees**: Indexed Sequential Access Method (ISAM), m-way search trees, B-trees of order m, Height of B-Tree, Insertion and Deletion from B-Tree. **Hash Tables**: Dictionaries, Hash Table Structure, Hash Functions.
Text Books & References Books	**TEXT BOOKS:** 1. Computer Programming and Data Structures by E. Balagurusamy, 4/e, McGraw Hill. 2. Data Structures and Algorithms – concepts, Techniques and Applications by G A V Pai, McGraw Hill. **REFERENCE BOOKS:** 1. C Programming & Data Structures, B. A. Forouzan and R. F. Gilberg, Third Edition, Cengage Learning. 2. An Introduction to Data structures with applications: Tremblay J P and Sorenson P G.
E-Resources	1. https://nptel.ac.in/courses 2. https://freevideolectures.com/university/iitm

20SH31SC-COMMUNICATION AND SOFT SKILLS

(Common to CSE, IT, AI&DS, & EEE)

Course Category:	Basic Sciences	**Credits:**	2
Course Type:	Skill Oriented	**Lecture-Tutorial-Practical:**	1-0-2
Pre-requisite:	Basic Level of LSRW skills	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected : 1. To acquire soft skills and use them effectively in a realistic professional work places. 2. To improve analytical abilities to think on a particular given topic 3. To develop interview skills 4. To learn writing a standard resume	
Course Outcomes	Upon successful completion of the course, the students will able to:	
	CO1	Define group discussion skills.
	CO2	Demonstrate effective résumés and job applications.
	CO3	Develop various skills for attending interviews.
	CO4	Classify intrapersonal and interpersonal relationship skills.
	CO5	Interpret personality development skills and put them in practice.
	CO6	Improve personal and professional grooming, business dressing and telephonic skills.
Course Content	**1. Group Discussion**: Dynamics of Group Discussion - Voice Modulation - Fluency and Coherence - Body Language - Summarizing **2. Résumé Writing:** Structure - Defining the Career Objective - Projecting one's Strengths and Skills - Formats and Styles - Cover Letter **3. Interview Skills:** Concept and Process - Pre-Interview Planning - Opening Strategies - Answering Strategies - Interviews through Online Platforms	

	4. Intrapersonal & Interpersonal Relationship Skills: Importance - Intrapersonal Vs. Interpersonal Relationship Skills - Team work at work places **5. Personality Development Skills** : Assertiveness - Positive Attitude - Self Confidence- Problem Solving Skills - Leadership Skills **6. Corporate Etiquettes:** Dressing Etiquette- Dining Etiquette – Telephonic Etiquette
	REFERENCE BOOKS: 1. Effective Technical Communication, M. Ashraf Rizvi, Tata Mc. Graw-Hill Publishing Company Ltd. 2. A Course in English communication, Madhavi Apte, Prentice-Hall of India, 2007. Communication Skills, Leena Sen, Prentice-Hall of India, 2005. 3. Academic Writing- A Practical guide for students, Stephen Bailey, Rontledge Falmer, London & New York, 2004. 4. Soft Skills, Dr K. Alex, S. Chand Publications, New Delhi. 5. A Textbook of English for Engineers and Technologists (combined edition, Vol. 1 &; Orient Black Swan 2010.

20MC3101-ENTREPRENEURSHIP

(Common to EEE,CSE, IT, AI &DS)

Course Category:	Mandatory Course	**Credits:**	0
Course Type:	Theory	**Lecture - Tutorial - Practical:**	2 -0- 0
Pre-requisite:	General Business awareness	**Sessional Evaluation :** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	The students develop and can systematically apply an entrepreneurial way of thinking that will allow them to identify and create business opportunities that may be commercialized successfully.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Understand/ Overview of Entrepreneurship
	CO2	Know the methods of generating ideas
	CO3	Understand the concept of Business planning
	CO4	Understand managing the new venture
	CO5	Know the production and marketing management
	CO6	Know the financial assistance to Enterprise
Course Content	**UNIT – I** **Introduction to Entrepreneurship**: Definition of Entrepreneur, Entrepreneurial Traits, Entrepreneur vs. Manager, Entrepreneur vsIntrapreneur,Opportunities for Entrepreneurs in India and abroad, Woman as Entrepreneur, Role of Entrepreneurship in economic development. **UNIT – II** **Creating the Ideas and Starting the Venture**: Sources of new Ideas, Methods of generating ideas, creating problem solving. Features and evaluation of joint ventures, acquisitions, merges, franchising, Public issues, rights issues, and bonus issue sand stock splits. **UNIT – III** **Business planning process:** Meaning of business plan, Business plan process- Writing ,evaluation and implementation of business plan , advantages of business planning , Business model canvas **UNIT – IV** **Managing the new venture**: Sources of capital, venture capital, Record keeping, recruitment, motivating and leading teams, **UNIT – V** **Production & Marketing management**: Thrust of production management, selection of production techniques, Marketing functions, market segmentation, market research.	

	UNIT – VI **Organization Assistance:** Industrial Park (Meaning, features, & examples),Special Economic Zone (Meaning, features & examples), Financial assistance by different agencies (SIDBI, DIC , NSTEDB, APPC etc.), MSME Act Small Scale Industries,
Assignment	All students (Maximum batch size 5) need to submit a business plan on any entity as per the norms of any financial agency
TEXT BOOKS **&** **REFERENCE BOOKS:**	**TEXT BOOKS:** 1.Entrepreneurship : Robert Hisrich, & Michael Peters, 5th ed., TMH., 1986 2.Entrepreneurship: Dollinger, Pearson, 4th ed., 2004. **REFERENCE BOOKS:** 1. Dynamics of Entrepreneurial Development and Management, Vasant, 2009. 2. Harvard Business Review on Entrepreneurship. HBR Paper Back, 1999. 3. Entrepreneurial Management, Robert J.Calvin, TMH, 2004. 4. Essential of Entrepreneurship and small business management, Thomas W. Zimmerer& Norman M. Scarborough, 4th ed., PHI, 2005 5. Industrial Relations &Labour Laws, Srivastava, Vikas, 2005.
E-Resources	1.https://nptel.ac.in/courses 2.https://freevideolectures.com/university/iitm

20EE31P1-CONTROL SYSTEMS & SIMULATION LAB

Course Category:	Professional core	**Credits:**	1.5
Course Type:	Laboratory	**Lecture-Tutorial-Practical:**	0-0-3
Pre-requisite:	Control systems, Electrical Machines, Microprocessors and MATLAB Software	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	To make the student learn about: 1. The design and analysis of compensators. 2. The frequency & time domain specifications of network. 3. The Speed control of various DC & AC motors. 4.The characteristics of synchros 5.The design of controllers using MATLAB 6.To write the programme to find frequency & time domain specifications of network using MATLAB	
Course Outcomes	After completing the course the student will be able to:	
	CO1	Apply appropriate compensator circuits experimentally.
	CO2	Analyse time and frequency specifications of network
	CO3	Examine the characteristics of various motors
	CO4	Enumerate the speed control of various motors using microprocessors.
	CO5	Demonstrate the usage of MATLAB in control system.
	CO6	Design the controllers.
Course Content:	Minimum of 10 experiments to be conducted out of the following: **LIST OF EXPERIMENTS** 1. Characteristics of Lag and Lead compensators. 2. Frequency response Specifications 3. Time response of first and second order System. 4. Characteristics of Synchros 5. Speed control of Stepper Motor 6. Speed control of DC Servo Motor 7. Root Locus & Bode plot for a given Transfer Function using MATLAB. 8. Simulation of P, PI and PID Controllers using MATLAB 9. AC Servo motor speed-torque characteristics 10. Polar & Nyquist plot for a given Transfer Function using MATLAB. 11. Testing of observability and controllability using MATLAB 12. Conversion of State Space Representation to Transfer function and vice-versa using MATLAB	

20EE31P2-ELCTROMECHANICAL ENERGY CONVERSION –II LAB

Course Category:	Professional Core	**Credits:**	1.5
Course Type:	Laboratory	**Lecture-Tutorial-Practical:**	0-0-3
Pre-requisite:	Electrical machines	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	Students undergoing this course are expected to learn:	
	1. About three phase transformers connections. 2. To connect the A.C windings for different pole machines. 3. The performance characteristics of three phase Induction motor 4. To obtain equivalent circuit characteristics of single phase induction motor. 5. To obtain voltage regulation of alternators. 6. Performance of synchronous motor.	
Course Outcomes:	Upon successful completion of the course, the students will able to:	
	CO1	Distinguish the regulation of alternators by various methods experimentally.
	CO2	Connect and verify the A.C winding connections of different pole machines
	CO3	Calculate the performance of A.C motors
	CO4	Obtain X_d& X_q parameters experimentally
	CO5	Apply the parallel operation of alternators
	CO6	Obtain V and Inverted V curves of synchronous motor experimentally.
Course Content:	Minimum of 10 experiments to be conducted out of the following: **LIST OF EXPERIMENTS** 1. 3-Ø to 2-Ø conversion using Scott connection. 2. 3-Ø transformer connections 3.2-pole and 4-pole winding connections of three phase Induction motor. 4. Circle diagram of 3-Ø induction motors 5. Equivalent circuit of 3-Ø induction motor 6. Load test on 3-Ø induction motor 7. Equivalent circuit of 1-Ø induction motor 8.Voltage regulation of an alternator using synchronous impedance and MMF method 9. Voltage regulation of an alternator using ZPF Method 10. Slip test 11. Parallel operation of two alternators 12. V and inverted V curves of synchronous motor	

NBKR INSTITUTE OF SCIENCE & TECHNOLOGY:: VIDYANAGAR (AUTONOMOUS)
(AFFILIATED TO JNTUA:: ANANTAPUR)
SPSR NELLORE DIST
III YEAR OF FOUR YEAR B.TECH DEGREE COURSE – II SEMESTER
ELECTRICAL AND ELECTRONICS ENGINEERING
SCHEME OF INSTRUCTION AND EVALUATION
(With effect from the academic year 2022-2023)
(For the batch admitted in the academic year 2020-2021)

S.No	Course Code	Course Title	Instruction Hours/Week			Credits	Evaluation									
							Sessional Test-1			Sessional Test-2			Total Sessional Marks (Max. 40)	End Semester Examination		Maximum Total Marks
		THEORY	L	T	D/P		Test-1 (2 Hr)	Assign-1	Max. Marks	Test-2 (2 Hr)	Assign-2	Max. Marks		Duration In Hours	Max. Marks	100
1	20EC3204	Microprocessors & Interfacing	3	-	-	3	34	6	40	34	6	40	0.8*Best of Two + 0.2*Least of Two	3	60	100
2	20EE3201	Electrical and Electronic Measurements	3	-	-	3	34	6	40	34	6	40		3	60	100
3	20EE3202	Power systems-III	3	-	-	3	34	6	40	34	6	40		3	60	100
4		**Professional Elective –II**	3	-	-	3	34	6	40	34	6	40		3	60	100
5		**Open Elective-II**	3	-	-	3	34	6	40	34	6	40		3	60	100
6	20IT32SC	Mobile App development Laboratory	1	-	2	2	-	-	-	-	-	-	Day to Day Evaluation and a test (40 Marks)	3	60	100
		PRACTICALS														
7	20EC32P4	Microprocessors & Interfacing Lab	-	-	3	1.5	-		-	-		-	Day to Day Evaluation and a test (40 Marks)	3	60	100
8	20EE32P1	EEM Lab	-	-	3	1.5	-		-	-		-		3	60	100
9	20CS32P2	PSS Lab	-	-	3	1.5	-		-	-		-		3	60	100
		MANDATORY														
10	20MC3201	Advanced Aptitude & Reasoning Skills @	3	-	-	-	34	6	40	34	6	40	0.8*Best of Two + 0.2*Least of Two	3	60	100
		TOTAL				**21.5**										

(***:** Common to all; **#**: Common to CE, ME, ECE & EEE; ******: Common to EEE & CSE $: Common to ECE&EEE; **@** : Common to EEE, CSE,IT,AI&DS)

20EC3204-MICROPROCESSORS AND INTERFACING

Course Category:	Professional core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 0- 0
Pre-requisite:	Computer architecture and Basic programming.	**Sessional Evaluation :** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to learn: 1. The evaluation of different types of microprocessors and features of 8085 µp along with memory interfacing. 2. The microprocessor 8085 internal architecture and its operation within the area of manufacturing and performance. 3. The knowledge on internal architecture of 8086µp and its modes of operations along with timing diagrams. 4. The Microprocessor I/O ports in order to interface the processor to external devices. 5. The different peripherals are interfaced with 8086 using DAC & ADC. 6. The different peripherals are interfaced with 8086 µc and develop hardware projects.	
Course Outcomes	Upon successful completion of the course , the students will be able to:	
	CO1	Understand the evaluation of different types of microprocessors and features of 8085 µp along with memory interfacing.
	CO2	Assess and solve basic binary math operations using the microprocessor and explain the microprocessor 8085 internal architecture and its operation within the area of manufacturing and performance.
	CO3	Gain the knowledge on internal architecture of 8086µp and its modes of operations along with timing diagrams.
	CO4	Design electrical circuitry to the Microprocessor I/O ports in order to interface the processor to external devices.
	CO5	Illustrate how the different peripherals are interfaced with 8086 using DAC & ADC.
	CO6	Illustrate how the different peripherals are interfaced with 8086 µc and develop hardware projects.
Course Content	**UNIT-I** **INTRODUCTION TO MICROPROCESSORS:** Types of microprocessors, Features of 8085 microprocessor, Architecture of 8085 microprocessor, pin configuration, Register set, Instruction Cycle, Timing Diagrams, Stack and Subroutines. **UNIT-II** **INSTRUCTION SET OF 8085 MICROPROCESSORS:** Addressing modes, Assembly Language Programs (8085) for addition, subtraction, multiplication, division etc., Interrupts of 8085, Memory interfacing of 8085 microprocessor. **UNIT-III** **ARCHITECTURE OF 8086 MICROPROCESSOR:** Architecture, pin description, Instruction set, Addressing modes, Interrupt system. Minimum mode and Maximum mode operations of 8086 and its timing diagrams, Assembler directives, Assembly language programs (8086).	

	UNIT- IV **Programmable peripheral IC's:** Programmable Communication Interface 8251,pin diagram, modes of operation and interfacing diagram with 8085/8086, Programmable Interrupt Controller (8259) , pin diagram, modes of operation and interfacing diagram with 8085/8086, Programmable DMA controller (8257) pin diagram, modes of operation and interfacing diagram with 8085/8086. **UNIT-V** **Programmable peripheral IC's:** Programmable Interval Timer (8253), pin diagram, modes of operation and interfacing diagram with 8085/8086,PPI (8255), pin diagram, modes of operation and interfacing diagram with 8085/8086, ADC and DAC pin diagram,operation and its Interfacing. **UNIT-VI** **MEMORY INTERFACING TO 8086:** Interfacing various types of RAM and ROM chips, Waveform generation, Traffic light controller, Stepper motor control, temperature measurement and control.
Text Books & Reference Books	**TEXT BOOKS:** 1. Ram. B, "Fundamentals of Microprocessors and Micro controllers", Dhanpat Rai publications. 2. Douglas V. Hall, "Microprocessors and interfacing: Programming and hard ware", TMH, 2nd edition. **REFERENCES BOOKS:** 1. A.K. Ray and K.M. Bhurchandi, "Advanced Microprocessors and Peripherals", TMH. 2. "Microprocessor Architecture, Programming, and Applications with the 8085" by Ramesh S. Gaonkar", Prentice Hall of India. 3. Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Prentium Proprocessor, Pentium II, III, IV by Barry B.Brey.
E-Resources	1.http://w3.ualg.pt/~jmcardo/ensino/ihs2004/Benner93.pdf 2.http://engreric.com/wpcontent/uploads/2014/06/Syllabus_CECS346_Fall15.pdf

20EE3201-ELECTRICAL & ELECTRONIC MEASUREMENTS
(EEE)

Course Category:	Professional core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Basic electrical sciences, principle's of energy conversion, EDC	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	Students undergoing this course are expected to learn :	
	1. The various potentiometers and bridges (both DC & AC). 2. The working principle of indicating instruments and integrating instruments. 3. About the instrument transformers and power factor meters. 4. The working of different types of oscilloscopes 5. The working of digital voltmeters, multimeter, tachometer and phase meter. 6. About the various transducers and the data acquisition systems	
Course Outcomes:	After completing the course the student will be able to	
	CO1	Understand the basics of measurements and working of PMMC & moving iron meters.
	CO2	Empathize various types of indicating instruments and integrating instruments, requirement of calibrations and instruments with errors in measurement etc.
	CO3	Understand the working of DC and AC potentiometers and the working principle of instrument transformers.
	CO4	Understand the working of CRO, the different types of oscilloscopes and ability to measure voltage, current, frequency and phase with Oscilloscope.
	CO5	Discriminate different bridges used for measurement of resistance, capacitance and inductance.
	CO6	Understand about different transducers and their working principles.

Course Content:

UNIT-I

Introduction to Measuring Instruments: Classification – deflecting, control and damping torques .

PMMC, moving iron type instruments – expression for the deflecting torque and control torque – Errors and compensations, extension of range using shunts and series resistance.

UNIT-II

Measurement of Power & Energy: Single phase dynamometer wattmeter, LPF and UPF, Double element wattmeter, expression for deflecting and control torques – Extension of range of wattmeter using instrument transformers.

Power Factor meters: Type of P.F. Meters – dynamometer and moving iron type

Single phase induction type energy meter – driving and braking torques – errors and compensations – testing by phantom loading .

UNIT-III

Potentiometers & Instrument transformers: Principle and operation of D.C. Crompton's potentiometer – standardization – Measurement of unknown resistance, current, voltage. A.C. Potentiometers: polar and coordinate type's standardization – applications.

CT and PT – Ratio and phase angle errors

	UNIT-IV **Cathode Ray Oscilloscope:** Block diagram of CRO, CRT, Electrostatic focusing, Electrostatic deflection sensitivity, Time Base generators, Oscilloscope amplifiers– Basic CRO Circuits, Observation of waveform on CRO, Principle of operation of Dual beam, Dual trace, Sampling and Storage CROs – Measurements with CRO (voltage, current, frequency, phase angle, Lissajous figures). **UNIT-V** **DC & AC bridges**: Method of measuring low, medium and high resistance – sensitivity of Wheat-stone's bridge, Kelvin's double bridge for measuring low resistance. **Measurement of inductance**- Maxwell's bridge, Hay's bridge, Anderson's bridge. **Measurement of capacitance** –Desaunty's Bridge - Wien's bridge – Schering Bridge. **Digital instruments:** Digital voltmeters-Ramp- Dual slope- stair case- successive approximation types- Digital multimeter - Digital tachometer- Digital phase meter- LCR meter. **UNIT-VI** **Transducers:** Definition of transducers, Classification of transducers, Advantages of Electrical transducers, Characteristics and choice of transducers; Principle operation of LVDT and capacitor transducers, LVDT Applications, Strain gauge and its principle of operation, gauge factor, Thermistors, Thermocouples, Piezo electric transducers.
Text Books & Reference Books:	**TEXT BOOKS:** 1. "Electrical and Electronics Measurements and Instrumentation", Prithwiraj Purkait, Tata McGraw Hill, 2013. 2. "Electrical & Electronic Measurements and Instrumentation", A.K. Sawhney, Dhanpath Rai& Co (P) Ltd, 2004. 3. Electrical Measurements and measuring Instruments – by E.W. Golding and F.C. Widdis, 5th Edition Reem publication,2011. **REFERENCE BOOKS:** 1. "Electrical Measurements and Measuring Instruments", Rajendra Prasad, Khanna publications,1984. 2. "Electrical and Electronics Measurements", R.K.Rajput, S.Chand publications. 3. Electrical Measurements: Fundamentals, Concepts, Applications – by Reissland, M.U, New Age International (P)Limited,2010.
e-Resources:	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

20EE3202-POWER SYSTEMS-III

(EEE)

Course Category:	Professional core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	PS-I & PS-II	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	To make the student learn about: 1. The concept of system modelling and per unit representation. 2. The steady-state analysis for a balanced three-phase power system. 3. The modelling of the networks in terms of symmetrical components and sequence network. 4.The necessity of load flow studies and the solution using GS method 5.The different methods of power flow solutions. 6. The different numerical integration methods and factors influencing stability.	
Course Outcomes:	After completing the course the student will be able to:	
	CO1	Understand the concept of system modelling and per unit representation.
	CO2	Analyze a network under symmetrical faults condition
	CO3	Model the networks in terms of symmetrical components and sequence networks.
	CO4	Explain the necessity of power flow studies and the solution using GS method
	CO5	Explain different methods of power flow solutions.
	CO6	Demonstrate different numerical integration methods and factors influencing stability.
Course Content:	**UNIT- I** **System modelling:** Representation of transmission lines-circuit representation of synchronous machine-two winding transformers-Per unit representation and advantages-single line diagram representation-impedance and reactance diagrams-changing the base of per unit quantities. **UNIT – II** **Symmetrical fault analysis:** Introduction, transients on transmission line, short circuit of a synchronous machine on no load, short circuit of a loaded synchronous machine-selection of circuit breakers. **UNIT – III** **Symmetrical components:** Introduction, symmetrical component transformation, sequence impedances of transmission lines, sequence impedance and sequence network of power system: synchronous machine, transmission line and transformers-construction of sequence network of a power system. **Unsymmetrical fault analysis:** Introduction, symmetrical component analysis of unsymmetrical faults, single-line-to-ground (LG) fault, line-to-line (LL) fault, double line-to-ground (LLG) fault, open conductor faults.	

Course Content:	**UNIT – IV** **Power flow Studies-I:** Necessity of power flow studies, data for power flow studies, derivation of static load flow equations, load flow solutions using Gauss Seidel method, acceleration factor, load flow solution with and without PV buses, algorithm and flowchart, numerical load flow solution for simple power systems (max. 3-buses), determination of bus voltages, injected active and reactive powers (sample one iteration only) and finding line flows/losses for the given bus voltages. **UNIT – V** **Power flow studies-II:** Newton Raphson method in rectangular and polar co-ordinates form, power flow solution with & without PV buses- derivation of Jacobian elements, algorithm and flow chart, decoupled and fast decoupled methods, comparison of different power flow methods. **UNIT – VI** **Power system stability:** Introduction, dynamics of a synchronous machine, power angle equation, node elimination techniques, simple systems, steady state stability, transient stability, equal area criterion, numerical solution of swing equation.
Text books & Reference books:	**Text books:** 1. "Modern power system analysis", by D.P Kothari and I J Nagarath.TMH, 4th Edition. 2. "Power system analysis and design", by B.R.Gupta Wheelers publishing, 6th Edition. **Reference books:** 1. "Elements of power system analysis", by John J. Grainger and William D.Stevenson , Jr TMH. 2. "Electrical power system", by C.L.Wadhwa New Age publications, 6th Edition.
e-Resources	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

S.No	PROFESSIONAL ELECTIVE-II (3)
1	Electrical Machine Design **(20EE32E1)**
2	HVDC Transmission systems **(20EE32E2)**
3	Modern Control Theory **(20EE32E3)**
4	Power semiconductor Drives **(20EE32E4)**

20EE32E1-ELECTRICAL MACHINE DESIGN

(EEE)

Course Category:	Professional Elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Electrical Machines	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	Students undergoing this course are expected to learn:	
	1. The principles of design of static and rotating machines. 2. To design armature and field systems for D.C machines 3. To design stator and rotor of induction machines. 4.To design stator and rotor of synchronous machines and study their thermal behavior. 5. To design core, yoke, windings and cooling systems of transformers. 6. The modes of heat dissipation and cooling methods.	
Course Outcomes:	After completing the course the student will be able to	
	CO1	Understand the importance of design of machines based on their applications.
	CO2	Demonstrate the design of various parts of D.C machines and solve the problems of design.
	CO3	Enumerate the design concepts of induction motors.
	CO4	Design the concepts of synchronous machines and solve the problems related to design
	CO5	Gain knowledge on the concepts of three phase transformer.
	CO6	Analyse the modes of heat dissipation and cooling methods
Course Content:	**UNIT I** **Basic considerations:** Basic concept of design, limitation in design, standardization, modern trends in design and manufacturing techniques, classification of insulating materials, general concepts in designing rotating machines. **UNIT II** **Design of DC machines:** Output equation, choice of specific loading and choice of number of poles, design of main dimensions of D.C machines, design of armature slot dimensions, commutator and brushes, magnetic circuit, estimation of ampere turns, design of yoke and poles, main and inter poles, field windings, shunt, series and inter poles **UNIT III** **Design of induction motors:** Output equation, choice of specific loadings, main dimensions of three phase induction motor, stator winding design, choice of length of the air gap, estimation of number of slots for the squirrel cage rotor, design of rotor bars and end ring, design of slip ring induction motor, estimation of no load current and leakage reactance and circle diagram.	

	UNIT IV **Design of synchronous machines:** Output equation, choice of specific loadings-short circuit ratio, design of main dimensions, armature slots and windings, slot details for the stator of salient and non- salient pole synchronous machines, design of rotor of salient pole synchronous machines, magnetic circuits, dimensions of the pole body, design of the field winding, and design of rotor of non- salient pole machine, introduction to computer aided design. **UNIT V** **Design of transformers:** Output equation for single phase, choice of specific loadings, expression for volts/turn, determination of main dimensions of the core, types of windings and estimation of number of turns and conductor cross sectional area of primary and secondary windings, estimation of no load current, expression for leakage reactance and voltage regulation, design of tank and cooling tubes (round and rectangular). **UNIT VI** **Heating and cooling**: Modes of heat dissipation & temperature rise time curves, methods of cooling ventilation (induced & forced, radial & axial), direct cooling& quantity of cooling medium calculation of total MMF and magnetizing current, specific permeance and leakage reactance.
Text books & Reference books:	**Text books:** 1."A course in electrical machine design", by A.K. Sawhney, DhanpatRai& Sons. 2."Design of electrical machines", by V.N. Mittle, 4^{th} Edition. **Reference books:** 1."Performance and design of A.C machines", by M.G. Say, CBS publishers and Distributors Pvt Ltd. 2."Design data handbook", by A.Shanmugasundarm, G,Gangadharam & R.Palani, Wiley Eastern Ltd.
e-Resources:	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

20EE32E2-HVDC TRANSMISSION SYSTEMS

Course category:	Professional Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 0 - 0
Pre-requisite:	Power Electronics, Converters and Power Systems	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	Students undergoing this course are expected to:	
	1. Learn the concept of HVDC Transmission system. 2.Learn the HVDC converters. 3. Learn converter system control. 4.Learn about D.C line and fault prevention. 5. Learn about the importance of reactive power. 6. Learn the harmonics in the system and their prevention.	
Course Outcomes:	Upon successful completion of the course, the students will be able to:	
	CO1	Develop the knowledge of HVDC transmission over conventional A.C transmission
	CO2	Analyze different converters viz.3,6 and 12 pulse converters.
	CO3	Understand different control schemes as well as starting and stopping of D.C links
	CO4	Understand the nature of faults happening on both the A.C and D.C sides of the converters and formulate protection schemes for the same.
	CO5	Analyse about reactive power requirement.
	CO6	Analyze the different harmonics generated by the converters and their variation with the change in firing angles.
Course Content:	**UNIT-I** **D.C power transmission technology:** Introduction, comparison of A.C & D.C transmission, application of D.C transmission, description of D.C transmission system, planning of HVDC transmission, modern trends in HVDC technology. **UNIT-II** **Analysis of HVDC converters:** Pulse number, choice of converter configuration, simplified analysis of graetz circuit, converter bridge characteristics, characteristics of twelve pulse converter, detailed analysis of six pulse converter. **UNIT-III** **Converter and HVDC system control:** Principles of D.C link control, converter control characteristics, system control hierarchy, firing angle control, current and excitation angle control, starting and stopping of D.C link, power control, higher level controllers.	

	UNIT-IV **Converter faults and protection:** Protection against over currents, over voltages in a converter station, surge arresters, protection against over voltages. **Smoothing reactor and D.C Line:** Smoothing reactors, D.C line, transient over voltages in D.C line, protection of D.C line, D.C breakers, monopolar operation. **UNIT-V** **Reactive Power Control:** Reactive power requirements in steady state, Sources of reactive power, Static VAR systems, Reactive power control during transients. **UNIT – VI** **Harmonics and Filters:** Generation of harmonics, design of AC filters, DC filters, active filters, carrier frequency and RI noise.
Text books & Reference books:	**TEXT BOOKS:** 1. "HVDC Power Transmission System", by K.R Padiyar, New academic science Ltd publication, 3rd Edition. 2. "EHV-AC &HVDC Transmission Engineering & Practice", by S. Rao, Khanna publication, 3rd Edition,. **REFERENCE BOOKS:** 1. "Direct current Transmission", by Edward Wilson Kimbark, Wiley Inter science, Volume-I. 2. "HVDC Power Transmission", by S.Kamakshaiah &V.Kamaraju, Tata Mcgraw Hill publishers.
e-Resources:	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

20EE32E3-MODERN CONTROL THEORY

(EEE)

Course Category:	Professional core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Control systems, circuits and networks, Mathematics	**Sessional Evaluation:** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	Students undergoing this course are expected to learn :	
	1.To derive mathematical models of typical engineering processes 2. To provide basic knowledge of control system analysis and design tools. 3.To Introduce the concepts of controllability and observability 4. To provide knowledge on analysis of non-linear systems using describing function analysis 5. To analyze non-linear systems using Liapunov function and design Liapunov functions 6. To provide basic knowledge on controllers and compensators design.	
Course Outcomes:	Upon successful completion of the course , the students will be able to:	
	CO1	Design compensators.
	CO2	Design P, PI and PID controllers
	CO3	Perform different system representations and examine the system controllability and observability
	CO4	Understand the concept of state transition matrix and design state feedback controller and observer.
	CO5	Enumerate the basic idea of non-linearities and stability analysis.
	CO6	Apply different techniques for non-linear systems stability analysis
Course Content:	**UNIT-I** **Linear system design:** Introduction of compensating networks, lead, lag, lead, lag cascade compensation in time-domain, feedback compensation. **UNIT-II** **Design of controllers:** P, PI and PID controllers design using Bode plot and Root locus techniques. **UNIT-III** **State variable analysis:** system representation in state variable form, phase variable representation, diagonalization, canonical variable representation. **Controllability and observability:** Definition of controllability, controllability tests for continuous time systems, definition of observability, observability tests for continuous time systems. **UNIT – IV** **Time response of linear systems:** Introduction, solution of state equations, state transition matrix, sylvester's expansion theorem, pole placement by state feedback, full order and reduced order observers.	

	UNIT – V **Non-linear systems:** Introduction, common physical non linearities, singular points, basic concepts and derivation of describing functions. stability analysis by describing function method. **UNIT – VI** **Stability:** Introduction, equilibrium points, stability concepts and definitions stability in the sense of liapunov stability of linear system, methods of constructing liapunov functions for non-linear system, krasovskii's method, variable gradient method.
Text books & Reference books:	**Text books:** 1. "Control systems engineering", by I.J.Nagrath and M.Gopal, New age International publishers. 2. "Modern control system theory", by M.Gopal, TMH publishers. 3. "Advanced Control Theory", by A.NagoorKani, 2nd Edition, RBA Publication. **Reference books:** 1."Discrete Time Control Systems", by Ogata. K, 2nd Edition, Pearson Publication. 2. "State functions and linear control systems", by Schultz and Melsa 3. "Control system Engineering", by NISE, Wiley, 2000. 4. "Modern control systems", by Richard. C. Dorfand. R. H. Bishop Addison Wesley longman.
e-Resources:	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

20EE32E4-POWER SEMICONDUCTOR DRIVES

(EEE)

Course Category:	Professional core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-practical:**	3-0-0
Pre-requisite:	Fundamentals of electrical circuits and networks, Power Electronics and Electrical Motors(A.C and D.C motor)	**Sessional Evaluation:** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	Students undergoing this course are expected to learn:	
	1. The importance of electrical drives. 2. The control of D.C motor by single phase and three phase converters. 3. The control of D.C motor by three phase converters and dual Converters. 4. The control of induction motor in four quadrants by controllers. 5. The losses and importance of energy conservation in electric drives. 6. The control of synchronous motor using voltage & current source inverters.	
Course Outcomes:	After completing the course the student will be able to	
	CO1	Understand the importance of electrical drives.
	CO2	Gain knowledge on D.C motor control by Single phase and three phase converters.
	CO3	Analyse the D.C motor control by three phase converters and dual converters.
	CO4	Demonstrate the Induction motor control in four quadrants by controllers.
	CO5	Describe the importance of energy conservation in electric drives.
	CO6	Design the synchronous motor control using voltage and current source inverters.
Course Content:	**UNIT-I** **Electric drives:** Concept of electric drive, classification, advantages and choice of electric drives, parts of electric drives, electric motor, power modulators, sources and control unit, steady state speed and torque expressions of various D.C motors, speed, torque characteristics. **UNIT-II** **Converter controlled D.C drives:** Single phase semi and fully controlled converters connected to D.C separately excited, continuous and discontinuous current operation **DC motor Drives:** Introduction to four quadrant operation, motoring operations, electric braking, plugging, dynamic and regenerative braking operations, four quadrant operation of D.C motors. **UNIT-III** **Converter controlled D.C drives:** Three phase semi and fully controlled converters connected to D.C separately excited motor, single quadrant. **Chopper controlled D.C drives:** Two quadrant and four quadrant chopper fed DC separately excited and series excited motors, continuous current operation, speed torque expressions, speed torque characteristics.	

	UNIT –IV **Induction motor drives:** Speed torque characteristics, variable voltage characteristics, control of induction motor by A.C voltage controllers .variable frequency characteristics, variable frequency control of induction motor by voltage source and current source inverter and cyclo converters, PWM control, comparison of VSI and CSI operations, closed loop operation of induction motor drives (block diagram only). **UNIT-V** **Slip power recovery schemes:** Static Scherbius drive, static kramer drive, their performance and speed torque characteristics, advantages applications, problems. **UNIT-VI** **Synchronous motor drives:** Speed-torque characteristics, separate control and self-control of synchronous motors, operation of self-controlled synchronous motors by VSI and CSI cyclo-converters, load commutated CSI fed closed loop control operation, variable frequency control using cyclo-converter.
Text books & Reference books:	**Text books:** 1. "Fundamentals of electric drives", by G K Dubey,Narosa Publications. 2. "Power electronic circuits, devices and applications", by M.H.Rashid, PHI. **Reference books:** 1. "Power electronic", by MD Singh and K B Khanchandani, Tata – McGraw-Hill Publishing company,1998 2. "Modern power electronics and A.C drives", by B.K.Bose, PHI publishers. 3. "Thyristor control of electric drives",by Vedam Subramanyam, Tata McGraw Hill Publications. 4. "A First course on Electrical Drives", by S K Pillai, New Age International(Pvt.) Ltd. 2nd Edition.
e-Resources:	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

S.No	**OPEN ELECTIVE-II (3)**	
1	Building Technology	(20CE32O2)
2	Operating Systems	(20CS32O2)
3	Software Engineering	(20CS32O1)
4	VLSI Design	(20EC32O3)

20CE32O2– BUILDING TECHNOLOGY

Course Category:	Open Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 0 - 0
Prerequisite:	None	**Sessional Evaluation :** **Univ. Exam Evaluation:** **Total Marks:**	40 60 100

Course Outcomes	CO1	Identify the factors to be considered in planning and construction of buildings and Plan a building following the bye-laws
	CO2	Understand various types of stones and methods of manufacturing of bricks and tiles.
	CO3	Identify the importance of ingredients of lime, cement and concrete.
	CO4	Provide scope of smart construction materials alternative for cement and also be able to understand various types of masonry construction.
	CO5	Evaluate various building components and their various types.
	CO6	Understand the techniques and importance of damp proofing and finishing works of the building.

Course Content

UNIT – I

Fundamentals requirements of buildings: Terms used in building drawing as per National Building Code (N.B.C) – Factors affecting in selection of site – Functional requirements of a residential building – Minimum size requirements as per N.B.C. – Standard sizes of Door – Windows and ventilators.

Basic building elements, Principles of planning. Relevant building by-laws (N.B.C) & Municipal, orientation of buildings – Provision of rainwater harvesting – provision for physically handicapped facilities.

UNIT – II

Stones: Properties of building stones – Relation to their structural requirements – Classification of stones.

Bricks: Composition of good brick earth, various types of bricks.

Tile: Characteristics of good tile and types of tiles.

UNIT – III

Lime: Various ingredients of lime –Constituents of lime stone – Classification of lime.

Cement: Portland cement – Chemical Composition – Hydration, setting and fineness of cement – Various types of cement and their properties – Various field and laboratory tests for Cement – Various ingredients of cement concrete and their importance – Various tests for concrete.

	UNIT – IV **Wood:** Introduction– Classification of timber (I.S.: 399) – Characteristics of good timber– Defects in timber – Types and Uses of Ply-wood and Engineered wood.–Uses of materialslike Aluminium, Gypsum, Glass and Bituminous materials. **Masonry:** Types of masonry – English and Flemish bonds – Cavity, partition and shear walls. **Smart Construction Materials:** Overview and use of Fly ash, Silica fume, Carbon fibers, Self-healing materials and Fiber reinforced plastics – Benefits of Nano-technology in construction industry. **UNIT – V** **Building Components:** Lintels – Arches – Vaults – Stair cases. **Floors:** Different types of floors – Concrete – Mosaic and Terrazzo floors. **Roofs:** Pitched roofs – Lean to roof – Coupled Roofs – Trussed roofs – King and Queen post Trusses – Flat roofs – R.C.C Roofs–Doors and windows. **UNIT – VI** **Building Finishes:** Damp Proofing and water proofing materials and uses. Plastering – Pointing – White washing and distempering. **Paints:** Constituents of paint – Types of paints –Painting of new/old wood – Varnish.
Textbooks & References	**TEXTBOOKS:** 1. S.C. Rangwala, *Engineering Materials*, Charotar publishing house, 43rd Edition, 2019. 2. B.C. Punmia, Arun K Jain, Ashok K Jain, *Building Construction*, Laxmi Publications, 11th Edition, 2016. 3. Dr. N. Kumara Swamy& A. KameswaraRao, *Building Planning and Drawing*, Charotar publishing house, 9th Edition, 2019. **REFERENCE BOOKS:** 1. S.K. Duggal, *Building Materials*, New age international, 4th Edition, 2012. 2. Sushil Kumar, *Building Construction*, Standard Publisher, 19th Edition 2020. 3. S. MahaboobBasha, *Building Materials, Construction and Planning*, ,Anuradha Publications, 2011.

20CS32O2 - OPERATING SYSTEMS

Course Category:	Open Elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Prerequisite:	Knowledge about Fundamentals of Computer basics	**Sessional Evaluation:** **Univ. Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	• Learn OS operations and supporting structures. • Knowledge about the different scheduling algorithms and their evaluation. • Obtain exposure on deadlock handling, protection and security mechanisms.	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Learn the Basics of Operating Systems and structures.
	CO2	Acquire knowledge about Inter process communication and Scheduling algorithms.
	CO3	Study Deadlock handling mechanisms.
	CO4	Understand various Memory management techniques.
	CO5	Gain insights of File system operations and implementation methods.
	CO6	Identify Disk Structures and various goals and principles of protection.

Course Content

UNIT-I

Introduction: What Operating Systems Do, OS Structure &Operations, Process Management, Memory and Storage Management, Protection and Security, Computing Environments, Open-Source Operating Systems.

System Structures: OS Services, User& OS Interface, System Calls, Types of System Calls, System Programs, OS Design and Implementation, Various structures of OS, System Boot.

UNIT-II

Process Management: Process Concept, Process Control Block, Process Scheduling, Operations on Processes, Interprocess Communication, Examples of IPC systems.

Process Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Multiple-Processor Scheduling, Algorithm Evaluation.

UNIT-III

Synchronization: The Critical-Section Problem, Peterson's Solution, Mutex Locks, Semaphores, Classic Problems of Synchronization-Reader/Writers Problem, Dining – Philosophers Problem, Monitors.

	Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock. **UNIT-IV** **Memory Management Strategies:** Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table. **Virtual Memory Management:** Background, Demand Paging, Copy on write, Page replacement, Frame allocation, Thrashing, Allocating Kernel Memory. **UNIT-V** **File System:** File Concept, Access Methods, Directory and Disk Structure, File Sharing, Protection. **Implementing File-System:** File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management, and Recovery. **UNIT-VI** **Mass Storage Structure:** Overview, Disk Structure, Disk Attachment, Disk Scheduling, Disk Management, RAID Levels. **System Protection and Security:** Goals, Principles and Domain of protection, Security Problem, Program Threats, System and Network Threats.
Text Books & References Books	**TEXT BOOKS:** 1. "Operating System Concepts", Abraham Silberchatz, Peter B Galvin, Greg Gagne, 9th Edition, John Wiley & Sons Publication, 2016. **REFERENCE BOOKS:** 1. "Modern Operating Systems", Andrew S. Tanenbaum, Herbert Bos, 4th Edition, Pearson Education, 2016. 2. "Operating Systems – Internals and Design Principles", William Stallings, 9th Edition, Pearson Education, 2018. 3. "Operating System: A Design-oriented Approach", Charles Crowley, 1st Edition TMH Publication, 2017.
E-Resources	1. https://nptel.ac.in/courses 2. https://freevideolectures.com/university/iitm

20CS32O1 - SOFTWARE ENGINEERING

Course Category:	Open Elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Prerequisite:	Require the fundamental concepts of computers and basic analytical capabilities	**Sessional Evaluation:** **Univ. Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	• To define various software engineering phases. • Explore the concepts of software products and processes. • To facilitate the environment of software development in the outside world. • To expose the importance of risk management and strive for quality assurance.	
Course Outcomes:	Upon successful completion of the course, the students will be able to:	
	CO1	Understand the basics of software engineering layers.
	CO2	Learn about different process models, planning and construction of analysis models.
	CO3	Study the data modeling concepts to create a behavioral model and exposure on design concepts.
	CO4	Identify various architectural styles to get the support for designing conventional components.
	CO5	Examine different Testing Strategies for conventional software.
	CO6	Study various ways to improve software quality assurance.
Course Content	**UNIT-I** **Introduction to Software Engineering:** Software evolution, Legacy software, Software myths. **A Generic View of Process:** Software engineering layers, Process frame work, Capability Maturity Model Integration (CMMI). **UNIT-II** **Process Models:** Prescriptive models, Waterfall model, Incremental process models, Evolutionary process models and Unified process, Agility, Agile Process, Principles, XP, FDD. **UNIT-III** **Analysis Model and Design:** Analysis model, Analysis modeling approaches, Data modeling concepts, Design process, Design quality, Design concepts.	

	UNIT-IV **Creating and Modeling the Design:** Software architecture, Architectural design, Nature of component,Designing class-based components: Principles, Guidelines, Cohesion, Coupling, Conducting component level design. **UNIT-V** **Testing strategies:** A strategic approach to software testing, Test strategies for conventional software, Test strategies for object-oriented software, Validation testing, System testing, Art of debugging. **UNIT-VI** **Quality Management**: Quality concepts, Software quality assurance, Software Reviews, Formal technical reviews, Statistical Software quality Assurance, Software reliability.
Text Books & References Books	**TEXT BOOKS:** 1. Pressman R S, Software Engineering-A Practitioner‟s Approach, 6th edition, McGraw-Hill **REFERENCE BOOKS:** 1. Sommerville I, Software Engineering, 5th edition, Pearson Education, 1996. 2. Jawadekar W S, Software Engineering – Principles and Practice, Tata McGraw-Hill, 2004.Hill, 2005. 3. Carlo gezzi, Fundamentals of Software Engineering, Second edition, Prentice Hall
E-Resources	1. https://nptel.ac.in/courses 2. https://freevideolectures.com/university/iitm

20EC32O3-VLSI DESIGN

Course category:	Program Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 0- 0
Prerequisite:	Electronic Devices & Circuits, Linear & Digital ICs and Basics of IC Fabrication	**Sessional Evaluation :** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected:	
	1. To introduce the fundamental structures of VLSI Systems at the lowest levels of System abstraction. 2. To know the basic electrical properties of MOS & BI-CMOS circuits 3. To understand the Basic Circuit Concepts and design process of VLSI circuits and also to introduce the fundamental principles of VLSI circuit design. 4. To know the Gate level design and physical design by considering partioning, floor Planning, Placement and Routing. 5. To bring both Circuits and System views on design together by considering circuit Subsystems and VLSI Design styles. 6. To have a profound understanding of the design of complex digital VLSI circuits, computer aided simulation and synthesis tool for hardware design	
Course Outcomes	Upon successful completion of the course , the students will be able to:	
	CO1	Be aware about the trends in semiconductor technology, and how it impacts scaling and performance.
	CO2	Know the basic electrical properties of MOS & BI-CMOS circuits
	CO3	Learn Layout, Stick diagrams, Fabrication steps, Static and Switching characteristics of inverters
	CO4	Compute terminal voltage and current characteristics for MOS transistors under a variety of conditions
	CO5	Understand MOS transistor as a switch and its capacitance
	CO6	Design digital systems using MOS circuits. Synthesis of digital VLSI systems from register-transfer or higher-level descriptions in hardware design languages.
Course Content	**UNIT-I** **INTRODUCTION:** IC fabrication - MOS, PMOS, NMOS, CMOS & Bi-CMOS Technologies - Oxidation, Lithography, Diffusion, Ion implantation, Metallization, Encapsulation, Probe testing, Integrated Resistors and capacitors. **UNIT-II** **BASIC ELECTRICAL PROPERTIES OF MOS & Bi-CMOS CIRCUITS:** I_{ds}-V_{ds} relationships, MOSFET threshold voltage, g_m, g_{ds}, W_o, Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design Bi-CMOS inverters.	

Course Content	**UNIT-III** **BASIC CIRCUIT CONCEPTS:** Sheet Resistance $R_s$and its concepts to MOS, Area Capacitance calculations, Inverter Delays, Driving large Capacitive Loads, Wiring Capacitances, Fan-In and Fan-Out. **VLSI CIRCUIT DESIGN PROCESSES:** VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, 2µm CMOS Design rules for wires, Contacts and Transistors, Layout Diagram's for NMOS and CMOS Inverters and gates , Scaling of MOS circuits, Limitation of Scaling. **UNIT-IV** **GATE LEVEL DESIGN:** Logic gates and other Complex gates, Switch Logic, Alternate Gate circuits. **PHYSICAL DESIGN:** Floor- Planning, Placement, routing, Power delay estimation, Clock and Power routing **UNIT-V** **SUBSYSTEM DESIGN:** Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Counters, High density Memory Elements. **VLSI DESIGN STYLES:** Full-custom, Standard Cells, Gate-arrays, FPGAs and CPLDs and Design approach for Full Custom and Semi-Custom devices. **UNIT-VI** **VHDL Synthesis:** VHDL Synthesis, Circuit Design Flow, Circuit Synthesis, Simulation, Layout, Design capture tools, Design Verification Tools. **TEST AND TESTABILITY:** Fault-modelling and simulation, test generation, design for testability, Built-in self-test.
Text Books and Reference Books	**TEXT BOOKS:** 1. Essentials of VLSI circuits and Systems – Kamran Eshraghian, Eshraghian Douglas and A. Pucknell, PHI, 2005 Edition. 2. D. Roy Chowdhury. Linear Integrated circuits, New Age International Edition(2003) 3. ASIC Design Flow by Smith. **REFERENCE BOOKS:** 1. Pronciples of CMOS VLSI Design- Weste and Eshraghian, Pearson Education, 1999. 2. Modern VLSI Design-Wayne Wolf, Pearson Education, 3rd Edition 1997. 3. Introduction to VLSI Circuits and Systems – John. P. Uyemura. John Wiley, 2003. 4. Digital Integrated Circuits – John M. Rabaey, PHI.
E-Resources	1. http://nptel.ac.in/courses 2. http://tocs.ulb.tu-darmstadt.de/35621702.pdf 3. http://www.ulb.tu-darmstadt.de/tocs/23570458.pdf 4. http://www.academia.edu/download/30922844/L1-print.pdf

20IT32SC - MOBILE APP DEVELOPMENT LABORATORY

(Common to CSE, IT, AI&DS, ECE and EEE)

Course Category:	Skill Oriented	**Credits:**	2
Course Type:	Practical	**Lecture-Tutorial-Practical:**	1-0-2
Prerequisite:	Required the basics of Java, XML, SQLite and Android Studio.	**Sessional Evaluation:** **Univ. Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	• Able to Design a Mobile Application. • Develop and deploy the Mobile Applications in marketplace.
Course Outcomes	Understand the fundamental issues and usage of mobile applications and develop various innovative applications which are useful for society.
Course Content	**Session-I:** Review of Java Concepts, Download and Install Android Studio, Android Setup, Application components, Resources, Activities, Services Develop a Hello World Program **Session-II:** Android User Interfaces: UI Layouts, UI Controls, Styles and Themes. Develop an application that uses GUI components, Font and Colours. **Session-III:** Android Event Handling, Drag and Drop, Notifications. Develop a basic Calculator application that uses Layout Managers and event listeners. **Session-IV:** Alert Dialogues, Clipboard, Animation Develop an application that draws basic graphical primitives on the screen. **Session-V:** Sending SMS, Phone calls Develop an application for SMS, Phone Calls. **Session-VI:** Android Audio Capture, Audio Manager, Audio Complete. Develop a program for Audio Capture. **Session-VII:**SqLite (CRUD). Develop an Android Program to connect Database and Develop Database Operations using SQLite. **Session-VIII:** Text to Speech Develop an Application for Text to Speech.

	Session-IX: Google Maps Develop an application for identify the current location. **Session-X:** Develop an application for College Requirement.
Text Books & Reference Books	**TEXT BOOKS:** 1. Java: The Complete Reference, 10th Edition, Herbert Schildt TMH, Indian Edition. 2. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012. **REFERENCE BOOKS:** 1. Charlie Collins, Michael Galpin and Matthias Kappler, "Android in Practice", DreamTech, 2012. 2. James Dovey and Ash Furrow, "Beginning Objective C", Apress, 2012. 3. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, "Beginning Ios. 4. Development: Exploring the iOS SDK", Apress, 2013.
E-Resources	1. http://developer.android.com/ 2. https://www.w3schools.com/ 3. https://www.docs.flutter.dev/ 4. https://www.tutorialspoint.com/android

20MC3201– Advanced Aptitude and Reasoning Skills

(Common to EEE, CSE, IT, AI&DS)

Course Category:	Mandatory Course	**Credits:**	0
Course Type:	Theory	**Lecture-Tutorial-Practical:**	2-0-0
Pre-requisite:	Basic Mathematical Skills	**Sessional Evaluation:**	40
		External Exam Evaluation:	60
		Total Marks:	100

Course Objectives:	Students undergoing this course are expected to learn:	
	1. Enhancing the problem solving skills. 2. Solving quantitative aptitude questions effortlessly using advanced strategies. 3. Advanced strategies of different counting techniques. 4. Better decision making concepts by proper analysation and representation of data. 5. Strengthening the basic programming skills for placements. 6. Enhancing critical thinking and innovative skills.	
Course Outcomes:	After completing the course the student will be able to	
	CO1	Become proficient in Solving quantitative aptitude questions effortlessly.
	CO2	Analyse different strategies of solving quantitative ability problems.
	CO3	Demonstrate different counting techniques effectively.
	CO4	Apply better decision making concepts by proper analysation and representation of data.
	CO5	Acquire skills for preparing for interviews, presentations and higher education.
	CO6	Enhance critical thinking and innovative skills.
Course Content:	**UNIT-I** **Quantitative Aptitude:** Logarithms, Arithmetic Progressions, Geometric Progressions, Mensuration: Areas & Volumes. **UNIT-II** **Quantitative Ability:** Time and Work, Time Speed and Distance, Percentages, Profit and Loss, Averages and Ages. **UNIT-III** **Permutation and Combination:** Fundamental Counting Principles, Permutations and Combinations, Computation of Linear and Circular Permutations-Advanced problems, Computation of Combination-Advanced problems. **UNIT-IV** **Data Analysis and Interpretation:** Data Sufficiency, Data interpretation: Advanced Interpretation tables, pie charts & bar charts. **UNIT-V** **Logical reasoning:** Logical Connectives, Syllogisms, Binary logic, Venn Diagram, Sequential output tracing, Crypto arithmetic.	

	UNIT-VI **Reasoning Ability:** Coding and Decoding, Input Type Diagrammatic Reasoning, Spatial Reasoning, Clocks and Calendar, Directions.
Text books & Reference books:	**Text books:** 1. "Quantitative Aptitude for Competitive Examinations", by R S Aggarwal, S. Chand Publishing, Delhi, 3rd Edition, 2017. 2. "Aptipedia Aptitude Encyclopaedia", by FACE, Wiley Publications, Delhi, 1st Edition, 2016. 3. "PlaceMentor", by SMART,Oxford University Press, 1st Edition, 2018. **Reference books:** 1. "An Introduction to Critical Thinking", by Daniel Flage, Pearson, London, 1stEdition, 2002. 2. "Aptimithra", by ETHNUS, McGraw-Hill Education Pvt. Ltd, 1stEdition, 2013. 3. "A modern approach to non-verbal reasoning", by Dr.Agarwal.R.S, S.Chand&Company Limited 2011 4. "How to Prepare for Quantitative Aptitude for CAT", by Arun Sharma, McGraw Hill Education. 5. "How to Prepare for Logical Reasoning for CAT", by Arun Sharma, McGraw Hill Education.
e-Resources	https://www.indiabix.com http://www.m4maths.com http://www.gyanjosh.com http://www.careerbless.com

20EE32P1-ELECTRICAL & ELECTRONIC MEASUREMENTS LAB

Course Category:	Professional core	**Credits:**	1.5
Course Type:	Laboratory	**Lecture-Tutorial-Practical:**	0-0-3
Pre-requisite:	Electrical measurements & Electronic measurements	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	To make the student learn about:	
	1. To analyze the meters and its working. 2. The calibration of different meters. 3. The different types of electrical measuring instruments. 4. Measuring unknown quantity using various instruments. 5. Test different types of electrical measuring instruments. 6. Measurement of non-electrical quantities	
Course Outcomes:	After completing the course the student will be able to:	
	CO1	Analyze the meters and its working.
	CO2	Analyze the calibration techniques for wattmeter, power factor meter, voltmeter, energy meter and current transformer etc.
	CO3	Measure the parameters of choke coil.
	CO4	Measure unknown parameters using different bridges.
	CO5	Verify the characteristics of transducers like RTD, Thermistor, Thermocouple and capacitive transducers.
	CO6	Measure the quantity using the transducers.
Course Content:	Minimum of 10 experiments to be conducted out of the following: **List of Experiments** 1. Calibration of power factor meter. 2. Calibration of dynamometer type wattmeter by phantom loading. 3. Measurement of power by using three voltmeter and three ammeter methods. 4. DC Crompton's potentiometer. 5. Measurement of capacitance using CRO. 6. Measurement of parameters of a choke coil using three voltmeter and three ammeter methods. 7. Calibration of single phase energy meter. 8. Calibration of current transformer. 9. Measurement of capacitance using Schering bridge. 10. Measurement of capacitance using Desauty's bridge. 11. Measurement of inductance using Hay's bridge. 12. Measurement of inductance using Anderson's bridge. 13. Measurement of resistance using Wheatstone's bridge. 14. Measurement of resistance using Kelvin's double bridge. 15. Characteristics of RTD. 16. Characteristics of thermocouple. 17. Characteristics of thermistor. 18. Characteristics of capacitance transducer.	

20EC32P4 – Microprocessor & Interfacing Laboratory

Course Category:	Professional Core	**Credits:**	1.5
Course Type:	Practical	**Lecture-Tutorial- Practice:**	0 - 0 - 3
Prerequisite:	Basic knowledge in programming C, knowledge in microprocessors and programming	**Sessional Evaluation:** **External Evaluation :** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected tounderstand:	
	1. The features of the software tool – T.A.S.A.M. simulator. 2. The arithmetic and data transfer instructions of 8086. 3. The various hardware modules to be interfaced with µp and µc. 4. The interfacing knowledge with Microprocessor kit 5. How to develop the ALP for simple logical and arithmetic operations. 6. Develop assembly language programs for various applications using 8051µc.	
Course Outcomes	Upon successful completion of the course , the students will be able to:	
	CO1	Set up programming strategies and select proper mnemonics and run their program on the training boards.
	CO2	Acquire interfacing knowledge with microprocessor kit.
	CO3	Design the high speed communication circuits using serial bus connection
	CO4	Use a commercial C.P.U.(s) as realistic vehicles to demonstrate these concepts by introducing students to C.P.U. instructions and internal register structures
	CO5	Understand the full internal workings of a typical simple C.P.U. including the utilization of the various hardware resources during the execution of instructions.
	CO6	Develop testing and experimental procedures on Microprocessor and Microcontroller analyse their operation under different cases.
Course Content	**LIST OF EXPERIMENTS** 1. Summation & Block Transfer of Data a) Write and execute 8086 to add the given series of B.C.D. numbers and show the result. b) Write and execute 8086 A.L.P. to transfer a Block of data from one memory area to another memory area. c) Write and execute 8086 A.L.P. to perform the following multiplications. 1) Repeated addition 2) Using SHIFT and ADD instruction d) Write and execute 8086 A.L.P. to perform the following. 1)Binary division 2)B.C.D. division 2. Searching & Sorting Data a) Write and execute 8086 A.L.P. to find the minimum and maximum number from a given data array	

Course Content	b) Write and execute 8086 A.L.P. to arrange the given data array in ascending order and descending order 3. Logic Controller Module Write and execute 8086 A.L.P. to design the logical expression using Logic controller interface module 4. Stepper Motor Module Write and execute 8086 A.L.P. to rotate a stepper motor either in clockwise direction or in anticlockwise direction and to control the speed of rotation 5. Serial Input Display Unit Module(S.I.D.U.) Write and execute 8086 A.L.P. to display the desired word in a display of serial input display unit interface module 6. Parallel Input Display Unit Module (P.I.D.U.) Write and execute 8086 A.L.P. to design an up and down counter using P.I.D.U. Interface module 7. Digital to Analog Converter Interface Module Write and execute 8086 A.L.P. to generate given waveform through C.R.O. using D.A.C. 8. Arithmetic & Logical operations using 8051. 9. (a) To find smallest number from given array of numbers using 8051. (b) To find largest number from given array of numbers using 8051. 10. Programming using arithmetic, logical and bit manipulation instructions of 8051.
REFERENCE BOOKS	**REFERENCE BOOKS:** 1. A K Ray and K M Bhurchandi, "Advanced Microprocessors &Peripherals", 2nd ed., TMH, 2006. 2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, "The 8051microcontroller and embedded systems", Pearson education, 2004.

20EE32P1-ELECTRICAL & ELECTRONIC MEASUREMENTS LAB

Course Category:	Professional core	**Credits:**	1.5
Course Type:	Laboratory	**Lecture-Tutorial-Practical:**	0-0-3
Pre-requisite:	Electrical measurements & Electronic measurements	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	To make the student learn about:	
	7. To analyze the meters and its working. 8. The calibration of different meters. 9. The different types of electrical measuring instruments. 10. Measuring unknown quantity using various instruments. 11. Test different types of electrical measuring instruments. 12. Measurement of non-electrical quantities	
Course Outcomes:	After completing the course the student will be able to:	
	CO1	Analyze the meters and its working.
	CO2	Analyze the calibration techniques for wattmeter, power factor meter, voltmeter, energy meter and current transformer etc.
	CO3	Measure the parameters of choke coil.
	CO4	Measure unknown parameters using different bridges.
	CO5	Verify the characteristics of transducers like RTD, Thermistor, Thermocouple and capacitive transducers.
	CO6	Measure the quantity using the transducers.
Course Content:	Minimum of 10 experiments to be conducted out of the following: **List of Experiments** 19. Calibration of power factor meter. 20. Calibration of dynamometer type wattmeter by phantom loading. 21. Measurement of power by using three voltmeter and three ammeter methods. 22. DC Crompton's potentiometer. 23. Measurement of capacitance using CRO. 24. Measurement of parameters of a choke coil using three voltmeter and three ammeter methods. 25. Calibration of single phase energy meter. 26. Calibration of current transformer. 27. Measurement of capacitance using Schering bridge. 28. Measurement of capacitance using Desauty's bridge. 29. Measurement of inductance using Hay's bridge. 30. Measurement of inductance using Anderson's bridge. 31. Measurement of resistance using Wheatstone's bridge. 32. Measurement of resistance using Kelvin's double bridge. 33. Characteristics of RTD. 34. Characteristics of thermocouple. 35. Characteristics of thermistor. 36. Characteristics of capacitance transducer.	

20EE32P2-POWER SYSTEMS & SIMULATION LAB

Course Category:	Professional core	**Credits:**	1.5
Course Type:	Laboratory	**Lecture-Tutorial-Practical:**	0-0-3
Pre-requisite:	Power system Analysis, power system, Switchgear and Protection	**Sessional Evaluation:** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	Students undergoing this course are expected to:	
	1. Procure sufficient knowledge on MATLAB to solve the power system problems. 2. Conduct different parameter analysis on transmission lines. 3. Learn about various system studies and different techniques used for Power system planning. 4.Learn about the dynamic analysis of power system 5. Present problem oriented knowledge of power system analysis methods. 6. Learn about AVR design in power system.	
Course Outcomes:	After completing the course the student will be able to	
	CO1	Understand the computation techniques to determine line parameters.
	CO2	Determine the Impedance and Admittance matrix of the given transmission line.
	CO3	Understand modeling of transmission lines by load flow techniques.
	CO4	Implement a good Unit Commitment method.
	CO5	Design a better Economic load dispatch in power systems.
	CO6	Predict the reasons for all faults in power system.
Course Content:	Minimum of 10 experiments to be conducted out of the following: **LIST OF EXPERIMENTS** 1. Computation of line parameters using MATAB. 2. Modelling of transmission lines. 3. Formation of Y_{bus}. 4. Load flow analysis using G-S method. 5. Economic load dispatch in power systems. 6. Load-frequency dynamics of single and two area power systems. 7. Numerical Solution of Swing Equation. 8. Simulate LG, LL, LLG and 3phase faults in a 3 machine 9 bus system at same location. 9. Unit Commitment Program. 10. Design AVR for a Power System. 11. Simulate the Ferranti effect for a short transmission line. 12. Simulate Voltage and Current wave forms for various Power factors (UPF, 0.8lag & 0.8 lead) for a simple power system.	

NBKR INSTITUTE OF SCIENCE &TECHNOLOGY:: VIDYANAGAR (AUTONOMOUS)
(AFFILIATED TO JNTUA :: ANANTAPUR)
SPSR NELLORE DIST
IV YEAR OF FOUR YEAR B.TECH DEGREE COURSE – I SEMESTER
ELECTRICAL AND ELECTRONICS ENGINEERING
SCHEME OF INSTRUCTION AND EVALUATION
(With effect from the academic year 2023-2024)
(For the batch admitted in the academic year 2020-2021)

S.No	Course Code	Course Title	Instruction Hours/Week			Credits	Evaluation									
							Sessional Test-1			Sessional Test-2			Total Sessional Marks (Max. 40)	End Semester Examination		Maximum Total Marks
		THEORY	L	T	D/ P		Test-1 (2 Hr)	Assign-1	Max. Marks	Test-2 (2 Hr)	Assign-2	Max. Marks		Duration In Hours	Max. Marks	100
1		**HSMC Elective**	3	-	-	3	34	6	40	34	6	40	0.8*Best of Two + 0.2*Least of Two	3	60	100
2		**PE3**	3	-	-	3	34	6	40	34	6	40		3	60	100
3		**PE4**	3	-	-	3	34	6	40	34	6	40		3	60	100
4		**PE5**	3	-	-	3	34	6	40	34	6	40		3	60	100
5		**(OE3)/ MOOCS**	3	-	-	3	34	6	40	34	6	40		3	60	100
6		**OE4**	3	-	-	3	34	6	40	34	6	40		3	60	100
7	20CS41SC	Data Analysis & Representation using R Laboratory@	1	-	2	2	-	-	-	-	-	-	Day to Day Evaluation and a test (40 Marks)	3	60	100
8		**Summer Internship (2months)**				3	**During summer vacation**									
		TOTAL				**23**										

(***:** Common to all; **#**: Common to CE,ECE& EEE; $: Common to ECE&EEE; **@** : Common to CSE,IT, AI&DS &EEE)

S.No	Humanities & Science Management course (HSMC) Elective
1	Management Science **(20SH41E1)**
2	Customer Relationship Management **(20SH41E2)**
3	Strategic Management **(20SH41E3)**
4	Corporate Governance and Business Ethics **(20SH41E4)**

20SH41E1-MANAGEMENT SCIENCE

Course Category:	Humanities	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	NIL	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to learn • The functions of Management and evolution of management thought • The application of the principles in an organization and aware of the social responsibilities of business. • The principles of strategy formulation, implementation and control in organizations and fundamental concepts of marketing. • The role of HRM in an organization • The concepts of production and operations management of an industrial undertaking. • The mechanism of PERT and CPM.	
Course Outcomes	Upon successful completion of the course , the students will be	
	CO1	Able to explain the concepts of management.
	CO2	Able to apply the principles of management in designing the organization structure of an enterprise.
	CO3	Able to Identify core concepts of marketing and develop marketing strategies based on product, price, place and promotion objectives
	CO4	Demonstrate the role of HRM in an organization and able to manage human resources efficiently and effectively with best HR practices.
	CO5	Able to select appropriate location for establishing industrial plants and design plant and production layouts
	CO6	Able to determine activities' times and schedule the projects using the CPM and PERT.
Course Content	**UNIT – I** **Introduction to Management**: Concept of Management — Functions of Management, Evolution of Management Thought: Taylor's Scientific Management Theory, Fayal's Principles of Management- Maslow's theory of Hierarchy of Human Needs- Douglas McGregor's Theory X and Theory Y - Hertzberg Two Factor Theory of Motivation - Leadership Styles.	

	UNIT – II **Design of Organization:** principles of Organization –Organisation process- Types of organisation: line , Staff or functional ,line and staff, committee, matrix, virtual, cellular, team organization. Boundary less organization, inverted pyramid structure, lean and flat organization. Managerial objectives and social responsibilities. **UNIT-III** **Strategic Management**: Corporate planning – Vision, Mission, Goals Objectives, Policies, & programmes -SWOT analysis – Strategy formulation and implementation. **Marketing Management**: Functions of Marketing-Marketing Mix - Marketing Strategies based on Product Life Cycle- Channels of distribution. **UNIT-IV** **Human Resources Management**: Manpower Planning- Recruitment & Selection- Training & Development- Job Evaluation- Performance Appraisal,-Incentives. **UNIT-V** **Production and Operations management**: Plant Location and Plant Layout concepts- methods of production (Job, Batch & Mass)-Production Planning and control. Work study- Basic procedure involved in Method Study -Work Measurement. **UNIT-VI** **Project Management (PERT/ CPM):** Network Analysis- Programme Evaluation and Review Technique (PERT)- Critical Path Method (CPM) -Project Cost Analysis- Project Crashing (simple problems).
Text Books & Reference Books	**TEXT BOOKS:** 1.Management Science , A.R.Aryasri, Tata McGraw-Hill Education 2.Industrial Engineering and Management, O. P. Khanna (2004), Dhanpat Rai, New Delhi. **REFERENCE BOOKS:** 1.Business organizations and management , C.B.Gupta, Sultan Chand and Sons. **2.I**ndustrial Engineering and Management (Including Production Management) T.R.Banga,S.C.Sharma, Khanna Publishers. 3.Production and Operations Management, Panner Selvam (2004), Prentice Hall of India, New Delhi

20SH41E2-CUSTOMER RELATIONSHIP MANAGEMENT

Course Category:	Humanities	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	NIL	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to learn • The importance of CRM in the real business. • The implementation of CRM in an organization such that it benefits their business needs. • How CRM helped define best practices and customer management methodology.	
Course Outcomes	On successful completion of this course, the students will be able to	
	CO1	Aware of the basics of customer relationship management
	CO2	Analyze the CRM link with the other aspects of marketing
	CO3	Know the CRM planning process.
	CO4	understand the Role of CRM in increasing the sales of the company
	CO5	Aware of the CRM practices in various markets and sectors
	CO6	Aware and analyze the different issues in CRM
Course Content	**Unit-I** **CRM Basics**: Meaning & Definition - Dimensions of CRM - Nature of CRM - Goals of CRM - Advantages of CRM **Unit II** **CRM Concepts :** Customer Value, Customer Expectation, Customer Satisfaction, Customer Centricity, Customer Acquisition, Customer Retention, Customer Loyalty, Customer Lifetime Value. Customer Experience Management, Customer Profitability, Enterprise Marketing Management, Customer Satisfaction Measurements, Web based Customer Support. **Unit III** **Planning for CRM :** Steps in Planning-Building Customer Centricity, Setting CRM Objectives, Defining Data Requirements, Planning Desired Outputs, Relevant issues while planning the Outputs, Elements of CRM plan. CRM Strategy: The Strategy Development Process, Customer Strategy Grid.	

	Unit IV **CRM and Marketing Strategy :** CRM Marketing Initiatives, Sales Force Automation, Campaign Management, Call Centres. **Unit- V** **Practice of CRM:** CRM in Consumer Markets, CRM in Services Sector, CRM in Mass Markets, CRM in Manufacturing Sector. **Unit VI** **CRM Planning and Implementation:** Issues and Problems in implementing CRM, Information Technology tools in CRM, Challenges of CRM Implementation. CRM Implementation Roadmap, Road Map (RM) Performance: Measuring CRM performance, CRM Metrics. .
Text Books & Reference Books	**TEXT BOOKS:** 1. Francis Buttle, Stan Maklan, Customer Relationship Management: Concepts and Technologies, 3rd edition, Routledge Publishers, 2015 2. Kumar, V., Reinartz, Werner Customer Relationship Management Concept, Strategy and Tools, 1st edition, Springer Texts, 2014 **REFERENCE BOOKS:** 1. JagdishN.Sheth, AtulParvatiyar&G.Shainesh, "Customer Relationship Management", Emerging Concepts, Tools and Application", 2010, TMH. 2. DilipSoman& Sara N-Marandi," Managing Customer Value" 1st edition, 2014, Cambridge. 3. Alok Kumar Rai, "Customer Relationship Management: Concepts and Cases", 2008, PHI. 4. Ken Burnett, the Handbook of Key "Customer Relationship Management", 2010, PearsonEducation. 5. MukeshChaturvedi, AbinavChaturvedi, "Customer Relationship Management- An Indian Perspective", 2010 Excel Books, 2nd edition

20SH41E3-STRATEGIC MANAGEMENT

Course Category:	Humanities	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	NIL	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to • Expose to various perspectives and concepts in the field of Strategic Management • Learn the principles of strategy formulation, implementation and control in organizations. • Develop skills for applying these concepts to the solution of business problems • Master the analytical tools of strategic management	
Course Outcomes	Upon successful completion of the course the students will be able to	
	CO1	Describe major theories, background work, concepts and research output in the field of strategic management.
	CO2	Prepare the mission statement for the operational efficiency
	CO3	Analyse the environment through SWOT Analysis
	CO4	Understand organizational change
	CO5	Demonstrate capability of making their own decisions in dynamic business landscape.
	CO6	To develop their capacity to think and execute strategically.
Course Content	**UNIT – I** **Strategic Management:** An Introduction Strategic thinking Vs Strategic management Vs Strategic planning, Meaning of strategic management, concept of strategy, policy and strategy, strategy and tactic, Strategy and strategic plan, Nature of strategic plan, nature of strategic decisions, approaches to strategic decision making, levels f strategies, The strategic management process, strategic management: merits and demerits **UNIT – II** **Mission, Objectives, Goals and Ethics** What is mission, concept of goals, Integration of individual and organisation goals: A Challenge, How Objectives are pursued, how are mission and objectives are formulated, why do mission and objective change, vision mission, objectives, goals and Strategy: Mutual relationships, core of strategic management: vision A-must, ethics and strategy. **UNIT-III** **External environment:** Analysis and appraisal Concept of environment, environmental analysis and appraisal, why environmental scanning and analysis, component of environment, SWOT:A tool of environment analysis, techniques of environmental search and analysis, ETOP: A technique of diagnosis, decision making on environmental information	

	UNIT-IV **Organisational change and innovation:-** Planned and unplanned change, causes or forces of organisational change, managing planned change, choosing a change strategy, creativity and innovation in organisations, organizational creativity and innovation process, learning organisation **UNIT-V** **Generic competitive strategy:-** Generic vs. competitive strategy, the five generic competitive strategy, competitive marketing strategy option, offensive vs. defensive strategy, **Corporate strategy:-** Concept of corporate strategy , offensive strategy, defensive strategy, scope and significance of corporate strategy **UNIT-VI** **Strategic evaluation and control:-** Evaluation of strategy and strategic control, why strategy evaluating, criteria for evaluation and the evaluation process, strategic control process, types of external controls.
Text Books & Reference Books	**TEXT BOOKS:** 1. Strategic management: the Indian context 5th edition, kindle editionR srinivasan 2. Strategic management : Indian and Global Contextsupriyasingh **REFERENCE BOOKS:** 1.Dess, G. G., Lumpkin, G. T., Eisner, A. B., McNamara, G. 2013. Strategic Management: Creating Competitive Advantages, 7th Edition, McGraw-Hill International Edition, McGraw-Hill/Irwin.

20SH41E4-Corporate Governance and Business Ethics

Course Category:	Humanities	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	NIL	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to learn • The Corporate Governance and regulatory mechanism in emerging economies. • The various corporate governance philosophies to explain how they contribute to world society. • The corporate governance in Indian perspective • The Corporate Governance in banking sector and in emerging economies. • The importance of Business Ethics in day-to-day working environment. • To explore the implications of business ethics at international level.	
Course Outcomes	Upon successful completion of the course , the students will be able to	
	CO1	Comprehend Corporate Governance and regulatory mechanism in emerging economies.
	CO2	Compare various corporate governance philosophies to explain how they contribute to world society.
	CO3	Analyze the corporate governance in Indian perspective
	CO4	Contrast the Corporate Governance in banking sector with emerging economies.
	CO5	Understand the importance of Business Ethics in day-to-day working environment.
	CO6	Explore the implications of business ethics at international level.
Course Content	**Unit – I** Corporate Governance – Concept of Corporate Governance (CG) – Aims and Objectives – Good Corporate Governance importance of CG — parties to CG – Issues in CG in Emerging Economies – corporate governance regulatory mechanisms in India. **Unit – II** Corporate Governance in Global – Developments CG in USA and UK – The Cadbury Committee, the Green bury Committee, Global convergence in CG- the OECD principals- Sarbanes-Oxley act 2002	

	Unit – III CG in India – Need and Importance CG – History of CG – The CII Initiatives – Naresh Chandra Committee – Kumaramangalam Birala Committee – Narayana Murthy Committee – Clause 49 of Listing agreement. **Unit – IV** Corporate Governance in Banks - Why Corporate Governance in Banks – CG and the World Bank – Basel Committee on Corporate Governance – Ganguly Committee Recommendations - RBI Initiatives **Unit – V** An overview of Business Ethics- Definition and nature of Business Ethics- Types of business ethic issues -Need and benefit of Business Ethics- - History of the development of Business ethics- Arguments for and against Business Ethics- competitive Issues Legal and Regulatory Philanthropic Issues. **Unit-VI** Business Ethics in a Global Economy- Ethical perceptions and International Business- Global Values- Various Ethical Issues around the Globe- Cross cultural Issues.
Text Books & Reference Books	**REFERENCE BOOKS:** 1.Fernando A.C – Corporate Governance- Principles, Policies and Practices – Pearson Education- New Delhi-2006. 2.Subhash Chandra Das – Corporate Governance –Codes, Systems, Standards and Practices – PHI Learning-New Delhi -2009. 3.C.S.V. Murthy - Business Ethics and Corporate Governance- Himalaya Publishing House- Mumbai- 2009 4.Kesho Prasad - Corporate Governance - PHI Learning-New Delhi - 2009 5.Singh S - Corporate Governance- Global Concepts and Practices – Excel Books – New Delhi -2005. 6.Donald H. Chew Jr. and Staurt L. Gillan - Corporate Governance at Crossroads – Tata Mc Graw-Hill Co.Ltd., New Delhi- 2006. Websites
e-Resources:	1. www.oecd.org 2. www.ecgi.org 3. www.cacg.org

S.No	PROFESSIONAL ELECTIVE-III(3)
1	Analogue IC Applications **(20EE41E1)**
2	Basics of power system harmonics & electrical insulation **(20EE41E2)**
3	Flexible AC Transmission Systems **(20EE41E3)**
4	Switchgear and Protection **(20EE41E4)**

20EE41E1 – ANALOG IC APPLICATIONS

(EEE)

Course category:	Professional core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	2 - 1 - 0
Pre-requisite:	Circuit & Networks, Electronic Devices & Circuits, Pulse & Analog Circuits	**Sessional Evaluation :** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to learn:	
	1. The basic building blocks of Op-amp & its characteristics. 2. The linear and non-linear applications of operational amplifiers. 3. The design of multivibrators and various filters using op amp. 4. The theory and applications of 555 timer and P.L.L. 5. The design of filters and regulators. 6. The design of A.D.C.s and D.A.C.s.	
Course Outcomes	Upon successful completion of the course, the students will be able to understand:	
	CO1	The various applications of the integrated circuits.
	CO2	The importance of operational amplifier.
	CO3	The generation of different waveforms using multivibrators.
	CO4	The working principles of 555 timer and PLL.
	CO5	The design of filters and regulators.
	CO6	The interfacing of ADCs and DACs.
Course Content:	**UNIT – I** **Operational amplifier :** Introduction to ICs, op-amp ideal characteristics, internal circuit, D.C and A.C characteristics of op-amp, inverting and non-inverting modes of operation, voltage follower, summer, adder-subtractor, integrator and differentiator **UNIT – II** **Operational amplifier applications:** Differential amplifier and its transfer characteristics, derivation of C.M.R.R. & improvement methods of differential amplifier characteristics, instrumentation amplifier, V-I and I-V converters, precision rectifiers, sample and hold circuit, analog computation. **UNIT – III** **Comparators and waveform generators:** Comparator, regenerative comparator, Astable and mono stable multivibrators using op-amp, triangular wave generator, sine wave generators using Op-amp (R.C. phase shift).	

	UNIT – IV **IC timers:** 555 Timer, Astable and monostable modes. **Phase locked loops:** Basic principles, lock and capture range, voltage control oscillator (I.C.-566), PLL (I.C.-565) and P.L.L applications. **UNIT – V** **Active filters:** Low-pass, high-pass and band-pass filters, state variable filters. **Voltage regulators:** Series op-amp regulator, IC voltage regulators, IC723 regulator, switching regulators. **UNIT – VI** **Electronic data converters:** Introduction, DAC.s, weighted resistor, R-2R and inverted R-2R. **Types of ADCs:** Parallel comparator type, counter type, successive approximation and dual slope ADCs, specifications of DAC and ADC.
Text books & Reference books	**TEXT BOOKS:** 1.“Linear integrated circuits”, by D. Roy Choudary, Shail B. Jain, New Age International Publishers, 2003. 2.“Design of analog integrated circuits”, by Sergio Franco. **REFERENCE BOOKS:** 1."Applications and design with analog integrated circuits", by J. Michael Jacob, PHI, EEE, 1997. 2."Op-amps and linear integrated circuits", by Ramkant A. Gayakwad, LPE, 4th Edition, Pearson Education.
e-Resources	1.http://www.nptel.ac.in 2. http:/www.ebookee.com/linearintegratedcircuits.

20EE41E2-BASICS OF POWER SYSTEM HARMONICS & ELECTRICAL INSULATION

(EEE)

Course Category:	Professional Elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Basic power system components.	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	To make the student learn about: 1.The terms associated with harmonics and the causes for harmonic producing loads. 2. The various effects of harmonics. 3.The concepts of harmonic instrumentation with computer simulation. 4.To select the appropriate insulation material, insulation failures and vacuum insulation. 5. The different types of insulation testing. 6. The advanced measuring and testing techniques.	
Course Outcomes:	At the end of the course, student will be able to:	
	CO1	Understand the terms associated with harmonics and the causes for harmonic producing loads.
	CO2	Demonstrate the various effects of harmonics.
	CO3	Assess the concepts of harmonic instrumentation with computer simulation
	CO4	Choose appropriate insulation material for the different applications.
	CO5	Enumerate different types of insulation testing.
	CO6	Distinguish among advanced measuring and testing techniques.
Course Content:	**UNIT I** **Sources and generation of harmonics:** Transformer magnetization-machines- fluorescent lamps with magnetic ballasts- power electronics loads such as line, commutated converters- typical current waveforms and THD-switched mode power supplies- typical current waveforms and THD- uncharacteristic and inter harmonics**.** **UNIT II** **Effects of harmonics:** Resonance- nuisance tripping- blown capacitor fuses and capacitor cells degradation of internal capacitance- digital clocks- motor overheating overloading neutrals-telephone interference. **UNIT III** **Investigation of harmonics:** Field measurements-requirements- harmonic symmetrical components-transducers-harmonic instrumentation computer simulation with an example. **UNIT IV** **Insulation materials and failures:** Insulation materials properties-application- causes of insulation degradation- failure modes- recent insulation testing and diagnostic techniques.	

	Vacuum insulation: Breakdown electron emission-pre-breakdown conduction- effective condition of electrodes- breakdown mechanism in vacuum- factors affecting breakdown voltage- vacuum circuit breaker-space application. **UNIT V** **Insulation testing:** Classification of testing- procedures and standards-testing automation- partial discharge test-dielectric loss test- insulation testing of equipments- testing of transformer and cable accessories- testing of electrical switchgear and circuit breakers-testing of motor and generators. **UNIT VI** **Advanced measurement and diagnostic technologies**: Digital impulse recorders-digital techniques in testing, testing automation- electric field measurements-electro optic sensors- magneto optic sensors-space charge measurement techniques- electro optical imaging techniques- insulation resistance measuring instruments.
Text books & Reference books:	**Text books:** 1. "Power system harmonics", by Arrillaga J. and Watson N. R., Wiley, 2nd Edition, U.S.A, Nov2003. 2."Understanding power system harmonics", by Prof. Mack Grady, Dept. of electrical & computer engineering university of Texas at Austin, U.S.A, 2012. 3."High voltage and electrical insulation engineering", by Ravindra Arora, Wolfgang Mosch, IEEEpress series on power Engineering, 2011. 4. "Electrical power equipment maintenance and testing", by Paul Gill, 2nd Edition, CRC Press, Taylor & Francis group, 2009. **Reference books:** 1."Electrical insulation in power systems", by N.H.Malik, A.A.Al-Arainy, M.I.Qureshi, CRC Press, Taylor & Francis group, 1998.
e-Resources:	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm www.ece.utexas.edu/~grady

20EE41E3-Flexible AC Transmission Systems

(EEE)

Course Category:	Professional elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Circuit analysis, Field theory, Power system -I, Power system-II and Power electronics	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	Students undergoing this course are expected to learn:	
	1. The basic concepts of reactive power compensation. 2. The concept of Flexible A.C transmission and the associated problems. 3. The working principles of FACTS devices (STATCOM) and their operating characteristics. 4. The working principles of FACTS devices (SSSC) and their operating characteristics. 5. About FACTS device for power quality improvement. 6. To initiate research to develop/design new schemes and techniques for power quality enhancement.	
Course Outcomes:	After completing the course the student will be able to:	
	CO1	Understand the basic concepts of reactive power.
	CO2	Gain knowledge about flexible A.C transmission system and its controllers.
	CO3	Analyze voltage stability issues in high voltage electrical systems using static VAR compensators.
	CO4	Demonstrate about static series compensation technique to increase power flow capability.
	CO5	Describe the combination of static shunt and series compensation techniques used to increase power flow capability.
	CO6	Develop/design new schemes and techniques for power quality enhancement.
Course Content:	**UNIT-I** **Reactive power compensation:** Overview of reactive power compensation-Power flow through a transmission line- Reactive power requirements in steady state, Sources of reactive power, Static VAR systems, Reactive power control during transients. **UNIT-II** **FACTS concept:** Introduction to FACTS power flow in an A.C system, loading capability limits, dynamic stability considerations, importance of controllable parameters, basic types of FACTS controllers, operation of facts controllers, benefits from FACTS controllers. **UNIT-III** **Static shunt compensation:** Expression for real and reactive power flow with mid-point voltage regulation, variable impedance type static VAR generators, V-I characteristics and control schemes of TCR, TSR, TSC. switching converter type VAR generators, V-I characteristics and control schemes of STATCOM.	

	UNIT-IV **Static series compensation:** Expression for real and reactive power flow with series line compensation, **Variable impedance type series compensators**: V-I characteristics and control schemes of GCSC, TSSC, TCSC, modes of operation, **Switching converter type series compensator:** V-I characteristics, internal and external control schemes of SSSC. **UNIT-V** **Unified power flow controllers:** Principle, expression for real and reactive power between two nodes of UPFC, independent real and reactive power flow control using UPFC, control schemes of UPFC. **UNIT-VI** **Dynamic voltage restorer and unified power quality conditioner:** Voltage sag/swell mitigation, dynamic voltage restorer, working principle and control strategies, series active filtering, Unified Power Quality Conditioner (UPQC), working principle, capabilities and control strategies.
Text books & Reference books:	**TEXT BOOKS:** 1. "Understanding FACTS", by NarainG,Hingorani, LarsloGyugi, Standard publishers 2001. 2."FACTS controllers", by K.R.Padiyar, New age international publication 3. "Electrical power systems quality", by Roger C. Dugan, Mark F. Mc Granaghan, Surya Santoso and H. Wayne Beaty, 3rd Edition, TATA McGraw Hill, 2010. **REFERENCE BOOKS:** 1. "Thyristor – based facts controllers for electrical transmission systems", by Mohan Mathur, R, Rajiv. K. Varma, IEEE press and John Wiley & Sons, Inc. 2. "Flexible A.C transmission system", by A.T.John, Institution of Electrical and Electronic Engineers (IEEE), 1999. 3. "Understanding power quality problems: voltage sags and interruptions", by Math H J Bollen, Wiley, 2010.
e-Resources:	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

20EE41E4 – SWITCHGEAR AND PROTECTION

(EEE)

Course Category:	Professional Elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Power system equipment, power system Analysis, circuit analysis and field theory.	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	Students undergoing this course are expected to learn :	
	1. About switchgear protective equipments. 2. The construction and operation of different types of circuit breakers. 3. Different types of relays and its operation. 4. The different types of relay applications. 5.The zones of protection and equipment protection in the power system. 6.The protection against overvoltage and to insulation co-ordination	
Course Outcomes:	After completing the course the student will be able to:	
	CO1	Understand the application and operation of the fuses as well as on Arcing Phenomenon.
	CO2	Enumerate the operation and application of various types of circuit breakers in the real time applications of power system.
	CO3	Differentiate the operation of different relays.
	CO4	Choose appropriate relays for the power system protection.
	CO5	Design zones of protection and equipment of protection in the power system.
	CO6	Gain knowledge in the field of over voltage protection.
Course Content:	**UNIT-I** **Fuses:** Definitions, characteristics, selection of fuses, types of fuses and applications. **Circuit breakers:** Arc phenomena, initiation & maintenance of arc, methods of arc interruption, restriking voltage and recovery voltages, restriking phenomenon, average and max. RRRV, expression for RRRV, resistance switching, single frequency transients, double frequency transients, current chopping, interruption of capacitive currents. **UNIT-II** **Classification of circuit breakers:** Principle of operation & constructional features of oil, air blast, SF_6 & vacuum CBs, ratings of CBs, testing of CBs, auto reclosures. **UNIT-III** **Protective relays:** Fundamental requirement of protective relays, primary and backup protection, principle of operation of protective schemes. **Classification of relays-I:** Types of Electromagnetic relays, over current relays, directional relays and non-directional relays, earth fault relays. **UNIT-IV** **Classification of relays-II:** Distance relays, negative sequence-differential and under frequency relays.	

	Static relays: Basic static relays used in protective scheme, classification of static relays, over current, directional, distance, differential relays. Comparators, amplitude & phase comparators, duality. **UNIT-V** **Feeder protection:** Transmission line, protection-bus bar protection. **Generator protection:** Protection for stator faults, rotor faults and protection for abnormal conditions. **Transformer protection:** Differential protection schemes-Buchholz relay. **UNIT-VI** **Over voltage protection:** Causes of over voltages in the power system, Phenomena of lightning, protection against direct strokes & indirect strokes, lightning arresters, zinc oxide lightning arrester, surge absorbers. **Insulation coordination:** Volt-time curve, basic impulse insulation levels of different equipments, insulation coordination of transformers, lightning arresters, bus bars and transmission lines.
Text books & Reference books:	**Text books:** 1."Power system protection and switchgear", by Badri Ram & D. N. Vishwakarma, Tata-McGraw-Hill, 2nd Edition 2."Electrical power systems", by C.L. Wadhwa, 7th Edition NAI publishers. 3."A Course in power systems", by J.B Gupta, Publisher: S.K. Kataria & Sons; 11th Edition. **Reference books:** 4. "Switchgear & protection", by Sunil S Rao, Khanna Publishers. 5. "Power system protection & switchgear" by B.Ravindranath and N. Chander, Wiley Eastern Limited. 6. "Electrical power", by Dr S L Uppal, Khanna Publishers.
e-Resources:	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm.

S.No	PROFESSIONAL ELECTIVE-IV(3)
1	Digital Signal Processing **(20EE41E5)**
2	Electrical energy conservation & auditing **(20EE41E6)**
3	Smart grid technology **(20EE41E7)**
4	Utilization Of Electric Power **(20EE41E8)**

20EE41E5 – DIGITAL SIGNAL PROCESSING

Course category:	Professional Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 0- 0
Pre-requisite:	Signal & System, Fourier transform, Laplace Transform & Z transform	**Sessional Evaluation :** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to:	
	1. Learn the basic concepts and analytical methods of Z-transform. 2. Learn to write various DFT & FFT algorithms. 3. Learn to introduce techniques and tools for digital filter structures. 4. Learn the design of FIR filters. 5. Learn about various IIR filters. 6.Learn truncation and rounding errors & quantization noise	
Course Outcomes:	Upon successful completion of the course , the students will be able to:	
	CO1	Understand the concept of Z-transform and its properties.
	CO2	Describe the use of DFT in linear filtering
	CO3	Apply the fast fourier transform algorithm in different applications
	CO4	Design the IIR filters and FIR filters for given specification
	CO5	Design the IIR filters from analog filters for given specification and design the discrete–time systems.
	CO6	Understand the truncation, rounding errors and quantization noise
Course Content:	**UNIT – I** **Review of discrete signals & systems:** Z-transform and Inverse Z-transform-theorems and properties- system function-fourier representation of finite duration sequences. **UNIT – II** **Discrete & Fast Fourier Transform**: DFT, properties of DFT- FFT- FFT algorithms-use of DFT for fast computation of convolution- IDFT. **UNIT – III** **Digital filter structures:** Basic FIR structures, IIR structures, direct form-I-direct form-II-parallel form-cascade form lattice structure-lattice-ladder structures. **UNIT – IV** **Design of IIR filters:** Properties of analog filters- frequency domain filter models-butter- worth-chebyshev and other approximations, filter design data-low pass to high-band pass and band stop transformation-filter response curves.	

	UNIT – V **Design of FIR filters**: Fourier series method- windowing- sampling. **UNIT-VI** **Finite word length effects**: Fixed point and floating point number representations, truncation and rounding errors, quantization noise, coefficient quantization error, product quantization error, overflow error, round-off noise power, limit cycle oscillations due to product round off and overflow errors.
Text books & Reference books:	**TEXT BOOKS:** 1."Digital signal processing", by A.V Oppenheim and R.W. Schafer, Prentice – Hall of India. 2."Digital signal processing", by S. Salivahanam – TMH. 3."Digital signal processing Computer Base Approach", by S.K. Mitra – Tata McGraw-Hill (III) **REFERENCE BOOKS :** 1."Digital signal processing", by P. Ramesh Babu, Scitech Publications. 2."Digital signal processing", by John G Proakis and monolokis – Wiley Eastern Economy edition.
e-Resources	1. http://nptel.ac.in/courses 2. https://dspace.mit.edu/handle/1721.1/57007 3. http://dl.acm.org/citation.cfm?id=562622

20EE41E6-ELECTRICAL ENERGY CONSERVATION & AUDITING

(EEE)

Course Category:	Professional Elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Basics of electrical Circuits and Generation of Electrical Power.	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	To make the student learn about: 1. The energy and its management 2. The importance of energy conservation. 3. The fundamentals of product strategy management. 4. The studying methods of energy accounting and energy auditing in energy sector, industry and final consumption. 5. The opportunities to increase the rational use of energy. 6. The energy conservation in industrial application	
Course Outcomes:	After completing the course the student will be able to	
	CO1	Familiarizing the current global energy scenario
	CO2	Explain the importance of energy conservation.
	CO3	Demonstrate the concepts of energy management.
	CO4	Describe the concepts of energy auditing.
	CO5	Understand the methods of improving energy efficiency in lighting systems.
	CO6	Enumerate the methods of improving energy efficiency in heating and air conditioning.
Course Content:	**UNIT- I** **Energy scenario:** Global & Indian energy scenario- classification of energy sources, energy needs of growing economy- energy sector reform-energy and environment, global environmental concerns- basics of energy and its various forms. **UNIT – II** **Energy conservation:** Power factor and energy instruments- Power factor - methods of improvement- location of capacitors- power factor with non linear loads effect of harmonics on power factor- numerical problems, energy instruments- watt-hour meter- data loggers- thermocouples- pyrometers- lux meters- tong testers- power analyzer. **UNIT – III** **Electric energy management:** Principles of electric energy management- energy management control systems-energy systems maintenance -energy management in water and waste water treatment- solid waste treatment-electricity act-energy conservation act. **UNIT – IV** **Energy audit:** Types of energy audit- energy management (audit) approach, understanding energy costs- bench marking- energy performance-matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel and energy substitution, energy audit instruments.	

	UNIT – V **Energy efficiency in lighting systems:** Lighting modification of existing systems, replacement of existing systems, definition of terms and units-luminous efficiency, polar curve, calculation of illumination level, types of lamps and types of lighting conservation measures. **UNIT – VI** **Energy efficiency in heating and air conditioning**: Space heating and ventilation, air conditioning (HVAC) and water heating-introduction- heating of buildings-transfer of heat- space heating methods- ventilation and air-conditioning-insulation-cooling load- electric water heating systems-energy conservation methods.
Text books & Reference books:	**Text books:** 1. "Energy management", by W.R. Murphy & G. Mckay Butter worth, Elsevier publications, 2012. 2. "Energy efficient electric motors", by John .C. Andreas, Marcel Dekker Inc Ltd 2nd Edition, 1995 3. "General aspects of energy management and audit", National Productivity Council of India, chennai (course material-national certification examination for energy management) **Reference books:** 1. "Electric Energy Utilization and Conservation", by S C Tripathy, Tata McGraw hill publishing company Ltd. New Delhi. 2. "Energy Management Handbook", by W.C. Turner, Marcel Dekker, Inc, New York, 5th Edition, 2005. 3. "Guide to Energy Management", by B. L. Capehart, W. C. Turner, W. J. Kennedy, CRC Press, New York, 2005.
e-resources	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

20EE41E7-SMART GRID TECHNOLOGY

(EEE)

Course Category:	Professional Elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Power systems, Power system analysis & switchgear and protection.	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	Students undergoing this course are expected to learn:	
	1. The introduction to Smart Grid 2. The necessity of smart grid 3. The operation and construction of measuring the smart grid signals 4. The automation technologies of smart grid 5. The Island, protection and applications of smart grid 6. The distributed Energy Resources	
Course Outcomes:	After completing the course the student will be able to	
	CO1	Gain the knowledge on introduction to smart grid.
	CO2	Demonstrate the necessity of smart grid.
	CO3	Enumerate the operation and construction of measuring the smart grid signals.
	CO4	Interpret the automation technologies of smart grid
	CO5	Describe on island, protection and applications of smart grid.
	CO6	Understand the concepts on distributed energy resources
Course Content:	**UNIT-I** **Introduction to smart grid:** Introduction to smart grid- Electricity network- Local energy networks- General considerations for a smart grid, characteristics of smart grids, elements in smart grids. Electric transportation- Low carbon central generation-Attributes of the smart grid- Alternate views of a smart grid. **UNIT-II** **Smart grid to evolve a perfect power system:** Introduction- Overview of the perfect power system configurations- Device level power system- Building integrated power systems- Distributed power systems- Fully integrated power system-Nodes of innovation. **UNIT –III** **Smart electric grid:** Smart electric grid: generation Distributed energy resources: Renewable energy, energy storage, solar energy, wind energy, biomass, hydro power, geothermal and fuel cell, effect of electric vehicles(EV's), transmission, distribution, and end-user; Basic concepts of power, load models, load flow analysis. **UNIT –IV** **Measurement technologies:** Wide area monitoring system (WAMS), advanced metering infrastructure (AMI), phasor measurement units. **UNIT –V** **Communication & networking technology:** Architectures, standards and adaptation of power line communication (PLC), zigbee, GSM, and more; machine to-machine communication models for the smart grid; Home area networks (HAN) and neighbourhood area networks (NAN)	

	UNIT-VI **Energy management in smart grids:** Aspects of energy management in the smart grid; SCADA; micro grids; demonstration projects; case studies. Policy and economic drives of the smart grid; environmental implications; sustainability issues; state of smart grid implementation.
Text books & Reference books:	**Text books:** 1."The smart grid: Enabling energy efficiency and demand response", by Clark W. Gellings, - CRC Press. 2."Smart grid: technology and applications", by JanakaEkanayake, N. Jenkins, K. Liyanage, J. Wu, Akihiko Yokoyama - Wiley. **Reference books:** 1."Smart grids", by Jean Claude Sabonnadiere, NouredineHadjsaid– Wiley Blackwell. 2."Securing the smart grid" by Tony Flick and Justin Morehouse- Elsevier Inc. 3."Smart power: climate change, the smart grid, and the future of electric utilities", by Peter S. Fox-Penner - Island Press. 4."SMART GRID: Fundamentals of design and analysis", by James Momoh- IEEE press, A John Wiley & Sons, Inc., Publication.
e-Resources	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

20EE41E8-UTILIZATION OF ELECTRIC POWER

(EEE)

Course Category:	Professional core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Electrical engineering, Kinematics	**Sessional Evaluation:** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	Students undergoing this course are expected to learn :	
	1.The basic concepts of illumination and design of different lighting schemes. 2.The concepts of different electric heating techniques. 3.The concepts of different electric welding techniques. 4.About the electrical drives, different motor characteristics and load classification. 5.About different traction systems and electrical breaking concepts. 6.The speed-time curves of different train services and calculation of tractive effort.	
Course Outcomes:	After completing the course the student will be able to	
	CO1	Understand the basic concepts of illumination and design of different lighting schemes.
	CO2	Distinguish the concepts of different electric heating techniques.
	CO3	Explain the concepts of different electric welding techniques.
	CO4	Enumerate the concepts of electrical drives, different motor characteristics and load classification.
	CO5	Demonstrate different traction systems and electrical braking concepts.
	CO6	Analyse speed-time curves of different train services and calculation of tractive effort.
Course Content:	**UNIT – I** **Illumination:** Introduction, terms used in Illumination-laws of Illumination- discharge lamps-MV and SV lamps- relative comparison between above methods- basic principles of light control- types and design of lighting schemes- flood lighting-efficient lighting systems-aviation and transport lighting-lighting for displays and signaling-neon signs- LED-LCD displays beacons and lighting for surveillance. **UNIT-II** **Electric heating:** Advantages and methods of electric heating- types and applications of electric heating equipment- resistance ovens-induction heating-dielectric heating-arc furnace **UNIT –III** **Electric welding:** Advantages of electric welding- choice of welding time- electric welding equipment- resistance welding and arc welding techniques-comparison of A.C and D.C welding.	

	UNIT –IV **Electric drives:** Types of Electric drives, choice of motor- starting and running characteristics - speed control- particular applications of electric drives- types of industrial loads-continuous-intermittent and variable loads- load equalization. **UNIT –V** **Electric traction:** Systems of electric traction and track electrification. review of existing electric traction systems in India-special features of traction motors- methods of electric braking- plugging- Rheostatic braking and regenerative braking. **UNIT –VI** **Mechanism of train movement**: Speed-time curves for different services- trapezoidal and quadrilateral speed time curves- calculations of tractive effort- power- specific energy consumption for a given run- effect of varying acceleration and braking retardation- adhesive weight and coefficient of adhesion.
Text books & Reference books:	**Text books:** 1. "Utilization of electric energy", by E.Openshaw Taylor, Orient Longman. 2. "Utilization of electrical power including Electric drives and Electric traction", by N.V.Suryanarayana, New Age International (P) Limited, Publishers, 1996. **Reference books:** 1. "Art & science of utilization of electrical energy", by H.Partab, DhanpatRai & Sons. 2. "Generation distribution and utilization of Electrical energy", by C.L.Wadhwa, New Age International (P) Limited, Publishers, 1997. 3. "A course in power systems", by J.B.Gupta, Kataria& sons, 11th Edition.
e-Resources:	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

S.No	PROFESSIONAL ELECTIVE-V(3)
1	Artificial Intelligence **(20EE41E9)**
2	Electrical Distribution Systems **(20EE41EA)**
3	Electrical & Hybrid vehicle **(20EE41EB)**
4	Power system operation and control **(20EE41EC)**

20EE41E9-ARTIFICIAL INTELLIGENCE

(EEE)

Course Category:	Professional Elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Basic knowledge of coding, Matrix operations and Probability theory.	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to learn: 1. The basics of Neural Networks. 2. The learning rules 3. The fuzzification and defuzzification 4. About Fuzzy sets and Fuzzy Logic theory. 5. The applications in Electrical Engineering. 6. To design of fuzzy systems.	
Course Outcomes	After completing the course the student will be able to:	
	CO1	Understand the principles of neural networks and fuzzy Logic fundamentals.
	CO2	Describe the learning rules.
	CO3	Acquire knowledge in supervised learning.
	CO4	Enumerate about unsupervised learning rules.
	CO5	Explain the concept of classical and fuzzy sets, fuzzification and defuzzification.
	CO6	Design the fuzzy systems
Course Content:	**UNIT-I** **Artificial Neural Networks**: Introduction to neural networks, biological neurons, artificial neurons, Mc-culloch, pitts model, neuron modeling for artificial neural systems, feed forward network, feedback network, perceptron network, supervised and unsupervised Learning. **UNIT-II** **Learning Rules**: Hebbain learning rule, perceptron learning rule, delta learning, winner take all learning rule, oustar learning rule. **UNIT-III** **Supervised Learning:** Perceptron, exclusive OR problem, single layer preceptron network **Multilayer Feed Forward Networks:** linearly non-separable pattern classification, delta learning rule for multi perceptron layer, error back propagation algorithm, training errors, ADALINE, introduction to Radial Basis Function Networks (RBFN) **UNIT- IV** **Unsupervised Learning:** Hamming net, Max net, winner take all learning, counter propagation network, feature mapping, self organizing feature maps. applications of neural algorithms, elementary aspects of applications of character recognition, neural network control applications, process identification.	

	UNIT-V **Fundamentals of Fuzzy Logic and Fuzzy Sets**: Definition of fuzzy set, fuzzy set cardinality, operations of fuzzy sets, union, intersection, complement, cartesian product, algebraic sum, definition of fuzzy relation, properties of fuzzy relations, fuzzy composition. **UNIT-VI** **Design of Fuzzy Systems:** Components of fuzzy systems, functions of fuzzification, rule base patterns, inference mechanisms. **Methods of defuzzification:** Centre of gravity method, mean of maxima method, weighted average method, height method. Design of fuzzy systems for temperature setting of storage water heater, fuzzy system for control of air conditioner.
Text books & Reference books:	**Text books:** 1."Introduction to artificial neural systems", by KacelM.Jurada, Jaico Publications,1st Edition,1992. 2. "Fuzzy set theory and its applications", by Zimmerman K.J. Kluwer Academic Publishers, 4th Edition, 2001. **Reference books:** 1. "Fuzzy logic with engineering applications", by Timothy Ross, Wiley publishers, 4th Edition, 2016. 2. "Foundations of neural networks, Fuzzy Systems, and Knowledge Engineering", by Nikola K. Kasabov, MIT press, Cambridge, London, 2nd Edition, 1996.
e-Resources	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

20EE41EA-ELECTRICAL DISTRIBUTION SYSTEMS

(EEE)

Course Category:	Professional elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-practical:**	3-0-0
Pre-requisite:	Fundamentals of power system transmission and distribution, electric power generation and Basic circuit analysis	**Sessional Evaluation:** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	Students undergoing this course are expected to learn:	
	1. The different load characteristics, modeling and analysis of different factors 2. The types of feeder, feeder voltage levels and its loading. 3. The benefits of optimal location of substations. 4. The power loss, voltage drop, efficiency for transmission lines. 5. The different protective devices operations, applications and co-ordination procedure. 6. The voltage improvement by using different types of power capacitors and optimum capacitor location.	
Course Outcomes:	After completing the course the student will be able to:	
	CO1	Understand different load characteristics, modeling and analysis of different factors.
	CO2	Demonstrate types of feeder, feeder voltage levels and its loading.
	CO3	Analyze benefits of optimal location of substations.
	CO4	Calculate power loss, voltage drop and efficiency of transmission lines.
	CO5	Enumerate different protective devices operations, applications and co-ordination procedure.
	CO6	Design voltage improvement by using different types of power capacitors and optimum capacitor location.
Course Content:	**UNIT–I** **Introduction to distributed systems:** Introduction, classification of loads (residential, commercial, and agricultural & industrial) and their characteristics, an overview of rate of computers in distributed system planning, load modeling and characteristics, coincidence factor contribution factor and loss factor. **UNIT–II** **Design of distributed networks:** Distribution feedback & substation, design considerations of distribution feeders, radial &loop types of primary feeders, voltage levels, feeder loading. **UNIT–III** **Location of substations:** Rating of distribution substations, service area with 'n' primary feeders, benefits of optimal location of substations. **UNIT–IV** **Distribution system analysis:** Voltage drop & power loss calculations, derivation of voltage drop & power loss in lines, manual methods of solution for radial networks, 3ϕ balanced primary lines.	

	UNIT–V **Protective devices & co-ordination:** Objectives of distribution system protection, types of common faults and procedure for fault calculations, protective devices, principles of operation of fuses, circuit breakers, general co-ordination procedure. **UNIT–VI** **Power factor & voltage control improvement:** Capacitive compensation for power factor control, different types of power capacitors, shunt & series capacitors, power factor correction, procedure to determine best capacitor location and equipment for voltage control.
Text books & Reference books:	**Text books:** 1."Electrical power distribution system engineering", by Turan Gonen, 3rd Edition, CRC press, Taylor & Francis group. 2."Electric power distribution", by A.S. Pabla, Tata McGraw Hill Company, 4th Edition. **Reference books:** 1."Guide to electrical power distribution systems", by Anthony J. Pansini, Fairmont Pr; 6th Edition (October 2004) 2."Electrical power systems quality", by Dugan Roger C, McGranaghan M F, Santoso S and Beaty H Wayne, 2nd Edition, McGraw-Hill, 2003.
e-Resources:	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

20EE41EB-ELECTRICAL AND HYBRID VEHICLES

(EEE)

Course Category:	Professional Elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Basics of Electrical engineering	**Sessional Evaluation:**	40
		External Exam Evaluation:	60
		Total Marks:	100

Course Objectives:	To make the student learn about:	
	1. The importance of electric vehicle systems 2. The basics of electric vehicle components and storage 3. The basics of battery technology 4. The various charging types and comfort 5. The safety methods in hybrid vehicle 6. The application of electric vehicle in smart grid	
Course Outcomes:	Upon successful completion of the course , the students will be able to:	
	CO1	Understand the importance of electric vehicle systems
	CO2	Design and develop basic schemes of electric vehicles and hybrid electric vehicles
	CO3	Choose a suitable drive scheme for developing an electric hybrid vehicle depending on resources
	CO4	Select proper energy storage systems for vehicle applications
	CO5	Describe the safety methods in hybrid vehicle
	CO6	Identify various communication protocols and technologies used in vehicle networks
Course Content:	**UNIT –I** **Introduction to Hybrid Electric Vehicles:** History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. **Conventional Vehicles**: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, mathematical models to describe vehicle performance. **UNIT-II** **Hybrid Electric Drive-trains:** Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis. **Electric Drive-trains:** Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis. **UNIT-III** **Electric Propulsion unit:** Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives **UNIT-IV** **Energy Storage:** Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Hybridization of different energy storage devices.	

	UNIT-V **Sizing the drive system:** Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology **UNIT-VI** **Communications and supporting subsystems:** In vehicle networks- CAN. **Energy Management Strategies:** Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies
Text books & Reference books:	**Text books:** 1. "Modern electric, hybrid electric and fuel cell vehicles: fundamentals, theory, and design", by M. Ehsani, Y. Gao, and A. Emadi, 2nd Edition, CRC Press, Aug. 2009. 2. Iqbal Hussein, "Electric and Hybrid Vehicles": Design Fundamentals, by Iqbal Hussein, CRC Press, 2003 3."Advanced electric drive vehicles", by A. Emadi , CRC Press, 1st Edition Oct. 2014. 4. "Hybrid electric vehicles: principles and applications with practical perspectives", by Chris Mi, M. AbulMasrur, 2nd Edition, November 2017, John Wiley & Sons Ltd. **Reference books:** 1."Electric & hybrid vehicles – design fundamentals", by IqbalHussain, 2nd Edition, CRC Press, 2011. 2."Electric vehicle technology explained", by James Larminie, John Wiley & Sons, 2003. 3."Smart Grid: technology and applications", by JanakaEkanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, John Wiley & sons inc, 2012.
e-Resources:	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

20EE41EC-POWER SYSTEM OPERATION AND CONTROL

(EEE)

Course Category:	Professional core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Generation of electric power, power systems, control systems, & electrical machines	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	Students undergoing this course are expected to learn: 1. The basics of power system control. 2. The analytical methods of arriving at the optimal operating strategies which must meet the minimum standards of reliability. 3. About hydro thermal scheduling and unit commitment. 4. The modeling of synchronous generator and exciters. 5. The importance of frequency control, automatic load frequency control mechanism of single area and two area systems. 6. The control operation of a power system using ALFC system.	
Course Outcomes:	After completing the course the student will be able to:	
	CO1	Understand the economic load dispatch problems and solution methods.
	CO2	Solve problems by posing different problem models related to economic load dispatch.
	CO3	Acquire knowledge on forecasting of base load and unit commitment using different methods.
	CO4	Demonstrate the modeling of synchronous generator and exciters.
	CO5	Design the automatic load frequency controller.
	CO6	Analyse to control the operation of a power system using Automatic load frequency control (ALFC) system.
Course Content:	**UNIT-I** **Economic operation of power systems –I :** Optimal operation of generators in thermal power stations, statement of economic dispatch problem, heat rate curve, cost curve, incremental fuel and production costs, input- output characteristics, optimal operations of generators on a bus bar without losses. **UNIT –II** **Economic operation of power systems –II:** Optimum generation allocation including the effect of transmission line losses, loss coefficients, derivation of transmission loss formula. **UNIT-III** **Hydrothermal scheduling**: Introduction, hydroelectric power plant model, scheduling problems, short term hydrothermal scheduling problem. **Unit commitment**: Need for unit commitment, constraints on unit commitment problem, solution methods for unit commitment problems, priority lists method, dynamic programming method.	

	UNIT-IV **Reactive power and voltage control-I**: Basic generator control loops, introduction to D.C and A.C excitation systems, types of exciters , exciter modeling, generator modeling, static performance of AVR loop, generation and absorption of reactive power, relation between voltage, power and reactive power at a node, single machine infinite bus systems, methods of reactive power control. **UNIT-V** **Reactive power and voltage control-II:** Overview of reactive power control-Power flow through a transmission line-Voltage control and line compensation-introduction-Shunt capacitors-Series capacitors-Synchronous compensation, Receiving end power circle diagrams. **UNIT- VI** **Automatic load frequency control (ALFC)**: Automatic load frequency control of single area systems, model of turbine speed governing system, turbine model, generator load model, block diagram representation of ALFC of an isolated power system, steady state analysis, and dynamic response, concept of control area, integral control, two area load frequency control concept and block diagram.
Text books & Reference books:	**Text books**: 1."Modern power system analysis", by I.J.Nagrath & D.P.Kothari Tata Mc Graw – Hill Publishing Company Ltd, 4th Edition. 2."Electrical power systems", by C.L.Wadhwa, Newage International, 3rd Edition 3 "Power system analysis", by Hadi Saadat – TMH Edition. 4. "A text book on power system engineering", by M.L. Soni, P.V. Gupta, U.S. Bhatnagar- DhanpatRai & co 5. "Switch Gear and Protection", by Sunil S. Rao, Khanna Publishers, New Delhi. **Reference books:** 1. "Power generation, operation and control", by Allen J Wood &Woollenberg. John Wiley and Sons. 2. "Electrical energy systems theory", by O.J Elgerd. 3. "Power system analysis, operation and control", by Abhijit Chakrabarti and Sunita Halder, PHI. 4. "Electric power systems", by B.M.Weedy and B.J. Cory.
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S.No	OPEN ELECTIVE-III(3)
1	MOOCS - Swayam (AICTE/ IGNOU) / NPTEL

S.No	OPEN ELECTIVE-IV(3)
1	Environmental Pollution and Control **(20CE41O8)**
2	ROBOTICS **(20ME41O2)**
3	Python programming-II **(20CS41O2)**
4	DSP Processor & Architecture **(20EC41O2)**

20CE41O8 - ENVIRONMENTAL POLLUTION AND CONTROL

Course Category	Open Elective	**Credits**	3
Course Type	Theory	**Lecture - Tutorial – Practical**	3-0-0
Pre-requisite	None	**Sessional Evaluation** **Semester End Exam Evaluation** **Total Marks**	40 60 100

Course Outcomes	CO1	Understand the nature, significance and effects of pollution.
	CO2	Understand the effects of air pollution and various controlling parameters.
	CO3	Understand the effects of water pollution and various controlling parameters.
	CO4	Understand the various methods for solid and hazardous waste disposal.
	CO5	Understand the environmental legislation acts for industrial pollution control.
	CO6	Understanding the characteristics and effects of noise pollution.

Course Content

UNIT – I

THE NATURE OF POLLUTION:

Air pollution and its effects on living and non-living things. Water pollution and its effects on living and non-living things, solid wastes and land pollution.

UNIT – II

AIR POLLUTION CONTROL:

Influence of metereological parameters, physical principles, dry systems, fabric collectors, wet scrubbers, electrostatic precipitations, fume incineration tall sacks. Physical separation systems gravity setting chambers, inertial separators, cyclones, fabric collectors, wet scrubbers, electrostatic precipitators, fume incineration.

UNIT – III

WATER POLLUTION CONTROL:

Routine methods for removal of suspended and dissolved impurities, advance methods like chemical oxidation, membrane separation process, and biological process for removal of phosphorous and nitrogen. Land treatment, eutrophication control.

	UNIT – IV **SOLD WASTE MANAGEMENT:** Quantities and characterizations of municipal solid wastes, recovery of materials and energy, sanitary land filling. Disposal of hazardous wastes. **UNIT – V** **ENVIRONMENTAL LEGISLATION AND INDUSTRIAL POLLUTION CONTROL:** Legislation conserving water pollution air pollution and hazards wastes. Caste studies of pollution control in cement industries, paper, & pulp industries, brewing. **UNIT – VI** **NOISE POLLUTION CONTROL:** Basics of acoustics and specification of sound; sound power, sound intensityand sound pressure levels; Sources of Noise, typical range of noiselevels, types of noise pollution, Characteristics of noise, Effects of noise on the human health, Reactions to noise, psychological effects.
Textbooks and Reference books	**TEXT BOOKS:** 1. CS Rao, Environmental Pollution Control Engineering, New Age International Private Limited; 4th edition, October 2021. 2. P. R. Trivedi, Environmental Pollution and Control, APH Publishing Corporation, December 2004. 3. J. Jeffrey Peirce, P AarneVesilind, Ruth Weiner, Environmental Pollution and Control, Butterworth-Heinemann publishers, 4th edition , January 1998. **REFERENCE BOOKS:** 1. Howard Peavy, Donald Rowe, George Tchobanoglous, Environmental Engineering, McGraw Hill Education publishers, First edition, July 2017 2. S.C. Bhatia, Noise Pollution and its control, Atlantic Publication, 2007. 3. P.A Vesilind, J.J. Peirce, Environmental pollution and control, Butterworth-Heinemann publishers, 4thedition, November 1997.

20ME41O2- ROBOTICS

Course Category:	Open Elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Physics, Differential Equations, Matrices and basic Geometry. Computer Simulation skills using Matlab	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	To make the student learn about: 1. The robotics as an integrated engineering field, classification of robotic manipulators and related technologies. 2. The skills associated with robot control 3. The skills associated with sensors and machine vision systems to robot control 4. The skills in performing kinematics analysis of robot systems 5. The skills in write a robot programme. 6. The skills and interactive applications of industrial robots	
Course Outcomes:	After completing the course the student will be able to	
	CO1	Understand the importance of robotics in today and future and robot configuration and subsystems
	CO2	Gain the knowledge about Control systems for motion control
	CO3	Gain the knowledge about sensors and machine vision.
	CO4	Gain the knowledge about skills in kinematics of robot motion
	CO5	Gain the competence in Design and implementation programming of robot systems.
	CO6	Gain the knowledge about Industrial robots applications.
Course Content:	**UNIT –I** **Introduction**: Need, anatomy of robot, types of joints, types of constructions- degree of freedom, coordinate system workspace/work volume, robot specification. **End-effectors**: Types- mechanical, magnetic, pneumatic **UNIT –II** **Actuators**: Introduction, actuators, characteristics, types, comparison, hydraulic, pneumatic, electric- D.C, A.C, servo, stepper. **Motion control systems**: Introduction, basic components and terminology, transfer function, open loop, feed-forward and closed-loop. microprocessor control of electric motor. **UNIT-III** **Sensors**: Introduction, characteristics, Types - position, velocity, acceleration, force and pressure, torque, proximity, micro switches, touch and tactile, range finders. **Machine vision**: Introduction to machine vision, the sensing and digitizing function in machine vision, image processing and analysis-training the vision system, robotic applications.	

	UNIT-IV **Kinematics of robots:** Introduction, reference frames, robots as mechanisms, matrix representation, transformations, forward and inverse kinematics of 2R and 3R robots, DH representation, degeneracy and dexterity. **UNIT-V** **Robot programming**: Methods of robot programming, a robot program as a path in space motion interpolation wait signal and delay commands branching **Robot languages:** Introduction, generation of robot programming languages, robot language structure, operating systems, robot language elements and functions **UNIT-VI** **Robot applications**: Manufacturing, material transfer and machine loading and unloading, processing operations, welding, other processing operations, assembly and inspection, robotic assembly, parts presentation methods, inspection automation
Text books & Reference books:	**Text books:** 1."Industrial Robotics", by M.P Groover 2nd Edition, McGraw-Hill Education (SIE). 2."Introduction to Robotics: Analysis,Control,Applications", by Saeed B Niku , 2nd Edition Wiley publishers. **Reference books:** 1."Introduction to Robotics", by Subir Kumar Saha Tata McGraw-Hill Education. 2."Robotics: Fundamental Concepts And Analysis", by Ashitava Ghosal oxford university press 3."Introduction to Robotics: Mechanics and Control", by Craig John J, 3rd Edition, Prentice-Hall, 2005. 4."Vision and Control", by P. Corke. Robotics, Springer Verlag, 2011.
e-Resources:	http://nptel.ac.in/courses http://freevideolectures.com/university/iitm

20CS41O2 - PYTHON PROGRAMMING - II

Course Category:	Open Elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Basic mathematical knowledge to solve problems and programming.	**Sessional Evaluation:** **Univ. Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	• To learn the fundamentals of NumPy, Pandas, Matplotlib, Scikit-Learn, Scipy • To develop various simple applications using NumPy, Pandas, Matplotlib. • To define Data analysis using python modules. • To explore features of Data Science and Machine Learning Concepts with Python Modules.	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Understand the NumPy Arrays with different operations.
	CO2	Acquire the knowledge how to apply Matrices in the data analysis.
	CO3	Understand the importance of Pandas for Data Analysis.
	CO4	Acquire knowledge in the concepts of Data Visualization.
	CO5	Understand and Apply the Machine Learning concepts using Scikit-learn
	CO6	Use Scipy functions in Machine Learning and Data Science
Course Content	**UNIT-I** **NumPy I: THE ABSOLUTE BASICS FOR BEGINNERS** Installing NumPy, Import NumPy, Difference between Python lists and NumPy Array, what is an Array, How to Create Basic Arrays, Adding Removing and Sorting Elements, How do You Know the Size and Shape of an Array, Can you Reshape An Array, 1D to 2D Arrays (How do you add new Axis to an Array), Indexing and Slicing, How to Create an array with an Existing Data, Basic Array Operations, More Useful Array Operations, **UNIT-II** **NumPy II:** Creating Matrices, Generating Random Numbers, How to get Unique Items and Counts, Transporting and Reshaping Matrices, Reverse an Array, Reshaping and Flattering Multi-Dimensional Arrays, How to Accessing the Docstring for more information, Working with Mathematical Formulas, How to save and load NumPy Objects. **UNIT-III** **Pandas: User Guide:** Object Creation, Viewing Data, Selection, Missing Data, Operations, Merge, Grouping, Reshaping, Time Series, Categorical, Getting Data In/ Out **Introduction to Data Structures:** Series, Data Frame.	

	UNIT-IV **Matplotlib:** Features of Matplotlib, anatomy and customization of a Matplotlib Plot. **Plotting and Plot Customization:** Creating a plot and figure, Axes, Subplots, Changing Figure sizes. **Customizing Plots:** Plot Titles, Labels and Legends, Text, Ticks, Layouts. Changing Colour of Elements, Visualization Examples. **UNIT-V** **Scikit-Learn:** Introduction to Machine Learning with Scikit-Learn: Machine Learning: The Problem Setting, Loading an Example Datasets, Learning and Predicting, Model Persistence, Conventions. **A Tutorial on Statistical-Learning for Scientific Data Processing:** Statistical Learning, Supervised Learning, Model Selection **UNIT-VI** **Scipy:** Basic Functions, Special Functions, Compressed Sparse Graph Routines, Spatial Data Structures and Algorithms, Statistics, Building Specific Distributions.
Text Books & References Books	**TEXT BOOKS:** 1. Hands on Data Analysis with NumPy and Python, Curtis Miller. **REFERENCE BOOKS:** 1. Learning the Pandas Library, Matt Harrison. 2. Machine Learning Using Python, Manaranjan Pradhan, U. Dinesh Kumar , Wiley Publications. 3. NumPy User Guide 1.20.0, Written by the NumPy Community 4. Pandas: Powerful Python Data Analysis Tool kit Release 1.3.0, Wes McKinney and the Pandas Development Team. 5. Data Visualization in Python, Daniel Nelson. 6. Scikit-Learn User Guide, Release 0.18.2 , Scikit-Learn Developers. 7. Scipy Reference Guide, Release 0.13.0, Written by the Scipy Community
E-Resources	1. https://www.w3schools.com 2. https://www.geeksforgeeks.org 3. https://numpy.org 4. Learn Pandas Tutorials (www.kaggle.com) 5. https://matplotlib.org 6. https://kaggle.com/learn/pandas 7. https://scipy-lectures.org 8. https://scikit-learn.org

20EC41O2-DSP PROCESSORS & ARCHITECTURE

Course Category:	Program Elective	**Credits:**	3
Course Type:	Theory	**Lecture -Tutorial-Practical:**	2-2-0
Prerequisite:	Basics of Signals and systems	**Sessional Evaluation:** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected:	
	1. To teach the basic concepts DSP 2. To educate the students about types Computational errors 3. To educate the students to develop & design architectures for programmable DSP 4. To show how to Write programming to dsp devices 5. To educate the students about implementation of FFT algorithms 6. To educate the students about interfacing	
Course Outcomes	Upon successful completion of the course , the students will be able to:	
	CO1	Understand various types of LTI systems
	CO2	Understand computational accuracy in DSP applications
	CO3	Develop the develop & design architectures for programmable DSP
	CO4	Develop the programming to DSP devices
	CO5	Develop the FFT algorithms
	CO6	Design different I/O interfacings
Course Content	**UNIT –I** **INTRODUCTION TO DIGITAL SIGNAL PROCESING**: Linear Time-Invariant systems, Digital filters, Decimation and interpolation, Analysis and Design tool for DSP Systems MATLAB, DSP using MATLAB. **UNIT-II** **COMPUTATIONAL ACCURACY IN DSP IMPLEMENTATIONS:** Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementations, A/D Conversion errors, DSP Computational errors, D/A Conversion Errors, Compensating filter.	

Course Content	**UNIT-III** **ARCHITECTURES FOR PROGRAMMABLE DSP DEVICES-I:** Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Speed Issues, Features for External interfacing, Commercial Digital signal-processing Devices, **UNIT-IV** **ARCHITECTURES FOR PROGRAMMABLE DSP DEVICES-II:** Data Addressing modes, Memory space, instructions, Program Control of TMS320C54XX Processors, and Programming On-Chip Peripherals, Interrupts, Pipeline Operation of TMS320C54XX Processors. **UNIT- V** **IMPLEMENTATIONS OF BASIC DSP & FFT ALGORITHMS:** The Q-notation, FIR Filters, IIR Filters, Interpolation Filters, Decimation Filters, PID Controller, Adaptive Filters, 2-D Signal Processing. An FFT Algorithm for DFT Computation, A Butterfly Computation, Overflow and scaling, Bit-Reversed index generation, An 8-Point FFT implementation on the TMS320C54XX, Computation of the signal spectrum. **UNIT- VI** **INTERFACING MEMORY AND I/O PERIPHERALS TO PROGRAMMABLE DSP DEVICES:** Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access (DMA). A Multichannel buffered serial port (McBSP), McBSP Programming, a CODEC interface circuit, CODEC programming, A CODEC-DSP interface example.
Text Books and Reference Books	**TEXT BOOKS:** 1. Digital Signal Processing – Avtar Singh and S. Srinivasan, Thomson Publications, 2004. 2. DSP Processor Fundamentals, Architectures & Features – Lapsley et al.S. Chand & CO, 2000. **REFERENCE BOOKS:** 1. Digital Signal Processors, Architecture, Programming and Applications- B.VenkataRamani and M. Bhaskar, TMH, 2004. 2. Digital Signal Processing – Jonatham Stein, John Wiley, 2005.
E-Resources	1. http://www.nptel.ac.in. 2. http:/www.ebookee.com/dsp processors and architectures.

20AD41SC - DATA REPRESENTATION AND ANALYSIS USING R LABORATORY

(Common to CSE, IT, AI&DS, ECE and EEE)

Course Category:	Skill Oriented	**Credits:**	2
Course Type:	Practical	**Lecture-Tutorial-Practical:**	1-0-2
Prerequisite:	Basic Knowledge of Data Analysis and R Programming Fundamentals	**Sessional Evaluation:** **Univ. Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	• To strengthen the ability to identify and apply the suitable R functions for the given Datasets. • To develop skills to Analyse and Visualize the Data.
Course outcomes	After the completion of this Course, the students will be able to Analyze and Visualize the Data.
Course Content	**Session-I:**Download and install R-Programming Environment and install basic packages using install.packages() command in R. **Session-II:**Learn the R Basic Syntax, Datatypes, variables and Reserved words. **Session-III:**Learn the operators, R statements, Loops and R functions. **Session-IV:R objects and Manipulation on R objects:** Vector, List, Array **Session-V:R objects and Manipulation on R objects:**Dataframe, Matrix, Factors. **Session-VI:**Conversion of one form of object to another form, Classes and objects in R, Data Reshaping in R, R Debugging. **Session-VII: Data Interfacing:** Reading file from Disk into R, Read CSV files into R, Using Clip Board for Making Data in R, Read the Binary files into R, Handling Missing values in R. **Session-VIII:**CollecttheDatasetsforPerformingManipulations,Mathematical operations in R, Solving Linear Equations Using R. **Session-IX:R Regression:** Linear Regression,Logistic Regression, Multiple Regression, Poisson Regression. **Session-X:R Statistics:** Normal Distribution, Binominal Distribution, R classification, Time Series Analysis, R Random Forest, Hypothesis, U-test, Chi-square test in R, Analysis of Correlation and Covariance in R.

	<u>Session-XI:</u>Data Visualization using R: visualization packages in R, Pie Charts, Bar Charts, Box Plots, Histograms, Line Graphs, Scatter Plots. **<u>Session-XII</u>** • Collect Dataset and Perform Statistical Analysis on the Collected data. • Collect Dataset and PerformRegression Analysis on the Collected data. **<u>Session-XIII</u>** • Collect Dataset and PerformData Visualization on the Collected data. • Collect Dataset and PerformSentiment Analysis on the Collected data.
Text Books & References Books	**TEXT BOOKS:** 1. Beginning R, the statistical programming language by Dr Mark Gardener. **REFERENCE BOOKS:** 1. "R Programming for Beginners: Fast and Easy Learning" by Steven Keller, Kindle Edition. 2. "A Handbook of Statistical Analyses Using R" by Brian Everitt and Torsten Hothorn. 3. "R Graphics Cookbook" by Winston Chang.
E-Resources	1. https://www.rstudio.com/ 2. https://www.w3schools.com/ 3. https://www.r-project.org/

NBKR INSTITUTE OF SCIENCE & TECHNOLOGY:: VIDYANAGAR (AUTONOMOUS)
(AFFILIATED TO JNTUA:: ANANTAPUR)
SPSR NELLORE DIST
IV YEAR OF FOUR YEAR B.TECH DEGREE COURSE – II SEMESTER
ELECTRICAL AND ELECTRONICS ENGINEERING
SCHEME OF INSTRUCTION AND EVALUATION
(With effect from the academic year 2023-2024)
(For the batch admitted in the academic year 2020-2021)

S.No	Course Code	Course Title	Instruction Hours/Week			Credits	Evaluation					
							Sessional Test-1	Sessional Test-2	Total Sessional Marks (Max. 40)	End Semester Examination		Maximum Total Marks
		THEORY	L	T	D/P					Duration In Hours	Max. Marks	100
1	20EE42PW	Major Project & Summer Industry Internship	-	-	24	12	-	-	Day to Day Evaluation and a test (80 Marks)	3	120	200
		TOTAL				**12**						

(***:** Common to all; #: Common to CE, ME, ECE & EEE; $: Common to ECE&EEE; **@** : Common to EEE, ECE,CE&ME)

20EE42PW-PROJECT WORK& SUMMER INDUSTRY INTERNSHIP

Course Category:	Professional core	**Credits:**	12
Course Type:	Project	**Lecture-Tutorial-Practical:**	0-0-24
Pre-requisite:	Power system Analysis, Switchgear and Protection, Power Electronics & Machines	**Sessional Evaluation:** **Univ.Exam Evaluation:** **Total Marks:**	80 120 200

Course Objectives:	Students undergoing this course are expected to:	
	1. Explore a problem or issue of particular personal or professional interest. 2. Explore to address the problem or issue through focused study and applied research. 3. Synthesize and apply the knowledge and skills acquired in his/her academic program to real-world issues and problems. 4. Affirms ability to think critically and creatively. 5. Solve practical problems and to make reasoned. 6. Take ethical decisions, and to communicate effectively.	
Course Outcomes:	After completing the course, the student will be able:	
	CO1	To provide with the opportunity to apply the knowledge and skills acquired in their courses to a specific problem or issue.
	CO2	To extend their academic experience into areas of personal interest, working with new ideas, issues, organizations and individuals.
	CO3	To think critically and creatively about academic, professional, or social issues.
	CO4	To develop their analytical and ethical leadership skills necessary to address and help to solve these issues.
	CO5	To provide opportunity to refine research skills and demonstrate their proficiency in written and/or oral communication skills.
	CO6	To take on the challenges of teamwork, prepare a presentation in a professional manner and document all aspects of design work.