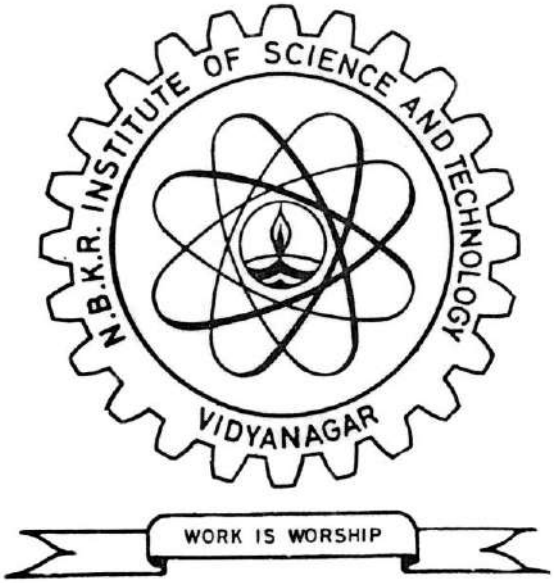
N.B.K.R. INSTITUTE OF SCIENCE & TECHNOLOGY

(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 2019-2020)

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 JNTU ANANTAPUR: NELLORE)
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 batch admitted in the academic year 2019-2020)

S.No	Course Code	Course Title	Instruction Hours/Week			Credits	Evaluation									
							Sessional Test-I			Sessional Test-2			Total Sessional Marks (Max. 40)	End Semester Examination		Maximum Total Marks
		THEORY	L	T	D/ P		Test-I (2Hr)	Assign-I	Max. Marks	Test-2 (2Hr)	Assign-2	Max. Marks		Duration In Hours	Max. Marks	
1	19SH1101	Functional English*	2	-	-	2	34	6	40	34	6	40	0.8*Best of two+ 0.2*least of two	3	60	100
2	19SH1102	Applied Physics #	2	1	-	3	34	6	40	34	6	40		3	60	100
3	19SH1104	Engineering Mathematics-I*	3	1	-	4	34	6	40	34	6	40		3	60	100
4	19CS1101	C Programming *	3	-	-	3	34	6	40	34	6	40		3	60	100
5	19EE1101	Basic Electrical Sciences @	2	1	-	3	34	6	40	34	6	40		3	60	100
		PRACTICALS														
6	19SH11P1	English Language Lab#	-	-	2	1	-		-	-		40	Day to Day Evaluation and a Test (40 Marks)	3	60	100
7	19SH11P2	Applied Physics Lab#	-	-	3	1.5	-		-	-		40		3	60	100
8	19ME11P2	Engineering workshop lab#	-	-	2	1	-		-	-		40		3	60	100
9	19CS11P1	C programming lab#	-	-	3	1.5	-		-	-		40		3	60	100
		TOTAL				20										

(*: Common to ALL #: Common to ECE, EEE, CSE & IT $: Common to EEE & ECE @: common to EEE,CSE&IT)

19SH1101- FUNCTIONAL ENGLISH

(Common to all Branches)

Course Category:	Basic Sciences	**Credits:**	2
Course Type:	Theory	**Lecture-Tutorial-Practical:**	2-0-0
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 learn writing paragraphs effectively with unity and coherence 3. To achieve specific linguistic and communicative competence. 4. To acquire relevant skills and use them effectively in realistic working context. 5. To learn writing simple and analytical essays. 6. To inculcate the habit of reading	
Course Outcomes	On successful completion of this course, the students will be able to:	
	CO1	Improve syntactical knowledge and use of phrases and clauses in sentences and encourage their appropriate use in writing.
	CO2	Obtain effective writing skills in practicing different types of formal letters.
	CO3	Attain both public speaking skills and writing skills by practicing drafting of speeches
	CO4	Acquire data interpretation and summarizing skills
	CO5	Acquire effective strategies for good writing and demonstrate the same in summarizing, writing well-organized essays, record and report the useful information.
	CO6	Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials.
Course Content	**UNIT-I** **Writing:** Paragraph Writing: Sentence Structures: use of phrases and clauses in sentences- importance of proper punctuation- The Five Parts: introducing the topic, logical order, creating coherence, unity and summarizing the main idea. **Grammar:** Parts of Speech: Nouns, Pronouns, Verbs, Adjectives and Adverbs; Nouns: Countable and Uncountable, Singular and Plural; Pronoun-Agreement; Subject-Verb Agreement. **UNIT-II** **Writing:** Letter Writing: Parts of a Letter - Formats of Letters- Types of Letters- Formal letter Writing (enquiry, complaints, seeking permission, seeking internship etc.) **Grammar:** Use of Articles and Zero Article, Prepositions, basic sentence structures; simple question form - wh-questions; word order in sentences	

	UNIT-III **Writing:** Drafting of Public Speech**:** Ideas / Content Generation, Structure **Grammar:** Tenses- Active Voice & Passive Voice; Conditional Sentences **UNIT-IV** **Writing:** Information transfer; comprehend, compare, contrast, identify significance/trends based on information provided in figures/charts/graphs/tables. **Grammar:** Degrees of Comparison; Question Tags, Non-finite Verbs (infinitives, gerunds & participles) **UNIT-V** **Writing:** Essay Writing: Writing structured essays on specific topics- Introducing, analyzing and arguing an issue-creating coherence-Usage of proper punctuation-importance of conclusion **Grammar:** Direct and Indirect Speech, Modifiers **UNIT-VI** **Reading:** Comprehension: Different Reading Strategies- Skimming-Scanning-Inferring, Predicting and Responding to Content - Guessing from context and vocabulary extension. **Grammar:** Common Errors: Identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, parallelism, subject verb agreement, pronoun agreement etc.)
Reference Books	**REFERENCE BOOKS:** 1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014. 2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018. 3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational. 4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012. 5. Murphy, Raymond. English Grammar in Use, 4th ed, CUP

19SH1102- APPLIED PHYSICS

(Common to EEE, ECE, CSE & IT Branches)

Course Category:	Basic Science	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	2-1-0
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 and their analysis using X-rays. 3. Apply principles of Quantum Mechanics to various atomic phenomena and learn the electrical behaviour of solids. 4. Explain and provide the knowledge about semiconductors and their use in electronic devices. 5. Basic properties of dielectric &magnetic materials and their uses in Science & Technology. 6. Learn the behaviour of superconductors, nano materials, 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 concept of polarization& magnetization and also applications of dielectric& magnetic materials in various disciplines.
	CO6	Basic ideas about superconductors and nano materials with their uses in various fields of Science & Technology

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 & its resolving power.

Lasers: Spontaneous & stimulated emission of radiation - Population inversion - Pumping methods – Properties of lasers (monochromacity, coherence, directionality, brightness) – Types of lasers: solid state (Ruby), gas (He–Ne) – Applications of lasers in science, engineering & medicine.

Course Content	**UNIT-II** **Crystallography& X-ray diffraction** **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. **X-ray diffraction**: X – Ray diffraction in crystals – Bragg's law of diffraction – X- ray diffraction techniques: Laue method – Powder method (Debye – Scherrer method). **UNIT-III** **Introduction to quantum mechanics & Free electron theory)** **Introduction to quantum mechanics** : Wave nature of particles (deBroglie 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) – Statement of Bloch's theorem for a particle in a periodic potential – Kronig–Penny model (non mathematical treatment) - Origin of energy bands. **UNIT-IV** **Semiconductor physics & Semiconductor devices:** **Semiconductor physics**: Intrinsic Semiconductors – Intrinsic conductivity – P&N type semiconductors - Variation of Fermi level with temperature –Law of mass action – 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) - Diode equation – Direct & indirect bandgap semiconductors – Light emitting diodes (construction, working, materials & applications) – Photo detectors – Solar cells **UNIT-V** **Dielectrics & Magnetic properties** **Dielectric properties**: Basic definitions – Electronic, ionic (quantitative) and orientation (qualitative) polarizations – Internal fields in solid dielectrics – Clausius – Mossotti equation. **Magnetic properties:** Introduction and basic definitions – 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 – BCS theory - Josephson effect (DC & AC) – Applications of superconductors **Nanomaterials:** Introduction – Significance of nanoscale – Types of nanomaterials – 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 Palanisamy, Scitech. 2. Engineering Physics by K.Thyagarajan, McGraw Hill. 3. Engineering Physics by Maninaidu, Pearson. **REFERENCE BOOKS:** 1. 1.Solid State Physics, by Kittel, Wiley 2. 2.Engineering Physics by Gaur and Gupta, Dhanpatrai Publications

19SH1104-ENGINEERING MATHEMATICS-I

(Common to all Branches)

Course Category:	Basic Sciences	**Credits:**	4
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-1-0
Pre -requisite:	Intermediate Mathematics	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to learn: 1. The concepts of Newton's law of cooling, Law of natural growth and decay. 2. Solutions of higher order linear differential equations with RHS of the different types. 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 concepts of Inverse Laplace transform and their applications. 5. The solution of system of linear equations by 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 students will be able to	
	CO1	Attains skills in solving first order differential equations and its applications.
	CO2	Solve the linear differential equations related to various engineering fields.
	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	Develop the use of matrix algebra techniques that is needed by engineers for practical applications.
	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 – Region of convergence – 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 Laplace transform– Method of partial fractions – Shifting property – Inverse Laplace transform of 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 – Cayley-Hamilton theorem(without proof)-Eigen values and Eigen vectors and their properties. **UNIT - VI** **Differential Calculus:** Taylor's and Maclaurin's series of single variable– Maxima and minima of function of two variables – Lagrangian method of multipliers with three variables only.
Text Books & Reference Books	**TEXT BOOKS:** 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

19CS1101 –C PROGRAMMING

(Common to all branches)

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

Course Objectives	Students undergoing this course are expected : 1. To learn the procedure how to develop algorithms, representations and programming development steps 2. To learn the basic building blocks of C language. 3. To usage of C constructs (arrays, structures, pointers and file management) to develop various programs 4. To create better awareness how effectively utilize the concepts of C for application development	
Course Outcomes	Upon the successful completion of the course, the student will be:	
	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, Flow charts, 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. **ITERATIVE STATEMENTS**: 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 Prototypes, 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	**TEXT BOOK(S):** 1. Programming with ANSI & TURBO C by Ashok N.Kamthane, Pearson Education 2007 **REFERENCE BOOKS:** 1. A Book on C by Al Kelley/Ira Pohl, Fourth Edition, Addison-Wesley.1999 **2.** Let Us C by YashavantKanetkar, BPB Publications. **3.** Programming in ANSI C by Balaguruswamy 6th Edition, Tata McGraw Hill Education, 2012.
E-Resources	https://nptel.ac.in/courses https://freevideolectures.com/university/iitm

19EE1101-BASIC ELECTRICAL SCIENCES

(Common to EEE, CSE & IT)

Course category:	Professional core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	2-1-0
Pre-requisite:	Fundamental concepts of Electricity and Electromagnetic induction.	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	To make the student learn about 1. Basic characteristics of R, L, C parameters and network reduction techniques. 2. The concept of form factor, Crest factor and j notation. 3. The concept of power triangle, series and parallel connection of R, L & C elements with sinusoidal Excitation. 4. Concepts of Graph theory and 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.
	CO3	Determine the real power, reactive power, power factor and response for a given circuit and Excitation.
	CO4	Understand the concepts of graph theory 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. **UNIT – III** **Single Phase AC Circuits:** Concept of Active and reactive power, power factor –power triangle. Examples Steady state Analysis of R, L and C elements(in series, parallel and series parallel combinations) –with sinusoidal Excitation - Phasor diagrams-Examples **UNIT – IV** **Graph Theory:** Network topology, Cut set and Tie set matrices – Incident matrices - Problems **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 , Dhanpat Rai 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

19SH11P1-ENGLISH LANGUAGE LABORATORY

(Common to EEE, ECE, CSE & IT)

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

Course Objectives	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	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 EXPERIMENTS** **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. Group Discussion** • Discussion in pairs/ small groups on specific topics • Short structured talks • Debates • Reporting/ summarizing **5. Presentations:** • Pre-planning • Non- verbal communication • Formal oral presentations on topics from academic contexts **6. Giving directions** • Giving directions • Asking for directions • Specific instruction • Importance of Landmarks

Reference Books	**REFERENCE BOOKS:** 1. A Manual for English Language Laboratories: Dr. D. Sudha Rani, Pearson Publications 2. Techniques of Teaching English: A.L. Kohli, Dhanpat Rai Publishers, 2019 3. https://www.talkenglish.com/

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19SH11P2-APPLIED PHYSICS LABORATORY

(Common to EEE, ECE, CSE & IT Branches)

Course Category:	Basic Science	**Credits:**	1.5
Course Type:	Practical	**Lecture-Tutorial-Practical:**	0-0-3
Pre-requisite:	Engineering 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 understanding 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 completed out of the following : **LIST OF EXPERIMENTS** 1. Determination of rigidity modulus of 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.

19ME11P2- ENGINEERING WORKSHOP

(Common to CSE, EEE, ECE & IT)

Course Category:	Engineering Science	**Credits**	1
Course type:	Practical	**Lecture- Tutorial-Practical**	0-0- 2
Pre-requisite:	No Pre-requisite	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	To make the student learn about 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	**LIST OF EXPERIMENTS** 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	1. Engineering Work shop practice for JNTU, V. Ramesh Babu, VRB Publishers Pvt. Ltd,2009 2. Work shop Manual / P.Kannaiah/ K.L.Narayana/ SciTech Publishers,2004 3. Engineering Practices Lab Manual, Jeyapoovan, SaravanaPandian, Vikas publishers,2007.	

19CS11P1 - C- PROGRAMMING LABORATORY

(Common to all Branches)

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

Objective	To learn the C programming constructs and its implementation
Course Outcomes	Upon successful completion of the course, the students will be able to Solve problems using C programming concepts
Course Content	**LIST OF EXPERIMENTS** 1. To evaluate expressions. 2. To implement if constructs. 3. To implement Switch statement. 4. To implement all iterative 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. To implement parameter passing techniques. 10. To implement Structures. 11. To implement basic File operations.
Text Books & Reference Books:	**TEXT BOOK(S):** 1. Programming with ANSI & TURBO C by Ashok N.Kamthane, Pearson Education 2007 **REFERENCE BOOKS:** 1. A Book on C by Al Kelley/Ira Pohl, Fourth Edition, Addison-Wesley.1999 2. Let Us C by YashavantKanetkar, BPB Publications. 3. Programming in ANSI C by Balaguruswamy6th Edition, Tata McGraw Hill Education,2012.

NBKR INSTITUTE OF SCIENCE & TECHNOLOGY: VIDYANAGAR (AUTONOMOUS)
(AFFILIATED TO JNTU ANANTAPUR: NELLORE)
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 batch admitted in the academic year 2019-20)

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 (2Hr)	Assign-1	Max. Marks	Test-2 (2Hr)	Assign-2	Max. Marks		Duration In Hours	Max. Marks	
1	19SH1201	Professional English*****	2	-	-	2	34	6	40	34	6	40	0.8*Best of two+ 0.2*least of two	3	60	100
2	19SH1203	Engineering Chemistry #	2	1	-	3	34	6	40	34	6	40		3	60	100
3	19SH1204	Engineering Mathematics-II *****	3	1	-	4	34	6	40	34	6	40		3	60	100
4	19CS1202	Data Structures$	2	1	-	3	34	6	40	34	6	40		3	60	100
5	19EE1201	Circuits & Networks	2	1	-	3	34	6	40	34	6	40		3	60	100
		PRACTICALS														
7	19SH12P3	Engineering Chemistry Lab #	-	-	3	1.5	-		-	-		40	Day to Day Evaluation and a Test (40 Marks)	3	60	100
8	19ME12P1	Computer Aided Engineering Drawing Laboratory #	-	-	6	3	-		-	-		40		3	60	100
9	19CS12P2	Data structures lab$	-	-	3	1.5	-		-	-		40		3	60	100
		TOTAL				21										

(*: Common to ALL #: Common to ECE, EEE, CSE& IT $:Common to EEE & ECE @: Common to EEE,CSE & IT)

19SH1201- PROFESSIONAL ENGLISH

(Common to all Branches)

Course Category:	Basic Sciences	**Credits:**	2
Course Type:	Theory	**Lecture-Tutorial-Practical:**	2-0-0
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 their basic professional writing skills in English 2. To achieve specific linguistic and verbal competence 3. To acquire relevant skills and function efficiently in a realistic professional working environment 4. To inculcate the habit of reading & writing 5. To learn writing analytical essays. 6. To acquire verbal proficiency	
Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Write effective descriptions on scientific/technical topics
	CO2	Draft effective business e-mails.
	CO3	Present perspective of an issue and analyze an argument.
	CO4	Write proposals and project reports for professional contexts
	CO5	Practice different techniques of note making and note taking.
	CO6	Write effective book reviews on technical & non-technical books. Equip themselves with verbal proficiency.
Course Content	**UNIT –I** **WRITING:** Descriptions: Descriptions on scientific/ technical in nature-writing introduction - defining – classifying - describing technical features – the structure of an automobile/gadget/product or the process - instruction or installation manuals. **VERBAL:** Verbal reasoning- Analogies, Homophones & Homonyms **UNIT-II** **WRITING:** E-mail Communication- Etiquette – Format- Writing Effective Business Email **VERBAL:** Idioms and Phrases, One-word substitutes **UNIT-III** **ANALYTICAL WRITING:** Presenting perspective of an issue- Compare & Contrast, Cause and Effect, Analyze an argument **VERBAL:** Affixes-prefix and suffix, root words, derivatives	

	UNIT-IV **TECHNICAL WRITING:** Writing Proposals: Significance, Structure, Style and Writing of Project Reports. **VERBAL:** Synonyms and Antonyms **UNIT-V** **WRITING:** Introduction to different kinds of materials: Technical & Non-technical- Note Taking and Note Making- Identification of important points and precise the content **VERBAL**: Words often confused **UNIT-VI** **BOOK REVIEWS**: Review of a Technical and Non-Technical - A brief written analysis including summary and appreciation **VERBAL:** Sentence Completion
Reference Books	**REFERENCE BOOKS:** 1. A Textbook of English for Engineers and Technologists (combined ed Vol. 1&2) Orient Black Swan 2010. 2. Word Power Made Easy , Norman Lewis, New Revised Edition, Goyal Publishers 3. A Communicative Grammar of English by Geoffrey Leech, Longman ,3rd ed 4. Effective Technical Communication, M. Ashraf Rizvi, Tata McGraw- Hill, 2011.

19SH1203-ENGINEERING CHEMISTRY

(Common to EEE, ECE, CSE &IT)

Course Category:	Basic science	**Credits**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	2-1-0
Pre-requisite:	Fundamental concepts of Chemistry	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected: 1. To familiarize engineering chemistry and its applications 2. To train the students on the principles and applications of electrochemistry and polymers 3. To impart the concept of soft and hard waters, softening methods of hard water	
Course Outcomes	On successful completion of this course student will be able to:	
	CO1	Illustrate the molecular orbital energy level diagram of different molecular species
	CO2	Apply Nernst equation for calculating electrode and cell potentials
	CO3	Demonstrate the corrosion prevention methods and factors affecting corrosion
	CO4	Explain the different types of polymers and their applications
	CO5	Explain the principles of reverse osmosis and electro dialysis
	CO6	Explain calorific values and refining of petroleum

Course content

UNIT – I

STRUCTURE AND BONDING MODELS: Planck's quantum theory, dual nature of matter, Schrodinger equation, significance of Ψ and Ψ^2, molecular orbital theory – bonding in homo and heteronuclear diatomic molecules – energy level diagrams of O_2 and CO. π-molecular orbitals of butadiene and benzene, calculation of bond order, crystal field theory – salient features – splitting in octahedral and tetrahedral geometry.

UNIT – II

WATER TREATMENT: Introduction –Hardness of water, Estimation of hardness of water by EDTA Method - Boiler troubles - scale and sludge, Priming and foaming, caustic embrittlement, Boiler corrosion, Industrial water treatment –Lime-soda, zeolite and ion-exchange processes - desalination of brackish water, reverse osmosis (RO) and electro dialysis.

UNIT-III

ELECTROCHEMISTRY AND APPLICATIONS: Electrodes – concepts, reference electrodes (Calomel electrode and glass electrode) electrochemical cell, Nernst equation, cell potential calculations, numerical problems.

Primary cells – Zinc-air battery, Fuel cells, hydrogen-oxygen– working of the cells.

Secondary cells – lead acid and lithium ion batteries. Potentiometry – potentiometric titration (strong acid *vs* strong base). Conductometry – conductometric titrations (strong acid *vs* strong base & weak acid *vs* strong base)

	UNIT-IV **CORROSION:** Introduction to corrosion, electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, metal oxide formation by dry electrochemical corrosion, Pilling Bedworth ratios and uses, Factors affecting the corrosion, prevention methods of corrosion- Metallic coatings(electroplating) and Cathodic protection. **UNIT – V** **POLYMER CHEMISTRY:** Introduction to polymers, Polymerisation and Types of polymerisation. Plastomers -Thermoplastics and Thermo-setting plastics- Preparation, properties and applications of PVC, Bakelite, Urea-Formaldehyde and Nylons. Elastomers – Preparation, properties and applications of Buna N, Thiokol and Silicone rubber **UNIT-VI** **FUEL TECHNOLOGY:** Chemical fuels – Introduction, classification, characteristics of a good fuel, calorific value, determination of calorific value(Bomb calorimeter and Boy's gas calorimeter), numerical problems based on calorific value. **Solid Fuels-** Analysis of coal. **Liquid Fuels -**Refining of petroleum, knocking and anti-knock agents, Octane and Cetane values. **Gaseous Fuels-** 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.

19SH1204-ENGINEERING MATHEMATICS -II

(Common to all Branches)

Course Category:	Basic Sciences	**Credits:**	4
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-1-0
Pre – requisite:	Intermediate Mathematics	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to learn: 1. The concepts of double integrals and its applications. 2. The basic concepts of triple integrals and its applications, Beta and Gamma functions. 3. The gradient, divergence and curl operators, Solenoidal and Irrotational vectors. 4. The basic concepts of vector integration and their applications. 5. To express a function in Fourier series in an interval. 6. The concepts of Fourier transform.	
Course Outcomes	After completing the course the student will be able to	
	CO1	Apply double integration techniques in evaluating areas bounded by region.
	CO2	Understand effectively in analyzing the Triple integrals, Beta and Gamma functions
	CO3	Interpret the physical meaning of different operators such as Gradient, Divergence and Curl.
	CO4	Apply Green's, Stokes and Divergence theorems in evaluation of double and triple integrals.
	CO5	Develop analytical skills in solving the problems involving Fourier Series.
	CO6	Understand effectively Fourier Sine and Cosine integral, Fourier Sine and Cosine transforms.
Course Content	**UNIT - I** **Double Integrals:** Double integrals– Change of order of integration – Change to polar coordinates –Area 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 functions– Vector differential operator – Gradient, Divergence and Curl– Solenoidal and Irrotational vectors. **UNIT – IV** **Vector Integration:** Line integral-circulation-work done – Surface integrals -flux – Volume integral – Vector integral theorems - Green's theorem, Stoke's theorem and Gauss-divergence theorem (without proof).	

	UNIT-V **Fourier Series:**Determination of Fourier coefficients (without proof) – Fourier series – Even and odd functions – Change of intervals. **UNIT-VI** **Fourier Transforms:**Fourier Integral Theorem (Without proof) – Fourier Sine and Cosine integrals — Fourier Transforms – Fourier Sine and Cosine transforms.
Text Books & Reference Books	**TEXT BOOKS:** 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

19CS1202 - DATA STRUCTURES

(Common to ECE & EEE**)**

Course Category:	Core	**Credits:**	3
Course Type:	Theory	**Lecture – Tutorial – Practical:**	3-0-3
Pre-requisite:	Basics of computer fundamentals, knowledge on programming	**Sessional Evaluation:** **Univ. Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to learn: 1. The basics of data structures, types and their representation 2. To creat awareness on operations of various data structures. 3. To gain knowledge about various data structures and its practical applications. 4. Different searching and sorting techniques.	
Course Outcomes	Upon the successful completion of the course, the student will be:	
	CO1	Learn the fundamentals of Data Structures including the basics of Stack and its applicability.
	CO2	Study various types of Queues to develop various applications.
	CO3	Acquire the basics of Linked List representation and effective utilization of Linked lists in memory allocation.
	CO4	Learn the applications of Set data structure and Trees representations.
	CO5	Study various Graph representations and its applications.
	CO6	Learn various searching and sorting techniques.
Course Content	**UNIT – I** **Introduction –** Definition and concepts, Overview of Data Structures, Implementation of Data Structures. **Stacks**: Introduction, Definition, Representation of a Stack usingArrays, Operations of Stacks, Application of queues . **UNIT – II** **Queues**: Introduction, Definition, Representation of Queues using Arrays, Various Queue Structures – Circular, Deque, Priority, Application – Round Robin Algorithm. **UNIT – III** **Linked Lists :** Definitions, Singly Linked List – representation and operations, Circular Linked List and double linked list, Operations on circular and double linked list. **UNIT – IV** **Sets**: Definitions and Terminologies, Representation and Operations of Set. **Trees:** Basic Terminologies, Definitions and Concepts, Representations of a Binary Tree and Operations on binary tree.	

	UNIT – V **Graphs**: Introduction, Graph Terminologies, Representation of Graphs, Operations – Linked List Representation, Illustration of Warshal, Dijikstra, Kruskal's Algorithms. **UNIT – VI** **Sorting:** Basic Terminologies, Sorting Techniques – Bubble sort, Insertion sort, Simple Merge Sort. **Searching:** Basic Terminologies, Searching Techniques – Linear Search with array, Binary Search, Non – linear Search Techniques - Binary Search Tree Searching.
Text Books & References	**Text Book:** 1. D. Samanta,"Classic Data Structures", Prentice Hall of India, 2nd Edition 2009. **Reference Books:** 1. S. Lipschutz, "Data Structures using C", Tata McGraw Hill, Special Indian Edition 2012.
E-Resources	https://nptel.ac.in/courses https://freevideolectures.com/university/iitm

19EE1201-CIRCUITS & NETWORKS

(EEE)

Course Category:	Professional core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	2-1-0
Pre-requisite:	Concepts of Basic electrical sciences, Calculus & Laplace Transforms.	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	To make the student learn about 1. Network theorems and their applications 2. The analysis of three phase balanced & unbalanced circuits 3. Necessary conditions for driving point function & transfer function 4. Time domain response from pole-zero plots 5. Transient response of RL, RC, RLC series circuit for DC excitation. 6. Transient response of RL, RC, RLC series circuit for AC excitation.	
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	Evaluate the two port network parameters for the given network.
	CO4	Draw the pole- zero plot and obtain the time domain response for a given transfer function.
	CO5	Find the time constant and transient response of a given circuit with and without D.C excitation.
	CO6	Determine the time constant and transient response of a given circuit with and without A.C excitation.
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-Application of Milliman's theorem-Star Delta Transformation Technique. **UNIT – III** **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 – IV **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. **UNIT – V** **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 – VI** **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.
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, Dhanpat Rai 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

19SH12P3-ENGINEERING CHEMISTRY LABORATORY

(Common for ECE, EEE, CSE & IT)

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	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	**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 total hardness of water by EDTA method 2. Determination of total alkalinity of water 3. Estimation of chlorides using potassium chromate indicator 4. Determination of cell constant and conductance of solutions 5. Conductometric titration of strong acid Vs strong base 6. Conductometric titration of weak acid Vs strong base 7. Determination of pH of unknown solution 8. Potentiometry - determination of redox potentials and emfs 9. Determination of Strength of an acid in Pb-Acid battery 10. Preparation of a polymer 11. Determination of viscosity of oils with Redwood viscometer 12. Adsorption of acetic acid by charcoal	
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& Chandrasekhar, Chemistry lab manual, 1 Ed., SM Enterprises, Hyderabad, 2014 3. Chatwal&Anand, Instrumental methods of chemical analysis, 2 Ed., Himalaya publications, 2006.	

19ME12P1-COMPUTER AIDED ENGINEERING DRAWING LABORATORY

(Common to EEE, ECE, CSE and IT)

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

Course Objectives	Students are made to learn 1. The various concepts like dimensioning, construction of conic sections, polygons, cycloids and involutes. 2. To impart and inculcate proper understanding of AutoCAD fundamentals. 3. To apply the knowledge of AutoCAD for the projections of points, lines and solids. 4. To know about sections and developments of solids. 5. 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.** **Sections of Solids:** Solids such as Prisms, Pyramids, Cylinders and Cones resting on their bases on HP. **DEVELOPMENT OF SURFACES.** **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. **ORTHOGRAPHIC PROJECTIONS:** Conversion of Pictorial views into Orthographic Views.
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.

19CS12P2 - DATA STRUCTURES LABORATORY

(Common to ECE &EEE)

Course Category:	Professional Core	**Credits:**	1.5
Course Type:	Laboratory	**Lecture – Tutorial – Practical:**	0-0-3
Pre-requisite:	Basic programming knowledge and C language fundamentals	**Sessional Evaluation:** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Objectives	• To learn the various data structures and their implementation. .
Course Outcomes	Upon successful completion of the course, the students will acquire knowledge on types of data structures and the operations that could be performed on them.
Course Content	1. Write a C program to implement Stack operations using arrays. 2. Write a C program to implement Queue operations using arrays. 3. Write a C program to implement various operations on a Singly Linked list. 4. Write a C program to implement the creation of following: a. Doubly Linked list b. Circular Linked list 5. Write a C program for a. Bubble Sort. b. Insertion Sort 6. Write a C program for a. Linear Search b. Binary Search
Text Books and References:	1. D. Samanta,"Classic Data Structures", Prentice Hall of India, 2nd Edition 2009. 2. S. Lipschutz, "Data Structures using C", Tata McGraw Hill, Special Indian Edition 2012.
E-Resources	1. https://nptel.ac.in/courses 2. https://freevideolectures.com/university/iitm

NBKR INSTITUTE OF SCIENCE & TECHNOLOGY:: VIDYANAGAR (AUTONOMOUS)
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SPSR NELLORE DIST
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 2020-2021)
(For the batch admitted in the academic year 2019-2020)

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	19SH2101	Engineering Mathematics – III#	2	1	-	3	34	6	40	34	6	40	0.8*Best of Two + 0.2*Least of Two	3	60	100
2	19EC21XX	Analog & Digital Electronics	2	1	-	3	34	6	40	34	6	40		3	60	100
3	19EC21XX	Signals & Systems$	2	1	-	3	34	6	40	34	6	40		3	60	100
4	19EE2101	Electro Mechanical Energy Conversion-I	2	1	-	3	34	6	40	34	6	40		3	60	100
5	19EE2102	Power Systems-I	3	1	-	4	34	6	40	34	6	40		3	60	100
		PRACTICALS														
6	19EC21PX	Analog & Digital Electronics lab	-	-	2	1	-		-	-		-	Day to Day Evaluation and a test (40 Marks)	3	60	100
7	19EE21P1	Electrical Circuits & Simulation Lab	-	-	3	1.5								3	60	100
8	19EE21P2	Electro Mechanical Energy Conversion-I lab	-	-	3	1.5	-		-	-		-		3	60	100
		TOTAL				20										
		MANDATORY														
9	19MC2101	Environmental Studies#	3	-	-	-	34	6	40	34	6	40	0.8*Best of Two + 0.2*Least of Two	3	60	100

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

19SH2101-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} and 4^{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-KuttaMethod 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 and References:	**TEXT BOOKS:** 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. 3. Advanced Engineering Mathematics - Erwin Kreyszig, Wiley, India **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.
e-Resources	1.https://nptel.ac.in/courses 2.https://freevideolectures.com/university/iitm

19EC21XX– 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. The 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

19EC21XX– 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** **CONTINUOUS TIME SIGNALS:** Signal classification, Types of signals- Dirac delta, unit step, ramp, Signum and Exponential functions, Operations on signals, Analogy between vectors and signals, Orthogonality, Mean square error. **UNIT-II** **FOURIER SERIES**: Definition, Dirichlet's conditions, Classification of Fourier Series, properties of Fourier Series. **UNIT III** **FOURIER TRANSFORM:** Existence of Fourier Transform, Properties of Fourier Transform, Inverse Fourier Transforms, Parseval's Theorem of Energy and Power signals, Auto and Cross correlation of signals, Power and Energy Spectral Densities,	

	UNIT-IV **CONTINUOUS TIME SYSTEMS:** Classification of systems, LTI System, Transmission of signals through LTI systems, Convolution, Impulse response, Frequency response of LTI Systems, Distortion less transmission, Ideal filters, Band Width, Rise time, Hilbert transform, Pre and complex envelopes, Band pass signals through band pass systems. **UNIT-V** **DISCRETE TIME SIGNALS AND SYSTEMS:** Unit impulse, step, ramp, and exponential signals, Periodicity of signals, Operations on signals, Linear Shift Invariant(LSI) system, Stability, Causality, Convolution, Linear constant coefficient difference equation, Impulse response. **UNIT-VI** **DISCRETE TIME FOURIER TRANSFORM**: Definition of Discrete Time Fourier Transform, Properties, Transfer function, System analysis using DTFT.
Text Books & Reference Books	**TEXT BOOKS:** 1. Signals &Systems :A.V.Oppenhiem & A.S.Willsky with S.HamidNawab – PHI 2. Linear Systems and Signals : B.P.Lathi – Oxford University Press 3. Signals & Systems : A Anand Kumar – PHI **REFERENCE BOOKS:** 1. Signals &Systems :J.S.Chitode – Technical Publications 2. Signals & Systems: P.Ramesh Babu-SP
e-Resourses	1. https://nptel.ac.in/courses 2. https://iete-elan.ac.in 3. https://freevideolectures.com/university/iit

19EE2101-ELECTRO MECHANICAL ENERGY CONVERSION -I

(EEE)

Course Category:	Professional core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	2-1-0
Pre-requisite:	Fundamental concepts of Electrical and Magnetic coupled circuits.	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	Students undergoing this course are expected to learn :	
	1. The constructional details, working principles & winding diagrams of DC machines. 2. The types of generators and their applications. 3. The characteristics of DC machines & speed control methods of DC motors. 4. The different performance tests on DC machines. 5. The constructional details, working principle & equivalent circuit of Transformer. 6. The testing of Transformer and Poly phase connections transformers	
Course Outcomes:	After completing the course, the student will be able to:	
	CO1	Understand the working principle of Generator and its winding diagrams.
	CO2	Identify the suitable DC generator for specific applications.
	CO3	Ascertain the suitable DC motor for specific applications.
	CO4	Understand the different tests on the DC machines to determine the performance of machines.
	CO5	Acquire the knowledge of principle, construction, and operation of a transformer and also analyze the equivalent circuit of a transformer.
	CO6	Conduct different types of tests and identify different connections of a poly-phase transformer.
Course Content:	**UNIT – I** **DC Generators**: Simple DC Generator working Principle-Constructional details of DC machine -operation - Armature windings - types of armature windings and winding drawings- numerical problems – Generated EMF equation - Armature reaction – it's effects and compensating Methods-numerical problems. **UNIT – II** **Types of DC Generators:** Characteristics of different types of generators – critical field resistance and critical speed – applications – numerical problems - commutation - methods of improving commutation - Compensating windings. **UNIT – III** **DC Motors:** Working principle – types of DC motors -Torque and Power developed by armature – characteristics of DC motors – Applications & numerical problems - Starting of DC motors - Constructional details of three point and four point starters – numerical problems - Speed control of DC motors – numerical problems. **UNIT – IV** **Losses and efficiency of DC machine**: Various losses in DC machine and efficiency, condition for maximum efficiency- numerical problems **Testing of DC machines**: Brake test - Swinburne's test - Hopkinson's test – Field's test - Retardation test - Separation of iron and friction Losses- numerical problems.	

	UNIT – V **Single Phase Transformers:** Types of Transformers - Constructional details - Principle of operation – EMF Equation - Phasor diagram - losses and efficiency – regulation - All day efficiency - effect of variations of frequency & supply voltage on iron losses - auto transformers-equivalent circuit - comparison with two winding transformers. **UNIT-VI** **Testing of Transformers and Poly-Phase Transformers:** OC and SC tests - Sumpner's test - predetermination of efficiency and regulation-separation of losses - parallel operation with equal and unequal voltage ratios - Poly-phase transformers - Poly-phase connections - Y/Y, Y/Δ , Δ/Y, Δ/Δ, Scott Connection and open Δ.
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 Mc Graw 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

19EE2102-POWER SYSTEMS-I

(EEE)

Course Category:	Professional core	**Credits:**	4
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-1-0
Pre-requisite:	Fundamental knowledge of DC power generation, 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 and mechanical design of OH 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	Gain the knowledge of operation, construction and design of various components of hydro power plant.
	CO3	Know 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 and mechanical design of over head 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. **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, string chart.
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, Dhanpat Rai.
e-Resources:	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

19MC2101 - ENVIRONMENTAL SCIENCES

(Common to CE, EEE, ECE, CSE & IT)

Course Category:	Mandatory course	**Credits:**	0
Course Type:	Theory	**Lecture – Tutorial – Practical:**	3-0-0
Pre-requisite:	Basic idea on environment, Environmental pollution causes, effects and control measures.	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	To make the student learn about	
	1.The importance of Environmental Sciences and understand the various components of environment. 2.The value of natural resources and need to protect them. 3.The value of biodiversity and it`s conservation methods. 4.The advanced methods to solve problems related to environmental pollution. 5.The social issues and provide plans to minimize the problems. 6.To articulate various environmental acts in order to protect the environment.	
Course Outcomes:	Upon successful completion of the course, the students will 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 themitigation 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** **Multidisciplinary nature of environmental sciences:** Introduction, Definition, Scope and Importance of environmental sciences - Various components of environment – Atmosphere, lithosphere, hydrosphere and biosphere –Multidisciplinary nature of environmental sciences. **UNIT-II** **Natural resources:** **Land resources:** Importance, Land degradation, Soil erosion and desertification, Effects of modern agriculture (fertilizer and pesticideproblems). **Forest Resources**: Use and over-exploitation-Mining and Dams-their effects on forest and tribalpeople. **Water Resources:** Use and over-utilization of surface and ground water - Floods and droughts. **Energy resources:** Renewable and non-renewable energy, need to use of alternate energy sources, Impact of energy use onenvironment. **UNIT-III** **Ecosystem**: Definition, types, structure (biotic and abiotic components) and functions of an Ecosystem –Energy flow, Food chain, 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 – in situ and ex situ conservation of biodiversity.	

	UNIT-IV **Environmental Pollution:** Causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution and Nuclear hazards. **Solid waste management**: causes, effects and control measures of urban and industrial waste. **Disaster management:** Floods, earthquake and cyclones. **UNIT-V** **Social issues and Environment:** From unsustainable to sustainable development, urban problems related to energy, water conservation, rainwater harvesting and water shed management. **Case Studies:** Silent valley project, Madhura Refinery and TajMahal, Tehri Dam, Kolleru Lake Aquaculture and Fluorosis in Andhra Pradesh. **Climate change-** Global warming, Acid rain and Ozone depletion. **UNIT-VI** **Human population and Environment:** Population growth, variation among nations and population explosion- Role of information technology in environment and human health. **Environmental Acts:** Water (Prevention and control of pollution) Act-Air (Prevention and control of pollution) Act – Wildlife protection Act and Forest conservation Act. **Field work:**Visit to Local Area having river/Forest/grass land/hill/mountain to document environmental assets.
Text Books and References:	**TEXT BOOKS:** 1. "Environmental science", by AnubhaKaushik and C.P.Kaushik. 2. "Environmental science and Engineering", by P.Anandan and R.K.Kumaravelan. **REFERENCE BOOKS:** 1. "Introduction to Environmental science", by Y.Anjaneyulu. 2. "Environmental studies", by Dr B.S.Chauhan. 3. "Environmental science", by M.Chandrasekhar.
e-Resources	1. https://nptel.ac.in/courses 2. https://freevideolectures.com/university/iitm

19EC21PX – 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 Exam 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 & Zener Diode Characteristics 2. a) Bi-Polar Junction Transistor Characteristics (CE Configuration) b) Junction Field Effect Transistor Characteristics c) Uni-Junction Transistor Characteristics 3. a) Rectifiers without Filters (HWR, FWR, BR) b) Rectifiers with Filters (C, LC, CLC) 4. a) R-C Coupled Amplifier b) FET Amplifier 5. Current Series Feedback Amplifier (With & Without feedback) 6. a) Basic Gates using Diode and Transistors b) Logic Gates 7. Realization of logic gates using NAND and NOR Gates 8. a) Full Adder b) Full Subtractor	

	9 a) Decoder & Implement Expression using Decoder b) Multiplexer & Implement Expression using MUX 10. Divide by N-Ripple Counter 11.Divide by N-Synchronous Counter 12. Shift Register

19EE21P1-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	Determine the two port network parameters experimentally.
	CO5	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	

19EE21P2-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 and Transformers 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. Load testing methods to obtain the performance of DC motors 3. The speed control methods of DC motors. 4. The separation of losses in DC motors . 5. The performance tests of single phase and three phase Transformers. 6. The assessment of DC machines and Transformers.	
Course Outcomes:	After completing the course the student will be able to	
	CO1	Test performance of DC motors and DC generators.
	CO2	Perform load tests on DC motors.
	CO3	Control the speed of DC motors.
	CO4	Separate the losses in DC motors.
	CO5	Evaluate the performance of single phase and three phase Transformers.
	CO6	Know the assessment of DC machines and Transformers.
Course Content:	Minimum of 10 experiments to be conducted out of the following: **List of Experiments** 1. Excitation Characteristics of a. Separately Excited DC Generator b. Self Excited DC Shunt Generator 2. External Characteristics of DC Shunt Generator 3. External Characteristics of DC Compound Generator 4. Swinburne's Test 5. Brake Test on DC Shunt Motor 6. Brake Test on DC Series Motor 7. Speed Control of DC Shunt Motor 8. Hopkinson's Test 9. Separation of Losses of DC Shunt Motor 10. Open Circuit and Short Circuit Test on 1-Φ Transformer 11. Load Test on 1- Φ Transformer 12. Sumpner's Test 13. Three phase transformer connections 14. Scott connection	

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 2020-2021)
(For the batch admitted in the academic year 2019-2020)

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	19EE2201	Electrical & Electronic Measurements	3	1	-	4	34	6	40	34	6	40	0.8*Best of Two + 0.2*Least of Two	3	60	100
2	19EE2202	Electromagnetic Fields	2	1	-	3	34	6	40	34	6	40		3	60	100
3	19EE2203	Control Systems	2	1	-	3	34	6	40	34	6	40		3	60	100
4	19EE2204	Electro Mechanical Energy Conversion-II	3	1	-	4	34	6	40	34	6	40		3	60	100
5	19EE2205	Power Systems-II	3	1	-	4	34	6	40	34	6	40		3	60	100
		PRACTICALS														
6	19EE22P1	Electrical workshop	-	-	3	1.5	-		-	-		-	Day to Day Evaluation and a test (40 Marks)	3	60	100
7	19EE22P2	Electrical & Electronic Measurements Lab	-	-	3	1.5	-		-	-		-		3	60	100
		TOTAL				21										
		MANDATORY														
8	19MC2203	Engineering Economics and Financial Accounting	3	-	-	-	34	6	40	34	6	40	0.8*Best of Two + 0.2*Least of Two	3	60	100

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

19EE2201-ELECTRICAL & ELECTRONIC MEASUREMENTS

(EEE)

Course Category:	Professional core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	2-2-0
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-counters. **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

19EE2202-ELECTROMAGNETIC FIELDS

Course Category:	Professional core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	2-1-0
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. The 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	Find 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 PublishersNew Delhi, 2005, 5th Edition. **REFERENCE BOOKS:** 1. "Electromagnetics", by Joseph A.Edminister, Mc Graw-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

19EE2203-CONTROL SYSTEMS

Course Category:	Professional core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	2-1-0
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, 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

19EE2204-ELECTROMECHANICAL ENERGY CONVERSION - II

Course Category:	Professional core	**Credits:**	4
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-1-0
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 construction, principle of operation and slip-torque characteristics of an Induction motor. 2. The testing of Induction motor and performance calculations. 3. The speed control of Induction motor. 4. The construction, EMF equation, equivalent circuit of alternator and voltage regulation of an alternator. 5. The theory of salient pole machine and parallel operation of Alternators. 6. The operation, Starting methods of Synchronous motor and single phase Induction motors.	
Course Outcomes:	After completing the course, the student will be able to:	
	CO1	Understand the principle, construction and operation of Induction Motor.
	CO2	Assess the performance and characteristics of an Induction motor using different testing methods.
	CO3	Know the speed control techniques of an Induction Motor and understand the principles of double cage motor and Induction generator.
	CO4	Understand the construction and working of an alternator and determine the voltage regulation using different experimental methods.
	CO5	Understand the operating principle of salient pole machine and parallel operation of synchronous generators with infinite bus-bars.
	CO6	Analyze the working and performance of the synchronous motor and understand the construction, operation of single phase induction motor.
Course Content:	**UNIT-I** **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-II** **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-III** **Speed control of Induction motors:** Change of voltage, Change of frequency, introduction to V/f control of three phase Induction motor, injection of EMF into rotor circuit (Principle of operation only), Induction generator (Principle of operation only). **UNIT-IV** **Synchronous generators**: Construction, types of alternators, armature windings, distribution, pitch and winding factors, EMF equation, armature reaction, leakage flux, synchronous reactance, equivalent circuit, phasor diagram. **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-V **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. **Parallel operation of alternators:** Parallel operation, load sharing, synchronizing alternators with infinite bus bars, Synchronizing power and synchronizing torque, effect of change of excitation and change of mechanical input. **UNIT-VI** **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, synchronous condenser, methods of starting. **Single phase induction motor**: Constructional features, Double revolving field theory, split-phase motors, shaded pole motor.
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 VK 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 Mc Graw-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

19EE2205-POWER SYSTEMS-II

Course Category:	Professional core	**Credits:**	4
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-1-0
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 transmission lines and performance calculation of transmission lines. 2. The different types of insulators , methods of equalising the potential across the string of insulators. 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 fundamental concepts of electrical power distribution, both AC & DC.	
Course Outcomes:	After completing the course the student will be able to	
	CO1	Understand the classification of transmission lines and performance calculation of over head transmission lines.
	CO2	Gain knowledge about the different types of insulators, methods of equalizing the potential across the string of insulators.
	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	Design and evaluate the performance of D.C distribution and A.C distribution.
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, Ferranti effect. **UNIT –II** **Overhead Line Insulators:** Introduction, Types of Insulators, potential distribution over a string of insulators, Methods of equalizing the potential, string efficiency. **UNIT-III** **Underground Cables**: Types of Cables, Construction, insulation types, insulating materials for EHV voltage cables, 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 earthed system, Resistance, Reactance, Arc suppression coil earthing and grounding transformers. Arcing grounds, protection against arcing grounds. **UNIT –VI** **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.
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

19MC2203-ENGINEERING ECONOMICS AND FINANCIAL ACCOUNTING

Course Category:	Mandatory course	**Credits:**	0
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Basics of economics & accountancy.	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	Students undergoing this course are expected to learn:	
	1. The causes of economic problems. 2. The behavior of a Consumer while purchasing and consuming various commodities and services. 3. The various production and cost concepts used in managerial decision making process. 4. The formation of different types of business organizations in India. 5. The application of the basic accounting concepts. 6. To evaluate and select profitable investment proposals	
Course Outcomes:	Upon successful completion of the course , the students will be able to	
	CO1	Demonstrate an ability to define, analyze and identify the appropriate solution to a business problem using sound economic and accounting principles.
	CO2	Know the role of various cost concepts in managerial decisions and the managerial uses of production function.
	CO3	Learn to take price and output decisions under various market structures.
	CO4	Understand in brief formalities to be fulfilled to start a business organization.
	CO5	Analyse the firm's financial position with the techniques of economic aspects as well as financial analysis.
	CO6	Evaluate and select profitable investment proposals
Course Content:	**UNIT – I** **BASIC CONCEPTS OF ECONOMICS**: Definition of Economics and basic micro and macro-economic concepts (including GDP/GNP/NI/Disposable Income). The concept of Demand-Law of demand – Elasticity of Demand: Types and measurement .Consumer's equilibrium: Marginal Utility Analysis. **UNIT – II** **THEORY OF PRODUCTION AND COST**: Production function – Cobb – Douglas production function and its properties – Law of variable proportions – Law of Returns to Scale – Cost concepts – Revenue curves – Break-Even Analysis. **UNIT-III** **THEORY OF PRICING**: Classification of markets – Pricing under perfect Competition – Pricing under Monopoly – Price discrimination – Monopolistic Competition.	

	UNIT-IV **TYPES OF BUSINESS ORGANIZATIONS:** Sole proprietorship, partnership and 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**: Concepts and principles, Journal and Ledger, Trial Balance, Final Accounts: Trading account, Profit and Loss account and Balance sheet -Simple problems. **UNIT-VI** **FUNDAMENTAL CONCEPTS OF CAPITAL BUDGETING AND WORKING CAPITAL:** Meaning, process and Methods (Payback period, NPV, ARR & IRR- simple problems), Working Capital: operating cycle, factors and sources.
Text Books & 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.
e-Resources:	http://nptel.ac.in/courses http://freevideolectures.com/university/iitm

19EE22P1-ELECTRICAL WORKSHOP

Course Category:	Professional core	**Credits:**	1.5
Course Type:	Laboratory	**Lecture-Tutorial-Practical:**	0-0-3
Pre-requisite:	Basic electric laws	**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 tools, electrical materials, symbols and devices. 2. The size and gauge of cables, personal protection equipment and safety. 3. The domestic and godown wiring. 4. The soldering, battery charging and testing. 5. The dismantling, assembling, repairing and testing of home appliances. 6. The energy measurement and earthing processes.	
Course Outcomes:	After completing the course the student will be able to	
	CO1	Understand tools, electrical materials, symbols and devices etc.
	CO2	Understand about personal protection equipment and safety.
	CO3	Perform domestic and godown wiring procedures practically.
	CO4	Perform soldering, battery charging and testing.
	CO5	Understand dismantling, assembling, repairing and testing of home appliances.
	CO6	Perform energy measurement and earthing processes.
Course Content:	Minimum of 10 experiments to be conducted out of the following: **List of Experiments** 1. Introduction of tools, electrical materials, symbols and devices etc. 2. To study the sizes and ratings of cables 3. Study of Personal Protective Equipment and safety. 4. Measurement of energy using single phase energy meter 5. Earth resistance measurement and earthing process 6. Connection of ceiling fan with regulator 7. Soldering 8. Godown wiring 9. 12V battery charging and testing 10. Dismantling, repairing, assembling and testing of domestic appliances 11. 16A metal clad socket, MCB connection 12. To study circuit and working of home inverter. 13. To make a switch board containing at least two switches, one fan regulator and one 5A plug point 14. 5 in 1socket-(16A & 5A), switch, fuse and indicator connection 15. Armature winding of ceiling fan	

19EE22P2-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.	

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 2021-2022)
(For the batch admitted in the academic year 2019-2020)

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	19EC3101	Microprocessors and Microcontroller$	3	-	-	3	34	6	40	34	6	40	0.8*Best of Two + 0.2*Least of Two	3	60	100
2	19EC3103	Pulse & Digital Circuits	2	1	-	3	34	6	40	34	6	40		3	60	100
3	19EE3101	Power Systems-III	2	1	-	3	34	6	40	34	6	40		3	60	100
4	19EE3102	Modern control Theory	2	1	-	3	34	6	40	34	6	40		3	60	100
5		Professional Elective-I	3	-	-	3	34	6	40	34	6	40		3	60	100
		PRACTICALS														
6	19EE31P1	Control Systems& simulation Lab	-	-	3	1.5	-		-	-		-	Day to Day Evaluation and a test (40 Marks)	3	60	100
7	19EE31P2	EMEC-II Lab	-	-	3	1.5			-	-		-				
		Audit course														
8	19AC3101	Human Resource Management &Organisational behaviour$	2	-	-	-	-		40	-		40	0.8*Best of Two + 0.2*Least of Two	3	60	100
		TOTAL				**18**										

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

19EC3101-MICROPROCESSORS AND MICROCONTROLLERS

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 Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to learn:	
	1. The history and need of different types of microprocessors and learn the internal architecture details, pin configuration, and their timing diagrams of 8085µp. 2. And develop various projects, by learning programming, and interfacing details of 8085 microprocessor. 3. The internal architecture details, pin configuration, Interrupts and their timing diagrams of 8086µp, and develop assemble language programs. 4. The internal architecture details, pin configuration, and their timing diagrams of 8051µp. 5. The programming and interfacing details of 8051 microcontroller and memory interfacing too. 6. The internal architecture details, pipelining, addressing modes, and C.P.U. Registers of P.I.C. µc.	
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 Microcontroller I/O ports in order to interface the processor to external devices.
	CO5	Illustrate how the different peripherals are interfaced with 8086 µc and develop hardware projects using DAC, ADC, & 7-Segment Display.
	CO6	Gain the knowledge on internal architecture of 8051µp and its modes of operations along with timing diagrams by which improving programming skills on microcontroller.
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.	

Course Content	**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** **DATA TRANSFER SCHEMES:** Programmable Communication Interface 8251, Programmable Interrupt Controller (8259) and its interfacing, Programmable DMA controller (8257) and its interfacing, Programmable Interval Timer (8253) and its interfacing. **UNIT-V** **MEMORY INTERFACING TO 8086:** Interfacing various types of RAM and ROM chips, PPI (8255) and its interfacing, ADC and DAC Interfacing, Waveform generation, Traffic light controller, Stepper motor control, temperature measurement and control. **UNIT-VI** **8051 MICROCONTROLLERS:** Architecture, pin description, Register set, Instruction set. Interrupt structure, timer & serial port operations, Simple Assembly language programs on general arithmetic and logical operations.
Text Books & Reference Books	**TEXT BOOKS:** 1. Ram. B, "Fundamentals of Microprocessors and Micro controllers", DhanpatRai publications. 2. Douglas V. Hall, "Microprocessors and interfacing: Programming and hard ware", TMH, 2nd edition. 3. The 8051 Micro-Controllers, Kenneth J. Ayala, 3rd Edition, Thomson Publications. 4. Design with PIC Micro-Controllers by John B. Peatman, Pearson Educations. **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

19EC3103 – PULSE & DIGITAL CIRCUITS

(EEE)

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

Course Objectives:	Students undergoing this course are expected to : 1. Analysis and design of wave shaping circuits. 2. Analysis and design of Switching Circuits. 3. Analysis and design of multi-vibrators. 4. Analysis and design of time base generators. 5. Analysis of Power Amplifiers. 6. Analysis of LC tuned amplifiers.	
Course Outcomes:	Upon successful completion of the course , the students will able to:	
	CO1	Design RC circuits for triggering
	CO2	Understand Switching circuits (BJT Inverter, NMOS, PMOS and CMOS Switching circuits)
	CO3	Understand design of Multi-vibrators and Schmitt trigger
	CO4	Understand Voltage/ Current Sweep Circuits
	CO5	Understand Power Amplifiers
	CO6	Understand Tuned amplifiers
Course Content:	**UNIT – I** **Wave Shaping Circuits**: Types of waveforms, RC low pass and high pass circuits, rise time, tilt, Diode as a switch, Diode clipper and clamper circuits. **UNIT – II** **Review Of Switching Circuits:** BJT Inverter, NMOS, PMOS and CMOS Switching circuits and their implementation (universal gates only). **UNIT-III** **Multi-Vibrators:** BJT switch and switching times, Bi-stable multivibrator& triggering methods, Schmitt-trigger, Mono-stable and Astable multi-vibrators using BJT. **UNIT – IV** **Time Base Circuits:** RC sweep circuits, constant current Miller and Bootstrap time base generators using BJT's, UJT relaxation oscillators, and sampling gates. **UNIT – V** **Power Amplifiers:** Classification of Power Amplifiers, Class-A, Transformer coupled Class-A, Class-B Push-pull, Complementary Class-B push-pull amplifiers. **Sinusoidal Oscillators:** Barkhausen criterion, RC Phase Shift, Wien Bridge, Hartley and Colpitts oscillators, Crystal oscillator.	

	UNIT –VI **Tuned Amplifiers:** Introduction, Q-factor, small signal tuned amplifiers, effect of cascading single tuned amplifier on bandwidth and stagger-tuned amplifiers.
Text Books & Reference Books:	**Text Books:** 1. "Pulse & Digital switching waveforms" by J.Milliman & H.Taub Mc Graw-Hill,2nd Edition 2008. 2. Design of analog CMOS Integrated circuits by Behadrazhavi, McGraw-Hill, 2nd Edition 2001. **Reference Books:** 1. Solid State pulse circuits, by David A. Bell, PHI.4th Edition 2008. 2. Electronic devices and circuit thoery by Boylestad, Louis Nashelsky, 9ed.,2008Pearson Education 3. Millman and Halkian "Integrated Electronics", McGraw-Hill.
E-Resources:	http://nptel.ac.in/cources https:// iete-elan.ac.in https://freevideolectures.com/university/iitm https://www.youtube.com/watch?v=aO6tA1z933k https://www.youtube.com/watch?v=wN6g_q3KPtw https://www.youtube.com/watch?v=x0BZeUACpK0

19EE3101-POWER SYSTEMS-III

(EEE)

Course Category:	Professional core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	2-1-0
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 modeling and per unit representation. 2. The steady-state analysis for a balanced three-phase power system. 3. The modeling 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 modeling 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 modeling:** Representation of transmission lines-circuit representation of synchronous machine-two winding and three 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, algorithm for short circuit studies-Z bus formulation. **UNIT – III** **Symmetrical components:** Introduction, symmetrical component transformation, phase shift in star-delta transformers, 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, bus impedance matrix method for analysis of unsymmetrical shunt faults. **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, D.C load flow. **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, some factors affecting transient stability.
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

19EE3102-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

<table>
<tr><td rowspan="2">Course Objectives:</td><td colspan="2">Students undergoing this course are expected to learn :</td></tr>
<tr><td colspan="2">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.</td></tr>
<tr><td rowspan="7">Course Outcomes:</td><td colspan="2">Upon successful completion of the course , the students will be able to:</td></tr>
<tr><td>CO1</td><td>Design compensators.</td></tr>
<tr><td>CO2</td><td>Design P, PI and PID controllers</td></tr>
<tr><td>CO3</td><td>Perform different system representations and examine the system controllability and observability</td></tr>
<tr><td>CO4</td><td>Understand the concept of state transition matrix and design state feedback controller and observer.</td></tr>
<tr><td>CO5</td><td>Enumerate the basic idea of non-linearities and stability analysis.</td></tr>
<tr><td>CO6</td><td>Apply different techniques for non-linear systems stability analysis</td></tr>
<tr><td>Course Content:</td><td colspan="2">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</td></tr>
</table>

	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

PROFESSIONAL ELECTIVE-I

1. Advanced instrumentation(19EE31E1)
2. High voltage Engineering(19EE31E2)
3. Industrial electrical systems(19EE31E3)
4. Utilization of Electrical Power (19EE31E4)

19EE31E1-ADVANCED INSTRUMENTATION SYSTEMS

(EEE)

Course Category:	Professional Elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Electrical & Electronic Measurements	**Sessional Evaluation:** **External Evaluation:**	40 60

		Total Marks:	100

Course Objectives:	Students undergoing this course are expected to learn:	
	1.The instruments used for measurement of process parameters like level, flow, pressure and temperature. 2.The various types of analyzers used in industrial applications. 3.The concepts of safety standards and risk analysis techniques. 4.The concepts of instrumentation standards. 5. The process flow diagrams and instrument loop diagrams. 6. Instrument hookup diagrams and piping & instrumentation diagrams.	
Course Outcomes:	After completing the course the student will be able to :	
	CO1	Understand the concepts of flow, level, temperature and pressure measurement
	CO2	Acquire basic knowledge on the various types of analyzers used in industries.
	CO3	Explain the role of safety instrumented system in the industry.
	CO4	Enumerate the standards of instrumentation in hazardous locations.
	CO5	Design, develop and interpret the documents used to define instruments and control system.
	CO6	Design, develop and interpret logic diagrams, hookup diagrams and cable routing diagrams.
Course Content:	**UNIT I** **Measurement of process parameters:** Measurement of temperature-pressure- flow and level-application- selection- calibration methods. **UNIT II** **Instruments for analysis:** Ion selective electrodes- gas &liquid chromatography -oxygen analyzers for gas and liquid –CO-CO_2 -NO and SO analyzers- hydrocarbon and H_2S analyzers-dust-smoke- toxic gas and radiation monitoring. **UNIT III** **Safety instrumentation:** Introduction to safety instrumented systems-hazards and risk-process hazards analysis (PHA)- safety life cycle-control and safety systems-safety instrumented function-safety integrity level (SIL)-selection- verification and validation. **UNIT IV** **Instrumentation standards:** Instrumentation standards-significance of codes and standards- overview of various types- introduction of various instrumentation standards-review- interpretation and significance of specific standards-examples of usage of standards on specific applications. **UNIT V** **Documentation in process industries-I:** Block diagram of a typical process-instrumentation symbols-abbreviations and identification of instruments- mechanical equipment- electrical equipment- instruments and automation systems- process flow diagram (PFD)-piping and	

	instrumentation diagram (P&ID). **UNIT VI** **Documentation in process industries-II:** Instrument lists and specification- logic diagrams- instrument loop diagrams- instrument hookup diagrams-location plans for instruments - cable routing diagrams-typical control track rooms layout-vendors documents and drawings
Text books & Reference books:	**Text books:** 1. "Instrumentation engineers handbook (Process Measurement & Analysis)", by B.G.Liptak, 4th Edition, Chilton Book Co, CRC Press, 2005 2. "Industrial instrumentation", by Al.Sutko,Jerry.D.Faulk, Delmar publishers, 1996. 3. "Safety instrumented systems: design, analysis, and justification", by Paul Gruhn, P.E., CFSE and Harry Cheddie, P.E., 2nd Edition, ISA,2006. **Reference books:** 1. Safety - ANSI/ISA84.00.01-2004, Part 1: Framework, definitions, system hardware and software requirements; ANSI/ISA84.00.01-2004 Part 2: Functional safety: safety instrumented systems for the process industry sector; ANSI/ISA84.00.01-2004 Part 3: Guidance for the determination of the required safety integrity levels-informative. 2. Standards - ANSI/ISA-75.01.01 -2002 (60534-2-1 Mod): flow equations for sizing control valves ISA84 process safety standards and user resources, 2nd edition, ISA, 2011 ISA88 batch standards and user resources, 4th edition, ISA, 2011.
e-Resources	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

19EE31E2-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:**	40 60

		Total Marks:	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

19EE31E3-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:**	40 60

		Total Marks:	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. **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.	

Course Content:	**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

19EE31E4-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:**	40 60

		Total Marks:	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

19AC3101-HUMAN RESOURCE MANAGEMENT AND ORGANISATIONAL BEHAVIOUR

(Common to EEE & ECE)

Course Category:	Humanities	**Credits:**	0
Course Type:	Theory	**Lecture-Tutorial-Practical:**	2-0-0

Pre-requisite:	NIL	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to learn	
	1.HRM concepts and the role of HRM has to play in different aspects of HRM 2. The role of recruitment and selection in relation to the organizations. 3.The job-based compensation scheme and performance management system and appraisals. 4.The development of organizational behavior and its importance in managing people at the workplace. 5.The human behavior as an individual. 6.The foundation of group dynamics and management of different types of conflict at the workplace.	
Course Outcomes	Upon successful completion of the course , the students will be able to	
	CO1	Understand HRM concepts and the role of HRM has to play in different aspects of HRM
	CO2	Explain the role of recruitment and selection in relation to the organizations.
	CO3	Enumerate job-based compensation scheme and performance management system and appraisals.
	CO4	Demonstrate the development of organizational behavior and its importance in managing people at the workplace.
	CO5	Gain knowledge on human behavior as an individual.
	CO6	Familiarize the foundation of group dynamics and management of different types of conflict at the workplace.
Course Content	**UNIT – I** Human Resource Management - Definition - Objectives - Functions - Scope - Importance - Computer Applications in Human Resource Management – characteristics of a good Human Resource Manager - Human Resource Planning - Job design. **UNIT – II** Recruitment and Selection - Sources of Recruitment - Selection Process - Test Types in selection-Interview Types - Placement and Induction-Training - Methods of Training. **UNIT-III** Performance Appraisal - Methods of Performance Appraisal - Transfers - Promotion - Wage & Salary Administration - Wage Incentive - Fringe Benefits . **UNIT-IV** .Definition, need and importance of organizational behaviour – Nature and scope – Frame work – Organizational behaviour models. Personality – types – Factors influencing personality – Theories – Learning – Types of learners – The learning process – Learning theories	

	UNIT-V Attitudes – Characteristics – Components – Formation – Measurement- Values. Perceptions – Importance – Factors influencing perception – Interpersonal perception- Impression Management. **UNIT-VI** Group dynamics- cohesiveness and productivity- Group decision making- Groups versus teams- Managing organizational conflict: sources, levels and types of conflict- Conflict resolution.
Text Books & Reference Books	**TEXT BOOKS:** 1. Human Resource Management - Dr. C.B. Gupta - Sultan and Sons. 2. Personnel & Human Resource Management - P. SubbaRao - Himalaya Publishing House. 3. Organisational Behaviour- L. M Prasad, S. Chand Publishers, New Delhi. 4. Organisational Behavior- Stephen P. Robins- PHI Learning / Pearson Education. **REFERENCE BOOKS:** 1. Human Resource and Personnel Management - K. Aswathappa - Tata McGraw Hill Publishing Co. Ltd. 2. Organisational Behaviour - Fred Luthans McGraw Hill ,NewYork.

19EE31P1-CONTROL SYSTEMS& SIMULATION LAB

Course Category:	Professional core	**Credits:**	1.5
Course Type:	Laboratory	**Lecture-Tutorial-Practical:**	0-0-3

Pre-requisite:	Linear 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 - Lead & Lead - Lag compensator 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	

19EE31P2-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 2021-2022)
(For the batch admitted in the academic year 2019-2020)

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	19EC3205	Analog IC Applications	2	1	-	3	34	6	40	34	6	40	0.8*Best of Two + 0.2*Least of Two	3	60	100
2	19EE3201	Power system operation and control	2	1	-	3	34	6	40	34	6	40		3	60	100
3	19EE3202	Power Electronics	2	1	-	3	34	6	40	34	6	40		3	60	100
4	19EE3203	Switchgear and protection	2	1	-	3	34	6	40	34	6	40		3	60	100
5		Professional Elective-II	3	-	-	3	34	6	40	34	6	40		3	60	100
		PRACTICALS														
6	19EC32P4	MP&MC Lab	-	-	3	1.5	-		-	-		-	Day to Day Evaluation and a test (40 Marks)	3	60	100
7	19EE32P1	Power Electronics & simulation Lab	-	-	3	1.5	-		-	-		-				
8	19EE32MP	Mini project	-	-	4	2	-		-	-		-				
		TOTAL				**20**										
9		**Summer Internship**											**During summer vacation**			

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

19EC3205 – 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.

19EE3201-POWER SYSTEM OPERATION AND CONTROL

(EEE)

Course Category:	Professional core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	2-1-0
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.
e-Resources	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

19EE3202 – POWER ELECTRONICS

(EEE)

Course Category:	Professional core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	2-1-0
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 (both120^0 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

19EE3203 – SWITCHGEAR AND PROTECTION

(EEE)

Course Category:	Professional Elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	2-1-0
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:** 1. "Switchgear & protection", by Sunil S Rao, Khanna Publishers. 2. "Power system protection & switchgear" by B.Ravindranath and N. Chander, Wiley Eastern Limited. 3. "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.

PROFESSIONAL ELECTIVE -II

1. Basics of power system harmonics & electrical insulation(19EE32E1)
2. Electrical machine design(19EE32E2)
3. Embedded systems (19EC32E5)
4. Wind & solar energy systems(19EE32E3)

19EE32E1-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

19EE32E2-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

19EC32E5-EMBEDDED SYSTEMS

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

Course Objectives:	Students undergoing this course are expected to learn: 1. The basic idea regarding the nature of embedded systems 2. The hardware aspects of modern microcontrollers. 3. The basic microcontroller programming. 4. The serial communication protocols. 5. Control analog devices in embedded systems. 6. The IOT working principles.	
Course Outcomes:	Upon successful completion of the course, the students will be able to:	
	CO1	Understand embedded system architects, programmers or researchers in the fields of e.g., automotive industry, robotics, telecom, industrial process control and consumer electronics etc
	CO2	Understand fundamental embedded systems design paradigms, architectures, possibilities and challenges, with respect to both software and hardware.
	CO3	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	Practically apply gained theoretical knowledge in order to design, analyse and implement embedded systems.
	CO5	Apply formal method, testing, verification, validation and simulation techniques and tools in order to engineer reliable and safe embedded systems.
	CO6	Demonstrate the electronics and physical principles used for embedded biomedical measuring systems.
Course Content:	**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-neumannVsharvard architecture, instruction set, instruction formats, and various addressing modes of 32-bit, fixed point and floating point arithmetic operations. **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 & Reference books:	**Text books :** 1."Introduction to embedded systems", by Shibu K.V, Tata McGraw Hill, 2009. 2."An introduction to the design of small-scale embedded systems", by Tim Wilmshurst, Palgrave, 2001. **Reference books :** 1.Device data sheets of ARM/PSoC/MSP430
e-Resources	nptel.ac.in/courses/117105079/

19EE32E3-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	**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

19EC32P4 – MP & MC Lab

Course Category:	Program Core	**Credits:**	1.5
Course Type:	Practical	**Lecture-Tutorial- Practice:**	0 - 0 - 3
Pre-requisite:	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 to learn:	
	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.
      i. Repeated addition
      ii. Using SHIFT and ADD instruction

   d) Write and execute 8086 A.L.P. to perform the following.
      i. Binary division
      ii. 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
   b) Write and execute 8086 A.L.P. to arrange the given data array in ascending order and descending order

Course Content	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. Arithematic Operations Using 8051 a) Write an assembly language program to perform the addition, subtraction, multiplication & Division of two numbers. b) Write an assembly language program to find the square of a given number N. 9. Searching Operations Using 8051 a) To find smallest, largest number from given array of numbers b) To sort given array of numbers in ascending & descending order 10. Logical And Bit Manipulation Operations Using 8051 a) Write an assembly language program to count number of ones and zeros in a eight bit number. b) Write an assembly language program to find whether given eight-bit number is odd or even. If odd store 00h in accumulator. If even store FFh in accumulator. c) Write an assembly language program to perform logical operations AND, OR, XOR on two eight-bit numbers stored in internal RAM locations 21h, 22h.
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 8051 microcontroller and embedded systems”, Pearson education, 2004.

19EE32P1-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	

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 2022-2023)

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	19SH4101	Management Science	3	-	-	3	34	6	40	34	6	40	0.8*Best of Two + 0.2*Least of Two	3	60	100
2	19EE4101	Electrical distribution systems	2	1	-	3	34	6	40	34	6	40		3	60	100
3	19EE4102	Power semiconductor drives	2	1	-	3	34	6	40	34	6	40		3	60	100
4		Professional Elective-III	3	-	-	3	34	6	40	34	6	40		3	60	100
5		Open Elective-1	3	-	-	3	34	6	40	34	6	40		3	60	100
		PRACTICALS														
6	19EE41P1	IoT Lab	-	-	3	1.5	-		-	-		-	Day to Day Evaluation and a test (40 Marks)	3	60	100
7	19EE41P2	Power Systems& Simulation Lab	-	-	3	1.5										
		TOTAL				**18**										

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

19SH4101-MANAGEMENT SCIENCE

(Common to ECE & EEE)

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

Course Objectives	Students undergoing this course are expected to • Learn the disciplines of management science and manager's role in business and other decision-making. • Gain an overview of the process of developing and using quantitative techniques in decision making and planning. • Aware of the ethical dilemmas faced by managers and the social responsibilities of business. • Know the significance of strategic management in competitive and dynamic global economy	
Course Outcomes	Upon successful completion of the course the students will be	
	CO1	Able to apply the concepts & principles of management in real life industry.
	CO2	Able to design & develop organization chart & structure for an enterprise
	CO3	Able to identify Marketing Mix Strategies for an enterprise
	CO4	Able to apply PPC techniques and Work-study principles in real life industry.
	CO5	Able to maintain Materials departments, & determine EOQ
	CO6	Able to develop PERT/CPM Charts for projects of an enterprise and estimate time & cost of project.
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. **UNIT – II** **Design of Organization:** principles of Organization –Organisation process-Types of organisation: line, line and staff organization, function, 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 – Mission, Objectives, programmers, 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 **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-V** **Materials Management:** Objectives -Need for Inventory Control- EOQ, ABC Analysis- VED Analysis- Purchase procedure and stores Management **UNIT-VI** **Project Management (PERT/ CPM):** Network Analysis- Programme Evaluation and Review Technique (PERT)-Critical Path Method (CPM), identifying critical path- probability of completing the project within given time- Project Cost Analysis- Project Crashing (simple problems).
Text Books & Reference Books	**TEXT BOOKS:** 1.Applied management Science and Operations Research by Dr. T.P. Singh, Er. Arvind Kumar 2.Management Science by A.R.Aryasri 3.Industrial Engineering and Management by O.P.Kanna **REFERENCE BOOKS:** 1.Business organizations and management by C.B.Gupta 2.Industrial Engineering and Management (Including Production Management) by T.R.Banga, S.C.Sharma

19EE4101-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

19EE4102-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",byVedam 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

PROFESSIONAL ELECTIVE –III

1. Electrical & hybrid Vehicles(19EE41E1)
2. Digital Signal Processing (19EC41E5)
3. HVDC Transmission Systems (19EE41E2)
4. Smart grid technology (19EE41E3)

19EE41E1-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:** **External Exam Evaluation:** **Total Marks:**	40 60 100

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

19EC41E5 – 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

19EE41E2-HVDC TRANSMISSION SYSTEMS

(EEE)

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 learn:	
	1.The concept of HVDC Transmission system. 2.About the HVDC converters 3.The converter system control. 4.About D.C line and fault prevention 5.The importance of reactive power. 6.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 on HVDC transmission over conventional A.C transmission
	CO2	**Analyze** different converters viz.3,6 and 12 pulse converter.
	CO3	Understand different control schemes as well as starting and stopping of D.C links
	CO4	Demonstrate 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	Describe about reactive power requirement.
	CO6	Design the filters for 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

19EE41E3-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

OPEN ELECTIVE-I

1. Advanced Python Programming(19CS41O1)
2. ROBOTICS(19ME41O1)
3. JAVA programming (19CS41O3)
4. Nanotechnology (19SH41O1)

19CS41O1 - ADVANCED PYTHON PROGRAMMING

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:	Students undergoing this course are expected to learn: • To know the basics of algorithmic problem solving • To read and write simple Python programs. • To develop Python programs with conditionals and loops. • To define Python functions and call them. • To use Python data structures – lists, tuples, dictionaries. • To do input/output with files in Python.	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Develop algorithmic solutions to simple computational problems
	CO2	Read, write, execute by hand simple Python programs.
	CO3	Structure simple Python programs for solving problems.
	CO4	Decompose a Python program into functions.
	CO5	Represent compound data using Python lists, tuples, dictionaries.
	CO6	Read and write data from/to files in Python Programs.
Course Content	**UNIT-I** **ALGORITHMIC PROBLEM SOLVING** Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hano. **UNIT-II** **DATA, EXPRESSIONS, STATEMENTS** Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points. **UNIT-III** **CONTROL FLOW** Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass;	

	UNIT-IV **FUNCTIONS** Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search. **UNIT-V** **LISTS, TUPLES, DICTIONARIES** Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, merge sort, histogram. **UNIT-VI** **FILES, MODULES, PACKAGES** Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.
Text Books & References Books	**TEXT BOOKS** 1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think- python/) 2. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd.,2011. **REFERENCE BOOKS** 1. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition,2013. 2. John V Guttag, "Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press ,2013 3. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012. 4. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers, LLC, 2013. 5. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd.,2016. 6. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd., 2015.
E-Resources	1. https://nptel.ac.in/courses 2. https://freevideolectures.com/university/iitm 3. https://wiki.python.org/moin/PythonBooks

19ME41O1- ROBOTICS
(ME)

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

19CS41O3 - JAVA PROGRAMMING

Course Category:	Open Elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Require the fundamental concepts of anyprogramming and basic analytical capabilities	**Sessional :**	40 60 100

Course Objectives:	Students undergoing this course are expected to understand: • To learn the fundamentals of building blocks and supporting exposure. • To study the development of programs using procedural programming methodologies • To identify various software development techniques that imposes a hierarchical structure on the design of the programs. • To learn the principles of object-oriented programming (OOP) techniques based on classes and objects. • To explore the environments of Integrated Development Environment (IDE), Eclipse and other tools to debug the programs

Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Understand the basics of Java including package concepts.
	CO2	Learn various I/O classes and supporting interfaces to develop simple programs
	CO3	Study the concept of exceptions and database connectivity to explore the qualityimprovement in various applications
	CO4	Identify various thread classes including applet class and implement the sameon design and development
	CO5	Examine the role of event handling mechanisms and its applicability
	CO6	Study various AWT controls and buttons which are used to develop smart userinterfaces
CourseContent	**UNIT-I** **OVERVIEW OF JAVA:** Object Oriented Programming Byte Code Concept, Java Buzzwords, A First Simple Program, Data Types, Variables and Arrays, primitive wrapper classes, Operators, Control Statements, Classes and Methods, Inheritance. **PACKAGES AND INTERFACE:** Packages, Access Protection, Importing Packages **UNIT-II** **INPUT/OUTPUT:** The Java I/O Classes and Interface, File, Standard Streams – System.In, System.Out, System.Err - Their Purpose and Usage, The Byte Streams - InputStream, Output Stream, File Input Stream, File Output Stream, Print Stream, The Character Streams – Reader, Writer, File Reader, File Writer, Buffered Reader, Buffered Writer, Printwriter, Serialization – Use of Object Input Stream and Object Output Stream. **UNIT-III** **EXCEPTION HANDLING:** Exception Handling Fundamentals, Exception Types, Using Try and Catch, Multiple Catch Clauses, Nested Try Statements, Throw, Throws, Finally Creating Own Exception Subclass.	

	DATA BASES: Data Bases Introduced, Jdbc: The Java Database Connectivity, JdbcExplored. **UNIT-IV** **MULTITHREADED PROGRAMMING:** The Java Thread Model, Creating Thread, Creating Multiple Threads, Synchronization, Interthread Communication. **THE APPLET CLASS:** Applet Fundamentals, Applet Basics, Applet Architecture, An Applet Skeleton, Simple Applet Display Methods, Requesting Repainting, Passing Parameters to Applets. **UNIT-V** **EVENT HANDLING:** Two Event Handling Mechanisms, The Event Delegation Modes, Event Classes (ActionEvent, AdjustmentEvent, MouseEvent, WindowEvent, KeyEvent, TextEvent) Sources Of Events, Event Listener Interface (ActionListener, AdjustmentListener, MouseListener, MouseMotionListener, Keylisten, WindowListener, TextListener), Adapter Classes, Inner Classes. **UNIT-VI** **INTRODUCTION TO AWT:** Working with Windows, Controls, Layout Managers, Awt Classes, Window Fundamentals, Working with Frame Windows, creating a Frame window From Applet, Controls, Labels, Using Buttons, Understanding Layout Managers,Menu Bars and Menus, Dialog Boxes, File Dialog.
Text Books& References Books	**TEXT BOOKS** 1.Java 7 The Complete Reference, 7th Edition Herbert Schildt. **REFERENCE BOOKS** 1.Steven Holzner, "Java 2 Programming Black Book", DreamTech, New Delhi, reprint: 2005. 2.Pratik Patel & KarlMoss, "Java database programming with JDBC" DreamTech,New Delhi, second edition, 2000
e-Resources	1.https://nptel.ac.in/courses 2.https://freevideolectures.com/university/iitm

19SH41O1- NANOTECHNOLOGY

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

Course Objectives	Students undergoing this course are expected to:	
	1. Learn the basic concepts of semiconductor nano devices. 2. Learn about types of photonic and molecular materials 3. Develop & design thermal and gas sensors 4. Learn about bio sensors and DNA based bio sensors 5. Learn about criteria for the choice of materials 6. Learn about protein based biosensors	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Understand various types of nano devices and nano mechanics
	CO2	Develop nano technology based LED,LASER…etc
	CO3	Develop the electroluminescent organic materials
	CO4	Develop the different thermal sensors
	CO5	Evaluate the response various materials
	CO6	Design different types of bio sensors
Course Content:	**UNIT –I** **Semiconductor nanodevices-I:** Single electron devices, nano scale MOSFET, resonant tunneling transistor, single-electron transistors, single-electron dynamics, nanorobotics and nano manipulation. **UNIT-II** **Semiconductor nanodevices -II:** Mechanical molecular nano devices, nano computers- theoretical models, optical fibers for nano devices, photochemical molecular devices,DNA, based nano devices, gas-based nano devices, micro and nano mechanics. **UNIT-III** **Electronic and photonic molecular materials:** Preparation, electroluminescent organic materials, laser diodes, quantum well lasers, quantum cascade lasers, cascade surface, emitting photonic crystal laser, quantum dotlasers, quantum wire lasers, white LEDs, LEDs based on nanowires, LEDs based on nanotubes, LEDs based on nanorods high efficiency materials for OLEDs, high efficiency materials for OLEDs, quantum well infrared photo detectors.	

	UNIT-IV **Thermal sensors**: Thermal energy sensors, temperature sensors, heat sensors, electromagnetic sensors electrical resistance sensors, electrical current sensors, electrical voltage sensors, electrical power sensors, magnetism sensors, mechanical sensors, pressure sensors, gas and liquid flow sensors, position sensors, chemical sensors, optical and radiation sensors. **UNIT-V** **Gas sensor materials:** Criteria for the choice of materials, experimental aspects, materials, properties, measurement of gas sensing property, sensitivity, discussion of sensors for various gases, gas sensors based on semiconductor devices. **UNIT-VI** **Biosensors:** Principles, DNA based biosensors, protein based biosensors, materials for bio sensor applications, fabrication of biosensors, future potential.
Text books & Reference books:	**Text books:** 1. "Nano Electronics and Information Technology", by W. Ranier, Wiley, (2003). 2. "Nano systems ", by K.E. Drexler, Wiley, (1992). **Reference books:** 1. "Introduction to Molecular Electronics", by M.C. Petty,1995.

19EE41P1-IoT Lab

Course Category:	Professional core	**Credits:**	1.5
Course Type:	Laboratory	**Lecture-Tutorial-Practical:**	0-0-3
Pre-requisite:	C-Programming &basic Electrical & Electronics 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 Microcontroller. 2. Measurements different parameter using Arduino 3. The 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 Microcontroller.
	CO2	Describe position error detection.
	CO3	Explain the working of different sensors using Arduino.
	CO4	Measure physical quantity using sensors and Arduino kit.
	CO5	Develop the basic programming on Arduino kit
	CO6	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	

19EE41P2-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, Switchgear and Protection	**Sessional Evaluation:**	40
		Univ.Exam Evaluation:	60
		Total Marks:	100

Course Objectives:	Students undergoing this course are expected to learn:	
	1. About various system studies and different techniques used for system planning. 2.The dynamic analysis of power system 3. Present problem oriented knowledge of power system analysis methods. 4. To analyze the performance of relays. 5. The re-wirablefuse characteristics . 6. To measure the earth resistance and breakdown voltage of the transformer oil.	
Course Outcomes:	After completing the course the student will be able to	
	CO1	Understand inverse over current, differential over current and percentage differential relay characteristics
	CO2	Describe the fuse characteristics
	CO3	Enumerate the modeling of transmission lines
	CO4	Measure the earth resistance and perform dielectric strength of transformer oil
	CO5	Explain the load flow studies by using G-S method
	CO6	Apply load frequency dynamics of single and two area power systems
Course Content:	Minimum of 10 experiments to be conducted out of the following: **LIST OF EXPERIMENTS** 1. String efficiency calculation of 3-disc String 2. characteristics of Inverse over current relay 3. characteristics of Directional over current relay 4. characteristics of Percentage differential relay 5. characteristics of re-wirable Fuse characteristics 6. Evaluation of ABCD parameters of a transmission line using MATLAB. 7. Measurement of Sequence impedances of synchronous machine 8. Measurement of earth resistance 9. Testing of dielectric strength of Transformer Oil. 10. Formation of Y_{bus} & Z_{bus} power system network using MATLAB programming. 11. Solution of power flow using G-S method with MATLAB programming. 12. Economic dispatch in power systems with MATLAB programming. 13. DVR with & without stabilizer using MATLAB programming. 14. Load-frequency dynamics of single and two area power systems using MATLAB 15. Numerical solution of the swing equation using MATLAB programming.	

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 2022-2023)
(For the batch admitted in the academic year 2019-2020)

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	0.8*Best of Two + 0.2*Least of Two	Duration In Hours	Max. Marks	100
1		Professional Elective-IV	3	-	-	3	34	6	40	34	6	40		3	60	100
2		Open Elective-II	3	-	-	3	34	6	40	34	6	40		3	60	100
		PROJECT														
3	19EE42PR	Project work	-	-	22	11	-		-	-		-	Day to Day Evaluation 80M	3	120	200
4	19EE42MO	MOOC's				3								-	-	-
5	19EE42IS	Internship				2							40M	3	60	100
		TOTAL				**22**										

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

PROFESSIONAL ELECTIVE-IV

1. Digital control systems (19EE42E1)
2. Electrical energy conservation & auditing(19EE42E2)
3. Flexible AC Transmission Systems (19EE42E3)
4. Neural Networks & Fuzzy Logic Systems (19EE42E4)

19EE42E1- DIGITAL CONTROL SYSTEMS
(EEE)

Course Category:	Professional Elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Control Systems, Signals & Systems, Laplace Transforms and Z Transforms.	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	Students undergoing this course are expected to learn:	
	1. The concepts of digital control systems. 2. The theory of z–transformations and application for the mathematical analysis of digital control systems. 3. To represent the discrete–time systems in state–space model and evaluation of state transition matrix. 4. To examine the stability of the system using different tests. 5. The conventional method of analyzing digital control systems in the w–plane. 6. The design of state feedback control by "the pole placement method.	
Course Outcomes:	After completing the course the student will be able to:	
	CO1	Understand discrete time control systems and the "knowhow" of various associated accessories.
	CO2	Demonstrate Z–transformations and their role in the mathematical analysis of different systems.
	CO3	Design the state feedback control by the pole placement method.
	CO4	Apply the stability criterion for digital systems and methods adopted for testing.
	CO5	Represent the discrete–time systems in state–space model and evaluation of state transition matrix.
	CO6	Design the conventional and state space methods of design.
Course Content:	**UNIT-I** **Introduction and signal processing:** Introduction to analog and digital control systems, advantages of digital systems, typical examples, signals and processing, sample and hold devices, sampling theorem and signal reconstruction, frequency domain characteristics of zero order hold. **UNIT-II** **Z–transformations:** Z–Transforms, theorems, finding inverse Z–transforms, formulation of difference equations and solving, block diagram representation, pulse transfer functions and finding open loop and closed loop responses. **UNIT-III** **State space analysis and the concepts of controllability and observability:** State space representation of discrete time systems, state transition matrix and methods of evaluation, discretization of continuous, time state equations, concepts of controllability and observability, tests(without proof). **UNIT- IV** **Stability analysis:** Mapping between the s-plane and the Z-plane –, primary strips and complementary strips, stability criterion, modified routh's stability criterion and jury's stability test.	

	UNIT-V **Design of digital control system:** Design of discrete PID controller, design of discrete state feedback controller, design of set, point tracker, design of discrete observer for LTI system, design of discrete compensator. **UNIT-VI** **Discrete output feedback control:** Design of discrete output feedback control, fast output sampling (FOS) and periodic output feedback controller design for discrete time systems.
Text books & Reference books:	**Text books:** 1."Discrete–time control systems", by K. Ogata, Pearson Education/PHI, 2nd Edition. 2. "Digital control engineering", M. Gopal, Wiley Eastern, 2nd Edition. 3."Digital control of dynamic systems", by G. F. Franklin, J. D. Powell and M. L. Workman, Addison-Wesley, 3rd Edition. **Reference books:** 1."Digital control engineering", by M. Sami Fadali Antonio Visioli, Elsevier Limited, Oxford, 2nd Edition, 2012. 2."Digital Control and State Variable Methods", by M.Gopal, TMH, 4th Edition. 3."Digital Control System", by B.C. Kuo, Holt, Rinehart and Winston, 2nd Edition.
e-Resources	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

19EE42E2-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

19EE42E3-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. McGranaghan, 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

19EE42E4-NEURAL NETWORKS AND FUZZY LOGIC

(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

OPEN ELECTIVE-II

1. Building planning and construction Techniques (19CE42O1)
2. R Programming (19CS42O3)
3. Computer organization (19EC42O1)
4. VLSI design (19EC42O2)

19CE42O1– BUILDING PLANNING AND CONSTRUCTION TECHNIQUES
(CE)

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

Course Objectives:	Students undergoing this course are expected to: 1. Study about the basic building materials, properties and their applications. 2. Study the various cementitious materials. 3. Learn the different types of smart construction materials and their applications. 4. Learn the various types of the building components. 5. Learn the techniques of damp proofing and finishing works of the building. 6. Learn the various factors considered in planning and construction of buildings.	
Course Outcomes:	**CO1**	Understand various types of stones and methods of manufacturing of bricks and tiles.
	CO2	Identify the importance of ingredients of lime, cement and concrete.
	CO3	Identify the properties of smart construction materials alternative for cement and also be able to understand various types of masonry construction.
	CO4	Understand various building components and their various types.
	CO5	Understand the techniques and importance of damp proofing and finishing works of the building.
	CO6	Identify the factors to be considered in planning and construction of buildings and Plan a building following the bye-laws
Course Content:	**UNIT – I** **Building materials -I:** **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 – II** **Building materials–II:** **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 – III **Wood:** Introduction, classification of timber (IS: 399), characteristics of good timber, defects in timber, types and uses of ply-wood and engineered wood, uses of materials like aluminium, gypsum, glass and bituminous materials. **Smart construction materials:** Overview and use of Fly ash, silica fume, carbon fibers, self-healing materials and fiber reinforced plastics, benefits of Nanotechnology in construction industry. **Building structures–I:** **Masonry:** Types of masonry, english and flemish bonds, cavity, partition and shear walls. **UNIT – IV** **Building structures–II:** **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 – V** **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. **UNIT – VI** **Building planning :** Terms used in building drawing as per NBC, factors affecting in selection of site, functional requirements of a residential building, minimum size requirements as per NBC, standard sizes of door, windows and ventilators. **Planning:** Principles of planning, factors to be considered in planning, planning of residential, buildings, preliminaries of vaastu, municipal bye – law, list of documents to be submitted for building plan approval.
Text books & Reference books:	**Text books:** 1. "Engineering materials" , by S.C. Rangwala. 2. "Building construction", by B.C. Punmia. 3."Building planning and drawing", by Dr. N. Kumara Swamy & A. Kameswara Rao. **Reference books:** 1. "Building materials", by S.K. Duggal. 2. "A text book of building construction", by S.K. Sharma &B.K.Kaul. 3. "Building construction", by Sushil Kumar. 4. "Indian standard institution, national building code of India", ISI, 1984, New Delhi

19CS42O3-R PROGRAMMING

Course Category:	Open Elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Require fundamental knowledge in any programming language, mathematics and statistical techniques	**Sessional Evaluation:** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course objectives	Students under going this course are expected to understand: • Gain a foundational understanding of R Programming basics • Master the R programming and understand how various constructs are implemented in complex problems and applications	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Understand the fundamental building blocks of R programming
	CO2	Learn some of the commands and packages to develop simple programs
	CO3	Acquire knowledge of Various storage and retrieval techniques and applicability
	CO4	Study various types of viewing and forms of data objects for application development
	CO5	Adapt different types of testing methodologies and supporting comparative study
	CO6	Get the clear view of how to analyze methods using graphical representations based on statistical data

Course Content

UNIT-I

Introduction to R programming: History of R programming, Reserved words of R, Variables and constants of R, Operators of R, precedence and association of R, data types in R. Decision making statements in R programming. Iterative statements, functions, strings, arrays, vectors, lists, matrices, factors, data frames, data reshaping and data interfacing.

UNIT-II

R-command packages: Standard Command Packages, Getting Extra Packages of R Commands- Installing Extra Packages for Windows, Running and Manipulating Packages, Loading Packages, Windows-Specific Package Commands.

UNIT-III

Simple Math: Use R Like a Calculator, Storing the Results of Calculations.
Reading and Getting Data into R: Using the combine Command for Making Data, Entering Numerical and Text Items as Data, Scan Command for Making Data.
Reading Bigger Data Files: read.csv () Command, Other Commands for Reading Data in R, Missing Values in Data Files.

	UNIT-IV **Manipulating Objects:** Manipulating Vectors, Manipulating Matrix and Data Frames, Manipulating Lists. **Constructing Data Objects:** Making Lists, Making Data Frames, Making Matrix Objects. **Forms of Data Objects:** Testing and Converting, Testing to See What Type of Object You have, Converting from One Object Form to Another, convert a Matrix to a DataFrame,convertaDataFrameintoaMatrix,convertaDataFrameintoaListandConvertaMatrixinto a list **UNIT-V** **Simple Hypothesis Testing:** Using the Student'st-test,Two-Samplet-TestwithUnequalVariance,Two-Samplet-Test with Equal Variance, One - Samplet-Testing, Using Directional Hypothesis Formula, Syntax and Sub setting Samples in the T-Test. **The Wilcox on U-Test (Mann-Whitney):** Two-Sample U-Test, One-Sample U-Test, Using Directional Hypotheses, and Formula Syntax and Sub setting Samples in the U-test. **Paired t- and U-Tests:** Correlation and Covariance, Simple Correlation, Covariance, Significance Testing in Correlation Tests and Formula Syntax **UNIT-VI** **Introduction to Graphical Analysis:** **Box-whisker Plots:** Basic Box plots, Customizing Box plots, Horizontal Box plots, Scatter Plots:2Basic Scatter Plots, Adding Axis Labels, www.Plotting Symbols, Setting Axis Limits, Using Formula Syntax, Adding Lines of Best-Fit to Scatter Plots. **Pairs Plots:** (Multiple Correlation Plots) Line Charts, Line Charts Using Numeric Data, Line Charts Using Categorical Data, Pie Charts, Cleveland Dot Charts. Bar Charts: Single-Category Bar Charts and Multiple Category Bar Charts.
Text Books & References Books	**TEXTBOOKS** 1.Beginning R, the statistical programming language by DrMark Gardener. **REFERENCEBOOKS** 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 Cook book" by Winston Chang.
E-Resources	1. https://nptel.ac.in/courses 2. https://freevideolectures.com/university/iitm

19EC42O1-COMPUTER ORGANIZATION
(ECE)

Course Category:	Open Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	2 - 2 – 0
Pre-requisite:	Switching theory & logic design, Basics of digital design	**Sessional Evaluation :** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	Students undergoing this course are expected to learn:	
	1.The register transfer and micro operations 2. The instruction cycle and various interrupts. 3. Machine language, assembly language and micro programmed control. 4. General register, stack organization, program control, pipeline and vector processing. 5. Detailed information of I/O devices and their interface, data transfer and its modes, priority interrupt and D.M.A. 6. Types and organization of memory, multiprocessor characteristics and inter processor communication.	
Course Outcome:	Upon successful completion of the course , the students will be able to:	
	CO1	Understand the architecture of modern computer, register transfer and micro operations
	CO2	Analyze types of instructions, timing & control
	CO3	Compare different control mechanisms in programming.
	CO4	Understand different blocks of central processing unit.
	CO5	Understand various input-output devices
	CO6	Understand how cache mapping occurs in a computer and solve various problems
Course Content:	**UNIT-I** **Register transfer and micro operations:** Register transfer, bus and memory transfers, arithmetic micro operations, logic micro operations, shift micro operations, arithmetic logic shift units. **UNIT-II** **Basic computer organization and design:** Instruction codes, computer registers and instructions, timing and control, instruction cycles, memory reference instructions, input-output and interrupt. **UNIT-III** **Programming the basic control:** Machine language, Assembly language, the assembler, programming arithmetic and logic operations, subroutines. **Micro programmed control:** Control memory, address sequencing, micro program example, design of control unit.	

	UNIT-IV **Central processing unit:** General register organization, stack organization, Instruction formats, addressing modes, program control, R.I.S.C., parallel processing, pipelining, arithmetic pipe-line, instruction pipe-line. **UNIT-V** **Input-output organization:** Peripheral devices, input-output interface, Asynchronous data transfer, modes of transfer, priority interrupt, D.M.A.,input - output processor, serial communication. **UNIT-VI** **Memory organization:** Memory hierarchy, main memory, auxiliary memory, associative memory, cache memory, virtual memory, characteristics of multi processors, inter processor arbitration, inter processor communication and synchronization and cache coherence.
Text books & Reference books:	**Text books:** 1."Computer system architechture", by M. Moris Mano, 3/e PHI-I. 2."Computer organization", by V.C. Hemacher, Z.G. Vranesic and others Mc-Graw-Hill. **Reference books:** 1."Computer architecture and organization" , by Hays& Briggs –P.H.I. 2."Computer Organization", by William stallings PHI.
e-Resources	1. http://nptel.ac.in/courses/106105085/4 2. http://nptel.ac.in/courses/106108052/1

19EC41O2-VLSI DESIGN
(ECE)

Course category:	Open Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 0- 0
Pre-requisite:	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 learn the fundamental structures of VLSI Systems at the lowest levels of System abstraction. 2. To learn the basic electrical properties of MOS & BI-CMOS circuits 3. To learn the basic circuit concepts and design process of VLSI circuits and also to introduce the fundamental principles of VLSI circuit design. 4. To learn 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 learn 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	Understand the trends in semiconductor technology, and its impacts scaling and performance.
	CO2	Understand the basic electrical properties of MOS & BI-CMOS circuits.
	CO3	Understand 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	Understand 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.	

	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 & Reference books:	**Text books:** 1."Essentials of VLSI circuits and Systems", by Kamran Eshraghian, Eshraghian Douglas and A. Pucknell, PHI, 2005 edition. 2."Linear Integrated circuits", by D. Roy Chowdhury, New Age International Edition(2003) 3.ASIC Design Flow by Smith. **Reference books:** 1."Principles of CMOS VLSI Design", by Weste and Eshraghian, Pearson Education, 1999. 2. "Modern VLSI Design", Wayne Wolf, Pearson Education, 3rd Edition 1997. 3."Introduction to VLSI Circuits and Systems", by John. P. Uyemura. John Wiley, 2003. 4."Digital Integrated Circuits", by 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

19EE42PW-PROJECT WORK

Course Category:	Professional core	**Credits:**	11
Course Type:	Project	**Lecture-Tutorial-Practical:**	0-0-22
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.