

2007-2008

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

**B.TECH ELECTRICAL AND ELECTRONICS ENGINEERING**

**I Year**

**Course Structure**

CODE	SUBJECT	T	P/D	C
	English	2+1*	-	4
	Mathematics-I	3+1*	-	6
	Applied Physics	2+1*	-	4
	Mathematical Methods	3+1*	-	6
	C Programming and Data Structures	3+1*	6	
	Electrical Circuit Analysis	3+1*	-	6
	Basic Electronic Devices and Circuits	2+1*	-	4
	Engineering Drawing	-	3	4
	Computer Programming Lab	-	3	4
	Electronic Devices and Circuits Lab	-	3	4
	Engineering Workshop and IT Workshop	-	3	4
	English Language Communication Skills Lab	-	3	4
	<b>Total</b>	<b>25</b>	<b>15</b>	<b>56</b>

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**B.TECH ELECTRICAL AND ELECTRONICS ENGINEERING**

**II year – I Semester**

**Course Structure**

CODE	SUBJECT	T	P	C
	Mathematics-III	4+1*	-	4
	Fluid Mechanics and Hydraulic Machinery	4+1*	-	4
	Pulse and Digital Circuits	4+1*	-	4
	Switching Theory and Logic Design	4+1*	-	4
	Electromagnetic Fields	4+1*	-	4
	Electrical Machines-I	4+1*	-	4
	Fluid Mechanics and Hydraulic Machinery Lab	-	3	2
	Electrical Circuits and Simulation Lab	-	3	2
	<b>Total</b>	<b>30</b>	<b>6</b>	<b>28</b>

**II Year – II Semester**

**Course Structure**

CODE	SUBJECT	T	P	C
	Managerial Economics and Financial Analysis	4+1*	-	4
	Environmental Studies	4+1*	-	4
	Linear and Digital IC Applications	4+1*	-	4
	Power Systems-I	4+1*	-	4
	Electrical Machines-II	4+1*	-	4
	Control Systems	4+1*	-	4
	IC and Pulse and Digital Circuits Lab	-	3	2
	Electrical Machines Lab – I	-	3	2
	<b>Total</b>	<b>30</b>	<b>6</b>	<b>28</b>

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**B.TECH ELECTRICAL AND ELECTRONICS ENGINEERING**

**III YEAR – I SEMESTER**

**Course Structure**

CODE	SUBJECT	T	P	C
	Computer System Organization	4+1*	-	4
	Electrical Measurements	4+1*	-	4
	Power Systems-II	4+1*	-	4
	Power Electronics	4+1*	4	
	Electrical Machines-III	4+1*	-	4
	Linear Systems Analysis	4+1*	-	4
	Electrical Machines Lab – II	-	3	2
	Control Systems and Simulation Lab	-	3	2
	<b>Total</b>	<b>30</b>	<b>6</b>	<b>28</b>

III year – II Semester

Course Structure

CODE	SUBJECT	T	P	C
	Digital Signal Processing	4+1*	-	4
	Microprocessors and Microcontrollers	4+1*	-	4
	Management Science	4+1*	-	4
	Instrumentation	4+1*	-	4
	Switch Gear and Protection	4+1*	4	
	VLSI Design	4+1*	-	4
	Advanced English Communications Skills Lab	-	3	2
	Power Electronics and Simulation Lab	-	3	2
	<b>Total</b>	<b>30</b>	<b>6</b>	<b>28</b>

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**IV year – I Semester**

**Course Structure**

CODE	SUBJECT	T	P	C
	Neural Networks and Fuzzy Logic	4+1*	-	4
	Power Semiconductor Drives	4+1*	-	4
	Power System Analysis	4+1*	-	4
	Power System Operation and Control	4+1*	-	4
	<b>ELECTIVE – I</b>	4+1*	-	4
	HVDC Transmission			
	EHV AC Transmission			
	High Voltage Engineering			
	<b>ELECTIVE – II</b>	4+1*	-	4
	Reliability Engineering and Application to Power Systems			
	Non-Conventional Sources of Energy			
	Electrical Distribution Systems			
	Microprocessors and Microcontrollers Lab	-	3	2
	Electrical Measurements Lab	-	3	2
	<b>Total</b>	30	6	28

**IV year – II Semester**

**Course Structure**

CODE	SUBJECT	T	P	C
	Utilization of Electrical Energy	4+1*	-	4
	<b>ELECTIVE – III</b>	4+1*	-	4
	Advanced Control Systems			
	Digital Control Systems			
	Optimization Techniques			
	<b>ELECTIVE – IV</b>	4+1*	-	4
	Programmable Logic Controllers			
	Object oriented programming			
	Database Management Systems			
	Seminar	-	-	2
	Industry Oriented Mini Project	-	-	2
	Comprehensive Viva	-	-	2
	Project Work	-	-	10
	<b>Total</b>	15	-	28

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**ENGLISH**

**1. INTRODUCTION :**

In view of the growing importance of English as a tool for global communication and the consequent emphasis on training students to acquire communicative competence, the syllabus has been designed to develop linguistic and communicative competence of Engineering students. The prescribed books and the exercises are meant to serve broadly as students' handbooks.

In the English classes, the focus should be on the skills of reading, writing, listening and speaking and for this the teachers should use the text prescribed for detailed study. For example, the students should be encouraged to read the texts/selected paragraphs silently. The teachers can ask comprehension questions to stimulate discussion and based on the discussions students can be made to write short paragraphs/essays etc.

The text for non-detailed study is for extensive reading/reading for pleasure by the students. Hence, it is suggested that they read it on their own with topics selected for discussion in the class. The time should be utilized for working out the exercises given after each section, as also for supplementing the exercises with authentic materials of a similar kind for example, from newspaper articles, advertisements, promotional material etc.. *However, the stress in this syllabus is on skill development and practice of language skills.*

**2. OBJECTIVES:**

- a. To improve the language proficiency of the students in English with emphasis on LSRW skills.
- b. To equip the students to study academic subjects with greater facility through the theoretical and practical components of the English syllabus.
- c. To develop the study skills and communication skills in formal and informal situations.

**3. SYLLABUS :****Listening Skills:**

## Objectives

1. To enable students to develop their listening skill so that they may appreciate its role in the LSRW skills approach to language and improve their pronunciation
2. To equip students with necessary training in listening so that can comprehend the speech of people of different backgrounds and regions

*Students should be given practice in listening to the sounds of the language to be able to recognise them, to distinguish between them to mark stress and recognise and use the right intonation in sentences.*

- Listening for general content
- Listening to fill up information
- Intensive listening
- Listening for specific information

**Speaking Skills :**

## Objectives

1. To make students aware of the role of speaking in English and its contribution to their success.
2. To enable students to express themselves fluently and appropriately in social and professional contexts.

- Oral practice
- Describing objects/situations/people
- Role play – Individual/Group activities (Using exercises from all the nine units of the prescribed text: *Learning English : A Communicative Approach.*)
- Just A Minute(JAM) Sessions.

**Reading Skills:**

## Objectives

1. To develop an awareness in the students about the significance of silent reading and comprehension.
2. To develop the ability of students to guess the meanings of words from context and grasp the overall message of the text, draw inferences etc.

- Skimming the text

- Understanding the gist of an argument
- Identifying the topic sentence
- Inferring lexical and contextual meaning
- Understanding discourse features
- Recognizing coherence/sequencing of sentences

**NOTE :** *The students will be trained in reading skills using the prescribed text for detailed study. They will be examined in reading and answering questions using 'unseen' passages which may be taken from the non-detailed text or other authentic texts, such as magazines/newspaper articles.*

#### **Writing Skills :**

##### Objectives

1. To develop an awareness in the students about writing as an exact and formal skill
2. To equip them with the components of different forms of writing, beginning with the lower order ones.

- Writing sentences
- Use of appropriate vocabulary
- Paragraph writing
- Coherence and cohesiveness
- Narration / description
- Note Making
- Formal and informal letter writing
- Editing a passage

#### **4. TEXTBOOKS PRESCRIBED:**

In order to improve the proficiency of the student in the acquisition of the four skills mentioned above, the following texts and course content, divided into **Eight Units**, are prescribed:

##### **For Detailed study**

- 1. LEARNING ENGLISH: A Communicative Approach**, KAKINADA: Orient Longman, 2006. (Six Selected Lessons)

##### **For Non-detailed study**

- 2. WINGS OF FIRE: An Autobiography – APJ Abdul Kalam**, Abridged version with Exercises, Universities Press (India) Pvt. Ltd., 2004.

#### **A. STUDY MATERIAL:**

##### Unit –I

1. Astronomy from **LEARNING ENGLISH: A Communicative Approach**, Orient Longman, 2005.

2. Chapters 1-4 from **Wings of Fire: An Autobiography – APJ Abdul Kalam, an abridged version with Exercises, Universities Press (India) Pvt. Ltd.,2004**

##### Unit –II

3. Information Technology from **LEARNING ENGLISH: A Communicative Approach, Orient Longman, 2005.**

4. Chapters 5-8 from **Wings of Fire: An Autobiography – APJ Abdul Kalam, an abridged version with Exercises, Universities Press (India) Pvt. Ltd.,2004**

##### Unit –III

5. Humour from **LEARNING ENGLISH: A Communicative Approach, Orient Longman, 2005.**

6. Chapters 9-12 from **Wings of Fire: An Autobiography – APJ Abdul Kalam, an abridged version with Exercises., Universities Press (India) Pvt. Ltd.,2004**

##### Unit –IV

7. Environment from **LEARNING ENGLISH: A Communicative Approach, Orient Longman, 2005.**

8. Chapters 13-16 from **Wings of Fire: An Autobiography – APJ Abdul Kalam, an abridged version with Exercises, Universities Press (India) Pvt. Ltd.,2004**

##### Unit –V

9. Inspiration from **LEARNING ENGLISH: A Communicative Approach, Orient Longman, 2005.**

10. Chapters 17-20 from **Wings of Fire: An Autobiography – APJ Abdul Kalam, an abridged version with Exercises, Universities Press (India) Pvt. Ltd.,2004.**

##### Unit – VI

11. Human Interest **from** *LEARNING ENGLISH: A Communicative Approach*, **Orient Longman, 2005.**

12. Chapters 21-24 **from** *Wings of Fire: An Autobiography – APJ Abdul Kalam, an abridged version with Exercises*, **Universities Press (India) Pvt. Ltd., 2004.**

\* Exercises from the lessons not prescribed shall also be used for classroom tasks.

#### **Unit – VII**

##### **Exercises on**

Reading and Writing Skills  
Reading Comprehension  
Situational dialogues  
Letter writing  
Essay writing

#### **Unit – VIII**

##### **Practice Exercises on Remedial Grammar covering**

Common errors in English, Subject-Verb agreement, Use of Articles and Prepositions, Tense and aspect

##### **Vocabulary development covering**

Synonyms & Antonyms, one-word substitutes, prefixes & suffixes, Idioms & phrases, words often confused.

#### **REFERENCES :**

1. **Strengthen Your English**, Bhaskaran & Horsburgh, Oxford University Press
2. **Basic Communication Skills for Technology**, Andrea J Rutherford, Pearson Education Asia.
3. **Murphy's English Grammar with CD**, Murphy, Cambridge University Press
4. **English Skills for Technical Students** by Orient Longman
5. **Everyday Dialogues in English** by Robert J. Dixson, Prentice-Hall of India Ltd., 2006.
6. **English For Technical Communication**, Vol. 1 & 2, by K. R. Lakshmi Narayanan, Sci tech. Publications.
7. **A Hand book of English for Engineers & Technologists** by Dr. P. Eliah, B. S. Publications.
8. **Developing Communication Skills** by Krishna Mohan & Meera Benerji (Macmillan)
9. **Speaking and Writing for Effective Business Communication**, Francis Soundararaj, MacMillan India Ltd., 2007.
10. **The Oxford Guide to Writing and Speaking**, John Seely, Oxford

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**MATHEMATICS – I**

**UNIT – I**

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, orthogonal trajectories.

**UNIT – II**

Non-homogeneous linear differential equations of second and higher order with constant coefficients with RHS term of the type  $e^{ax}$ ,  $\sin ax$ ,  $\cos ax$ , polynomials in  $x$ ,  $e^{ax} V(x)$ ,  $xV(x)$ , method of variation of parameters.

**UNIT – III**

Rolle's Theorem – Lagrange's Mean Value Theorem – Cauchy's mean value Theorem – Generalized Mean Value theorem (all theorems without proof) Functions of several variables – Functional dependence- Jacobian- Maxima and Minima of functions of two variables with constraints and without constraints

**UNIT – IV**

Radius, Centre and Circle of Curvature – Evolutes and Envelopes Curve tracing – Cartesian, polar and Parametric curves.

**UNIT – V**

Applications of integration to lengths, volumes and surface areas in Cartesian and polar coordinates multiple integrals - double and triple integrals – change of variables – change of order of integration.

**UNIT – VI**

Sequences – series – Convergences and divergence – Ratio test – Comparison test – Integral test – Cauchy's root test – Raabe's test – Absolute and conditional convergence

**UNIT – VII**

Vector Calculus: Gradient- Divergence- Curl and their related properties of sums- products- Laplacian and second order operators. Vector Integration - Line integral – work done – Potential function – area- surface and volume integrals Vector integral theorems: Green's theorem-Stoke's and Gauss's Divergence Theorem (With out proof). Verification of Green's - Stoke's and Gauss's Theorems.

**UNIT – VIII**

Laplace transform of standard functions – Inverse transform – first shifting Theorem, Transforms of derivatives and integrals – Unit step function – second shifting theorem – Dirac's delta function – Convolution theorem – Periodic function - Differentiation and integration of transforms-Application of Laplace transforms to ordinary differential equations Partial fractions-Heaviside's Partial fraction expansion theorem.

**Text Books:**

1. A text Book of Engineering Mathematics, Vol-1 T. K. V. Iyengar, B. Krishna Gandhi and Others, S. Chand & Company.
2. A text Book of Engineering Mathematics, C. Sankaraiah, V. G. S. Book Links.
3. A text Book of Engineering Mathematics, Shahnaz Bathul, Right Publishers.
4. A text Book of Engineering Mathematics, P. Nageshwara Rao, Y. Narasimhulu & N. Prabhakar Rao, Deepthi Publications.

**References:**

1. A text Book of Engineering Mathematics, B. V. Raman, Tata Mc Graw Hill.
2. Advanced Engineering Mathematics, Irvin Kreyszig, Wiley India Pvt. Ltd.
3. A text Book of Engineering Mathematics, Thomson Book Collection.



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**APPLIED PHYSICS**

**UNIT I**

**BONDING IN SOLIDS** : Introduction - Types of bonding in solids - Estimation of cohesive energy – Madelung constant.

**CRYSTAL STRUCTURES AND X-RAY DIFFRACTION**: Introduction -Space lattice - Basis - Unit cell - Lattice parameter - Bravais lattices – Crystal systems - Structure and packing fractions of Simple cubic - Body centered cubic – Face centered cubic crystals - Directions and planes in crystals – Miller indices - Separation between successive [h k l] planes - Diffraction of X-rays by crystal planes - Bragg's law - Laue method - Powder method.

**UNIT II**

**PRINCIPLES OF QUANTUM MECHANICS**: Waves and particles - Planck's quantum theory – de Broglie hypothesis – Matter waves - Davisson and Germer experiment – G. P. Thomson experiment – Heisenberg uncertainty principle - Schrödinger's time independent wave equation - Physical significance of the wave function - Particle in one dimensional potential box.

**UNIT III**

**ELECTRON THEORY OF METALS**: Classical free electron theory - Mean free path - Relaxation time and drift velocity - Quantum free electron theory - Fermi-Dirac distribution (analytical) and its dependence on temperature – Fermi energy – Electron scattering and resistance.

**BAND THEORY OF SOLIDS**: Bloch theorem - Kronig-Penney model (qualitative treatment) - Origin of energy band formation in solids – Classification of materials into conductors, semi conductors & insulators - Concept of effective mass of an electron.

**UNIT IV**

**DIELECTRIC PROPERTIES**: Introduction - Dielectric constant - Electronic, ionic and orientational polarizations - Internal fields in solids – Clausius - Mossotti equation – Dielectrics in alternating fields – Frequency dependence of the polarizability - Ferro and Piezo electricity.

**MAGNETIC PROPERTIES** : Permeability - Magnetization - Origin of magnetic moment – Classification of magnetic materials - Dia, para and ferro magnetism - Hysteresis curve - Soft and hard magnetic materials.

**UNIT V**

**SEMICONDUCTORS** : Introduction - Intrinsic semiconductor and carrier concentration – Equation for conductivity - Extrinsic semiconductor and carrier concentration - Drift and diffusion - Einstein's equation - Hall effect – Direct & indirect band gap semiconductors.

**SUPERCONDUCTIVITY**: General properties - Meissner effect - Penetration depth - Type I and Type II superconductors - Flux quantization – DC and AC Josephson effect –BCS Theory - Applications of superconductors.

**UNIT VI**

**LASERS**: Introduction - Characteristics of Lasers - Spontaneous and stimulated emission of radiation - Einstein's coefficients - Population inversion - Ruby laser - Helium-Neon Laser – CO<sub>2</sub> laser -Semiconductor Laser – Applications of lasers.

**UNIT VII**

**FIBER OPTICS AND HOLOGRAPHY**: Introduction - Principle of optical fiber - Acceptance angle and acceptance cone - Numerical aperture – Types of optical fibers and refractive index profiles – Attenuation in optical fibers - Application of optical fibers – Basic principles of holography – Construction and reconstruction of image on hologram – Applications of holography.

**UNIT VIII**

**SCIENCE & TECHNOLOGY OF NANOMATERIALS**: Introduction to Nano materials - Basic principles of Nanoscience & Technology – Fabrication of nano materials – Physical & chemical properties of nanomaterials – Carbon nanotubes – Applications of nanotechnology.

**TEXTBOOKS:**

1. Applied Physics 2<sup>nd</sup> edition by Dr. P. Appala Naidu & Dr. M. Chandra Shekar, V.G.S. Book links.
2. Introduction to Solid State Physics by C. Kittel ; Wiley Eastern Ltd.
3. Nanotechnology by Mark Ratner and Daniel Ratner; Pearson Education.

**REFERENCES:**

1. Materials Science and Engineering by V. Raghavan; Prentice-Hall India.
2. Materials Science by M. Arumugam; Anuradha Agencies.
3. Solid State Physics by N.W. Ashcroft & N. David Merwin; Thomson Learning.
4. Materials Science by M.S.Vijaya & G. Rangarajan; Tata McGraw Hill.
5. Solid State Physics by P.K. Palanisamy; Scitech Publications (India) Pvt. Ltd.
6. Nano Materials by A.K. Bandyopadhyay, New Age International Publishers.
7. Applied Physics by P.K.Mittal; I.K. International.
8. Applied Physics by K. Vijay Kumar & T. Sreekanth; S. Chand & Company Ltd.

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**MATHEMATICAL METHODS**

**UNIT – I**

Matrices and Linear systems of equations: Elementary row transformations-Rank-Echelon form, Normal form – Solution of Linear Systems – Direct Methods- LU Decomposition- LU Decomposition from Gauss Elimination –Solution of Tridiagonal Systems-Solution of Linear Systems

**UNIT – II**

Eigen values, eigen vectors – properties – Cayley-Hamilton Theorem - Inverse and powers of a matrix by Cayley-Hamilton theorem – Diagonalization of matrix. Calculation of powers of matrix – Modal and spectral matrices.

**UNIT – III**

Real matrices – Symmetric, skew - symmetric, orthogonal, Linear Transformation – Orthogonal Transformation. Complex matrices: Hermitian, Skew-Hermitian and Unitary – Eigen values and eigen vectors of complex matrices and their properties. Quadratic forms- Reduction of quadratic form to canonical form – Rank - Positive, negative definite - semi definite - index - signature - Sylvester law.

**UNIT – IV**

. Solution of Algebraic and Transcendental Equations: Introduction – The Bisection Method – The Method of False Position – The Iteration Method – Newton-Raphson Method.

**Interpolation:** Introduction- Errors in Polynomial Interpolation – Finite differences- Forward Differences- Backward differences –Central differences – Symbolic relations and separation of symbols-Differences of a polynomial-Newton's formulae for interpolation – Central difference interpolation Formulae – Gauss Central Difference Formulae –Interpolation with unevenly spaced points-Lagrange's Interpolation formula.

**UNIT – V**

Curve fitting: Fitting a straight line –Second degree curve-exponential curve-power curve by method of least squares. Numerical Differentiation and Integration– Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule.

**UNIT – VI**

Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Euler's Method-Runge-Kutta Methods –Predictor-Corrector Methods- Adams-Moulton Method –Milne's Method.

**UNIT – VII**

Fourier Series: Determination of Fourier coefficients – Fourier series – even and odd functions – Fourier series in an arbitrary interval – even and odd periodic continuation – Half-range Fourier sine and cosine expansions. Fourier integral theorem (only statement)– Fourier sine and cosine integrals. Fourier transform – Fourier sine and cosine transforms – properties – inverse transforms – Finite Fourier transforms.

**UNIT – VIII**

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – solutions of first order linear (Lagrange) equation and nonlinear (standard type) equations. Method of separation of variables. z-transform – inverse z-transform - properties – Damping rule – Shifting rule – Initial and final value theorems. Convolution theorem – Solution of difference equation by z-transforms.

**Text Books:**

1. Mathematical Methods, T. K. V. Iyengar, B. Krishna Gandhi and Others, S. Chand & Company.
2. Mathematical Methods, C. Sankaraiah, V. G. S. Book Links.
3. A text book of Mathematical Methods, V. Ravindranath, A. Vijayalaxmi, Himalaya Publishers.
4. A text book of Mathematical Methods, Shahnaz Bathul, Right Publisshers.

**References:**

1. A text Book of Engineering Mathematics, B. V. Raman, Tata Mc Graw Hill.
2. Advanced Engineering Mathematics, Irvin Kreyszig, Wiley India Pvt. Ltd.
3. Numerical Methods for Scientific and Engineering Computation, M. K. Jain, S. R. K. Iyengar & R. K. Jain, New Age International Publishers.
4. Elementary Numerical Analysis, Aitkinson & Han, Wiely India, 3<sup>rd</sup> Edition, 2006

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**C PROGRAMMING AND DATA STRUCTURES**

**UNIT - I**

Algorithm / pseudo code, flowchart, program development steps, structure of C program, A Simple C program, identifiers, basic data types and sizes, Constants, variables, arithmetic, relational and logical operators, increment and decrement operators, conditional operator, bit-wise operators, assignment operators, expressions, type conversions, conditional expressions, precedence and order of evaluation.

Input-output statements, statements and blocks, if and switch statements, loops- while, do-while and for statements, break, continue, goto and labels, programming examples.

**UNIT - II**

Designing structured programs, Functions, basics, parameter passing, storage classes- extern, auto, register, static, scope rules, block structure, user defined functions, standard library functions, recursive functions, header files, C preprocessor, example c programs.

**UNIT - III**

Arrays- concepts, declaration, definition, accessing elements, storing elements, arrays and functions, two-dimensional and multi-dimensional arrays, applications of arrays. pointers- concepts, initialization of pointer variables, pointers and function arguments, address arithmetic, Character pointers and functions, pointers to pointers, pointers and multidimensional arrays, dynamic memory managements functions, command line arguments, c program examples.

**UNIT - IV**

Derived types- structures- declaration, definition and initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self referential structures, unions, typedef, bitfields, C program examples.

**UNIT - V**

Input and output – concept of a file, text files and binary files, streams, standard I/o, Formatted I/o, file I/o operations, error handling, C program examples.

**UNIT - VI**

Searching – Linear and binary search methods, sorting – Bubble sort, selection sort, Insertion sort, Quick sort, merge sort.

**UNIT – VII**

Introduction to data structures, singly linked lists, doubly linked lists, circular list, representing stacks and queues in C using arrays and linked lists, infix to post fix conversion, postfix expression evaluation.

**UNIT - VIII**

Trees- Binary trees, terminology, representation, traversals, graphs- terminology, representation, graph traversals (dfs & bfs)

**TEXT BOOKS :**

1. Computer science, A structured programming approach using C, B.A. Forouzan and R.F. Gilberg, Third edition, Thomson.
2. DataStructures Using C – A.S.Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/Pearson education.

**REFERENCES :**

1. C& Data structures – P. Padmanabham, B.S. Publications.
2. The C Programming Language, B.W. Kernighan, Dennis M.Ritchie, PHI/Pearson Education
3. C Programming with problem solving, J.A. Jones & K. Harrow, dreamtech Press
4. Programming in C – Stephen G. Kochan, III Edition, Pearson Eductaion.
5. Data Structures and Program Design in C, R.Kruse, C.L. Tondo, BP Leung, Shashi M, Second Edition, Pearson Education.

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**ELECTRICAL CIRCUIT ANALYSIS**

**Objective :**

This course introduces the basic concepts of circuit analysis which is the foundation for all subjects of the Electrical Engineering discipline. The emphasis of this course is laid on the basic analysis of circuits which includes Single phase circuits, magnetic circuits, theorems, transient analysis and network topology.

**UNIT – I Introduction to Electrical Circuits**

Circuit Concept – R-L-C parameters – Voltage and Current sources – Independent and dependent sources-Source transformation – Voltage – Current relationship for passive elements – Kirchhoff's laws – network reduction techniques – series, parallel, series parallel, star-to-delta or delta-to-star transformation.

**UNIT – II Magnetic Circuits**

Magnetic Circuits – Faraday's laws of electromagnetic induction – concept of self and mutual inductance – dot convention – coefficient of coupling – composite magnetic circuit - Analysis of series and parallel magnetic circuits

**UNIT – III Single Phase A.C Circuits**

R.M.S and Average values and form factor for different periodic wave forms, Steady state analysis of R, L and C (in series, parallel and series parallel combinations) with sinusoidal excitation – Concept of Reactance, Impedance, Susceptance and Admittance – Phase and Phase difference – concept of power factor, Real and Reactive powers – J-notation, Complex and Polar forms of representation, Complex power – Locus diagrams – series R-L, R-C, R-L-C and parallel combination with variation of various parameters – Resonance – series, parallel circuits, concept of band width and Q factor.

**UNIT – IV Three Phase Circuits**

Three phase circuits: Phase sequence – Star and delta connection – Relation between line and phase voltages and currents in balanced systems – Analysis of balanced and Unbalanced 3 phase circuits – Measurement of active and reactive power.

**UNIT – V Network topology**

Definitions – Graph – Tree, Basic cutset and Basic Tieset matrices for planar networks – Loop and Nodal methods of analysis of Networks with independent voltage and current sources - Duality & Dual networks.

**UNIT – VI Network theorems (without proofs)**

Tellegen's, Superposition, Reciprocity, Thevenin's, Norton's, Maximum Power Transfer, Millman's and Compensation theorems for d.c. and a.c. excitations.

**UNIT – VII Transient Analysis**

Transient response of R-L, R-C, R-L-C circuits (Series combinations only) for d.c. and sinusoidal excitations – Initial conditions - Solution using differential equation approach and Laplace transform methods of solutions.

**UNIT – VIII Network Parameters**

Two port network parameters – Z, Y, ABCD and hybrid parameters and their relations– – concept of transformed network – 2-port network parameters using transformed variables.

**TEXT BOOKS:**

1. Engineering circuit analysis – by William Hayt and Jack E. Kimmerly, Mc Graw Hill Company, 6<sup>th</sup> edition.
2. Linear circuit analysis (time domain phasor, and Laplace transform approaches)  
Second edition by RAYMOND A.DeCARLO and PEN-MIN-LIN,  
Oxford University Press. Second edition 2004.

**REFERENCE BOOKS:**

1. Network Analysis by Vanvalkenburg, PHI.
2. Network Theory: - N.C. Jagan & C.Lakshminarayana, B.S Publications.
3. Electrical Circuits: S.Sudhakar, P.S.M.Satyanarayana, TMH Publication.
4. Electric Circuits by A. Chakrabarthy, Dhanipat Rai & Co.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

I Year B.Tech EEE

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**BASIC ELECTRONIC DEVICES AND CIRCUITS**

**UNIT-I**

**ELECTRON DYNAMICS AND CRO:** Motion of charged particles in electric and magnetic fields. Simple problems involving electric and magnetic fields only Electrostatic and magnetic focusing. Principles of CRT, deflection sensitivity (Electrostatic and magnetic deflection),

**UNIT- II**

**JUNCTION DIODE CHARACTERISTICS :** Review of semi conductor Physics, Open-circuited p-n junction, , PN diode as a rectifier (forward bias and reverse bias), The current components in p-n diode, Law of junction, Diode equation(Qualitative treatment only), Volt-ampere characteristics of p-n diode, Temperature dependence of VI characteristic, Transition and Diffusion capacitances, Breakdown Mechanisms in Semi Conductor (Avalanche and Zener breakdown) Diodes, Zener diode characteristics, Characteristics of Tunnel Diode, Varactor Diode, LED, LCD. And photo diode.

**UNIT- III**

**RECTIFIERS, FILTERS AND REGULATORS :** Half wave rectifier, ripple factor, full wave rectifier, Harmonic components in a rectifier circuit, Inductor filter, Capacitor filter, L- section filter,  $\Pi$ - section filter, Simple circuit of a regulator using zener diode, Series and Shunt voltage regulators.

**UNIT- IV**

**TRANSISTOR and FET CHARACTERISTICS :** construction, principle of operation/ Input and Output characteristics of transistor in Common Base, Common Emitter, and Common collector configurations, JFET characteristics (Qualitative treatment only) and MOSFETS, Enhancement and depletion mode MOSFET , , Introduction to SCR and UJT.

**UNIT-V**

**BIASING AND STABILISATION :** BJT biasing, DC equivalent model, criteria for fixing operating point, Methods of bias stabilization, Stabilization Techniques(Fixed bias, Collector to base bias, Self bias) Stabilization factors, ( $S$ ,  $S$ ,  $S'$ ), Thermistor and Sensor Compensation techniques, (Compensation against variation in  $V_{BE}$ ,  $I_{CO}$ ) Thermal run away, Condition to avoid Thermal Run away.

**UNIT- VI**

**AMPLIFIERS :** Small signal low frequency transistor amplifier circuits:Hybrid model of a transistor, voltage gain, current gain, Input impedance and Output impedance,FET and MOSFET Small Signal model,Voltage gain of common drain FET amplifier, Voltage gain of common source FET amplifier.

**UNIT- VII**

**FEEDBACK AMPLIFIERS :** Concept of feedback, Classification of feedback amplifiers, General characteristics of negative feedback amplifiers, Effect of Feedback on input and output characteristics in various feedback topologies, Simple Examples of various topologies with discrete components.

**UNIT-VIII**

**OSCILLATORS :** Condition for oscillations. Barkhausen criterion,RC-phase shift oscillators with Transistor and FET devices, Wein bridge oscillator, Crystal oscillators.

**TEXT BOOKS :**

1. Electronic Devices and Circuits – J.Millman, C.C.Halkias, and Satyabratha Jit Tata McGraw Hill, 2<sup>nd</sup> Ed., 2007.
2. Electronic Devices and Circuits – R.L. Boylestad and Louis Nashelsky, Pearson/Prentice Hall,9th Edition,2006.

**REFERENCES :**

1. Electronic Devices and Circuits – T.F. Bogart Jr., J.S.Beasley and G.Rico, Pearson Education, 6th edition, 2004.
2. Microelectronics – Millman and Grabel, Tata McGraw Hill, 1988.
3. Electronic Devices and Circuits – Dr. K. Lal Kishore, B.S. Publications, 2<sup>nd</sup> Edition, 2005.
4. Electronic Devices and Circuits-Dr K.Satyaprasad, VGS Publications,2006
5. Electronic Devices and Circuits –Prof B..Visvesvara Rao et.al Peason Education 2 nd Edition

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

I Year B.Tech EEE

<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>3</b>	<b>4</b>

**ENGINEERING DRAWING**

**UNIT – I**

Introduction to engineering graphics – construction of ellipse, parabola and hyperbola – cylindrical curves.

**UNIT – II**

Orthographic projections of points, lines and planes – axis inclined to one planes and inclined to both the planes.

**UNIT – III****Orthographic projections of solids :**

Cylinder, cone, prism, pyramid and sphere positions and axis inclined to both the planes.

**UNIT – IV**

Isometric projections of lines, planes and simple solids

**UNIT – V**

Conversion of orthographic views into isometric views and vice-versa.

**TEXT BOOKS :**

1. Engineering drawings By N.D.Bhatt
2. Engineering graphics By K.L. Narayana & P.Kannayya

**REFERENCES:-**

1. Engineering drawing and graphics: Venugopal/ New age
2. Engineering drawing : Johle / TMH

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

I Year B.Tech EEE

<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>3</b>	<b>4</b>

**COMPUTER PROGRAMMING LAB**

Objectives:

- To make the student learn a programming language.
- To teach the student to write programs in C solve the problems
- To Introduce the student to simple linear and non linear data structures such as lists, stacks, queues, trees and graphs.

**Recommended Systems/Software Requirements:**

- Intel based desktop PC
- ANSI C Compiler with Supporting Editors

**Week 1.**

- a) Write a C program to find the sum of individual digits of a positive integer.
- b) A Fibonacci Sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.
- c) Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.

**Week 2.**

- a) Write a C program to calculate the following Sum:  
Sum= $1-x^2/2! + x^4/4! - x^6/6! + x^8/8! - x^{10}/10!$
- b) Write a C program to find the roots of a quadratic equation.

**Week 3**

- a) Write C programs that use both recursive and non-recursive functions
  - i) To find the factorial of a given integer.
  - ii) To find the GCD (greatest common divisor) of two given integers.
  - iii) To solve Towers of Hanoi problem.

**Week 4**

- a) The total distance travelled by vehicle in 't' seconds is given by distance =  $ut + 1/2at^2$  where 'u' and 'a' are the initial velocity (m/sec.) and acceleration (m/sec<sup>2</sup>). Write C program to find the distance travelled at regular intervals of time given the values of 'u' and 'a'. The program should provide the flexibility to the user to select his own time intervals and repeat the calculations for different values of 'u' and 'a'.
- b) Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +, -, \*, /, % and use Switch Statement)

**Week 5**

- a) Write a C program to find both the largest and smallest number in a list of integers.
- b) Write a C program that uses functions to perform the following:
  - i) Addition of Two Matrices
  - ii) Multiplication of Two Matrices

**Week 6**

- a) Write a C program that uses functions to perform the following operations:
  - i) To insert a sub-string in to given main string from a given position.
  - ii) To delete n Characters from a given position in a given string.
- b) Write a C program to determine if the given string is a palindrome or not

**Week 7**

- a) Write a C program that displays the position or index in the string S where the string T begins, or - 1 if S doesn't contain T.
- b) Write a C program to count the lines, words and characters in a given text.

**Week 8**

- a) Write a C program to generate Pascal's triangle.
- b) Write a C program to construct a pyramid of numbers.



**Week 9**

Write a C program to read in two numbers,  $x$  and  $n$ , and then compute the sum of this geometric progression:

$$1+x+x^2+x^3+\dots+x^n$$

For example: if  $n$  is 3 and  $x$  is 5, then the program computes  $1+5+25+125$ .

Print  $x$ ,  $n$ , the sum

Perform error checking. For example, the formula does not make sense for negative exponents – if  $n$  is less than 0. Have your program print an error message if  $n < 0$ , then go back and read in the next pair of numbers without computing the sum. Are any values of  $x$  also illegal? If so, test for them too.

**Week 10**

a) 2's complement of a number is obtained by scanning it from right to left and complementing all the bits after the first appearance of a 1. Thus 2's complement of 11100 is 00100. Write a C program to find the 2's complement of a binary number.

b) Write a C program to convert a Roman numeral to its decimal equivalent.

**Week 11**

Write a C program that uses functions to perform the following operations:

- i) Reading a complex number
- ii) Writing a complex number
- iii) Addition of two complex numbers
- iv) Multiplication of two complex numbers

(Note: represent complex number using a structure.)

**Week 12**

a) Write a C program which copies one file to another.

b) Write a C program to reverse the first  $n$  characters in a file.

(Note: The file name and  $n$  are specified on the command line.)

**Week 13**

Write a C program that uses functions to perform the following operations on singly linked list.:

- i) Creation
- ii) Insertion
- iii) Deletion
- iv) Traversal

**Week 14**

Write a C program that uses functions to perform the following operations on doubly linked list.:

- i) Creation
- ii) Insertion
- iii) Deletion
- iv) Traversal in both ways

**Week 15**

Write C programs that implement stack (its operations) using

- i) Arrays
- ii) Pointers

**Week 16**

Write C programs that implement Queue (its operations) using

- i) Arrays
- ii) Pointers

**Week 17**

Write a C program that uses Stack operations to perform the following:

- i) Converting infix expression into postfix expression
- ii) Evaluating the postfix expression

**Week 18**

Write a C program that uses functions to perform the following:

- i) Creating a Binary Tree of integers
- ii) Traversing the above binary tree in preorder, inorder and postorder.

**Week 19**

Write C programs that use both recursive and non recursive functions to perform the following searching operations for a Key value in a given list of integers :

- i) Linear search
- ii) Binary search

**Week 20**

Write C programs that implement the following sorting methods to sort a given list of integers in ascending order:

- i) Bubble sort
- ii) Quick sort

**Week 21**

Write C programs that implement the following sorting methods to sort a given list of integers in ascending order:

- i) Insertion sort
- ii) Merge sort

**Week 22**

Write C programs to implement the Lagrange interpolation and Newton- Gregory forward interpolation.

**Week 23**

Write C programs to implement the linear regression and polynomial regression algorithms.

**Week 24**

Write C programs to implement Trapezoidal and Simpson methods.

**Text Books**

1. C programming and Data Structures, P. Padmanabham, Third Edition, BS Publications
2. Data Structures: A pseudo code approach with C, second edition R.F. Gilberg and B.A. Forouzan
3. Programming in C, P.Dey & M. Ghosh, Oxford Univ.Press.
4. C and Data Structures, E Balaguruswamy, TMH publications.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

I Year B.Tech EEE

<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>3</b>	<b>4</b>

**ELECTRONIC DEVICES AND CIRCUITS LAB**

**PART A : (Only for viva voce Examination)**

ELECTRONIC WORKSHOP PRACTICE ( in 6 lab sessions) :

1. Identification, Specifications, Testing of R, L, C Components (Colour Codes), Potentiometers, Switches (SPDT, DPDT, and DIP), Coils, Gang Condensers, Relays, Bread Boards.
2. Identification, Specifications and Testing of Active Devices, Diodes, BJTs, Lowpower JFETs, MOSFETs, Power Transistors, LEDs, LCDs, Optoelectronic Devices, SCR, UJT, DIACs, TRIACs, Linear and Digital ICs.
3. Soldering practice – Simple Circuits using active and passive components.
4. Single layer and Multi layer PCBs (Identification and Utility).
5. Study and operation of
  - Multimeters (Analog and Digital)
  - Function Generator
  - Regulated Power Supplies
    1. Study and Operation of CRO.

**PART B : (For Laboratory examination – Minimum of 16 experiments)**

1. PN Junction diode characteristics A. Forward bias B. Reverse bias.
2. Zener diode characteristics
3. Transistor CB characteristics (Input and Output)
4. Transistor CE characteristics (Input and Output)
5. Rectifier without filters (Full wave & Half wave)
6. Rectifier with filters (Full wave & Half wave)
7. FET characteristics
8. Measurement of h parameters of transistor in CB, CE, CC configurations
9. CE Amplifier
10. CC Amplifier (Emitter Follower).
11. Single stage R-C coupled Amplifier.
12. FET amplifier (Common Source)
13. Wien Bridge Oscillator
14. RC Phase Shift Oscillator
15. Feed back amplifier (Current Series).
16. Feed back amplifier (Voltage Series).
17. Hartley Oscillator.
18. Colpitts Oscillator.
19. SCR characteristics.

**PART C:****Equipment required for Laboratories:**

- |   |   |  |
|---|---|--|
| 1. Regulated Power supplies (RPS)                         | - | 0-30v  |
| 2. CROs   | - | 0-20M Hz.  |
| 3. Function Generators                                    | - | 0-1 M Hz.  |
| 4. Multimeters  |   |  |
| 5. Decade Resistance Boxes/Rheostats                      |   |  |
| 6. Decade Capacitance Boxes                               |   |  |
| 7. Micro Ammeters (Analog or Digital)                     | - | 0-20 $\mu$ A, 0-50 $\mu$ A, 0-100 $\mu$ A, 0-200 $\mu$ A |
| 8. Voltmeters (Analog or Digital)                         | - | 0-50V, 0-100V, 0-250V                                    |
| 9. Electronic Components                                  | - | Resistors, Capacitors, BJTs, LCDs, SCRs, UJTs,           |
| FETs, LEDs,   |   |  |
| MOSFETs, diodes (ge&sitype), transistors (npn & pnp type) |   |  |

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

I Year B.Tech EEE

<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>3</b>	<b>4</b>

**ENGINEERING WORKSHOP AND IT WORKSHOP**

**I. TRADES FOR EXERCISES:**

1. Carpentry
2. Fitting
3. House Wiring – List of Experiments
  - i) One lamp controlled by one switch with provision for plug socket with switch control
  - ii) Two lamps control using two way switches
  - iii) Two lamps control by a single switch
  - iv) Staircase wiring Circuit
  - v) Godown Wiring
  - vi) Wiring circuit of Fluorescent Lamp
4. IT Workshop – I: Computer Hardware, Identification of parts, Disassembly, Assembly of Computer to working condition, simple diagnostic exercises.
5. IT Workshop – II: Installation of Operating System Windows and Linux, simple diagnostic exercises.

**II. TRADES FOR DEMONSTRATION & EXPOSURE:**

1. Plumbing
2. Welding
3. Machine Shop
4. Power Tools in construction, wood working, Electrical Engineering & Mechanical Engineering.
5. Metal cutting (water plasma)

**TEXT BOOKS:**

1. Workshop Manual, P.Kannaiah, K.L.Narayana, Scitech Publishers
2. Electrical Workshop, R.P.Singh, I.K.International Pvt.Ltd.2007

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

I Year B.Tech EEE

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**ENGLISH LANGUAGE COMMUNICATION SKILLS LAB**

The **Language Lab** focuses on the production and practice of sounds of language and familiarises the students with the use of English in everyday situations and contexts.

**Objectives:**

1. To expose the students to a variety of self-instructional, learner-friendly modes of language learning.
2. To help the students cultivate the habit of reading passages from the computer monitor, thus providing them with the required facility to face computer-based competitive exams such GRE, TOEFL, GMAT etc.
3. To enable them to learn better pronunciation through stress on word accent, intonation, and rhythm.
4. To train them to use language effectively to face interviews, group discussions, public speaking.
5. To initiate them into greater use of the computer in resume preparation, report writing, format-making etc.

**SYLLABUS :**

The following course content is prescribed for the **English Language Laboratory** sessions:

1. Introduction to the Sounds of English- Vowels, Diphthongs & Consonants.
2. Introduction to Stress and Intonation.
3. Situational Dialogues / Role Play.
4. Oral Presentations- Prepared and Extempore.
5. 'Just A Minute' Sessions (JAM).
6. Describing Objects / Situations / People.
7. Information Transfer
8. Debate
9. Telephoning Skills.
10. Giving Directions.

**Minimum Requirement:**

**The English Language Lab shall have two parts:**

- i) **The Computer aided Language Lab** for 60 students with 60 systems, one master console, LAN facility and English language software for self- study by learners.
- ii) **The Communication Skills Lab** with movable chairs and audio-visual aids with a P.A System, a T. V., a digital stereo –audio & video system and camcorder etc.

**System Requirement ( Hardware component):**

*Computer network with Lan with minimum 60 multimedia systems with the following specifications:*

- i) P – IV Processor
  - a) Speed – 2.8 GHZ
  - b) RAM – 512 MB Minimum
  - c) Hard Disk – 80 GB
- ii) Headphones of High quality

**Suggested Software:**

- Cambridge Advanced Learners' English Dictionary with CD.
- The Rosetta Stone English Library
- Clarity Pronunciation Power – Part I
- Mastering English in Vocabulary, Grammar, Spellings, Composition
- Dorling Kindersley series of Grammar, Punctuation, Composition etc.
- Language in Use, Foundation Books Pvt Ltd with CD.
- Oxford Advanced Learner's Compass, 7<sup>th</sup> Edition
- Learning to Speak English - 4 CDs
- Microsoft Encarta with CD
- Murphy's English Grammar, Cambridge with CD
- English in Mind, Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge

**Books Suggested for English Language Lab Library (to be located within the lab in addition to the CDs of the text book which are loaded on the systems):**

1. **Spoken English** (CIEFL) in 3 volumes with 6 cassettes, OUP.
2. **English Pronouncing Dictionary** Daniel Jones Current Edition with CD.
3. **Spoken English-** R. K. Bansal and J. B. Harrison, Orient Longman 2006 Edn.

4. **English Language Communication : A Reader cum Lab Manual** Dr A Ramakrishna Rao, Dr G Natanam & Prof SA Sankaranarayanan, Anuradha Publications, Chennai
5. **Speaking English Effectively** by Krishna Mohan & NP Singh (Macmillan)
6. **A Practical Course in English Pronunciation**, (with two Audio cassettes) by J. Sethi, Kamlesh Sadanand & D.V. Jindal, Prentice-Hall of India Pvt. Ltd., New Delhi.
7. **A text book of English Phonetics for Indian Students** by T.Balasubramanian (Macmillan)
8. **English Skills for Technical Students**, WBSCTE with British Council, OL

**DISTRIBUTION AND WEIGHTAGE OF MARKS*****English Language Laboratory Practical Paper:***

1. The practical examinations for the English Language Laboratory shall be conducted as per the University norms prescribed for the core engineering practical sessions.
2. For the Language lab sessions, there shall be a continuous evaluation during the year for 25 sessional marks and 50 year-end Examination marks. Of the 25 marks, 15 marks shall be awarded for day-to-day work and 10 marks to be awarded by conducting Internal Lab Test(s). The year- end Examination shall be conducted by the teacher concerned with the help of another member of the staff of the same department of the same institution.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

II Year B.Tech EEE I-Sem

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**MATHEMATICS – III**

**UNIT – I**

**Special functions:** Gamma and Beta Functions – Their properties – evaluation of improper integrals. Bessel functions – properties – Recurrence relations – Orthogonality. Legendre polynomials – Properties – Rodrigue's formula – Recurrence relations – Orthogonality.

**UNIT-II**

Functions of a complex variable – Continuity – Differentiability – Analyticity – Properties – Cauchy-Riemann equations in Cartesian and polar coordinates. Harmonic and conjugate harmonic functions – Milne – Thompson method.

**UNIT-III**

Elementary functions: Exponential, trigonometric, hyperbolic functions and their properties – General power  $Z^C$  (c is complex), principal value.

**UNIT-IV**

Complex integration: Line integral – evaluation along a path and by indefinite integration – Cauchy's integral theorem – Cauchy's integral formula – Generalized integral formula.

**UNIT-V**

Complex power series: Radius of convergence – Expansion in Taylor's series, Maclaurin's series and Laurent series. Singular point – Isolated singular point – pole of order m – essential singularity.

**UNIT-VI**

Residue – Evaluation of residue by formula and by Laurent series - Residue theorem. Evaluation of integrals of the type

(a) Improper real integrals $\int_{-\infty}^{\infty} f(x)dx$	(b) $\int_c^{c+2\pi} f(\cos \theta, \sin \theta)d\theta$
(c) $\int_{-\infty}^{\infty} e^{imx} f(x)dx$	(d) Integrals by identification.

**UNIT-VII**

Argument principle – Rouche's theorem – determination of number of zeros of complex polynomials - Maximum Modulus principle - Fundamental theorem of Algebra, Liouville's Theorem.

**UNIT-VIII**

Conformal mapping: Transformation by  $e^z$ ,  $\ln z$ ,  $z^2$ ,  $z^n$  (n positive integer),  $\sin z$ ,  $\cos z$ ,  $z + a/z$ . Translation, rotation, inversion and bilinear transformation – fixed point – cross ratio – properties – invariance of circles and cross ratio – determination of bilinear transformation mapping 3 given points .

**Text Books:**

1. A text Book of Engineering Mathematics, Vol-III T. K. V. Iyengar, B. Krishna Gandhi and Others, S. Chand & Company.
2. A text Book of Engineering Mathematics, C. Sankaraiah, V. G. S. Book Links.
3. A text Book of Engineering Mathematics, Shahnaz Bathul, Prentice Hall of India.
4. A text Book of Engineering Mathematics, P. Nageshwara Rao, Y. Narasimhulu & N. Prabhakar Rao, Deepthi Publications.

**References:**

1. A text Book of Engineering Mathematics, B. V. Raman, Tata Mc Graw Hill.
2. Advanced Engineering Mathematics, Irvin Kreyszig, Wiley India Pvt. Ltd.
3. A text Book of Engineering Mathematics, Thomson Book Collection.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
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II Year B.Tech EEE I-Sem

<b>T</b>	<b>P</b>	<b>C</b>
<b>4+1*</b>	<b>0</b>	<b>4</b>

**FLUID MECHANICS AND HYDRAULIC MACHINERY**

**UNIT I**

**Fluid statics:** Dimensions and units: physical properties of fluids- specific gravity, viscosity surface tension- vapor pressure and their influence on fluid motion- atmospheric gauge and vacuum pressure – measurement of pressure- Piezometer, U-tube and differential manometers.

**UNIT II**

**Fluid kinematics:** stream line, path line and streak lines and stream tube, classification of flows-steady & unsteady, uniform, non uniform, laminar, turbulent, rotational, and irrotational flows-equation of continuity for one dimensional flow.

**Fluid dynamics:** surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its application on force on pipe bend.

**UNIT III**

**Closed conduit flow: Reynold's** experiment- Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel- total energy line-hydraulic gradient line.  
Measurement of flow: pilot tube, venturimeter, and orifice meter, Flow nozzle, Turbine flow meter (Ref.4)

**UNIT IV**

**Basics of turbo machinery:** hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes.

**UNIT V**

**Hydroelectric power stations:** Elements of hydro electric power station-types-concept of pumped storage plants-storage requirements, mass curve (explanation only) estimation of power developed from a given catchment area; heads and efficiencies.

**UNIT VI**

**Hydraulic Turbines:** classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design –draft tube-theory- functions and efficiency.

**UNIT VII**

**Performance of hydraulic turbines:** Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer.

**UNIT-VIII**

**Centrifugal pumps:** classification, working, work done – manometric head- losses and efficiencies-specific speed- pumps in series and parallel-performance characteristic curves, NPSH.

**Reciprocating pumps:** Working, Discharge, slip, indicator diagrams

**TEXT BOOKS:**

1. Hydraulics, fluid mechanics and Hydraulic machinery MODI and SETH.
2. Fluid Mechanics and Hydraulic Machines by Rajput.

**REFERENCE BOOKS:**

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria & Sons.
2. Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International.
3. Hydraulic Machines by Banga & Sharma, Khanna Publishers.
4. Instrumentation for Engineering Measurements by James W. Dally, William E. Riley, John Wiley & Sons Inc. 2004 (Chapter 12 – Fluid Flow Measurements)



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

**II Year B.Tech EEE I-Sem**

<b>T</b>	<b>P</b>	<b>C</b>
<b>4+1*</b>	<b>0</b>	<b>4</b>

**PULSE AND DIGITAL CIRCUITS**

**UNIT I**

**LINEAR WAVESHAPING**

High pass, low pass RC circuits, their response for sinusoidal, step, pulse, square and ramp inputs. RC network as differentiator and integrator, attenuators, its applications in CRO probe, RL and RLC circuits and their response for step input, Ringing circuit.

**UNIT II**

**NON-LINEAR WAVE SHAPING**

Diode clippers, Transistor clippers, clipping at two independent levels, Transfer characteristics of clippers, Emitter coupled clipper, Comparators, applications of voltage comparators, clamping operation, clamping circuits using diode with different inputs, Clamping circuit theorem, practical clamping circuits, effect of diode characteristics on clamping voltage, Transfer characteristics of clampers.

**UNIT III**

**SWITCHING CHARACTERISTICS OF DEVICES**

Diode as a switch, piecewise linear diode characteristics, Transistor as a switch, Break down voltage consideration of transistor, saturation parameters of Transistor and their variation with temperature, Design of transistor switch, transistor-switching times.

**UNIT IV**

**MULTIVIBRATORS**

Analysis and Design of Bistable, Monostable, Astable Multivibrators and Schmitt trigger using transistors.

**UNIT V**

**TIME BASE GENERATORS**

General features of a time base signal, methods of generating time base waveform, Miller and Bootstrap time base generators – basic principles, Transistor miller time base generator, Transistor Bootstrap time base generator, Current time base generators.

**UNIT VI**

**SYNCHRONIZATION AND FREQUENCY DIVISION**

Principles of Synchronization, Frequency division in sweep circuit, Astable relaxation circuits, Monostable relaxation circuits, Synchronization of a sweep circuit with symmetrical signals, Sine wave frequency division with a sweep circuit.

**UNIT VII**

**SAMPLING GATES**

Basic operating principles of sampling gates, Unidirectional and Bi-directional sampling gates, Reduction of pedestal in gate circuits, Applications of sampling gates.

**UNIT VIII**

**REALIZATION OF LOGIC GATES USING DIODES & TRANSISTORS**

AND, OR gates using Diodes, Resistor, Transistor Logic, Diode Transistor Logic.

**TEXT BOOKS**

1. Pulse, Digital and Switching Waveforms J. Millman and H. Taub, McGraw-Hill, 1991.
2. Solid State Pulse circuits - David A. Bell, PHI, 4<sup>th</sup> Edn., 2002 .

**REFERENCES**

1. Pulse and Digital Circuits – A. Anand Kumar, PHI.
2. Wave Generation and Shaping L. Strauss.
3. Pulse, Digital Circuits and Computer Fundamentals - R.Venkataraman.

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II Year B.Tech EEE I-Sem

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**SWITCHING THEORY AND LOGIC DESIGN**

**UNIT I**

**NUMBER SYSTEMS & CODES** : Philosophy of number systems – complement representation of negative numbers-binary arithmetic-binary codes-error detecting & error correcting codes –hamming codes.

**UNIT II**

**BOOLEAN ALGEBRA AND SWITCHING FUNCTIONS** : Fundamental postulates of Boolean Algebra - Basic theorems and properties - switching functions–Canonical and Standard forms-Algebraic simplification digital logic gates, properties of XOR gates –universal gates-Multilevel NAND/NOR realizations.

**UNIT III**

**MINIMIZATION OF SWITCHING FUNCTIONS** : Map method, Prime implicants, Don't care combinations, Minimal SOP and POS forms, Tabular Method, Prime –Implicant chart, simplification rules.

**UNIT IV**

**COMBINATIONAL LOGIC DESIGN**

Design using conventional logic gates, Encoder, Decoder, Multiplexer, De-Multiplexer, Modular design using IC chips, MUX Realization of switching functions Parity bit generator, Code-converters, Hazards and hazard free realizations.

**UNIT V**

**PROGRAMMABLE LOGIC DEVICES, THRESHOLD LOGIC** : Basic PLD's-ROM, PROM, PLA, PLD Realization of Switching functions using PLD's. Capabilities and limitations of Threshold gate, Synthesis of Threshold functions, Multigate Synthesis.

**UNIT VI**

**SEQUENTIAL CIRCUITS - I** : Classification of sequential circuits (Synchronous, Asynchronous, Pulse mode, Level mode with examples) Basic flip-flops-Triggering and excitation tables. Steps in synchronous sequential circuit design. Design of modulo-N Ring & Shift counters, Serial binary adder, sequence detector.

**UNIT VII**

**SEQUENTIAL CIRCUITS - II** : Finite state machine-capabilities and limitations, Mealy and Moore models-minimization of completely specified and incompletely specified sequential machines, Partition techniques and Merger chart methods-concept of minimal cover table.

**UNIT VIII**

**ALGORITHMIC STATE MACHINES** : Salient features of the ASM chart-Simple examples-System design using data path and control subsystems-control implementations-examples of Weighing machine and Binary multiplier.

**TEXTBOOKS :**

1. Switching & Finite Automata theory – Zvi Kohavi, TMH, 2nd Edition.
2. Digital Design – Morris Mano, PHI, 3<sup>rd</sup> Edition, 2006.

**REFERENCES :**

1. An Engineering Approach To Digital Design – Fletcher, PHI. Digital Logic – Application and Design – John M. Yarbrough, Thomson.
2. Fundamentals of Logic Design – Charles H. Roth, Thomson Publications, 5th Edition, 2004.
3. Digital Logic Applications and Design – John M. Yarbrough, Thomson Publications, 2006.

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**II Year B.Tech EEE I-Sem**

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**ELECTROMAGNETIC FIELDS**

**Objective :**

The objective of this course is to introduce the concepts of electric field and magnetic fields and their applications which will be utilized in the development of the theory for power transmission lines and electrical machines.

**UNIT – I Electrostatics :**

Electrostatic Fields – Coulomb's Law – Electric Field Intensity (EFI) – EFI due to a line and a surface charge – Work done in moving a point charge in an electrostatic field – Electric Potential – Properties of potential function – Potential gradient – Gauss's law – Application of Gauss's Law – Maxwell's first law,  $\text{div} (D) = \rho_v$

**UNIT – II Conductors and Dipole:**

Laplace's and Poisson's equations – Solution of Laplace's equation in one variable. Electric dipole – Dipole moment – potential and EFI due to an electric dipole – Torque on an Electric dipole in an electric field – Behavior of conductors in an electric field – Conductors and Insulators.

**UNIT – III Dielectric & Capacitance :**

Electric field inside a dielectric material – polarization – Dielectric – Conductor and Dielectric – Dielectric boundary conditions, Capacitance – Capacitance of parallel plate and spherical and co-axial capacitors with composite dielectrics – Energy stored and energy density in a static electric field – Current density – conduction and Convection current densities – Ohm's law in point form – Equation of continuity

**UNIT – IV Magneto Statics :**

Static magnetic fields – Biot-Savart's law – Oersted's experiment - Magnetic field intensity (MFI) – MFI due to a straight current carrying filament – MFI due to circular, square and solenoid current – Carrying wire – Relation between magnetic flux, magnetic flux density and MFI – Maxwell's second Equation,  $\text{div}(B)=0$ .

**UNIT – V Ampere's circuital law and its applications**

Ampere's circuital law and its applications viz. MFI due to an infinite sheet of current and a long current carrying filament – Point form of Ampere's circuital law – Maxwell's third equation,  $\text{Curl} (H)=J_c$ , Field due to a circular loop, rectangular and square loops.

**UNIT – VI Force in Magnetic fields :**

Magnetic force - Moving charges in a Magnetic field – Lorentz force equation – force on a current element in a magnetic field – Force on a straight and a long current carrying conductor in a magnetic field – Force between two straight long and parallel current carrying conductors – Magnetic dipole and dipole moment – a differential current loop as a magnetic dipole – Torque on a current loop placed in a magnetic field

**UNIT – VII Magnetic Potential :**

Scalar Magnetic potential and its limitations – vector magnetic potential and its properties – vector magnetic potential due to simple configurations – vector Poisson's equations.

Self and Mutual inductance – Neumann's formulae – determination of self-inductance of a solenoid and toroid and mutual inductance between a straight long wire and a square loop wire in the same plane – energy stored and density in a magnetic field. Introduction to permanent magnets, their characteristics and applications.

**UNIT – VIII Time Varying Fields :**

Time varying fields – Faraday's laws of electromagnetic induction – Its integral and point forms – Maxwell's fourth equation,  $\text{Curl} (E) = -\partial B / \partial t$  – Statically and Dynamically induced EMFs – Simple problems -Modification of Maxwell's equations for time varying fields – Displacement current – Poynting Theorem and Poynting vector.

**TEXT BOOKS**

1. "Engineering Electromagnetics" by William H. Hayt & John. A. Buck Mc. Graw-Hill Companies, 7<sup>th</sup> Edition.2006.
2. "Electro magnetic Fields" by Sadiku, Oxford Publications

**REFERENCE BOOKS :**

1. "Introduction to Electro Dynamics" by D J Griffiths, Prentice-Hall of India Pvt.Ltd, 2<sup>nd</sup> edition
2. "Electromagnetics" by J P Tewari.
3. "Electromagnetics" by J. D Kraus Mc Graw-Hill Inc. 4<sup>th</sup> edition 1992.
4. "Electromagnetic fields", by S. Kamakshaiah, Right Publishers, 2007.

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II Year B.Tech EEE I-Sem

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**ELECTRICAL MACHINES - I**

**Objective :**

Electrical machines course is one of the important courses of the Electrical discipline. In this course the different types of DC generators and motors which are widely used in industry are covered and their performance aspects will be studied.

**UNIT – I Electromechanical Energy Conversion**

Electromechanical Energy conversion – forces and torque in magnetic field systems – energy balance – energy and force in a singly excited magnetic field system, determination of magnetic force - co-energy – multi excited magnetic field systems.

**UNIT – II D.C. Generators – Construction & Operation**

D.C. Generators – Principle of operation – Action of commutator – constructional features – armature windings – lap and wave windings – simplex and multiplex windings – use of laminated armature – E. M.F Equation – Problems

**UNIT – III Armature reaction in D.C. Generator**

Armature reaction – Cross magnetizing and de-magnetizing AT/pole – compensating winding – commutation – reactance voltage – methods of improving commutation.

**UNIT – IV Types of D.C Generators**

Methods of Excitation – separately excited and self excited generators – build-up of E.M.F - critical field resistance and critical speed - causes for failure to self excite and remedial measures.

**UNIT – V Load Characteristics of Generators**

Load characteristics of shunt, series and compound generators – parallel operation of d.c series generators – use of equalizer bar and cross connection of field windings – load sharing.

**UNIT – VI D.C. Motors**

D.C Motors – Principle of operation – Back E.M.F. - Torque equation – characteristics and application of shunt, series and compound motors – Armature reaction and commutation.

**UNIT – VII Speed control of D.C. Motors**

Speed control of d.c. Motors: Armature voltage and field flux control methods. Ward-Leonard system. Principle of 3 point and 4 point starters – protective devices.

**UNIT – VIII Testing of D.C. Machines**

Testing of d.c. machines: Losses – Constant & Variable losses – calculation of efficiency – condition for maximum efficiency

Methods of Testing – direct, indirect and regenerative testing – brake test – Swinburne's test – Hopkinson's test – Field's test – Retardation test – separation of stray losses in a d.c. motor test.

**TEXT BOOKS:**

1. Electric Machinery – A. E. Fitzgerald, C. Kingsley and S. Umans, Mc Graw-Hill Companies, 5<sup>th</sup> edition
2. Electrical Machines – P.S. Bimbra., Khanna Publishers

**REFERENCE BOOKS:**

1. Performance and Design of D.C Machines – by Clayton & Hancock, BPB Publishers
2. Electrical Machines -S.K. Battacharya,
3. Electric Machines by I.J. Nagrath & D.P. Kothari, Tata Mc Graw – Hill Publishers, 3<sup>rd</sup> edition, 2004.
4. Electromechanics – I (D.C. Machines) S. Kamakshaiah Hi-Tech Publishers.

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**II Year B.Tech EEE I-Sem**

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**FLUID MECHANICS AND HYDRAULIC MACHINES LAB**

1. Impact of jets on Vanes
2. Performance Test on Pelton Wheel.
3. Performance Test on Francis Turbine
4. Performance Test on Kaplan Turbine
5. Performance Test on Single Stage Centrifugal Pump
6. Performance Test on Multi Stage Centrifugal Pump
7. Performance Test on Reciprocating Pump
8. Calibration of Venturimeter
9. Calibration of Orifice meter.
10. Determination of friction factor for a given pipe line.
11. Determination of loss of head due to sudden contraction in a pipeline.
12. Turbine flow meter.

**Note:** Any 10 of the above 12 experiments are to be conducted.

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KAKINADA**

**II Year B.Tech EEE I-Sem**

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**ELECTRICAL CIRCUITS AND SIMULATION LAB**

**PART-A: ELECTRICAL CIRCUITS**

- 1) Thevenin's, Norton's and Maximum Power Transfer Theorems
- 2) Superposition theorem and RMS value of complex wave
- 3) Verification of Compensation Theorem
- 4) Reciprocity, Millmann's Theorems
- 5) Locus Diagrams of RL and RC Series Circuits
- 6) Series and Parallel Resonance
- 7) Determination of Self, Mutual Inductances and Coefficient of coupling
- 8) Z and Y Parameters
- 9) Transmission and hybrid parameters
- 10) Measurement of Active Power for Star and Delta connected balanced loads
- 11) Measurement of Reactive Power for Star and Delta connected balanced loads
- 12) Measurement of 3-phase Power by two Wattmeter Method for unbalanced loads

**PART-B: PSPICE SIMULATION**

- 1) Simulation of DC Circuits
- 2) DC Transient response
- 3) Mesh Analysis
- 4) Nodal Analysis

**NOTE:**

- PSPICE Software Package is necessary.
- Eight experiments are to be conducted from PART-A and any Two from PART-B

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
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II Year B.Tech EEE II-Sem

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**MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS**

**Unit I Introduction to Managerial Economics:**

Definition, Nature and Scope of Managerial Economics–Demand Analysis: Demand Determinants, Law of Demand and its exceptions.

**Unit II Elasticity of Demand:**

Definition, Types, Measurement and Significance of Elasticity of Demand. Demand Forecasting, Factors governing demand forecasting, methods of demand forecasting (survey methods, statistical methods, expert opinion method, test marketing, controlled experiments, judgmental approach to demand forecasting)

**Unit III Theory of Production and Cost Analysis:**

Production Function – Isoquants and Isocosts, MRTS, Least Cost Combination of Inputs, Cobb-Douglas Production function, Laws of Returns, Internal and External Economies of Scale.

**Cost Analysis:** Cost concepts, Opportunity cost, Fixed vs. Variable costs, Explicit costs Vs. Implicit costs, Out of pocket costs vs. Imputed costs. Break-even Analysis (BEA)-Determination of Break-Even Point (simple problems)- Managerial Significance and limitations of BEA.

**Unit IV Introduction to Markets & Pricing Policies:**

**Market structures:** Types of competition, Features of Perfect competition, Monopoly and Monopolistic Competition. Price-Output Determination in case of Perfect Competition and Monopoly.

**Objectives and Policies of Pricing- Methods of Pricing:** Cost Plus Pricing, Marginal Cost Pricing, Sealed Bid Pricing, Going Rate Pricing, Limit Pricing, Market Skimming Pricing, Penetration Pricing, Two-Part Pricing, Block Pricing, Bundling Pricing, Peak Load Pricing, Cross Subsidization.

**Unit V Business & New Economic Environment:**

Characteristic features of Business, Features and evaluation of Sole Proprietorship, Partnership, Joint Stock Company, Public Enterprises and their types, Changing Business Environment in Post-liberalization scenario.

**Unit VI Capital and Capital Budgeting:**

Capital and its significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising finance.

Nature and scope of capital budgeting, features of capital budgeting proposals, Methods of Capital Budgeting: Payback Method, Accounting Rate of Return (ARR) and Net Present Value Method (simple problems)

**Unit VII Introduction to Financial Accounting:**

Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments).

**Unit VIII Financial Analysis through ratios:**

Computation, Analysis and Interpretation of Liquidity Ratios (Current Ratio and quick ratio), Activity Ratios (Inventory turnover ratio and Debtor Turnover ratio), Capital structure Ratios (Debt- Equity ratio, Interest Coverage ratio), and Profitability ratios (Gross Profit Ratio, Net Profit ratio, Operating Ratio, P/E Ratio and EPS).

**TEXT BOOKS:**

1. Aryasri: Managerial Economics and Financial Analysis, 2/e, TMH, 2005.
2. Varshney & Maheswari: Managerial Economics, Sultan Chand, 2003.

**REFERENCES:**

1. Ambrish Gupta, Financial Accounting for Management, Pearson Education, New Delhi.
2. H. Craig Peterson & W. Cris Lewis, Managerial Economics, PHI, 4<sup>th</sup> Ed.
3. Suma Damodaran, Managerial Economics, Oxford University Press.
4. Lipsey & Chrystal, Economics, Oxford University Press.
5. S. A. Siddiqui & A. S. Siddiqui, Managerial Economics & Financial Analysis, New age International Space Publications.
6. Domnick Salvatore: Managerial Economics In a Global Economy, 4th Edition, Thomson.
7. Narayanaswamy: Financial Accounting—A Managerial Perspective, PHI.



8. Raghunatha Reddy & Narasimhachary: Managerial Economics & Financial Analysis, Scitech.
9. S.N.Maheswari & S.K. Maheswari, Financial Accounting, Vikas.
10. Truet and Truet: Managerial Economics: Analysis, Problems and Cases, Wiley.
11. Dwivedi: Managerial Economics, 6th Ed., Vikas.

**Prerequisites:** Nil

**Objective:** To explain the basic principles of managerial economics, accounting and current business environment underlying business decision making.

**Codes/Tables:** Present Value Tables need to be permitted into the examinations Hall.

**Question Paper Pattern:** 5 Questions to be answered out of 8 questions.  
Each question should not have more than 3 bits.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, KAKINADA  
KAKINADA**

**II Year B.Tech EEE II-Sem**

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**ENVIRONMENTAL STUDIES**

**UNIT - I**

**Multidisciplinary nature of Environmental Studies:** Definition, Scope and Importance – Need for Public Awareness.

**UNIT - II**

**Natural Resources :** Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems - Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources. Case studies. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

**UNIT - III**

**Ecosystems :** Concept of an ecosystem. - Structure and function of an ecosystem. - Producers, consumers and decomposers. - Energy flow in the ecosystem - Ecological succession. - Food chains, food webs and ecological pyramids. - Introduction, types, characteristic features, structure and function of the following ecosystem:

- a. Forest ecosystem
- b. Grassland ecosystem
- c. Desert ecosystem
- d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

**UNIT - IV**

**Biodiversity and its conservation :** Introduction - Definition: genetic, species and ecosystem diversity. Bio-geographical classification of India - Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - . Biodiversity at global, National and local levels. - . India as a megadiversity nation - Hot-spots of biodiversity - Threats to biodiversity: habitat loss, poaching of wildlife, man/wildlife conflicts. - Endangered and endemic species of India - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

**UNIT - V**

**Environmental Pollution :** Definition, Cause, effects and control measures of :

- a. Air pollution
- b. Water pollution
- c. Soil pollution
- d. Marine pollution
- e. Noise pollution
- f. Thermal pollution
- g. Nuclear hazards

**Solid waste Management :** Causes, effects and control measures of urban and industrial wastes. – Role of an individual in prevention of pollution. - Pollution case studies. - Disaster management: floods, earthquake, cyclone and landslides.

**UNIT - VI**

**Social Issues and the Environment :** From Unsustainable to Sustainable development -Urban problems related to energy -Water conservation, rain water harvesting, watershed management -Resettlement and rehabilitation of people; its problems and concerns. Case Studies -Environmental ethics: Issues and possible solutions. -Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies. -Wasteland reclamation. -Consumerism and waste products. –Environment Protection Act. -Air (Prevention and Control of Pollution) Act. -Water (Prevention and control of Pollution) Act -Wildlife Protection Act -Forest Conservation Act -Issues involved in enforcement of environmental legislation. -Public awareness.

**UNIT - VII**

**Human Population and the Environment:** Population growth, variation among nations. Population explosion - Family Welfare Programme. -Environment and human health. -Human Rights. -Value Education. -HIV/AIDS. -Women and Child Welfare. -Role of information Technology in Environment and human health. -Case Studies.

**UNIT - VIII**

**Field work :** Visit to a local area to document environmental assets River /forest grassland/hill/mountain -Visit to a local polluted site-Urban/Rural/industrial/ Agricultural Study of common plants, insects, birds. - Study of simple ecosystems-pond, river, hill slopes, etc.

**TEXT BOOK:**

- 1 Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
- 2 Environmental Studies by R. Rajagopalan, Oxford University Press.

**REFERENCE:**

- 1 Textbook of Environmental Sciences and Technology by M. Anji Reddy, BS Publication.

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**II Year B.Tech EEE II-Sem**

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**LINEAR AND DIGITAL IC APPLICATIONS**

**UNIT I**

**INTEGRATED CIRCUITS**

Classification, chip size and circuit complexity, basic information of Op-amp, ideal and practical Op-amp, internal circuits, Op-amp characteristics, DC and AC characteristics, 741 op-amp and its features, modes of operation-inverting, non-inverting, differential.

**UNIT II**

**OP-AMP APPLICATIONS**

Basic application of Op-amp, instrumentation amplifier, ac amplifier, V to I and I to V converters, sample & hold circuits, multipliers and dividers, Differentiators and Integrators, Comparators, Schmitt trigger, Multivibrators, introduction to voltage regulators, features of 723.

**UNIT III**

**ACTIVE FILTERS & OSCILLATORS**

Introduction, 1st order LPF, HPF filters. Band pass, Band reject and all pass filters. Oscillator types and principle of operation – RC, Wien and quadrature type, waveform generators – triangular, sawtooth, square wave and VCO.

**UNIT IV**

**TIMERS & PHASE LOCKED LOOPS**

Introduction to 555 timer, functional diagram, monostable and astable operations and applications, Schmitt Trigger. PLL - introduction, block schematic, principles and description of individual blocks of 565.

**UNIT V**

**D-A AND A- D CONVERTERS**

Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, and IC 1408 DAC, Different types of ADCs - parallel comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC. DAC and ADC specifications.

**UNIT VI**

Classification of Integrated circuits, comparison of various logic families, standard TTL NAND Gate- Analysis & characteristics, TTL open collector O/Ps, Tristate TTL, MOS & CMOS open drain and tristate outputs, CMOS transmission gate, IC interfacing- TTL driving CMOS & CMOS driving TTL .

**UNIT VII**

Design using TTL-74XX & CMOS 40XX series, code converters, decoders, Demultiplexers, decoders & drives for LED & LCD display. Encoder, priority Encoder, multiplexers & their applications, priority generators/checker circuits. Digital arithmetic circuits-parallel binary adder/subtractor circuits using 2's, Complement system. Digital comparator circuits.

**UNIT VIII**

**SEQUENTIAL CIRCUITS**

Flip-flops & their conversions. Design of synchronous counters. Decade counter, shift registers & applications, familiarities with commonly available 74XX & CMOS 40XX series of IC counters. Memories: ROM architecture, types & applications, RAM architecture, Static & Dynamic RAMs, synchronous DRAMs.

**TEXT BOOKS**

1. Linear Integrated Circuits –D. Roy Chowdhury, New Age International (p) Ltd, 2<sup>nd</sup> Ed., 2003.
2. Op-Amps & Linear ICs – Ramakanth A. Gayakwad, PHI, 1987.
3. Digital Fundamentals – Floyd and Jain, Pearson Education, 8<sup>th</sup> Edition, 2005.

**REFERENCES:**

1. Operational Amplifiers and Linear Integrated Circuits – R.F. Coughlin and Fredrick F. Driscoll, PHI, 1977.
2. Operational Amplifiers and Linear Integrated Circuits: Theory and Applications –Denton J. Daibey, TMH.
3. Design with Operational Amplifiers and Analog Integrated Circuits - Sergio Franco, McGraw Hill, 3<sup>rd</sup> Ed., 2002.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY,  
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**II Year B.Tech EEE II-Sem**

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**POWER SYSTEMS-I**

**Objective :**

Electrical Power plays significant role in day to day life of entire mankind. This course concerns the generation and distribution of power along with the economic aspects.

**UNIT-1 Thermal Power Stations**

Line diagram of Thermal Power Station (TPS) showing paths of coal, steam, water, air, ash and flue gasses.- Brief description of TPS components: Economizers, Boilers, Super heaters, Turbines, Condensers, Chimney and Cooling towers.

**UNIT-2 Gas and Nuclear Power Stations**

Nuclear Power Stations: Nuclear Fission and Chain reaction.- Nuclear fuels.- Principle of operation of Nuclear reactor.-Reactor Components: Moderators, Control rods, Reflectors and Coolants.- Radiation hazards: Shielding and Safety precautions.- Types of Nuclear reactors and brief description of PWR, BWR and FBR.

Gas Power Stations: Principle of Operation and Components ( Block Diagram Approach Only)

**UNIT-3 General Aspects of Distribution Systems and D.C. Distribution Systems**

Classification of Distribution Systems - Comparison of DC vs AC and Under-Ground vs Over - Head Distribution Systems- Requirements and Design features of Distribution Systems- Voltage Drop Calculations (Numerical Problems) in D.C Distributors for the following cases: Radial D.C Distributor fed one end and at the both the ends (equal/unequal Voltages) and Ring Main Distributor.

**Unit-4 A.C. Distribution Systems.**

Voltage Drop Calculations (Numerical Problems) in A.C. Distributors for the following cases: Power Factors referred to receiving end voltage and with respect to respective load voltages.

**Unit-5 Substations.**

Classification of substations: **Air insulated substations** - Indoor & Outdoor substations: Substations layout showing the location of all the substation equipment.

Bus bar arrangements in the Sub-Stations: Simple arrangements like single bus bar, sectionalized single bus bar, main and transfer bus bar system with relevant diagrams.

**Gas insulated substations (GIS)** – Advantages of Gas insulated substations, different types of gas insulated substations, single line diagram of gas insulated substations, bus bar, construction aspects of GIS, Installation and maintenance of GIS, Comparison of Air insulated substations and Gas insulated substations.

**UNIT-6 Power factor and Voltage Control**

Causes of low p.f -Methods of Improving p.f -Phase advancing and generation of reactive KVAR using static Capacitors-Most economical p.f. for constant KW load and constant KVA type loads, Numerical Problems.

Dependency of Voltage on Reactive Power flow.- Methods of Voltage Control: Shunt Capacitors, Series Capacitors, Synchronous Capacitors, Tap changing and Booster Transformers

**UNIT-7 Economic Aspects of Power Generation**

Load curve, load duration and integrated load duration curves-load, demand, diversity, capacity, utilization and plant use factors- Numerical Problems.

**Unit-8 Tariff Methods**

Costs of Generation and their division into Fixed, Semi-fixed and Running Costs.

Desirable Characteristics of a Tariff Method.-Tariff Methods: Flat Rate, Block-Rate, two-part, three –part, and power factor tariff methods and Numerical Problems

**TEXT BOOKS**

1. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagar and A.Chakraborti, Dhanpat Rai & Co. Pvt. Ltd., 1999.
2. Principles of Power Systems by V.K Mehta and Rohit Mehta S.CHAND& COMPANY LTD., New Delhi 2004.

**REFERENCE BOOKS**

1. Elements of Power Station design and practice by M.V. Deshpande, Wheeler Publishing.
2. Electrical Power Systems by C.L.Wadhawa New age International (P) Limited, Publishers 1997.
3. Electrical Power Generation, Transmission and Distribution by S.N.Singh., PHI, 2003.
4. Gas turbine performance, by PP Wals, P.Fletcher, Blackwell Publisher, 2004.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY,  
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II Year B.Tech EEE II-Sem

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**ELECTRICAL MACHINES – II**

**Objective :**

As an extension of Electrical machines I course this subject facilitates to study of the performance of Transformers and Induction motors which are the major part of industrial drives and agricultural pump sets.

**UNIT-I Single Phase Transformers – Construction & Operation**

Single phase transformers-types - constructional details-minimization of hysteresis and eddy current losses-emf equation - operation on no load and on load - phasor diagrams

**UNIT-II Single Phase Transformers - Performance**

Equivalent circuit - losses and efficiency-regulation. All day efficiency - effect of variations of frequency & supply voltage on iron losses.

**UNIT-III Testing of Single Phase Transformer and Autotransformer**

OC and SC tests - Sumpner's test - predetermination of efficiency and regulation-separation of losses test-parallel operation with equal and unequal voltage ratios - auto transformers-equivalent circuit - comparison with two winding transformers.

**UNIT-IV Polyphase Transformers**

Polyphase transformers - Polyphase connections - Y/Y, Y/Δ, Δ/Y, Δ/Δ and open Δ, Third harmonics in phase voltages-three winding transformers-tertiary windings-determination of Z<sub>p</sub>, Z<sub>s</sub> and Z<sub>t</sub> transients in switching - off load and on load tap changing; Scott connection.

**UNIT-V Polyphase Induction Motors**

Polyphase induction motors-construction details of cage and wound rotor machines-production of a rotating magnetic field - principle of operation - rotor emf and rotor frequency - rotor reactance, rotor current and pf at standstill and during operation.

**UNIT-VI Characteristics of Induction Motors**

Rotor power input, rotor copper loss and mechanical power developed and their inter relation-torque equation-deduction from torque equation - expressions for maximum torque and starting torque - torque slip characteristic - double cage and deep bar rotors - equivalent circuit - phasor diagram - crawling and cogging

**UNIT-VII Circle Diagram of Induction Motors**

Circle diagram-no load and blocked rotor tests-predetermination of performance-methods of starting and starting current and torque calculations

**UNIT-VIII Speed Control Methods**

Speed control-change of frequency; change of poles and methods of consequent poles; cascade connection. injection of an emf into rotor circuit (qualitative treatment only)-induction generator-principle of operation.

**TEXT BOOKS:**

1. Electric machinery - A.E. Fitzgerald, C.Kingsley and S.Umans, Mc Graw Hill Companies, 5<sup>th</sup> edition
2. Electrical machines-PS Bhimbra, Khanna Publishers.

**REFERENCE BOOKS:**

1. Performance and Design of AC Machines by MG.Say, BPB Publishers
2. Theory of Alternating Current Machinery- by Langsdorf, Tata McGraw-Hill Companies, 2<sup>nd</sup> edition.
3. Electric Machines –by I.J.Nagrath & D.P.Kothari,Tata Mc Graw Hill, 7<sup>th</sup> Edition.2005
4. Electromechanics-II (transformers and induction motors) S. Kamakashaiah Hitech publishers.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

**II Year B.Tech EEE II-Sem**

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**CONTROL SYSTEMS**

**Objective :**

In this course it is aimed to introduce to the students the principles and applications of control systems in every day life. The basic concepts of block diagram reduction, time domain analysis solutions to time invariant systems and also deals with the different aspects of stability analysis of systems in frequency domain and time domain.

**UNIT – I INTRODUCTION**

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

Mathematical models – Differential equations, Impulse Response and transfer functions - Translational and Rotational mechanical systems

**UNIT II TRANSFER FUNCTION REPRESENTATION**

Transfer Function of DC Servo motor - AC Servo motor- Synchro transmitter and Receiver, Block diagram representation of systems considering electrical systems as examples -Block diagram algebra – Representation by Signal flow graph - Reduction using Mason's gain formula.

**UNIT-III TIME RESPONSE ANALYSIS**

Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants – Effects of proportional derivative, proportional integral systems.

**UNIT – IV STABILITY ANALYSIS IN S-DOMAIN**

The concept of stability – Routh's stability criterion – qualitative stability and conditional stability – limitations of Routh's stability

**Root Locus Technique:**

The root locus concept - construction of root loci-effects of adding poles and zeros to  $G(s)H(s)$  on the root loci.

**UNIT – V FREQUENCY RESPONSE ANALYSIS**

Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Phase margin and Gain margin-Stability Analysis from Bode Plots.

**UNIT – VI STABILITY ANALYSIS IN FREQUENCY DOMAIN**

Polar Plots-Nyquist Plots-Stability Analysis.

**UNIT – VII CLASSICAL CONTROL DESIGN TECHNIQUES**

Compensation techniques – Lag, Lead, Lead-Lag Controllers design in frequency Domain, PID Controllers.

**UNIT – VIII State Space Analysis of Continuous Systems**

Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and it's Properties – Concepts of Controllability and Observability

**TEXT BOOKS:**

1. Automatic Control Systems 8th edition– by B. C. Kuo 2003– John wiley and son's.,
2. Control Systems Engineering – by I. J. Nagrath and M. Gopal, New Age International (P) Limited, Publishers, 2<sup>nd</sup> edition.

**REFERENCE BOOKS:**

1. Modern Control Engineering – by Katsuhiko Ogata – Prentice Hall of India Pvt. Ltd., 3<sup>rd</sup> edition, 1998.
2. Control Systems by N.K.Sinha, New Age International (P) Limited Publishers, 3<sup>rd</sup> Edition, 1998.
3. Control Systems Engg. by NISE 3<sup>rd</sup> Edition – John wiley
4. "Modelling & Control Of Dynamic Systems" by Narciso F. Macia George J. Thaler, Thomson Publishers.



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II Year B.Tech EEE II-Sem

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**I.C. AND PULSE AND DIGITAL CIRCUITS LAB**

1. Linear wave shaping
2. Non Linear Wave Shaping – Clippers
3. Non Linear Wave Shaping – Clampers
4. Study of Logic Gates & Some Applications
5. Astable Multivibrator, Monostable Multivibrator using transistors
6. Bistable Multivibrator, Schmitt Trigger using transistors
7. IC 741 OP AMP Applications – Adder, Integrator and Differentiator Circuits
8. Active Filters – LPF, HPF (first order)
9. Function Generator using 741 OP AMP
10. IC 555 Timer – Monostable Operation Circuits, Astable Operation Circuits
11. Schmitt Trigger Circuits – Using IC 741 and IC 555
12. Voltage Regulator using IC 723
13. 4 bit DAC using 741 OP AMP

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KAKINADA**

II Year B.Tech EEE II-Sem

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**ELECTRICAL MACHINES LAB – I**

**The following experiments are required to be conducted compulsory experiments:**

1. Magnetization characteristics of DC shunt generator. Determination of critical field resistance and critical speed.
2. Load test on DC shunt generator. Determination of characteristics.
3. Load test on DC series generator. Determination of characteristics.
4. Load test on DC compound generator. Determination of characteristics.
5. Hopkinson's test on DC shunt machines. Predetermination of efficiency.
6. Fields test on DC series machines. Determination of efficiency.
7. Swinburne's test and speed control of DC shunt motor. Predetermination of efficiencies.
8. Brake test on DC compound motor. Determination of performance curves.

**In addition to the above eight experiments, atleast any two of the experiments from the following list are required to be conducted:**

9. Brake test on DC shunt motor. Determination of performance curves.
10. Retardation test on DC shunt motor. Determination of losses at rated speed.
11. Separation of losses in DC shunt motor.

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KAKINADA**

III Year B.Tech EEE I-Sem

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**COMPUTER SYSTEM ORGANIZATION**

**Objective:**

- Is to acquaint budding engineers with the basic principles of organization, operation and performance of modern-day computer systems.
- It covers all aspects of computer technology, from the underlying integrated circuit technology used to construct computer components, to the use of parallel organization concepts in combining those components.

**UNIT-I:**

**BASIC STRUCTURE OF COMPUTERS:**Computer Types, Functional unit, Basic OPERATIONAL concepts, Bus structures, Software, Performance, multiprocessors and multi computers. Data Representation. Fixed Point Representation. Floating – Point Representation. Error Detection codes.

**UNIT-II:**

**REGISTER TRANSFER LANGUAGE AND MICROOPERATIONS:**Register Transfer language. Register Transfer Bus and memory transfers, Arithmetic Microoperatiaons, logic micro operations, shift micro operations, Arithmetic logic shift unit. Instruction codes. Computer Registers Computer instructions – Instruction cycle.

**UNIT – III:**

Memory – Reference Instructions. Input – Output and Interrupt. STACK organization. Instruction formats. Addressing modes. DATA Transfer and manipulation. Program control. Reduced Instruction set computer

**UNIT-IV:**

**MICRO PROGRAMMED CONTROL:**Control memory, Address sequencing, microprogram example, design of control unit Hard wired control. Microprogrammed control

**UNIT-V:**

**THE MEMORY SYSTEM:**Basic concepts semiconductor RAM memories. Read-only memories Cache memories performance considerations, Virtual memories secondary storage.

**UNIT-VI:**

**INPUT-OUTPUT ORGANIZATION:** Peripheral Devices, Input-Output Interface, Asynchronous data transfer Modes of Transfer, Priority Interrupt Direct memory Access.

**UNIT-VII:**

**PIPELINE AND VECTOR PROCESSING:**Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline Vector Processing, Array Processors.

**UNIT-VIII:**

**MULTI PROCESSORS:**Characteristics or Multiprocessors, Interconnection Structures, Interprocessor Arbitration. InterProcessor Communication and Synchronization Cache Coherence. Shared Memory Multiprocessors.

**TEXT BOOKS:**

1. Computer Systems Architecture – M.Moris Mano, IIIrd Edition, PHI/Pearson.
2. Computer Organization and Architecture by V.Rajaraman and T.Radhakrishnan, PHI Publications.

**REFERENCES:**

1. Computer Organization and Architecture – William Stallings Sixth Edition, PHI/Pearson.
2. Structured Computer Organization – Andrew S. Tanenbaum, 4<sup>th</sup> Edition PHI/Pearson.
3. Fundamentals or Computer Organization and Design, - Sivaraama Dandamudi Springer Int. Edition.
4. Computer Organization – Car Hamacher, Zvonks Vranesic, SafeaZaky, Vth Edition, McGraw Hill.

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III Year B.Tech EEE I-Sem

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**ELECTRICAL MEASUREMENTS**

**Objective :**

Electrical measurements course introduces the basic principles of all measuring instruments. It also deals with the measurement of RLC parameters voltage, current Power factor, power, energy and magnetic measurements.

**UNIT-I Measuring Instruments**

Classification – deflecting, control and damping torques – Ammeters and Voltmeters – PMMC, moving iron type instruments – expression for the deflecting torque and control torque – Errors and compensations, extension of range using shunts and series resistance. Electrostatic Voltmeters-electrometer type and attracted disc type – Extension of range of E.S. Voltmeters.

**UNIT –II Instrument transformers**

CT and PT – Ratio and phase angle errors – design considerations Type of P.F. Meters – dynamometer and moving iron type – 1-ph and 3-ph meters – Frequency meters – resonance type and Weston type – synchrosopes.

**UNIT –III Measurement of Power**

Single phase dynamometer wattmeter, LPF and UPF, Double element and three element dynamometer wattmeter, expression for deflecting and control torques – Extension of range of wattmeter using instrument transformers – Measurement of active and reactive powers in balanced and unbalanced systems.

**UNIT –IV Measurement of Energy**

Single phase induction type energy meter – driving and braking torques – errors and compensations – testing by phantom loading using R.S.S. meter. Three phase energy meter – trivector meter, maximum demand meters.

**UNIT – V Potentiometers**

Principle and operation of D.C. Crompton's potentiometer – standardization – Measurement of unknown resistance, current, voltage.

A.C. Potentiometers: polar and coordinate types standardization – applications.

**UNIT – VI Resistance Measurements**

Method of measuring low, medium and high resistance – sensitivity of Wheatstone's bridge – Carey Foster's bridge, Kelvin's double bridge for measuring low resistance, measurement of high resistance – loss of charge method.

**UNIT –VII A.C. Bridges**

Measurement of inductance, Quality Factor - Maxwell's bridge, Hay's bridge, Anderson's bridge, Owen's bridge. Measurement of capacitance and loss angle - Desauty bridge. Wien's bridge – Schering Bridge.

**UNIT – VIII**

**Magnetic Measurements:**

Ballistic galvanometer – equation of motion – flux meter – constructional details, comparison with ballistic galvanometer. Determination of B-H Loop methods of reversals six point method – A.C. testing – Iron loss of bar samples– core loss measurements by bridges and potentiometers.

**TEXT BOOK:**

1. Electrical Measurements and measuring Instruments – by E.W. Golding and F.C. Widdis, fifth Edition, Wheeler Publishing.
2. Electrical & Electronic Measurement & Instruments by A.K.Sawhney Dhanpat Rai & Co. Publications.

**REFERENCE BOOKS:**

1. Electrical Measurements – by Buckingham and Price, Prentice – Hall
2. Electrical Measurements by Harris.
3. Electrical Measurements: Fundamentals, Concepts, Applications – by Reissland, M.U, New Age International (P) Limited, Publishers.

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III Year B.Tech EEE I-Sem

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**POWER SYSTEMS-II**

**Objective :**

This course is an extension of Power systems-I course. It deals with basic theory of transmission lines modeling and their performance analysis. Also this course gives emphasis on mechanical design of transmission lines, cables and insulators.

**UNIT-I Transmission Line Parameters**

Types of conductors - calculation of resistance for solid conductors - Calculation of inductance for single phase and three phase, single and double circuit lines, concept of GMR & GMD, symmetrical and asymmetrical conductor configuration with and without transposition, Numerical Problems.

Calculation of capacitance for 2 wire and 3 wire systems, effect of ground on capacitance, capacitance calculations for symmetrical and asymmetrical single and three phase, single and double circuit lines, Numerical Problems.

**UNIT-II Performance of Short and Medium Length Transmission Lines**

Classification of Transmission Lines - Short, medium and long line and their model representations - Nominal-T, Nominal-Pie and A, B, C, D Constants for symmetrical & Asymmetrical Networks, Numerical Problems.

Mathematical Solutions to estimate regulation and efficiency of all types of lines - Numerical Problems.

**UNIT-III Performance of Long Transmission Lines**

Long Transmission Line-Rigorous Solution, evaluation of A,B,C,D Constants, Interpretation of the Long Line Equations, Incident, Reflected and Refracted Waves -Surge Impedance and SIL of Long Lines, Wave Length and Velocity of Propagation of Waves - Representation of Long Lines - Equivalent-T and Equivalent Pie network models (numerical problems).

**UNIT – IV Power System Transients**

Types of System Transients - Travelling or Propagation of Surges - Attenuation, Distortion, Reflection and Refraction Coefficients - Termination of lines with different types of conditions - Open Circuited Line, Short Circuited Line, T-Junction, Lumped Reactive Junctions (Numerical Problems). Bewley's Lattice Diagrams (for all the cases mentioned with numerical examples).

**UNIT-V Various Factors Governing the Performance of Transmission line**

Skin and Proximity effects - Description and effect on Resistance of Solid Conductors - Ferranti effect - Charging Current - Effect on Regulation of the Transmission Line, Shunt Compensation. Corona - Description of the phenomenon, factors affecting corona, critical voltages and power loss, Radio Interference.

**UNIT-VI Overhead Line Insulators**

Types of Insulators, String efficiency and Methods for improvement, Numerical Problems - voltage distribution, calculation of string efficiency, Capacitance grading and Static Shielding.

**UNIT-VII Sag and Tension Calculations**

Sag and Tension Calculations with equal and unequal heights of towers, Effect of Wind and Ice on weight of Conductor, Numerical Problems - Stringing chart and sag template and its applications.

**UNIT-VIII Underground Cables**

Types of Cables, Construction, Types of Insulating materials, Calculations of Insulation resistance and stress in insulation, Numerical Problems.

Capacitance of Single and 3-Core belted cables, Numerical Problems.

Grading of Cables - Capacitance grading, Numerical Problems, Description of Inter-sheath grading.

**TEXT BOOKS:**

1. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagar, A.Chakrabarthy, Dhanpat Rai & Co Pvt. Ltd.
2. Electrical power systems - by C.L.Wadhwa, New Age International (P) Limited, Publishers,1998.

**REFERENCE BOOKS:**

1. Power system Analysis-by John J Grainger William D Stevenson, TMC Companies, 4th edition
2. Power System Analysis and Design by B.R.Gupta, Wheeler Publishing.
3. Power System Analysis by Hadi Saadat – TMH Edition..
4. Modern Power System Analysis by I.J.Nagaraj and D.P.Kothari, Tata McGraw Hill, 2<sup>nd</sup> Edition.

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III Year B.Tech EEE I-Sem

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**POWER ELECTRONICS**

**Objective :**

With the advent of semiconductor devices, revolution is taking place in the power transmission distribution and utilization. This course introduces the basic concepts of power semiconductor devices, converters and choppers and their analysis.

**UNIT – I POWER SEMI CONDUCTOR DEVICES**

Thyristors – Silicon Controlled Rectifiers (SCR's) – BJT – Power MOSFET – Power IGBT and their characteristics and other thyristors – Basic theory of operation of SCR – Static characteristics – Turn on and turn off methods- Dynamic characteristics of SCR - Turn on and Turn off times -Salient points

**UNIT – II DEVICES AND COMMUTATION CIRCUITS**

Two transistor analogy – SCR - UJT firing circuit — Series and parallel connections of SCR's – Snubber circuit details – Specifications and Ratings of SCR's, BJT, IGBT - Numerical problems – Line Commutation and Forced Commutation circuits.

**UNIT – III SINGLE PHASE HALF CONTROLLED CONVERTERS**

Phase control technique – Single phase Line commutated converters – Mid point and Bridge connections – Half controlled converters with Resistive, RL loads and RLE load– Derivation of average load voltage and current -Active and Reactive power inputs to the converters without and with Free wheeling Diode – Numerical problems

**UNIT – IV SINGLE PHASE FULLY CONTROLLED CONVERTERS**

Fully controlled converters, Mid point and Bridge connections with Resistive, RL loads and RLE load– Derivation of average load voltage and current – Line commutated inverters -Active and Reactive power inputs to the converters without and with Free wheeling Diode, Effect of source inductance – Derivation of load voltage and current – Numerical problems.

**UNIT – V THREE PHASE LINE COMMUTATED CONVERTERS**

Three phase converters – Three pulse and six pulse converters – Mid point and bridge connections average load voltage With R and RL loads – Effect of Source inductance–Dual converters (both single phase and three phase) - Waveforms –Numerical Problems.

**UNIT – VI AC VOLTAGE CONTROLLERS & CYCLO CONVERTERS**

AC voltage controllers – Single phase two SCR's in anti parallel – With R and RL loads – modes of operation of Triac – Triac with R and RL loads – Derivation of RMS load voltage, current and power factor wave forms – Firing circuits -Numerical problems -Cyclo converters – Single phase mid point cyclo converters with Resistive and inductive load (Principle of operation only) – Bridge configuration of single phase cyclo converter (Principle of operation only) – Waveforms

**UNIT – VII CHOPPERS**

Choppers – Time ratio control and Current limit control strategies – Step down choppers Derivation of load voltage and currents with R, RL and RLE loads- Step up Chopper – load voltage expression Morgan's chopper – Jones chopper and Oscillation chopper (Principle of operation only) Waveforms — AC Chopper – Problems.

**UNIT – VIII INVERTERS**

Inverters – Single phase inverter – Basic series inverter – Basic parallel Capacitor inverter bridge inverter – Waveforms – Simple forced commutation circuits for bridge inverters – Mc Murray and Mc Murray – Bedford inverters - Voltage control techniques for inverters Pulse width modulation techniques – Numerical problems.

**TEXT BOOKS :**

1. Power Electronics – by M. D. Singh & K. B. Kanchandhani, Tata Mc Graw – Hill Publishing company, 1998.
2. Power Electronics : Circuits, Devices and Applications – by M. H. Rashid, Prentice Hall of India, 2<sup>nd</sup> edition, 1998

**REFERENCE BOOKS :**

1. Power Electronics – by Vedam Subramanyam, New Age International (P) Limited, Publishers
2. Power Electronics - by V.R.Murthy , 1<sup>st</sup> edition -2005, OXFORD University Press
3. Power Electronics-by P.C.Sen,Tata Mc Graw-Hill Publishing.

4. Thyristorised Power Controllers – by G. K. Dubey, S. R. Doradra, A. Joshi and R. M. K. Sinha, New Age International (P) Limited Publishers, 1996.



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III Year B.Tech EEE I-Sem

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**ELECTRICAL MACHINES - III**

**Objective :**

This subject is an extension of previous machines courses. It deals with the detailed analysis of Synchronous generators and motors which are the prime source of electrical power generation and its utilities. Also concerns about the different types of single phase motors which are having significant applications in house hold appliances and control systems.

**UNIT – I Construction and Principle of operation**

Constructional Features of round rotor and salient pole machines – Armature windings – Integral slot and fractional slot windings; Distributed and concentrated windings – distribution, pitch and winding factors – E.M.F Equation.

**UNIT-II Synchronous Generator Characteristics**

Harmonics in generated e.m.f. – suppression of harmonics – armature reaction - leakage reactance – synchronous reactance and impedance – experimental determination - phasor diagram – load characteristics.

**UNIT – III Regulation of Synchronous Generator**

Regulation by synchronous impedance method, M.M.F. method, Z.P.F. method and A.S.A. methods – salient pole alternators – two reaction analysis – experimental determination of  $X_d$  and  $X_q$  (Slip test) Phasor diagrams – Regulation of salient pole alternators.

**UNIT – IV Parallel Operation of Synchronous Generator**

Synchronizing alternators with infinite bus bars – synchronizing power torque – parallel operation and load sharing - Effect of change of excitation and mechanical power input. Analysis of short circuit current wave form – determination of sub-transient, transient and steady state reactances.

**UNIT – V Synchronous Motors – Principle of Operation**

Theory of operation – phasor diagram – Variation of current and power factor with excitation – synchronous condenser – Mathematical analysis for power developed .

**UNIT-VI Power Circles**

Excitation and power circles – hunting and its suppression – Methods of starting – synchronous induction motor.

**UNIT – VII Single Phase Motors**

Single phase Motors: Single phase induction motor – Constructional features-Double revolving field theory – Elementary idea of cross-field theory – split-phase motors – shaded pole motor.

**UNIT – VIII Special Motors**

Principle & performance of A.C. Series motor-Universal motor – Principle of permanent magnet and reluctance motors.

**TEXT BOOKS**

1. Electric Machines – by I.J.Nagrath & D.P.Kothari, Tata Mc Graw-Hill Publishers, 7<sup>th</sup> Edition 2005.
2. Electrical Machines – by P.S. Bimbra, Khanna Publishers.

**REFERENCE BOOKS:**

1. The Performance and Design of A.C.Machines – by M.G.Say, ELBS and Ptiman & Sons.
2. Electric Machinery – by A.E. Fitzgerald, C.Kingsley and S.Umans, Mc Graw-Hill Companies, 5<sup>th</sup> edition, 1990.
3. Theory of Alternating Current Machinery by Langsdorf, Tata Mc Graw-Hill, 2<sup>nd</sup> edition.
4. Electromechanics-III (Synchronous and single phase machines), S.Kamakashiah, Right Publishers

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III Year B.Tech EEE I-Sem

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**LINEAR SYSTEMS ANALYSIS**

**UNIT-I STATE VARIABLE ANALYSIS**

Choice of state variables in Electrical networks-Formulation of state equations for Electrical networks-Equivalent source method.Network topological method - Solution of state equations-Analysis of simple networks with state variable approach.

**UNIT-II FOURIER SERIES AND FOURIER TRANSFORM REPRESENTATION**

Introduction, Trigonometric form of Fourier series, Exponential form of Fourier series, Wave symmetry, Fourier integrals and transforms, Fourier transform of a periodic function, Properties of Fourier Transform, Parseval's theorem, Fourier transform of some common signals, Fourier transform relationship with Laplace Transform.

**UNIT-III APPLICATIONS OF FOURIER SERIES AND FOURIER TRANSFORM REPRESENTATION**

Introduction, Effective value and average values of non sinusoidal periodic waves, currents, Power Factor, Effects of harmonics, Application in Circuit Analysis, Circuit Analysis using Fourier Series.

**UNIT - IV LAPLACE TRANSFORM APPLICATIONS**

Application of Laplace transform Methods of Analysis – Response of RL, RC, RLC Networks to Step, Ramp, and impulse functions, Shifting Theorem – Convolution Integral – Applications

**UNIT-V TESTING OF POLYNOMIALS**

Elements of realisability-Hurwitz polynomials-positive real functions-Properties-Testing-Sturm's Test, examples.

**UNIT-VI NETWORK SYNTHESIS**

Network synthesis:  
Synthesis of one port LC networks-Foster and Cauer methods-Synthesis of RL and RC one port networks-Foster and Cauer methods

**UNIT-VII SAMPLING**

Sampling theorem – Graphical and Analytical proof for Band Limited Signal impulse sampling, natural and Flat top Sampling, Reconstruction of signal from its samples, effect of under sampling – Aliasing, introduction to Band Pass sampling, Cross correlation and auto correlation of functions, properties of correlation function, Energy density spectrum, Power density spectrum, Relation between auto correlation function and Energy / Power spectral density function.

**UNIT-VIII Z-TRANSFORMS**

Fundamental difference between continuous and discrete time signals, discrete time complex, exponential and sinusoidal signals, periodicity of discrete time complex exponential, concept of Z-Transform of a discrete sequence. Distinction between Laplace, Fourier and Z-Transforms. Region of convergence in Z-Transforms, constraints on ROC for various classes of signals, Inverse Z-Transform properties of Z-Transforms.

**TEXT BOOKS:**

1. Signals, Systems and Communications by B.P. Lathi, BS Publications 2003.
2. Network Analysis and Synthesis – Umesh Sinha- Satya Prakashan Publications

**REFERENCE BOOKS:**

1. Linear System Analysis – A N Tripathi, New Age International
2. Network and Systems – D Roy Chowdhary, New Age International
3. Engineering Network Analysis and Filter Design- Gopal G Bhisk & Umesh
4. Linear system analysis by A.Cheng, Oxford publishers.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
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III Year B.Tech EEE I-Sem

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**ELECTRICAL MACHINES LAB – II**

**The following experiments are required to be conducted as compulsory experiments:**

1. O.C. & S.C. Tests on Single phase Transformer
2. Sumpner's test on a pair of single phase transformers
3. Scott connection of transformers
4. No-load & Blocked rotor tests on three phase Induction motor
5. Regulation of a three –phase alternator by synchronous impedance & m.m.f. methods
6. V and Inverted V curves of a three—phase synchronous motor.
7. Equivalent Circuit of a single phase induction motor
8. Determination of  $X_d$  and  $X_q$  of a salient pole synchronous machine

**In addition to the above eight experiments, atleast any two of the following experiments are required to be conducted from the following list:**

1. Parallel operation of Single phase Transformers
2. Separation of core losses of a single phase transformer
3. Brake test on three phase Induction Motor
4. Regulation of three-phase alternator by Z.P.F. and A.S.A methods
5. Efficiency of a three-phase alternator
6. Heat run test on a bank of 3 Nos. of single phase Delta connected transformers
7. Measurement of sequence impedance of a three-phase alternator.
8. Performance characteristics of a Schrage motor

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

III Year B.Tech EEE I-Sem

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**CONTROL SYSTEMS AND SIMULATION LAB**

**Any Eight of the following experiments are to be conducted:**

1. Time response of Second order system
2. Characteristics of Synchros
3. Programmable logic controller – Study and verification of truth tables of logic gates, simple Boolean expressions and application of speed control of motor.
4. Effect of feedback on DC servo motor
5. Transfer function of DC motor
6. Effect of P, PD, PI, PID Controller on a second order systems
7. Lag and lead compensation – Magnitude and phase plot
8. Transfer function of DC generator
9. Temperature controller using PID
10. Characteristics of magnetic amplifiers
11. Characteristics of AC servo motor

**Any two simulation experiments are to be conducted:-**

1. PSPICE simulation of Op-Amp based Integrator and Differentiator circuits.
2. Linear system analysis (Time domain analysis, Error analysis) using MATLAB.
3. Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system using MATLAB
4. State space model for classical transfer function using MATLAB – Verification.

**REFERENCE BOOKS:**

1. Simulation of Electrical and electronics Circuits using PSPICE – by M.H.Rashid, M/s PHI Publications.
2. PSPICE A/D user's manual – Microsim, USA.
3. PSPICE reference guide – Microsim, USA.
4. MATLAB and its Tool Books user's manual and – Mathworks, USA.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

III Year B.Tech EEE II-Sem

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**DIGITAL SIGNAL PROCESSING**

**UNIT I**

**INTRODUCTION:** Introduction to Digital Signal Processing: Discrete time signals & sequences, linear shift invariant systems, stability, and causality. Linear constant coefficient difference equations. Frequency domain representation of discrete time signals and systems.

**UNIT II**

**DISCRETE FOURIER SERIES:** Properties of discrete Fourier series, DFS representation of periodic sequences, Discrete Fourier transforms: Properties of DFT, linear convolution of sequences using DFT, Computation of DFT. Relation between Z-transform and DFS

**UNIT III**

**FAST FOURIER TRANSFORMS:** Fast Fourier transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms, Inverse FFT, and FFT for composite N

**UNIT IV**

**REALIZATION OF DIGITAL FILTERS:** Review of Z-transforms, Applications of Z – transforms, solution of difference equations of digital filters, Block diagram representation of linear constant-coefficient difference equations, Basic structures of IIR systems, Transposed forms, Basic structures of FIR systems, System function,

**UNIT V**

**IIR DIGITAL FILTERS:** Analog filter approximations – Butter worth and Chebyshev, Design of IIR Digital filters from analog filters, Design Examples: Analog-Digital transformations

**UNIT VI**

**FIR DIGITAL FILTERS :** Characteristics of FIR Digital Filters, frequency response. Design of FIR Digital Filters using Window Techniques, Frequency Sampling technique, Comparison of IIR & FIR filters.

**UNIT VII**

**MULTIRATE DIGITAL SIGNAL PROCESSING:** Decimation, interpolation, sampling rate conversion, Implementation of sampling rate conversion.

**UNIT VIII**

**INTRODUCTION TO DSP PROCESSORS:** Introduction to programmable DSPs: Multiplier and Multiplier Accumulator (MAC), Modified Bus Structures and Memory Access schemes in DSPs Multiple access memory, multiport memory, VLSI Architecture, Pipelining, Special addressing modes, On-Chip Peripherals.

Architecture of TMS 320C5X- Introduction, Bus Structure, Central Arithmetic Logic Unit, Auxiliary Registrar, Index Registrar, Auxiliary Register Compare Register, Block Move Address Register, Parallel Logic Unit, Memory mapped registers, program controller, Some flags in the status registers, On-chip registers, On-chip peripherals

**TEXT BOOKS:**

1. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris G. Manolakis, Pearson Education / PHI, 2007.
2. Discrete Time Signal Processing – A.V.Oppenheim and R.W. Schaffer, PHI
3. Digital Signal Processors – Architecture, Programming and Applications,, B.Venkataramani, M. Bhaskar, TATA McGraw Hill, 2002

**Reference Books:**

1. Digital Signal Processing: Andreas Antoniou, TATA McGraw Hill , 2006
2. Digital Signal Processing: MH Hayes, Schaum's Outlines, TATA Mc-Graw Hill, 2007.
3. DSP Primer - C. Britton Rorabaugh, Tata McGraw Hill, 2005.
4. Fundamentals of Digital Signal Processing using Matlab – Robert J. Schilling, Sandra L. Harris, Thomson, 2007.
5. Digital Signal Processing – Alan V. Oppenheim, Ronald W. Schafer, PHI Ed., 2006

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

III Year B.Tech EEE II-Sem

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**MICROPROCESSORS AND MICROCONTROLLERS**

**Objective :**

The objective of the Microprocessor and Microcontrollers is to do the students familiarize the architecture of 8086 processor, assembling language programming and interfacing with various modules. The student can also understand of 8051 Microcontroller concepts, architecture, programming and application of Microcontrollers. Student able to do any type of industrial and real time applications by knowing the concepts of Microprocessor and Microcontrollers.

**UNIT-I 8086 ARCHITECTURE:**

Functional Diagram, Register Organization, Addressing modes, Instructions, Functional schematic, Minimum and Maximum mode operations of 8086, 8086 Control signal interfacing, Timing Diagrams.

**UNIT-II ASSEMBLY LANGUAGE PROGRAMMING OF 8086**

Assembly Directives, Macro's, Simple Programs using Assembler, Implimentation of FOR Loop, WHILE, REPEAT and IF-THEN-ELSE Features.

**UNIT-III I/O INTERFACE**

8255 PPI, Various modes of operations and interface of I/O devices to 8086, A/D, D/A Converter Interfacing.

**UNIT-IV INTERFACING WITH ADVANCED DEVICES.**

8086 System bus structure, Memory and I/O Interfacing with 8086, Interfacing through various IC Peripheral Chips, 8257 (DMA Controller), 8259 (Interrupt Priority Control).

**UNIT-V COMMUNICATION INTERFACE**

Serial Communication Standards, USART Interfacing RS-232, IEEE-488, 20mA Current Loop, Prototyping and Trouble shooting, Software Debugging tolls, MDS.

**UNIT-VI INTRODUCTION TO MICRO CONTROLLERS**

Overview of 8051 Micro Controller, Architecture, I/O ports and Memory Organization, Addressing modes and Instruction set of 8051, Simple Programs using Stack Pointer, Assembly language programming.

**UNIT-VII 8051 INTERRUPTS COMMUNICATION**

Interrupts, Timer/Counter and Serial Communication, Programming Timer Interrupts, Programming External H/W interrupts, Programming the serial communication interrupts, Interrupt Priority in the 8051, Programming 8051 Timers, Counters and Programming.

**UNIT- VIII INTERFACING AND INDUSTRIAL APPLICATIONS**

Applications of Micro Controllers, Interfacing 8051 to LED's, Push button, Relay's and Latch Connections, Keyboard Interfacing, Interfacing Seven Segment Display, ADC and DAC Interfacing.

**TEXT BOOKS:**

1. Kenneth J Ayala, " The 8051 Micro Controller Architecture, Programming and Applications", Thomson Publishers, 2<sup>nd</sup> Edition.
2. D.V.Hall, "Micro Processor and Interfacing ", Tata McGraw-Hill.

**REFERENCE BOOKS:**

1. Ajay V. Deshmukh, "Microcontrollers – theory applications", Tata McGraw-Hill Companies – 2005.
2. Ray and BulChandi, " Advanced Micro Processors", Tata McGraw-Hill.
3. Kenneth J Ayala, " The 8086 Micro Processors Architecture, Programming and Applications", Thomson Publishers, 2005.
4. Microcomputer Systems: The 8086/8088 Family: Architecture, Programming and Design, 2<sup>nd</sup> ed., Liu & Gibson

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

III Year B.Tech EEE II-Sem

<b>T</b>	<b>P</b>	<b>C</b>
<b>4+1*</b>	<b>0</b>	<b>4</b>

**MANAGEMENT SCIENCE**

**Unit I: *Introduction to Management:*** Concepts of Management and organization- Nature and Importance of Management, Functions of Management, Taylor's Scientific Management Theory, Fayol's Principles of Management, Maslow's Theory of Human Needs, Douglas McGregor's Theory X and Theory Y, Herzberg's Two-Factor Theory of Motivation, Systems Approach to Management, Leadership Styles, Social responsibilities of Management.

**Unit II: *Designing Organisational Structures:*** Basic concepts related to Organisation - Departmentation and Decentralisation, Types of mechanistic and organic structures of organisation (Line organization, Line and staff organization, functional organization, Committee organization, matrix organization, Virtual Organisation, Cellular Organisation, team structure, boundaryless organization, inverted pyramid structure, lean and flat organization structure) and their merits, demerits and suitability.

**Unit III: *Operations Management:*** Principles and Types of Plant Layout-Methods of production (Job, batch and Mass Production), Work Study -Basic procedure involved in Method Study and Work Measurement-Statistical Quality Control:  chart, R chart, c chart, p chart, (simple Problems), Acceptance Sampling, Deming's contribution to quality.

**Unit IV: A) *Materials Management:*** Objectives, Need for Inventory control, EOQ, ABC Analysis, Purchase Procedure, Stores Management and Stores Records - Supply Chain Management  
**B) *Marketing:*** Functions of Marketing, Marketing Mix, Marketing Strategies based on Product Life Cycle., Channels of distribution.

**Unit V: *Human Resources Management (HRM):*** Concepts of HRM, HRD and Personnel Management and Industrial Relations (PMIR), HRM vs. PMIR, Basic functions of HR Manager: Manpower planning, Recruitment, Selection, Training and Development, Placement, Wage and Salary Administration, Promotion, Transfer, Separation, Performance Appraisal, Grievance Handling and Welfare Administration, Job Evaluation and Merit Rating.

**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)

**Unit VII: *Strategic Management:*** Mission, Goals, Objectives, Policy, Strategy, Programmes, Elements of Corporate Planning Process, Environmental Scanning, SWOT Analysis, Steps in Strategy Formulation and Implementation, Generic Strategy alternatives.

**Unit VIII: *Contemporary Management Practices:*** Basic concepts of Just-In-Time (JIT) System, Total Quality Management (TQM), Six sigma and Capability Maturity Model (CMM) Levels, Value Chain Analysis, Enterprise Resource Planning (ERP), Performance Management, Business Process outsourcing (BPO), Business Process Re-engineering and Benchmarking, Balanced Score Card.

**Text Book:**

1. Aryasri: *Management Science*, TMH, New Delhi.

**Reference Books:**

1. Kotler Philip & Keller Kevin Lane: *Marketing Management* 12/e, PHI, 2007
2. Koontz & Weihrich: *Essentials of Management*, 6/e, TMH, 2007
3. Thomas N. Duening & John M. Ivancevich *Management—Principles and Guidelines*, Biztantra, 2007.
4. Kanishka Bedi, *Production and Operations Management*, Oxford University Press, 2007.
5. Memoria & S.V. Ganker, *Personnel Management*, Himalaya, 25/e, 2007
6. Schermerhorn: *Management*, Wiley, 2007.
7. Parnell: *Strategic Management*, Biztantra, 2007.
8. L.S. Srinath: *PERT/CPM*, Affiliated East-West Press, 2007.

**Pre-requisites:** Managerial Economics

**Objective:** To familiarize with the process of management and to provide basic insights into select contemporary management practices.

**Codes/Tables:** Normal Distribution Function Table need to be permitted into the examination Hall.

**Question Paper Pattern:** 5 Questions to be answered out of 8 questions.

Each question should not have more than 3 bits.

*Unit VIII will have only short questions, not essay questions.*



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

III Year B.Tech EEE II-Sem

<b>T</b>	<b>P</b>	<b>C</b>
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**INSTRUMENTATION**

**Objective :**

Instrumentation is essential in monitoring and analysis of any Physical system and its control. This course deals with different types of transducers, digital voltmeters, oscilloscopes and measurement of non electrical quantities.

**UNIT-I Characteristics of Signals**

Measuring Systems, Performance Characteristics, - Static characteristics, Dynamic Characteristics; Errors in Measurement – Gross Errors, Systematic Errors, Statistical Analysis of Random Errors.

**UNIT-II Signals and their representation**

Signal and their representation: Standard Test, periodic, aperiodic, modulated signal, sampled data, pulse modulation and pulse code modulation

**UNIT-III Oscilloscope**

Cathode ray oscilloscope-Cathode ray tube-time base generator-horizontal and vertical amplifiers-CRO probes-applications of CRO-Measurement of phase and frequency-lissajous patterns-Sampling oscilloscope-analog and digital type

**UNIT-IV Digital Voltmeters**

Digital voltmeters- Successive approximation, ramp, dual-Slope integration continuous balance type-Micro processor based ramp type DVM digital frequency meter-digital phase angle meter-

**UNIT-V Signal Analyzers**

Wave Analysers- Frequency selective analyzers, Heterodyne, Application of Wave analyzers- Harmonic Analyzers, Total Harmonic distortion, spectrum analyzers, Basic spectrum analyzers, spectral displays, vector impedance meter, Q meter. Peak reading and RMS voltmeters

**UNIT-VI Transducers**

Definition of transducers, Classification of transducers, Advantages of Electrical transducers, Characteristics and choice of transducers; Principle operation of resistor, inductor, LVDT and capacitor transducers; LVDT Applications, Strain gauge and its principle of operation, gauge factor, Thermistors, Thermocouples, Synchros, Piezo electric transducers, photovoltaic, photo conductive cells, photo diodes.

**UNIT-VII Measurement of Non-Electrical Quantities-I**

Measurement of strain, Gauge Sensitivity, Displacement, Velocity, Angular Velocity, Acceleration, Force, Torque.

**UNIT-VIII Measurement of Non-Electrical Quantities-II**

Measurement of Temperature, Pressure, Vacuum, Flow, Liquid level.

**TEXT BOOKS:**

1. Transducers and Instrumentation by D.V.S Murthy, Prentice Hall of India
2. A course in Electrical and Electronic Measurements and Instrumentation, A.K. Sawhney, Dhanpatrai & Co.

**REFERENCE BOOKS:**

1. Measurements Systems, Applications and Design – by D O Doebelin
2. Principles of Measurement and Instrumentation – by A.S Morris, Pearson /Prentice Hall of India
3. Electronic Instrumentation-by H.S.Kalsi Tata MCGraw-Hill Edition, 1995.
4. Modern Electronic Instrumentation and Measurement techniques – by A.D Helfrick and W.D.Cooper, Pearson/Prentice Hall of India.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

III Year B.Tech EEE II-Sem

<b>T</b>	<b>P</b>	<b>C</b>
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**SWITCH GEAR AND PROTECTION**

**Objective :**

This course introduces all varieties of Circuit Breakers and Relays for protection of Generators, Transformers and feeder bus bars from over voltages and other hazards. It emphasis on Neutral grounding for overall protection.

**UNIT – I Circuit Breakers-1**

Circuit Breakers: Elementary principles of arc interruption, Recovery, Restriking Voltage and Recovery voltages.- Restriking Phenomenon, Average and Max. RRRV, Numerical Problems - Current Chopping and Resistance Switching - CB ratings and Specifications : Types and Numerical Problems. – Auto reclosures.

**UNIT –II Circuit Breakers-2**

Description and Operation of following types of circuit breakers: Minimum Oil Circuit breakers, Air Blast Circuit Breakers, Vacuum and SF6 circuit breakers.

**UNIT – III Electromagnetic and Static Relays**

Principle of Operation and Construction of Attracted armature, Balanced Beam, induction Disc and Induction Cup relays.

Relays Classification: Instantaneous, DMT and IDMT types.

Application of relays: Over current/ Under voltage relays, Direction relays, Differential Relays and Percentage Differential Relays.

Universal torque equation, Distance relays: Impedance, Reactance and Mho and Off-Set Mho relays, Characteristics of Distance Relays and Comparison.

Static Relays: Static Relays verses Electromagnetic Relays.

**UNIT – IV Generator Protection**

Protection of generators against Stator faults, Rotor faults, and Abnormal Conditions. Restricted Earth fault and Inter-turn fault Protection. Numerical Problems on % Winding Unprotected.

**UNIT –V Transformer Protection**

Protection of transformers: Percentage Differential Protection, Numerical Problem on Design of CT s Ratio, Buchholtz relay Protection.

**UNIT –VI Feeder and Bus-Bar Protection**

Protection of Lines: Over Current, Carrier Current and Three-zone distance relay protection using Impedance relays. Translay Relay.

Protection of Bus bars – Differential protection.

**UNIT – VII Neutral Grounding**

Grounded and Ungrounded Neutral Systems.- Effects of Ungrounded Neutral on system performance. Methods of Neutral Grounding: Solid, Resistance, Reactance - Arcing Grounds and Grounding Practices.

**UNIT – VIII Protection against over voltages**

Generation of Over Voltages in Power Systems.-Protection against Lightning Over Voltages - Valve type and Zinc-Oxide Lighting Arresters - Insulation Coordination -BIL, Impulse Ratio, Standard Impulse Test Wave, Volt-Time Characteristics.

**TEXT BOOKS:**

1. Switchgear and Protection – by Sunil S Rao, Khanna Publishers
2. Power System Protection and Switchgear by Badari Ram , D.N Viswakarma, TMH Publications

**REFERENCE BOOKS:**

1. Fundamentals of Power System Protection by Paithankar and S.R.Bhide., PHI, 2003.
2. Art & Science of Protective Relaying – by C R Mason, Wiley Eastern Ltd.
3. Electrical Power Systems – by C.L.Wadhwa, New Age international (P) Limited, Publishers, 3<sup>rd</sup> editon
4. A Text book on Power System Engineering by B.L.Soni, Gupta, Bhatnagar, Chakrabarthy, Dhanpat Rai & Co.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

III Year B.Tech EEE II-Sem

<b>T</b>	<b>P</b>	<b>C</b>
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**VLSI DESIGN**

**UNIT I**

**INTRODUCTION** : Introduction to IC Technology – MOS, PMOS, NMOS, CMOS & BiCMOS technologies- Oxidation, Lithography, Diffusion, Ion implantation, Metallisation, Encapsulation, Probe testing, Integrated Resistors and Capacitors.

**UNIT II**

**BASIC ELECTRICAL PROPERTIES** : Basic Electrical Properties of MOS and BiCMOS Circuits:  $I_{ds}$ - $V_{ds}$  relationships, MOS transistor threshold Voltage,  $g_m$ ,  $g_{ds}$ , figure of merit  $\theta$ ; Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.

**UNIT III**

**VLSI CIRCUIT DESIGN PROCESSES** : VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, 2  $\mu$ m CMOS Design rules for wires, Contacts and Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits, Limitations of Scaling.

**UNIT IV**

**GATE LEVEL DESIGN** : Logic Gates and Other complex gates, Switch logic, Alternate gate circuits, Basic circuit concepts, Sheet Resistance  $R_S$  and its concept to MOS, Area Capacitance Units, Calculations - - Delays, Driving large Capacitive Loads, Wiring Capacitances, Fan-in and fan-out, Choice of layers

**UNIT V**

**SUBSYSTEM DESIGN** : Subsystem Design, Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Zero/One Detectors, Counters, High Density Memory Elements.

**UNIT VI**

**SEMICONDUCTOR INTEGRATED CIRCUIT DESIGN** : PLAs, FPGAs, CPLDs, Standard Cells, Programmable Array Logic, Design Approach.

**UNIT VII**

**VHDL SYNTHESIS** : VHDL Synthesis, Circuit Design Flow, Circuit Synthesis, Simulation, Layout, Design capture tools, Design Verification Tools, Test Principles.

**UNIT VIII**

**CMOS TESTING** : CMOS Testing, Need for testing, Test Principles, Design Strategies for test, Chiplevel Test Techniques, System-level Test Techniques, Layout Design for improved Testability.

**TEXTBOOKS :**

1. Essentials of VLSI circuits and systems – Kamran Eshraghian, Eshraghian Douglas and A. Pucknell, PHI, 2005 Edition.
2. Principles of CMOS VLSI Design - Weste and Eshraghian, Pearson Education, 1999.

**REFERENCES :**

1. Chip Design for Submicron VLSI: CMOS Layout & Simulation, - John P. Uyemura, Thomson Learning.
2. Introduction to VLSI Circuits and Systems - John .P. Uyemura, JohnWiley, 2003.
3. Digital Integrated Circuits - John M. Rabaey, PHI, EEE, 1997.
4. Modern VLSI Design - Wayne Wolf, Pearson Education, 3rd Edition, 1997.
5. VLSI Technology – S.M. SZE, 2<sup>nd</sup> Edition, TMH, 2003.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

III Year B.Tech EEE II-Sem

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**ADVANCED ENGLISH COMMUNICATIONS SKILLS LAB**

**1. Introduction**

The introduction of the English Language Lab is considered essential at 3<sup>rd</sup> year level. At this stage the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalised context.

The proposed course should be an integrated theory and lab course to enable students to use 'good' English and perform the following:

- Gather ideas and information, to organise ideas relevantly and coherently.
- Engage in debates.
- Participate in group discussions.
- Face interviews.
- Write project/research reports/technical reports.
- Make oral presentations.
- Write formal letters.
- Transfer information from non-verbal to verbal texts and vice versa.
- To take part in social and professional communication.

**2. Objectives:**

This Lab focuses on using computer-aided multimedia instruction for language development to meet the following targets:

- To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
- Further, they would be required to communicate their ideas relevantly and coherently in writing.

**3. Syllabus:**

The following course content is prescribed for the Advanced Communication Skills Lab:

- Functional English - starting a conversation – responding appropriately and relevantly – using the right body language – role play in different situations.
- Vocabulary building – synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, analogy, idioms and phrases.
- Group Discussion – dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence.
- Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele and video-conferencing.
- Resume' writing – structure and presentation, planning, defining the career objective, projecting ones strengths and skill-sets, summary, formats and styles, letter-writing.
- Reading comprehension – reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading.
- Technical Report writing – Types of formats and styles, subject matter – organization, clarity, coherence and style, planning, data-collection, tools, analysis.

**4. Minimum Requirement:**

**The English Language Lab shall have two parts:**

- i) **The Computer aided Language Lab** for 60 students with 60 systems, one master console, LAN facility and English language software for self- study by learners.
- ii) **The Communication Skills Lab** with movable chairs and audio-visual aids with a P.A System, a T. V., a digital stereo –audio & video system and camcorder etc.

**System Requirement ( Hardware component):**

*Computer network with Lan with minimum 60 multimedia systems with the following specifications:*

- iii) P – IV Processor
  - a) Speed – 2.8 GHZ
  - b) RAM – 512 MB Minimum
  - c) Hard Disk – 80 GB
- iv) Headphones of High quality

**5. Suggested Software:**

The software consisting of the prescribed topics elaborated above should be procured and used.

**Suggested Software:**

- **Clarity Pronunciation Power** – part II

- **Oxford Advanced Learner's Compass**, 7<sup>th</sup> Edition
- **DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice**.
- **Lingua TOEFL CBT Insider**, by Dreamtech
- **TOEFL & GRE**( KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
- **The following software from 'train2success.com'**
  - **Preparing for being Interviewed,**
  - **Positive Thinking,**
  - **Interviewing Skills,**
  - **Telephone Skills,**
  - **Time Management**
  - **Team Building,**
  - **Decision making**
- **English in Mind**, Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge

#### 6. Books Recommended:

1. **Effective Technical Communication**, M. Ashraf Rizvi, Tata Mc. Graw-Hill Publishing Company Ltd.
2. **A Course in English communication** by Madhavi Apte, Prentice-Hall of India, 2007.
3. **Communication Skills** by Leena Sen, Prentice-Hall of India, 2005.
4. **Academic Writing- A Practical guide for students** by Stephen Bailey, Rontledge Falmer, London & New York, 2004.
5. **English Language Communication : A Reader cum Lab Manual** Dr A Ramakrishna Rao, Dr G Natanam & Prof SA Sankaranarayanan, Anuradha Publications, Chennai
6. **Body Language- Your Success Mantra** by Dr. Shalini Verma, S. Chand, 2006.
7. **DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice**, New Age International (P) Ltd., Publishers, New Delhi.
8. Books on **TOEFL/GRE/GMAT/CAT** by Barron's/cup
9. **IELTS series with CDs** by Cambridge University Press.
10. **Technical Report Writing Today** by Daniel G. Riordan & Steven E. Pauley, Biztantra Publishers, 2005.
11. **Basic Communication Skills for Technology** by Andra J. Rutherford, 2<sup>nd</sup> Edition, Pearson Education, 2007.
12. **Communication Skills for Engineers** by Sunita Mishra & C. Muralikrishna, Pearson Education, 2007.
13. **Objective English** by Edgar Thorpe & Showick Thorpe, 2<sup>nd</sup> edition, Pearson Education, 2007.
14. **Cambridge Preparation for the TOEFL Test** by Jolene Gear & Robert Gear, 4<sup>th</sup> Edition.
15. **Technical Communication** by Meenakshi Raman & Sangeeta Sharma, Oxford University Press.

#### DISTRIBUTION AND WEIGHTAGE OF MARKS:

##### **Advanced Communication Skills Lab Practicals:**

1. The practical examinations for the English Language Laboratory practice shall be conducted as per the University norms prescribed for the core engineering practical sessions.
2. For the English Language lab sessions, there shall be a continuous evaluation during the year for 25 sessional marks and 50 End Examination marks. Of the 25 marks, 15 marks shall be awarded for day-to-day work and 10 marks to be awarded by conducting Internal Lab Test(s). The End Examination shall be conducted by the teacher concerned with the help of another member of the staff of the same department of the same institution.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

III Year B.Tech EEE II-Sem

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**POWER ELECTRONICS AND SIMULATION LAB**

***Any Eight of the Experiments in Power Electronics Lab***

1. Study of Characteristics of SCR, MOSFET & IGBT
2. Gate firing circuits for SCR's
3. Single Phase AC Voltage Controller with R and RL Loads
4. Single Phase fully controlled bridge converter with R and RL loads
5. Forced Commutation circuits ( Class A, Class B, Class C, Class D & Class E)
6. DC Jones chopper with R and RL Loads
7. Single Phase Parallel, inverter with R and RL loads
8. Single Phase Cycloconverter with R and RL loads
9. Single Phase Half controlled converter with R load
10. Three Phase half controlled bridge converter with R-load
11. Single Phase series inverter with R and RL loads
12. Single Phase Bridge converter with R and RL loads
13. Single Phase dual converter with RL loads

**Any two simulation experiments with PSPICE/PSIM**

PSPICE simulation of single-phase full converter using RLE loads and single-phase AC voltage controller using RLE loads.

PSPICE simulation of resonant pulse commutation circuit and Buck chopper.

PSPICE simulation of single phase Inverter with PWM control.

**REFERENCE BOOKS:**

1. Simulation of Electric and Electronic circuits using PSPICE – by M.H.Rashid, M/s PHI Publications.
2. PSPICE A/D user's manual – Microsim, USA.
3. PSPICE reference guide – Microsim, USA.
4. MATLAB and its Tool Books user's manual and – Mathworks, USA.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

IV Year B.Tech EEE I-Sem

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**NEURAL NETWORKS AND FUZZY LOGIC**

**Objective :**

This course introduces the basics of Neural Networks and essentials of Artificial Neural Networks with Single Layer and Multilayer Feed Forward Networks. Also deals with Associate Memories and introduces Fuzzy sets and Fuzzy Logic system components. The Neural Network and Fuzzy Network system application to Electrical Engineering is also presented. This subject is very important and useful for doing Project Work.

**Unit – I: Introduction to Neural Networks**

Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Hodgkin-Huxley Neuron Model, Integrate-and-Fire Neuron Model, Spiking Neuron Model, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN.

**Unit- II: Essentials of Artificial Neural Networks**

Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Application

**Unit-III: Single Layer Feed Forward Neural Networks**

Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks, Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications.

**Unit- IV: Multilayer Feed forward Neural Networks**

Credit Assignment Problem, Generalized Delta Rule, Derivation of Backpropagation (BP) Training, Summary of Backpropagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements.

**Unit V: Associative Memories**

Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory (Associative Matrix, Association Rules, Hamming Distance, The Linear Associator, Matrix Memories, Content Addressable Memory), Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm, BAM Energy Function, Proof of BAM Stability Theorem

Architecture of Hopfield Network: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis, Capacity of the Hopfield Network

Summary and Discussion of Instance/Memory Based Learning Algorithms, Applications.

**Unit – VI: Classical & Fuzzy Sets**

Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions.

**UNIT VII: Fuzzy Logic System Components**

Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods.

**UNIT VIII: Applications**

**Neural network applications:** Process identification, control, fault diagnosis and load forecasting.

**Fuzzy logic applications:** Fuzzy logic control and Fuzzy classification.

**TEXT BOOK:**

1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by Rajasekharan and Rai – PHI Publication.
2. Introduction to Neural Networks using MATLAB 6.0 - S.N.Sivanandam, S.Sumathi, S.N.Deepa, TMH, 2006

**REFERENCE BOOKS:**

1. Neural Networks – James A Freeman and Davis Skapura, Pearson Education, 2002.
2. Neural Networks – Simon Hakins , Pearson Education
3. Neural Engineering by C.Eliasmith and CH.Anderson, PHI
4. Neural Networks and Fuzzy Logic System by Bart Kosko, PHI Publications.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

IV Year B.Tech EEE I-Sem

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**POWER SEMICONDUCTOR DRIVES**

**Objective :**

This course is an extension of Power Electronics applications to AC and DC drives. Control of DC motor drives with single phase and three phase converters and choppers are given in detail. The control of AC motor drives with variable frequency converters and variable voltage are presented.

**UNIT – I: Control of DC motors by Single phase Converters**

Introduction to Thyristor controlled Drives, Single Phase semi and Fully controlled converters connected to d.c separately excited and d.c series motors – continuous current operation – output voltage and current waveforms – Speed and Torque expressions – Speed – Torque Characteristics- Problems on Converter fed d.c motors.

**UNIT-II: Control of DC motors by Three phase Converters**

Three phase semi and fully controlled converters connected to d.c separately excited and d.c series motors – output voltage and current waveforms – Speed and Torque expressions – Speed – Torque characteristics – Problems.

**UNIT – III: Four Quadrant operation of DC Drives**

Introduction to Four quadrant operation – Motoring operations, Electric Braking – Plugging, Dynamic and Regenerative Braking operations. Four quadrant operation of D.C motors by dual converters – Closed loop operation of DC motor (Block Diagram Only)

**UNIT-IV: Control of DC motors by Choppers**

Single quadrant, Two –quadrant and four quadrant chopper fed dc separately excited and series excited motors – Continuous current operation – Output voltage and current wave forms – Speed torque expressions – speed torque characteristics – Problems on Chopper fed d.c Motors – Closed Loop operation ( Block Diagram Only)

**UNIT – V: Control of Induction Motor through Stator voltage**

Variable voltage characteristics-Control of Induction Motor by Ac Voltage Controllers – Waveforms – speed torque characteristics.

**UNIT – VI : Control of Induction Motor through Stator Frequency**

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 – Speed torque characteristics – numerical problems on induction motor drives – Closed loop operation of induction motor drives (Block Diagram Only)

**UNIT –VII: Control of Induction motor of Rotor side**

Static rotor resistance control – Slip power recovery – Static Scherbius drive – Static Kramer Drive – their performance and speed torque characteristics – advantages applications – problems

**UNIT – VIII: Control of Synchronous Motors**

Separate control & self control of synchronous motors – Operation of self controlled synchronous motors by VSI and CSI cycloconverters. Load commutated CSI fed Synchronous Motor – Operation – Waveforms – speed torque characteristics – Applications – Advantages and Numerical Problems – Closed Loop control operation of synchronous motor drives (Block Diagram Only), variable frequency control, Cyclo converter, PWM, VFI, CSI

**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 Electronics – MD Singh and K B Khanchandani, Tata – McGraw-Hill Publishing company,1998
2. Modern Power Electronics and AC Drives by B.K.Bose, PHI.
3. Thyristor Control of Electric drives – Vedam Subramanyam Tata McGraw Hill Publications.
4. A First course on Electrical Drives – S K Pillai New Age International(P) Ltd. 2<sup>nd</sup> Edition.



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

IV Year B.Tech EEE I-Sem

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**POWER SYSTEM ANALYSIS**

**Objective :**

This course introduces formation of Z bus of a transmission line, power flow studies by various methods. It also deals with short circuit analysis and analysis of power system for steady state and transient stability.

**UNIT -I Power System Network Matrices-1**

Graph Theory: Definitions, Bus Incidence Matrix,  $Y_{bus}$  formation by Direct and Singular Transformation Methods, Numerical Problems.

**UNIT -II Power System Network Matrices-2**

Formation of  $Z_{bus}$ : Partial network, Algorithm for the Modification of  $Z_{bus}$  Matrix for addition element for the following cases: Addition of element from a new bus to reference, Addition of element from a new bus to an old bus, Addition of element between an old bus to reference and Addition of element between two old busses (Derivations and Numerical Problems).- Modification of  $Z_{bus}$  for the changes in network ( Problems )

**UNIT -III Power flow Studies-1**

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 P-V 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 – IV Power flow Studies-2**

Newton Raphson Method in Rectangular and Polar Co-Ordinates Form: Load Flow Solution with or without PV Busses- Derivation of Jacobian Elements, Algorithm and Flowchart.

Decoupled and Fast Decoupled Methods.- Comparison of Different Methods – DC load Flow

**UNIT – V Short Circuit Analysis-1**

Per-Unit System of Representation. Per-Unit equivalent reactance network of a three phase Power System, Numerical Problems.

Symmetrical fault Analysis: Short Circuit Current and MVA Calculations, Fault levels, Application of Series Reactors, Numerical Problems.

**UNIT –VI Short Circuit Analysis-2**

Symmetrical Component Theory: Symmetrical Component Transformation, Positive, Negative and Zero sequence components: Voltages, Currents and Impedances.

Sequence Networks: Positive, Negative and Zero sequence Networks, Numerical Problems.

Unsymmetrical Fault Analysis: LG, LL, LLG faults with and without fault impedance, Numerical Problems.

**UNIT –VII Power System Steady State Stability Analysis**

Elementary concepts of Steady State, Dynamic and Transient Stabilities.

Description of: Steady State Stability Power Limit, Transfer Reactance, Synchronizing Power Coefficient, Power Angle Curve and Determination of Steady State Stability and Methods to improve steady state stability.

**UNIT –VIII Power System Transient State Stability Analysis**

Derivation of Swing Equation. Determination of Transient Stability by Equal Area Criterion, Application of Equal Area Criterion, Critical Clearing Angle Calculation.- Solution of Swing Equation: Point-by-Point Method. Methods to improve Stability - Application of Auto Reclosing and Fast Operating Circuit Breakers.

**TEXT BOOKS:**

1. Computer Techniques in Power System Analysis by M.A.Pai, TMH Publications.
2. Modern Power system Analysis – by I.J.Nagrath & D.P.Kothari: Tata McGraw-Hill Publishing company, 2<sup>nd</sup> edition.

**REFERENCE BOOKS:**

1. Power System Analysis by Grainger and Stevenson, Tata McGraw Hill.
2. Power System Analysis – by A.R.Bergen, Prentice Hall, Inc.
3. Power System Analysis by Hadi Saadat – TMH Edition.
4. Power System Analysis by B.R.Gupta, Wheeler Publications.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

IV Year B.Tech EEE I-Sem

<b>T</b>	<b>P</b>	<b>C</b>
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**POWER SYSTEM OPERATION AND CONTROL**

**Objective :**

This subject deals with Economic operation of Power Systems, Hydrothermal schedulings and modeling of turbines, generators and automatic controllers. It emphasizes on single area and two area load frequency control and reactive power control.

**UNIT – I Economic Operation of Power Systems-1**

Optimal operation of Generators in Thermal Power Stations, - heat rate Curve – Cost Curve – Incremental fuel and Production costs, input-output characteristics, Optimum generation allocation with line losses neglected.

**UNIT – II Economic Operation of Power Systems-2**

Optimum generation allocation including the effect of transmission line losses – Loss Coefficients, General transmission line loss formula.

**UNIT – III Hydrothermal Scheduling**

Optimal scheduling of Hydrothermal System: Hydroelectric power plant models, Scheduling problems- Short term Hydrothermal scheduling problem.

**UNIT –IV Modelling of Turbine, Generator and Automatic Controllers**

Modelling of Turbine: First order Turbine model, Block Diagram representation of Steam Turbines and Approximate Linear Models.

Modelling of Generator (Steady State and Transient Models): Description of Simplified Network Model of a Synchronous Machine (Classical Model), Description of Swing Equation (No Derivation) and State-Space II-Order Mathematical Model of Synchronous Machine.

Modelling of Governor: Mathematical Modelling of Speed Governing System – Derivation of small signal transfer function.

Modelling of Excitation System: Fundamental Characteristics of an Excitation system, Transfer function, Block Diagram Representation of IEEE Type-1 Model

**UNIT – V Single Area Load Frequency Control**

Necessity of keeping frequency constant.

Definitions of Control area – Single area control – Block diagram representation of an isolated power system – Steady state analysis – Dynamic response – Uncontrolled case.

**UNIT – VI Two-Area Load Frequency Control**

Load frequency control of 2-area system – uncontrolled case and controlled case, tie-line bias control

**UNIT-VII Load Frequency Controllers**

Proportional plus Integral control of single area and its block diagram representation, steady state response – Load Frequency Control and Economic dispatch control.

**UNIT – VIII Reactive Power Control**

Overview of Reactive Power control – Reactive Power compensation in transmission systems – advantages and disadvantages of different types of compensating equipment for transmission systems; load compensation – Specifications of load compensator, Uncompensated and compensated transmission lines: shunt and Series Compensation.

**TEXT BOOKS:**

1. Electrical Power Systems by C.L.Wadhwa, Newage International-3<sup>rd</sup> Edition
2. *Modern Power System Analysis* – by I.J.Nagrath & D.P.Kothari Tata M Graw – Hill Publishing Company Ltd, 2<sup>nd</sup> edition.

**REFERENCE BOOKS:**

1. Power System Analysis and Design by J.Duncan Glover and M.S.Sarma., THOMPSON, 3<sup>rd</sup> Edition.
2. Electric Energy systems Theory – by O.I.Elgerd, Tata Mc Graw-hill Publishing Company Ltd., Second edition.
3. Power System Analysis by Grainger and Stevenson, Tata McGraw Hill.
4. Power System Analysis by Hadi Saadat – TMH Edition.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

IV Year B.Tech EEE I-Sem

<b>T</b>	<b>P</b>	<b>C</b>
<b>4+1*</b>	<b>0</b>	<b>4</b>

**H.V.D.C. TRANSMISSION  
(ELECTIVE-I)**

**Objective :**

This subject deals with the importance of HVDC transmission, analysis of HVDC converters, Faults and protections, Harmonics and Filters. It also deals with Reactive power control and Power factor improvements of the system.

**UNIT – I BASIC CONCEPTS**

Economics & Terminal equipment of HVDC transmission systems: Types of HVDC Links – Apparatus required for HVDC Systems – Comparison of AC & DC Transmission, Application of DC Transmission System – Planning & Modern trends in D.C. Transmission.

**UNIT – II ANALYSIS OF HVDC CONVERTERS**

Choice of Converter configuration – analysis of Graetz – characteristics of 6 Pulse & 12 Pulse converters – Cases of two 3 phase converters in star – star mode – their performance.

**UNIT – III CONVERTER & HVDC SYSTEM CONTROL**

Principle of DC Link Control – Converters Control Characteristics – Firing angle control – Current and extinction angle control – Effect of source inductance on the system; Starting and stopping of DC link; Power Control.

**UNIT-IV REACTIVE POWER CONTROL IN HVDC**

Reactive Power Requirements in steady state-Conventional control strategies-Alternate control strategies-sources of reactive power-AC Filters – shunt capacitors-synchronous condensers.

**UNIT –V POWER FLOW ANALYSIS IN AC/DC SYSTEMS**

Modelling of DC Links-DC Network-DC Converter-Controller Equations-Solution of DC loadflow – P.U. System for d.c. quantities-solution of AC-DC Power flow-Simultaneous method-Sequential method.

**UNIT-VI CONVERTER FAULT & PROTECTION**

Converter faults – protection against over current and over voltage in converter station – surge arresters – smoothing reactors – DC breakers – Audible noise-space charge field-corona effects on DC lines-Radio interference.

**UNIT – VII HARMONICS**

Generation of Harmonics – Characteristics harmonics, calculation of AC Harmonics, Non- Characteristics harmonics, adverse effects of harmonics – Calculation of voltage & Current harmonics – Effect of Pulse number on harmonics

**UNIT-VIII FILTERS**

Types of AC filters, Design of Single tuned filters – Design of High pass filters.

**TEXT BOOKS:**

1. HVDC Power Transmission Systems: Technology and system Interactions – by K.R.Padiyar, New Age International (P) Limited, and Publishers.
2. EHVAC and HVDC Transmission Engineering and Practice – S.Rao.

**REFERENCE BOOKS:**

1. HVDC Transmission – J.Arrillaga.
2. Direct Current Transmission – by E.W.Kimbark, John Wiley & Sons.
3. Power Transmission by Direct Current – by E.Uhlmann, B.S.Publications.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

IV Year B.Tech EEE I-Sem

<b>T</b>	<b>P</b>	<b>C</b>
<b>4+1*</b>	<b>0</b>	<b>4</b>

**EHV AC TRANSMISSION  
(Elective-I)**

**Unit – I: Preliminaries:**

Necessity of EHV AC transmission – advantages and problems – power handling capacity and line losses – mechanical considerations – resistance of conductors – properties of bundled conductors – bundle spacing and bundle radius- Examples.

**Unit – II: Line and ground reactive parameters:**

Line inductance and capacitances – sequence inductances and capacitances – modes of propagation – ground return - Examples

**Unit – III: Voltage gradients of conductors:**

Electrostatics – field of sphere gap – field of line charges and properties – charge – potential relations for multi-conductors – surface voltage gradient on conductors – distribution of voltage gradient on sub-conductors of bundle – Examples.

**Unit – IV: Corona effects – I:**

Power loss and audible noise (AN) – corona loss formulae – charge voltage diagram – generation, characteristics - limits and measurements of AN – relation between 1-phase and 3-phase AN levels – Examples.

**Unit – V: Corona effects – II:**

Radio interference (RI) - corona pulses generation, properties, limits – frequency spectrum – modes of propagation – excitation function – measurement of RI, RIV and excitation functions – Examples.

**Unit – VI: Electro static field:**

Electrostatic field: calculation of electrostatic field of EHV/AC lines – effect on humans, animals and plants – electrostatic induction in unenergised circuit of double-circuit line – electromagnetic interference- Examples.

**Unit- VII: Traveling wave theory**

Traveling wave expression and solution- source of excitation- terminal conditions- open circuited and short-circuited end- reflection and refraction coefficients-Lumped parameters of distributed lines-generalized constants-No load voltage conditions and charging current.

**Unit –VIII: Voltage control:**

Power circle diagram and its use – voltage control using synchronous condensers – cascade connection of shunt and series compensation – sub synchronous resonance in series capacitor – compensated lines – static VAR compensating system.

**TEXT BOOKS:**

1. EHVAC Transmission Engineering by R. D. Begamudre, New Age International (p) Ltd.
2. HVAC and DC Transmission by S. Rao

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

IV Year B.Tech EEE I-Sem

<b>T</b>	<b>P</b>	<b>C</b>
<b>4+1*</b>	<b>0</b>	<b>4</b>

**HIGH VOLTAGE ENGINEERING  
(ELECTIVE-I)**

**Objective ;**

This subject deals with the detailed analysis of Breakdown occur in gaseous, liquids and solid dielectrics. Information about generation and measurement of High voltage and current. In addition the High voltage testing methods are also discussed.

**UNIT I INTRODUCTION TO HIGH VOLTAGE TECHNOLOGY AND APPLICATIONS**

Electric Field Stresses, Gas / Vacuum as Insulator, Liquid Dielectrics, Solids and Composites, Estimation and Control of Electric Stress, Numerical methods for electric field computation, Surge voltages, their distribution and control, Applications of insulating materials in transformers, rotating machines, circuit breakers, cable power capacitors and bushings.

**UNIT II BREAK DOWN IN GASEOUS AND LIQUID DIELECTRICS**

Gases as insulating media, collision process, Ionization process, Townsend's criteria of breakdown in gases, Paschen's law. Liquid as Insulator, pure and commercial liquids, breakdown in pure and commercial liquids.

**UNIT III BREAK DOWN IN SOLID DIELECTRICS**

Intrinsic breakdown, electromechanical breakdown, thermal breakdown, breakdown of solid dielectrics in practice, Breakdown in composite dielectrics, solid dielectrics used in practice.

**UNIT IV GENERATION OF HIGH VOLTAGES AND CURRENTS**

Generation of High Direct Current Voltages, Generation of High alternating voltages, Generation of Impulse Voltages, Generation of Impulse currents, Tripping and control of impulse generators.

**UNIT V MEASUREMENT OF HIGH VOLTAGES AND CURRENTS**

Measurement of High Direct Current voltages, Measurement of High Voltages alternating and impulse, Measurement of High Currents-direct, alternating and Impulse, Oscilloscope for impulse voltage and current measurements.

**UNIT VI OVER VOLTAGE PHENOMENON AND INSULATION CO-ORDINATION**

Natural causes for over voltages – Lightning phenomenon, Overvoltage due to switching surges, system faults and other abnormal conditions, Principles of Insulation Coordination on High voltage and Extra High Voltage power systems.

**UNIT VII NON-DSTRUCTIVE TESTING OF MATERIAL AND ELECTRICAL APPARATUS**

Measurement of D.C Resistivity, Measurement of Dielectric Constant and loss factor, Partial discharge measurements.

**UNIT VIII HIGH VOLTAGE TESTING OF ELECTRICAL APPARATUS**

Testing of Insulators and bushings, Testing of Isolators and circuit breakers, Testing of cables, Testing of Transformers, Testing of Surge Arresters, Radio Interference measurements.

**TEXT BOOKS:**

1. High Voltage Engineering by M.S.Naidu and V. Kamaraju – TMH Publications, 3<sup>rd</sup> Edition
2. High Voltage Engineering: Fundamentals by E.Kuffel, W.S.Zaengl, J.Kuffel by Elsevier, 2<sup>nd</sup> Edition.

**REFERENCE BOOKS:**

1. High Voltage Engineering by C.L.Wadhwa, New Age International (P) Limited, 1997.
2. High Voltage Insulation Engineering by Ravindra Arora, Wolfgang Mosch, New Age International (P) Limited, 1995.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

IV Year B.Tech EEE I-Sem

<b>T</b>	<b>P</b>	<b>C</b>
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**RELIABILITY ENGINEERING AND APPLICATIONS TO POWER SYSTEMS  
(ELECTIVE-II)**

**UNIT – I Basics of Probability theory & Distribution**

Basic probability theory – rules for combining probabilities of events – Bernoulli's trials – probabilities density and distribution functions – binomial distribution – expected value and standard deviation of binomial distribution.

**UNIT – II Network Modelling and Reliability Analysis**

Analysis of Series, Parallel, Series-Parallel networks – complex networks – decomposition method.

**UNIT – III Reliability functions**

Reliability functions  $f(t)$ ,  $F(t)$ ,  $R(t)$ ,  $h(t)$  and their relationships – exponential distribution – Expected value and standard deviation of exponential distribution – Bath tub curve – reliability analysis of series parallel networks using exponential distribution – reliability measures MTTF, MTTR, MTBF.

**UNIT – IV Markov Modelling**

Markov chains – concept of stochastic transitional probability Matrix, Evaluation of limiting state Probabilities. – Markov processes one component repairable system – time dependent probability evaluation using Laplace transform approach – evaluation of limiting state probabilities using STPM – two component repairable models.

**UNIT – V Frequency & Duration Techniques**

Frequency and duration concept – Evaluation of frequency of encountering state, mean cycletime, for one , two component repairable models – evaluation of cumulative probability and cumulative frequency of encountering of merged states.

**UNIT – VI Generation System Reliability Analysis**

Reliability model of a generation system– recursive relation for unit addition and removal – load modeling - Merging of generation load model – evaluation of transition rates for merged state model – cumulative Probability, cumulative frequency of failure evaluation – LOLP, LOLE.

**UNIT – VII Composite Systems Reliability Analysis**

Decompositions method – Reliability Indices – Weather Effects on Transmission Lines.

**UNIT – VIII Distribution System and Reliability Analysis**

Basic Concepts – Evaluation of Basic and performance reliability indices of radial networks.

**TEXT BOOKS:**

1. Reliability Evaluation of Engg. System – R. Billinton, R.N.Allan, Plenum Press, New York, reprinted in India by B.S.Publications, 2007.
2. Reliability Evaluation of Power systems – R. Billinton, R.N.Allan, Pitman Advance Publishing Program, New York, reprinted in India by B.S.Publications, 2007.



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

IV Year B.Tech EEE I-Sem

<b>T</b>	<b>P</b>	<b>C</b>
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**NON-CONVENTIONAL SOURCES OF ENERGY  
(ELECTIVE-II)**

**Objective :**

It introduces solar energy its radiation, collection, storage and application. It also introduces the Wind energy, Biomass energy, Geothermal energy and ocean energy as alternative energy sources.

**UNIT – I**

**PRINCIPLES OF SOLAR RADIATION:** Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

**UNIT-II**

**SOLAR ENERGY COLLECTION:** Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

**UNIT-III**

**SOLAR ENERGY STORAGE AND APPLICATIONS:** Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications- solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.

**UNIT-IV**

**WIND ENERGY:** Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria

**UNIT-V**

**BIO-MASS:** Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C.Engine operation and economic aspects.

**UNIT-VI**

**GEOTHERMAL ENERGY:** Resources, types of wells, methods of harnessing the energy, potential in India.

**UNIT-VII**

**OCEAN ENERGY:** OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

**UNIT-VIII**

**DIRECT ENERGY CONVERSION:** Need for DEC, Carnot cycle, limitations, principles of DEC. Thermo-electric generators, seebeck, peltier and joul Thomson effects, Figure of merit, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHD Engine, power generation systems, electron gas dynamic conversion, economic aspects. Fuel cells, principles, faraday's law's, thermodynamic aspects, selection of fuels and operating conditions.

**TEXT BOOKS:**

1. Non-Conventional Energy Sources /G.D. Rai
2. Renewable Energy Technologies /Ramesh & Kumar /Narosa

**REFERENCE BOOKS:**

1. Renewable energy resources/ Tiwari and Ghosal/ Narosa.
2. Non-Conventional Energy / Ashok V Desai /Wiley Eastern.
3. Non-Conventional Energy Systems / K Mittal /Wheeler
4. Solar Energy /Sukhame

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

IV Year B.Tech EEE I-Sem

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**ELECTRICAL DISTRIBUTION SYSTEMS  
(ELECTIVE-II)**

**UNIT – I GENERAL CONCEPTS**

Introduction to distribution systems, Load modelling and characteristics. Coincidence factor, contribution factor loss factor - Relationship between the load factor and loss factor. Classification of loads (Residential, commercial, Agricultural and Industrial) and their characteristics.

**UNIT – II DISTRIBUTION FEEDERS**

Design Considerations of Distribution Feeders: Radial and loop types of primary feeders, voltage levels, feeder loading; basic design practice of the secondary distribution system.

**UNIT – III SUBSTATIONS**

Location of Substations: Rating of distribution substation, service area within primary feeders. Benefits derived through optimal location of substations.

**UNIT – IV SYSTEM ANALYSIS**

Voltage drop and power-loss calculations: Derivation for voltage drop and power loss in lines, manual methods of solution for radial networks, three phase balanced primary lines.

**UNIT – V PROTECTION**

Objectives of distribution system protection, types of common faults and procedure for fault calculations. Protective Devices: Principle of operation of Fuses, Circuit Reclosures, line sectionalizes, and circuit breakers

**UNIT – VI COORDINATION**

Coordination of Protective Devices: General coordination procedure.

**UNIT – VII COMPENSATION FOR POWER FACTOR IMPROVEMENT**

Capacitive compensation for power-factor control.

Different types of power capacitors, shunt and series capacitors, effect of shunt capacitors (Fixed and switched),

Power factor correction, capacitor allocation - Economic justification - Procedure to determine the best capacitor location.

**UNIT – VIII VOLTAGE CONTROL**

Voltage Control: Equipment for voltage control, effect of series capacitors, effect of AVB/AVR, line drop compensation.

**TEXT BOOK:**

1. "Electric Power Distribution system, Engineering" – by Turan Gonen, Mc Graw-hill Book Company.
2. Electric Power Distribution – by A.S. Pabla, Tata Mc Graw-hill Publishing company, 4<sup>th</sup> edition, 1997.

**REFERENCE BOOK:**

1. Electrical Power Distribution and Automation by S.Sivanagaraju, V.Sankar, Dhanpat Rai & Co, 2006
2. Electrical Power Distribution Systems by V.Kamaraju, Right Publishers.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

IV Year B.Tech EEE I-Sem

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**MICROPROCESSORS AND MICROCONTROLLERS LAB**

**I . Microprocessor 8086:**

Introduction to MASM/TASM.

Arithmetic operation – Multi byte addition and subtraction, Multiplication and Division – Signed and unsigned Arithmetic operation, ASCII – arithmetic operation.

Logic operations – Shift and rotate – Converting packed BCD to unpacked BCD, BCD to ASCII conversion.

By using string operation and Instruction prefix: Move Block, Reverse string, Sorting, Inserting, Deleting, Length of the string, String comparison.

Modular Program: Procedure, Near and Far implementation, Recursion.

Dos/BIOS programming: Reading keyboard (Buffered with and without echo) – Display characters, Strings.

**II. Interfacing**

8259 – Interrupt Controller.

8279 – Keyboard Disply.

8255 – PPI.

8251 – USART.

**III. Mcrocontroller 8051:**

1. Reading and Writing on a parallel port.
2. Timer in different modes.
3. Serial communication implementation.
4. Understanding three memory areas of 00 – FF (Programs using above areas).
5. Using external interrupts
6. Programs using special instructions like swap, bit/byte, set/reset etc.
7. Programs based on short, page, absolute addressing.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

IV Year B.Tech EEE I-Sem

<b>T</b>	<b>P</b>	<b>C</b>
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**ELECTRICAL MEASUREMENTS LAB**

**The following experiments are required to be conducted as compulsory experiments:**

1. Calibration and Testing of single phase energy Meter
2. Calibration of dynamometer power factor meter
3. Crompton D.C. Potentiometer – Calibration of PMMC ammeter and PMMC voltmeter
4. Kelvin's double Bridge – Measurement of resistance – Determination of Tolerance.
5. Measurement of % ratio error and phase angle of given C.T. by comparison.
6. Schering bridge & Anderson bridge.
7. Measurement of 3 phase reactive power with single-phase wattmeter.
8. Measurement of parameters of a choke coil using 3 voltmeter and 3 ammeter methods.

**In addition to the above eight experiments, atleast any two of the experiments from the following list are required to be conducted:**

9. Optical bench – Determination of polar curve measurement of MHCP of filament lamps
10. Calibration LPF wattmeter – by Phantom testing
11. Measurement of 3 phase power with single watt meter and 2 No's of C.T.
12. C.T. testing using mutual Inductor – Measurement of % ratio error and phase angle of given C.T. by Null method.
13. P.T. testing by comparison – V.G. as Null detector – Measurement of % ratio error and phase angle of the given P.T.
14. Dielectric oil testing using H.T. testing Kit
15. LVDT and capacitance pickup – characteristics and Calibration
16. Resistance strain gauge – strain measurements and Calibration
17. Polar curve using Lux meter, Measurement of intensity of illumination of fluorescent lamp.
18. Transformer turns ratio measurement using a.c. bridge.
19. Relay testinf using secondary current injection set for over current & reverse current.
20. A.C. Potentiometer – Polar form/Cartesian form – Calibration of AC Voltmeter, Parameters of Choke.
21. Measurement of Iron loss in a bar specimen using a CRO and using a wattmeter.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

**IV Year B.Tech EEE. II-Sem**

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**UTILIZATION OF ELECTRICAL ENERGY**

**Objective :**

This subject deals with the fundamentals of illumination and its classification and the electric heating and welding. It gives the detailed study of all varieties of Electric drives and their application to electrical traction systems.

**UNIT – I ELECTRIC DRIVES**

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

**UNIT – II ELECTRIC HEATING**

Advantages and methods of electric heating, resistance heating induction heating and dielectric heating.

**UNIT – III ELECTRIC WELDING**

Electric welding, resistance and arc welding, electric welding equipment, comparison between A.C. and D.C. Welding.

**UNIT – IV ILLUMINATION FUNDAMENTALS**

Introduction, terms used in illumination, laws of illumination, polar curves, photometry, integrating sphere, sources of light.

**UNIT – V VARIOUS ILLUMINATION METHODS**

Discharge lamps, MV and SV lamps – comparison between tungsten filament lamps and fluorescent tubes, Basic principles of light control, Types and design of lighting and flood lighting.

**UNIT – VI ELECTRIC TRACTION – I**

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

**UNIT – VII ELECTRIC TRACTION – II**

Mechanics of train movement. Speed-time curves for different services – trapezoidal and quadrilateral speed time curves.

**UNIT – VIII ELECTRIC TRACTION-III**

Calculations of tractive effort, power, specific energy consumption for given run, effect of varying acceleration and braking retardation, adhesive weight and braking retardation adhesive weight and coefficient of adhesion.

**TEXT BOOK:**

1. Utilisation of Electric Energy – by E. Openshaw Taylor, Orient Longman.
2. Art & Science of Utilization of electrical Energy – by Partab, Dhanpat Rai & Sons.

**REFERENCE BOOKS:**

1. Utilization of Electrical Power including Electric drives and Electric traction – by N.V.Suryanarayana, New Age International (P) Limited, Publishers, 1996.
2. Generation, Distribution and Utilization of electrical Energy – by C.L. Wadhwa, New Age International (P) Limited, Publishers, 1997.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

IV Year B.Tech EEE. II-Sem

<b>T</b>	<b>P</b>	<b>C</b>
<b>4+1*</b>	<b>0</b>	<b>4</b>

**ADVANCED CONTROL SYSTEMS  
(ELECTIVE – III)**

**Objective :**

This subject deals with state space, describing function, phase plane and stability analysis including controllability and observability. It also deals with modern control and optimal control systems.

**UNIT – I STATE SPACE ANALYSIS**

State Space Representation, Solution of State Equation, State Transition Matrix, Canonical Forms – Controllable Canonical Form, Observable Canonical Form, Jordan Canonical Form.

**UNIT – II            CONTROLLABILITY AND OBSERVABILITY**

Tests for controllability and observability for continuous time systems – Time varying case, minimum energy control, time invariant case, Principle of Duality, Controllability and observability form Jordan canonical form and other canonical forms.

**UNIT – III            DESCRIBING FUNCTION ANALYSIS**

Introduction to nonlinear systems, Types of nonlinearities, describing functions, describing function analysis of nonlinear control systems.

**UNIT-IV PHASE-PLANE ANALYSIS**

Introduction to phase-plane analysis, Method of Isoclines for Constructing Trajectories, singular points, phase-plane analysis of nonlinear control systems.

**UNIT-V STABILITY ANALYSIS**

Stability in the sense of Lyapunov., Lyapunov's stability and Lyapunov's instability theorems. Direct method of Lyapunov for the Linear and Nonlinear continuous time autonomous systems.

**UNIT – VI            MODAL CONTROL**

Effect of state feedback on controllability and observability, Design of State Feedback Control through Pole placement. Full order observer and reduced order observer.

**UNIT-VII CALCULUS OF VARIATIONS**

Minimization of functionals of single function, Constrained minimization. Minimum principle. Control variable inequality constraints. Control and state variable inequality constraints. Euler Lagrangine Equation.

**UNIT –VIII            OPTIMAL CONTROL**

Formulation of optimal control problem. Minimum time, Minimum energy, minimum fuel problems. State regulator problem. Output regulator problem. Tracking problem, Continuous-Time Linear Regulators.

**TEXT BOOKS:**

1. Modern Control System Theory – by M. Gopal, New Age International Publishers, 2<sup>nd</sup> edition, 1996

**REFERENCE BOOKS:**

1. Modern Control Engineering – by K. Ogata, Prentice Hall of India, 3<sup>rd</sup> edition, 1998
2. Control Systems Engineering by I.J. Nagarath and M.Gopal, New Age International (P) Ltd.
3. Digital Control and State Variable Methods – by M. Gopal, Tata Mc Graw-Hill Companies, 1997.
4. Systems and Control by Stainslaw H. Zak , Oxford Press, 2003.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

IV Year B.Tech EEE. II-Sem

<b>T</b>	<b>P</b>	<b>C</b>
<b>4+1*</b>	<b>0</b>	<b>4</b>

**DIGITAL CONTROL SYSTEMS  
(ELECTIVE-III)**

**UNIT – I SAMPLING AND RECONSTRUCTION**

Introduction, Examples of Data control systems – Digital to Analog conversion and Analog to Digital conversion, sample and hold operations.

**UNIT-II THE Z – TRANSFORMS**

Introduction, Linear difference equations, pulse response, Z – transforms, Theorems of Z – Transforms, the inverse Z – transforms, Modified Z- Transforms

**UNIT-III Z-PLANE ANALYSIS OF DISCRETE-TIME CONTROL SYSTEM**

Z-Transform method for solving difference equations; Pulse transforms function, block diagram analysis of sampled – data systems, mapping between s-plane and z-plane.

**UNIT – IV STATE SPACE ANALYSIS**

State Space Representation of discrete time systems, Pulse Transfer Function Matrix solving discrete time state space equations, State transition matrix and its Properties, Methods for Computation of State Transition Matrix, Discretization of continuous time state – space equations

**UNIT – V CONTROLLABILITY AND OBSERVABILITY**

Concepts of Controllability and Observability, Tests for controllability and Observability. Duality between Controllability and Observability, Controllability and Observability conditions for Pulse Transfer Function

**UNIT – VI STABILITY ANALYSIS**

Mapping between the S-Plane and the Z-Plane – Primary strips and Complementary Strips – Constant frequency loci, Constant damping ratio loci, Stability Analysis of closed loop systems in the Z-Plane. Jury stability test – Stability Analysis by use of the Bilinear Transformation and Routh Stability criterion.

**UNIT – VII DESIGN OF DISCRETE TIME CONTROL SYSTEM BY CONVENTIONAL METHODS**

Transient and steady – State response Analysis – Design based on the frequency response method – Bilinear Transformation and Design procedure in the w-plane, Lead, Lag and Lead-Lag compensators and digital PID controllers.

**UNIT – VIII STATE FEEDBACK CONTROLLERS AND OBSERVERS**

Design of state feedback controller through pole placement – Necessary and sufficient conditions, Ackerman's formula.  
State Observers – Full order and Reduced order observers.

**TEXT BOOKS:**

1. Discrete-Time Control systems - K. Ogata, Pearson Education/PHI, 2<sup>nd</sup> Edition

**REFERENCE BOOKS:**

1. Digital Control Systems, Kuo, Oxford University Press, 2<sup>nd</sup> Edition, 2003.
2. Digital Control and State Variable Methods by M.Gopal, TMH

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

IV Year B.Tech EEE. II-Sem

<b>T</b>	<b>P</b>	<b>C</b>
<b>4+1*</b>	<b>0</b>	<b>4</b>

**OPTIMIZATION TECHNIQUES  
(ELECTIVE-III)**

**UNIT – I Introduction and Classical Optimization Techniques:**

Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems.

**UNIT – II Classical Optimization Techniques**

Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints.

Solution by method of Lagrange multipliers – multivariable Optimization with inequality constraints – Kuhn – Tucker conditions.

**UNIT – III Linear Programming**

Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm.

**UNIT – IV Transportation Problem**

Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel's approximation method – testing for optimality of balanced transportation problems.

**UNIT – V Unconstrained Nonlinear Programming:**

One – dimensional minimization methods: Classification, Fibonacci method and Quadratic interpolation method

**UNIT – VI Unconstrained Optimization Techniques**

Univariate method, Powell's method and steepest descent method.

**UNIT – VII Constrained Nonlinear Programming:**

Characteristics of a constrained problem, Classification, Basic approach of Penalty Function method; Basic approaches of Interior and Exterior penalty function methods. Introduction to convex Programming Problem.

**UNIT – VIII Dynamic Programming:**

Dynamic programming multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution - examples illustrating the tabular method of solution.

**TEXT BOOKS:**

1. "Engineering optimization: Theory and practice"-by S. S.Rao, New Age International (P) Limited, 3<sup>rd</sup> edition, 1998.
2. " Introductory Operations Research" by H.S. Kasene & K.D. Kumar, Springer(India), Pvt .LTd.

**REFERENCE BOOKS:**

- 1 " Optimization Methods in Operations Research and systems Analysis" – by K.V. Mital and C. Mohan, New Age International (P) Limited, Publishers, 3<sup>rd</sup> edition, 1996.
2. Operations Research – by Dr. S.D.Sharma.
3. "Operations Research : An Introduction" – by H.A. Taha, PHI Pvt. Ltd., 6<sup>th</sup> edition
4. Linear Programming – by G. Hadley



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

**IV Year B.Tech EEE. II-Sem**

<b>T</b>	<b>P</b>	<b>C</b>
<b>4+1*</b>	<b>0</b>	<b>4</b>

**PROGRAMMABLE LOGIC CONTROLLERS  
(ELECTIVE-IV)**

**Unit-I:**

PLC Basics: PLC system, I/O modules and interfacing, CPU processor, programming Equipment, programming formats, construction of PLC ladder diagrams, Devices connected to I/O modules.

**Unit-II:**

PLC Programming: Input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill press operation.

**Unit-III:**

Digital logic gates, programming in the Boolean algebra system, conversion examples  
Ladder Diagrams for process control: Ladder diagrams & sequence listings, ladder diagram construction and flowchart for spray process system.

**Unit-IV:**

PLC Registers: Characteristics of Registers, module addressing, holding registers, Input Registers, Output Registers.

**Unit-V:**

PLC Functions: Timer functions & Industrial applications, counters, counter function industrial applications, Arithmetic functions, Number comparison functions, number conversion functions

**Unit-VI:**

Data Handling functions: SKIP, Master control Relay, Jump, Move, FIFO, FAL, ONS, CLR & Sweep functions and their applications

**Unit-VII:**

Bit Pattern and changing a bit shift register, sequence functions and applications, controlling of two-axis & three axis Robots with PLC, Matrix functions.

**Unit-VIII:**

Analog PLC operation: Analog modules & systems, Analog signal processing, Multi bit Data Processing, Analog output Application Examples, PID principles, position indicator with PID control, PID Modules, PID tuning, PID functions.

**Text Books:**

1. Programmable Logic Controllers- Principles and Applications by John W. Webb & Ronald A. Reiss, Fifth Edition, PHI
2. Programmable Logic Controllers- Programming Method and Applications –JR.Hackworth &F.D Hackworth Jr. –Pearson, 2004

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

IV Year B.Tech EEE. II-Sem

<b>T</b>	<b>P</b>	<b>C</b>
<b>4+1*</b>	<b>0</b>	<b>4</b>

**OBJECT ORIENTED PROGRAMMING  
(ELECTIVE – IV)**

**Objectives:**

1. To teach the student OOP principles using Java.
2. To teach the student to apply these principles in problem solving

**UNIT-I:**

**Introduction:** Creation of Java, importance of Java to internet, byte code, Java buzzwords, OOP Principles, Encapsulation, Inheritance and Polymorphism, data types, variables, declaring variables, dynamic initialization, scope and life time of variables, arrays, operators, control statements, type conversion and casting, compiling and running of simple Java program.

**UNIT-II:**

**Classes and Objects:** Concepts of classes and objects, class fundamentals Declaring objects, assigning object reference variables, introducing methods, constructors, usage of static with data and methods, usage of final with data, access control, this key word, garbage collection, overloading methods and constructors, parameter passing – call by value, recursion, nested classes and inner classes, exploring the String class.

**UNIT-III:**

**Inheritance:** Basic concepts, member access rules, usage of super key word, forms of inheritance, method overriding, abstract classes, dynamic method dispatch, using final with inheritance, the Object class.

**UNIT-IV:**

**Packages and Interfaces:** Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages, differences between classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces.

**UNIT-V:**

**Exception Handling and Multithreading:** Concepts of Exception handling, types of exceptions, usage of try, catch, throw, throws and finally keywords, Built-in exceptions, creating own exception sub classes, Concepts of Multithreading, differences between process and thread, thread life cycle, creating multiple threads using Thread class, Runnable interface, Synchronization, thread priorities, inter thread communication, daemon threads, deadlocks, thread groups.

**UNIT-VI:**

**Event Handling:** Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes.

**AWT:** Concepts of components, container, panel, window, frame, canvas, Font class, Color class and Graphics.

**UNIT-VII:**

**AWT Controls:** Buttons, Labels, Text fields, Text area, Check boxes, Check box groups, Lists, Choice, Scrollbars, Menus, Layout Managers – Flow, Border, Grid, Card and Gridbag.

**Swing** – JApplet, JFrame and JComponent, Icons and Labels, Handling threading issues, text fields, buttons – The JButton class, Check boxes, Radio buttons, Combo boxes, Tabbed Panes, Scroll Panes, Trees, and Tables.

Applets – Concepts of Applets, differences between applets and applications, life cycle of an applet, types of applets, creating applets, passing parameters to applets.

**UNIT-VIII:**

**Networking and Java Library:** Basics of Networking, InetAddress, TCP/IP sockets, Datagrams, URL, URL connection, String handling, java.util, java.io and java.net packages.

**TEXT BOOKS:**

1. The Complete Reference Java J2SE 5<sup>th</sup> Edition, Herbert Schildt, TMH Publishing Company Ltd, NewDelhi./PHI
2. Big Java 2<sup>nd</sup> Edition, Cay Horstmann, John Wiley and Sons.

**REFERENCE BOOKS:**

1. Java How to Program, Sixth Edition, H.M.Dietel and P.J.Dietel, Pearson Education.
2. Core Java 2, Vol 1, Fundamentals, Cay.S.Horstmann and Gary Cornell, Seventh Edition, Pearson Education.
3. Core Java 2, Vol 2, Advanced Features, Cay.S.Horstmann and Gary Cornell, Seventh Edition, Pearson Education.
4. Beginning in Java 2, Iver Horton, Wrox Publications.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

**IV Year B.Tech EEE. II-Sem**

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**DATABASE MANAGEMENT SYSTEMS  
(ELECTIVE-IV)**

**Objective:**

Learn about database design concepts, data models (Entity-Relationship and Relational Model), the database query language SQL and components of a database management system. Further topics include query processing and optimization techniques, transaction management, and storage and file structures

**Syllabus:**

**UNIT – I:**

Data base System Applications, data base System VS file System – View of Data – Data Abstraction – Instances and Schemas – data Models – the ER Model – Relational Model – Other Models – Database Languages – DDL – DML – database Access for applications Programs – data base Users and Administrator – Transaction Management – data base System Structure – Storage Manager – the Query Processor – History of Data base Systems. Data base design and ER diagrams – Beyond ER Design Entities, Attributes and Entity sets – Relationships and Relationship sets – Additional features of ER Model – Concept Design with the ER Model – Conceptual Design for Large enterprises.

**UNIT – II:**

Relational Model: Introduction to the Relational Model – Integrity Constraint Over relations – Enforcing Integrity constraints – Querying relational data – Logical data base Design – Introduction to Views – Destroying /altering Tables and Views.

Relational Algebra and Calculus: Relational Algebra – Selection and projection set operations – renaming – Joins – Division – Examples of Algebra overviews – Relational calculus – Tuple relational Calculus – Domain relational calculus – Expressive Power of Algebra and calculus.

**UNIT – III:**

Form of Basic SQL Query – Examples of Basic SQL Queries – Introduction to Nested Queries – Correlated Nested Queries Set – Comparison Operators – Aggregative Operators – NULL values – Comparison using Null values – Logical connectivity's – AND, OR and NOTR – Impact on SQL Constructs – Outer Joins – Disallowing NULL values – Complex Integrity Constraints in SQL 0 Triggers and Active Data bases.

**UNIT – IV:**

Schema refinement – Problems Caused by redundancy – Decompositions – Problem related to decomposition – reasoning about FDS – FIRST, SECOND, THIRD Normal forms – BCNF – Lossless join Decomposition – Dependency preserving Decomposition – Schema refinement in Data base Design – Multi valued Dependencies – forth Normal Form.

**UNIT – V:**

Overview of Transaction Management: ACID Properties – Transactions and Schedules – Concurrent Execution of transaction – Lock Based Concurrency Control – Performance Locking – Transaction Support in SQL – Introduction to Crash recovery.

**UNIT – VI:**

Concurrency Control: Serializability, and recoverability – Introduction to Lock Management – Lock Conversions – Dealing with Dead Locks – Specialized Locking Techniques – Concurrency without Locking.

Crash recovery: Introduction to ARIES – the Log – Other Recovery related Structures – the Write-Ahead Log Protocol – Check pointing – re3covering from a System Crash – Media recovery – Other approaches and Interaction with Concurrency control.

**UNIT – VII:**

Overview of Storage and Indexing: Data on External Storage – File Organization and Indexing – Cluster Indexes, Primary and Secondary Indexes – Index data Structures – Hash Based Indexing – Tree base Indexing – Comparison of File Organizations – Indexes and Performance Tuning.

**UNIT – VIII:**

Storing data: Disks and Files: - The Memory Hierarchy – Redundant Arrays of Independent – Disks – Disk Space Management – Buffer Manager – Files of records – Page Formats – record formats.

Tree Structured Indexing: Intuitions for tree Indexes – Indexed Sequential Access Methods (ISAM) – B+ Trees: A Dynamic Index Structure.

Hash Based Indexing: Static Hashing – Extendable hashing – Linear Hashing – Exendble vs. Liner hashing.

**Text Books:**

1. Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, TATA McGrawHill 3<sup>rd</sup> Edition
2. Data base System Concepts, Silberschatz, Korth, Mc.Graw hill, IV edition.

**References:**

1. Introduction to Database Systems, C.J.Date Pearson Education
2. Data base Systems design, Implementation, and Management, Rob & Coronel 5<sup>th</sup> Edition.Thomson
3. Data base Management System, Elmasri Navrate Pearson Education
4. Data base Management System Mathew Leon, Leon Vikas.
5. Data base Systems, Connoley Pearson education