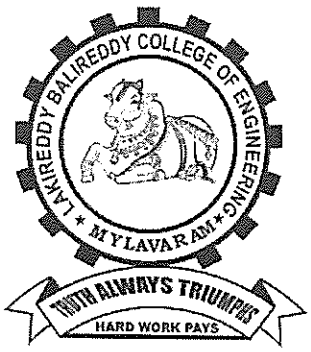
LAKIREDDY BALIREDDY COLLEGE OF ENGINEERING

(AUTONOMOUS)

(Approved by AICTE, Affiliated to JNTUK, Accredited by NBA, ISO 9001 : 2008 Certified & Accredited by **NAAC with "A" Grade)**

B.TECH. FOUR YEAR DEGREE COURSE
(Applicable for the batches admitted from 2011-12)

ELECTRICAL AND ELECTRONICS ENGINEERING



L.B.Reddy Nagar :: Mylavaram – 521 230 :: Krishna District
ANDHRA PRADESH STATE

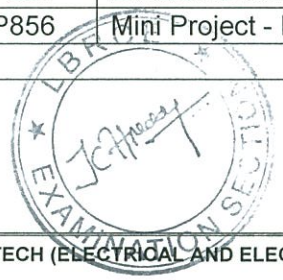
COURSE STRUCTURE

I-SEMESTER

Code No.	Name of the Course	Scheme of Instruction Periods per Week			Scheme of Examination Maximum Marks		Total	Credits
		Lectures	Tutorial	Lab.	Internal	External		
T118	Applied Mathematics - I	4	1	--	25	75	100	4
T131	C Programming	4	1	--	25	75	100	4
T197	English - I	4	--	--	25	75	100	3
T191	Engineering Chemistry	4	--	--	25	75	100	3
T195	Engineering Physics	4	1	---	25	75	100	3
P806	C Programming Lab	--	--	3	25	75	100	2
P830	Engineering Physics & Chemistry Lab.	--	--	3	25	75	100	2
P831	Engineering Workshop	--	--	3	25	75	100	2
P832	English Language Communication skills lab	--	--	3	25	75	100	2
	TOTAL	**20**	**3**	**12**	**225**	**675**	**900**	**25**

II-SEMESTER

Code No.	Name of the Course	Scheme of Instruction Periods per Week			Scheme of Examination Maximum Marks		Total	Credits
		Lectures	Tutorial	Lab	Internal	External		
T119	Applied Mathematics - II	4	1	--	25	75	100	4
T198	English - II	4	--	--	25	75	100	3
T264	Numerical methods	4	1	--	25	75	100	4
T179	Electrical Circuit Analysis - I	4	1	--	25	75	100	3
T188	Electronics Devices and Circuits	4	1	--	25	75	100	4
T153	Data structures	4	--	--	25	75	100	3
P829	Engineering Drawing through Auto CAD Lab	--	--	3	25	75	100	2
P827	Electronic Devices and Circuits using Lab VIEW			3	25	75	100	2
P856	Mini Project - I	--	--	3	25	25	50	2
	TOTAL	**24**	**4**	**9**	**225**	**625**	**850**	**27**



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III-SEMESTER

Code No.	Name of the Course	Scheme of Instruction			Scheme of Examination		Total	Credits
		Periods per Week			Maximum Marks			
		Lectures	Tutorial	Lab.	Internal	External		
T180	Electrical Circuit Analysis - II	4	1	-	25	75	100	4
T186	Electromagnetic Fields	4	1	-	25	75	100	4
T320	Switching Theory and Digital Logic	4	1	-	25	75	100	4
T181	Electrical Machines - I	4	1	-	25	75	100	4
T280	Power Systems -1	4	1	-	25	75	100	4
T205	Fluid Mechanics and Hydraulic Machinery	4	1	-	25	75	100	4
P822	Electrical Circuits Lab	-	-	3	25	75	100	2
P834	Fluid Mechanics and Hydraulic Machines Lab	-	-	3	25	75	100	2
P870	Seminar - I			2	50	--	50	1
TOTAL		**24**	**6**	**8**	**250**	**600**	**850**	**29**

IV-SEMESTER

Code No.	Name of the Course	Scheme of Instruction			Scheme of Examination		Total	Credits
		Periods per Week			Maximum Marks			
		Lectures	Tutorial	Lab	Internal	External		
T199	Environmental Studies	4	-	-	25	75	100	3
T281	Power Systems-II	4	1	-	25	75	100	4
T294	Pulse and Digital Circuits	4	1	-	25	75	100	4
T196	Engineering Thermo Dynamics	4	1	-	25	75	100	4
T266	Object Oriented Programming (C++)	4	1	-	25	75	100	4
T182	Electrical Machines-II	4	1	-	25	75	100	4
P823	Electrical Machines - I Lab	-	-	3	25	75	100	2
P861	Objected Oriented Programming (C++)Lab	-	-	3	25	75	100	2
P85	Mini Project - II				25	25	50	2
TOTAL		**24**	**5**	**6**	**225**	**625**	**850**	**29**

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V-SEMESTER

Code No.	Name of the Course	Scheme of Instruction			Scheme of Examination		Total	Credits
		Periods per Week			Maximum Marks			
		Lectures	Tutorial	Lab	Internal	External		
T235	Linear and Digital IC applications	4	1	-	25	75	100	4
T183	Electrical Measurements and Instrumentation	4	1	-	25	75	100	4
T148	Control systems	4	1	-	25	75	100	4
T146	Computer Organization	4	1	-	25	75	100	4
T140	Communication systems	4	-	-	25	75	100	3
T344	Linear System Analysis	4	1	-	25	75	100	4
T290	Professional ethics	4	1	-	25	75	100	3
P824	Electrical machines-II Lab	-	-	3	25	75	100	2
P814	Control Systems and Instrumentation Lab	-	-	3	25	75	100	2
P871	Seminar - II			-	50	--	50	1
TOTAL		**28**	**6**	**6**	**275**	**675**	**950**	**31**

VI-SEMESTER

Code No.	Name of the Course	Scheme of Instruction			Scheme of Examination		Total	Credits
		Periods per Week			Maximum Marks			
		Lectures	Tutorial	Lab.	Internal	External		
T279	Power system protection and switchgear	4	1	-	25	75	100	4
T221	Industrial Management	4	-	-	25	75	100	3
T163	Digital Signal Processing	4	1	-	25	75	100	4
T255	Microprocessors and Micro Controllers	4	1	-	25	75	100	4
T275	Power Electronics	4	1	-	25	75	100	4
	ELECTIVE – I							
T285	Probability and Statistics							
T298	Renewable Energy Systems	4	-	-	25	75	100	3
T316	Special Machines							
T300	Robotics							
P863	Power electronics Lab	-	-	3	25	75	100	2
P846	LDIC Lab	-	-	3	25	75	100	2
P810	Comprehensive Viva-Voce - I				100	-	100	2
	TOTAL	**24**	**4**	**6**	**300**	**600**	**900**	**28**

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VII-SEMESTER

Code No.	Name of the Course	Scheme of Instruction			Scheme of Examination		Total	Credits
		Periods per Week			Maximum Marks			
		Lectures	Tutorial	Lab	Internal	External		
T315	Solid State Drives	4	1	-	25	75	100	4
T283	Power System Operation and Control	4	1	-	25	75	100	4
T262	Neural Networks and Fuzzy Logic	4	1	-	25	75	100	4
T338	VLSI Design	4	1	-	25	75	100	4
T282	Power system Analysis	4	-	-	25	75	100	4
T213 T270 T145 T161	**ELECTIVE – II** High Voltage Engineering Optimization Techniques Computer networks Digital Image Processing	4	1	-	25	75	100	3
P853	Micro Processor and Micro Controllers lab	-	-	3	25	75	100	2
P864	Power Systems Lab	-	-	3	25	75	100	2
P878	Term paper				25	25	50	2
P843	Internship				50	-	50	2
	TOTAL	**24**	**5**	**6**	**275**	**625**	**900**	**31**

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VIII-SEMESTER

Code No.	Name of the Course	Scheme of Instruction Periods per Week			Scheme of Examination Maximum Marks		Total	Credits
		Lectures	Tutorial	Lab.	Internal	External		
T215	HVDC and FACTS	4	1	-	25	75	100	4
	ELECTIVE – III							
T278	Power Quality							
T190	Embedded Systems	4	1	-	25	75	100	3
T335	Utilization of Electrical Energy							
T308	Software Engineering							
	ELECTIVE - IV							
T168	Distribution Systems and Automation							
T102	Advanced Control Systems	4	1	-	25	75	100	3
T155	Data Base Management Systems							
T128	Bio-Medical Instrumentation							
P811	Comprehensive Viva-Voce - II			-	100	-	100	2
P867	Project Work			-	60	140	200	8
	TOTAL	**12**	**3**	**-**	**235**	**365**	**600**	**20**
TOTAL CREDITS : 220								

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I-SEMESTER

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T118 – APPLIED MATHEMATICS – I

Lecture	: 4 Periods/week	Internal Marks	: 25
Tutorial	: 1 Period/Week	External Marks	: 75
Credits	: 4	External Examination	: 3 Hrs

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

Linear differential equations of second and higher order with constant coefficients and with variable coefficients, method of variation of parameters and their simple applications to Simple Harmonic Motion and Electrical Circuits.

UNIT - III

Generalized Mean Value theorems (without proof), Functions of several variables, Maxima and Minima of functions of two variables with constraints and without constraints. Lagrangian Multiplier method.

UNIT - IV

Curve tracing – Cartesian curves. Applications of Integration to Lengths, Volumes and Surface areas of revolution in Cartesian Coordinates. Multiple integrals - double and triple integrals (Cartesian Coordinates only) – Changing of order of Integration. (Cartesian Coordinates only)

UNIT - V

Vector Differentiation: 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: Greens, Stokes and Gauss Divergence Theorems (Without proof) and related problems.

TEXT BOOKS

1. Higher Engineering Mathematics by Dr. B.S. Grewal
2. Higher Engineering Mathematics by Dr. B. V. Ramana – TMGH

REFERENCES

1. Advanced Engineering Mathematics by M. D. Greenberg – TMGH
2. Advanced Engineering Mathematics by Erwin Krezig - John Wiley & sons
3. Elementary Differential equations by W. E. Boyce and R. C. Diprima - John Wiley & sons
4. Advanced Engineering Mathematics by Peter V. O. Neil - Thomson

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T131 – C - PROGRAMMING

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1 Period/Week**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

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.

TEXT BOOKS

1. Computer science, A structured programming approach using C, B.A. Forouzan and R.F. Gilberg, Third edition, Thomson.
2. The C Programming Language, B.W. Kernighan, Dennis M.Ritchie, PHI/Pearson Education

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REFERENCES

1. C Programming with problem solving, J.A. Jones & K. Harrow, Dreamtech Press
2. Programming in C – Stephen G. Kochan, III Edition, Pearson Eductaion
3. C and Data Structures:A Snap Shot Oriented Treatise Using Live Engineering Examples by Prof. N.B.Venkateswarlu and, Prof.E.V.Prasad, S Chand & Co, New Delhi
4. C/C++ for Engineers and Scientists, Harry H.Cheng ,McGrawHill,

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T197 - ENGLISH - I

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
		External Marks	**: 75**
Credits	**: 3**	**External Examination**	**: 3 Hrs**

English Language continues to be regarded as an important tool for global communication and employability. Hence, it is imperative that students need to acquire communicative competence besides their core skills. The syllabus has been designed to develop linguistic and communicative competence of Engineering students with special emphasis on professional and functional aspects of English language i.e., on Listening, Speaking, Reading and Writing (LSRW Skills).

OBJECTIVES

- To improve the language proficiency of the students in English with emphasis on LSRW skills.
- To develop the study skills and Communication skills of the students in both formal and informal situations.
- To enable the students to face the academic and professional challenges of the present day scenario.
- To help students acquire the ability to speak effectively in English in the real life situations.
- To inculcate reading as a habit and to develop reading skills among students.
- To train students to improve their active and passive vocabulary.
- To familiarize the students with different rhetorical functions of Technical English.
- To enable the students write letters and reports effectively in formal and professional situations.

UNIT - I

Chapter – 1: "Read & Proceed" from Step by Step (*Pearson*)
Extensive Reading - Masterminds– The Trailblazers – **Jagadis Chandra Bose***(Orient Longman)*

UNIT - II

Chapter – 2: "Travel" from Step by Step (*Pearson*)
Extensive Reading - Masterminds– The World of Figures and Physics – **Chandra SekharaVenkata Raman** *(Orient Longman)*

UNIT - III

Chapter – 3: "Gender" from Step by Step (*Pearson*)
Extensive Reading - Masterminds–The Institution Builders– **Shanti SwarupBhatnagar** (*Orient Longman*)

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UNIT - IV

Vocabulary – Synonyms, Antonyms, Words often Confused, Gerunds & Infinitives, Prefixes & Suffixes, Word plurals, Analogy
Grammar – Parts of Speech, Sentence Completion, Question Tags, Tense and Aspect

UNIT - V

Analytical Writing – Sentence Construction – Types of sentences, Exercises with scrambled words & Jumbled sentences, Paragraph writing, Dialogue writing (Formal & Informal), Letter Writing (Formal & Informal), Resume writing, Expansion (of a given topic), Abstract Writing (Summarizing / Synopsis), Decision-making, Drafting E-Mails & Memo writing, Essay writing.

TEXT BOOKS

- Step by Step (*Pearson*)
- Masterminds by EnakshiChatterjee (*Orient Longman*)

REFERENCES

1. Andrea J Rutherford. *Basic Communication Skills for Technology*: Pearson Education, New Delhi, 2009.
2. Murphy. *English Grammar with CD*: Cambridge University Press, New Delhi, 2004
3. Rizvi, M Ashraf. *Effective Technical Communication*: Tata McGraw Hill, New Delhi, 2008.
4. Blum Rosen. *Word Power*: Cambridge University Press, New Delhi, 2009.

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T191 - ENGINEERING CHEMISTRY

Lecture	**: 3 Periods/week**	**Internal Marks**	**: 25**
		External Marks	**: 75**
Credits	**: 3**	**External Examination**	**: 3 Hrs**

UNIT - I

WATER TECHNOLOGY: Introduction, Hardness of Water - Temporary and Permanent hardness. Units and inter conversions of Units. Problems on Temporary and Permanent hardness. Boiler troubles – scale & sludge formation, Caustic embrittlement, Corrosion, priming & foaming, softening of water Methods of Treatment of Water for Domestic Purposes - Sedimentation, Coagulation, Filtration, Disinfection – Sterilization, Chlorination, Break point chlorination, Ozonization.
Water Treatment: Internal Treatment - Colloidal, Phosphate, Calgon, Carbonate, Sodium aluminates Conditioning of Water. External Treatment - Lime-Soda Process, Zeolite Process, Ion- Exchange Process.

UNIT - II

FUELS AND COMBUSTION: Definition and classification of Fuels- conventional fuels (solid, liquid, gaseous), Solid fuels- coal - analysis, Proximate and ultimate analyses of coal – significances, Liquid Fuels – primary- petroleum- refining of petroleum- cracking, knocking, synthetic petrol – Bergius and Fischer Tropsech's process; Gaseous fuels- octane number – cetane number,– water gas, producer gas CNG, and biogas - gross and net calorific values – (definition only) – flue gas analysis – Orsat's apparatus.

UNIT - III

CORROSION: Definition, Examples, Types of Corrosion: Theories of Corrosion and Mechanism - Dry Corrosion (Direct Chemical corrosion), Wet Corrosion (Electro Chemical corrosion) Principles of Corrosion, Galvanic Series, Galvanic Corrosion, Concentration Cell Corrosion, Mechanism of Wet and Chemical Corrosion - Hydrogen evolution type, Oxygen absorption type. Factors Influencing Corrosion. Control of Corrosion - Proper Design, Use of pure metal and metal alloys, Passivity, Cathodic Protection - Sacrificial anode and Impressed Current, Modifying the Environment and use of Inhibitors.

UNIT - IV

Polymer Science and Technology: Types of polymerization, Mechanism (Chain growth & step growth), Plastics –Thermosetting and Thermoplastic resins – preparation, properties and engineering applications of Polyethylene, PVC, Polystyrene, Teflon, Bakelite, Nylon, Conducting polymers: polyacetylene, polyaniline, conduction, doping, application. Characteristics and uses Rubber - Natural Rubber, Vulcanization and significance, Elastomers – Buna S, Buna N, Thiokol, Fibers- Polyester, fiber reinforced plastics (FRP), applications.

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UNIT - V

1. REFRACTORIES & INSULATORS: Definition, Classification with Examples, Criteria of a Good Refractory Material, Causes for the failure of a Refractory Material, Insulators – Definition and Classification with Examples. Characteristics of Insulating Materials, Thermal Insulators, Electrical Insulators - Their Characteristics and Engineering Applications.

2. LUBRICANTS: Introduction to Lubricants, Principles and function of lubricants - Types of Lubrication and Mechanism - Thick Film or Hydrodynamic Lubrication, Thin Film or Boundary Lubrication, Extreme Pressure Lubrication. Classification and properties of lubricants-Viscosity, flash and fire point, cloud and pour point, aniline point, Neutralization Number and mechanical strength, Selection of lubricants.

TEXT BOOKS

1. A text book of Engineering Chemistry by Jain & Jain, Dhanpat Rai Publishing Company, New Delhi (15th Edition) (2006).
2. A Text book of Engineering Chemistry by Dr. Y. Bharathi Kumari and Dr. Jyotsna Cherukuri, VGS Publications, First Edition, 2009.

REFERENCES

1. A Text book of Engineering Chemistry by Shashi Chawla, Dhanpat Rai Publishing Company, First Edition, 2002.
2. Advanced Engineering Chemistry by Dr. M. R. Senapati, University Science Press (Impart from Laxmi Publications), 3rd Edition 2009.
3. N. Krishnamurthy, P. Vallinayagam and D. Madhavan, Engineering Chemistry, 2nd Edition. PHI Learning PVT., LTD, New Delhi, 2008.
4. A Text book of Engineering Chemistry by S. S. Dara, S CHAND Publications.

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T195 - ENGINEERING PHYSICS

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**:**	**External Marks**	**: 75**
Credits	**: 3**	**External Examination**	**: 3 Hrs**

UNIT - I

INTERFERENCE: Superposition of waves-double slit interference- Young's double slit experiment- Coherence – Interference from thin films- Newton's rings.
DIFFRACTION: Diffraction and wave theory of light (Fresnel and Fraunhofer diffractions) - single slit Diffraction, Intensity in single- slit diffraction, Calculating the intensity– Double slit interference and diffraction combined.
GRATINGS AND SPECTRA - Multiple slits-width of the maxima, Diffraction gratings, Grating spectrum – Dispersion and Resolving power.
POLARIZATION: Polarization by reflection Brewster's law - Double refraction -Polarization by scattering - Retarders -Optical Activity.

UNIT - II

CRYSTAL STRUCTURES: Introduction –periodic arrays of atoms-Lattice translation vectors, Basis and crystal structure, Primitive cell, fundamental types of lattices-three dimension lattice types, Crystal systems- Structure and packing fractions of Simple cubic-Body centered cubic- Face centered cubic crystals.
X-RAY DIFFRACTION: Directions and planes in crystals – Miller indices – separation between successive (h k l) planes- Diffraction of X- rays by crystal planes – Braggs law-Laue method- powder method.

UNIT - III

LASERS: Introduction – Characteristics of Lasers- Principle of laser (Absorption, Spontaneous and stimulated emission of Radiation), Einstein Coefficients- Population Inversion - Helium Neon Laser, Semiconductor laser, Applications of Lasers.
FIBER OPTICS: Introduction- Principle of optical Fiber- Acceptance angle and Acceptance cone- Numerical aperture - refractive index profile-Application of optical fibers.

UNIT - IV

SUPER CONDUCTIVITY : Phenomenon, Meissner effect, critical parameters, Type I, Type II Super conductors, BCS theory of super conductivity, Applications of Super conductors.

UNIT - V

NON-DESTRUCTIVE TESTING USING ULTRASONICS: Characteristics Production and detection of ultrasonics-Piezoelectric and magnetostiriction methods,Ultrasonic Testing - Basic Principle –Transducer – Couplant and inspection Standards – Inspection Methods – Pulse echo Testing Technique – Flaw detector- Different Types of Scans – Applications.

TEXT BOOKS

1. Fundamentals of physics Resinic, Halliday and Krane, John Wiley 2003
2. Engineering Physics by V RAJENDRAN , Tata McGrawhill

REFERENCES

1. Introduction to solid state physics, C. Kittel, John wiley, 1999.
2. Engineering physics by H K MALIK AK SINGH TATA McGRAHILL

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P806 – C - PROGRAMMING LAB

		Internal Marks	**: 25**
Lab/Practicals:	**3 Period/Week**	**External Marks**	**: 75**
Credits	**: 2**	**External Examination**	**: 3 Hrs**

I) Write a programme in 'C' language to cover the following problems.
a) Roots of Quadratic Equation.

b) Example program which shows the usage of various Operators available in C Language.

c) Example program which shows the usage of various preliminary Data types available in C Language.

d) Example programs to illustrate the *order of evaluation.*

II) WRITE EXAMPLE PROGRAMS

a) To check whether the given year is leap year (or) not
b) Converting given two digit number into words using switch statement
c) To illustrate the usage of 'goto' statement.
d) Finding smallest& biggest number from the given set of 4 numbers using 'if' statement.
e) Calculate the student grade in the examination – assume suitable constraints.
f) Prepare electricity bill for the consumed units – assume suitable constraints.

III) EXAMPLE PROGRAMS

a) To Display first N natural numbers
b) To find whether the given number is Armstrong (or) not
c) To find reverse of the given number and to check whether it is palindrome (or) not.
d) To find whether given number is strong number (or) not.
e) To check whether given number is Prime (or) not
f) To display prime numbers with in the given range(Nesting of Loops).
g) To display the following structure(Nesting of Loops)

i)
```
        1
      1   2
    1   2   3
  1   2   3   4
1   2   3   4   5
```

ii)
```
5 4 3 2
  4 3 2 1
    3 2 1
      2 1
        1
```

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IV) Write example programs in C Language:
a) To find factorial of a given number using functions.
b) Swap two numbers using functions.
c) To find GCD of two numbers using recursion
d) Write a recursive function to solve Towers of Honai problem.
e) Write an example program to illustrate use of external & static storage classes.

V) Write example programs in C Language to perform following operations:
a) Finding the sum and average of given numbers using Arrays.
b) To display elements of array in reverse order
c) To search whether the given element is in the array (or) not using linear search & binary search.
d) Write a C program to perform the following operations
i) Addition, subtraction and multiplication of Matrices
ii) Transpose of given matrix
(The above operations are to be exercised using functions also by passing arguments)
e) Write a C program to find whether the given string is palindrome (or) not.
f) To accept line of text and find the number of characters, number of vowels and number of blank spaces in it.
g) Write an example program to illustrate the use of any 5 string handling functions.

VI) a) Example program to bring clarity on pointer declaration & initialization and Pointer arithmetic.
b) Write an example program to describe the usage of *call by reference*.
c) Write a program to find sum of the elements of the array using functions.
d) Write an example program to illustrate the usage of command line arguments.
e) Program to illustrate the usage of dynamic memory management functions.

VII) a) Write an example program using structures to process the student record. Assume suitable fields for student structures (Different kinds of initialization of structure variables are to be exercised)
b) Write a program to read records of 10 employees and find their average salary (exercise array of structures & Nested structures concepts through this program).
c) Write a program to handle a structure variable using pointers and implement self referential structure(i.e. A structure variable having a pointer to itself)

VIII) Write an example program on file to perform following operations:
a) Accessing content from files and writing content in to it.
(Exercise different file operation modes)
b) Copy the contents of one file into another (Exercise different file operation modes)

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P830 - ENGINEERING PHYSICS AND CHEMISTRY LAB

		Internal Marks	**: 25**
Lab/Practicals:	**3 Period/Week**	**External Marks**	**: 75**
Credits	**: 2**	**External Examination**	**: 3 Hrs**

ENGINEERING PHYSICS LABORATORY
(Any 5 experiments)

LIST OF EXPERIMENTS

1. LCR Resonance circuit
2. Newton's Rings – Determination of Radius of curvature of plano convex lens
3. Verification of laws by using sonometer
4. Meldy's experiment
5. Wedge shaped film
6. Volume Resonator
7. Refractive index of light
8. Diffraction Grating – Normal incidence method
9. Rigidity modulus of a given wire
10. Frequency of AC supply – Sonometer

ENGINEERING CHEMISTRY LABORATORY
(Any 5 experiments)

1. Estimation of total Hardness of water by EDTA method
2. Determination of Temporary and permanent hardness of water.
3. Iodometric Titration of $K_2Cr_2O_7$ v/s $Na_2S_2O_3$ to determine the percentage purity of $K_2Cr_2O_7$ sample.
4. Preparation of Stanard Potassium Dichromate and Estimation of Copper by Iodometry.
5. Determine the amount of Oxalic acid and Sulphuric acid in 1 liter solution by using given standard Sodium Hydroxide and Potassium Permanganate solution
6. Determination of alkalinity of water sample.
7. Determination of Dissolved Oxygen (DO) content by Winkler's method.
8. Preparation of Urea formaldehyde resin.

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P831 - ENGINEERING WORKSHOP

		Internal Marks	**: 25**
Lab/Practicals:	**3 Period/Week**	**External Marks**	**: 75**
Credits	**: 2**	**External Examination**	**: 3 Hrs**

TRADES FOR EXERCISES:

At least three exercise from each trade:

1. Carpentry
2. Fitting
3. House – Wiring
4. Plumbing

TRADES FOR EXERCISES: (MECHANICAL ENGINEERING)

At least two exercise from each trade:

1. Carpentry
2. Fitting
3. Tin - Smithy
4. Black - Smithy
5. House - Wiring
6. Plumbing

TEXT BOOK :

Workshop manual / P. Kannaiah / K.L. Narayana Scitech Publications, India Pvt Ltd, Chennai.

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P832 - ENGLISH LANGUAGE COMMUNICATION SKILLS LAB

		Internal Marks	**: 25**
Lab/ Practicals	**: 3 Period/Week**	**External Marks**	**: 75**
Credits	**: 2**	**External Examination**	**: 3 Hrs**

The English Language Communications Skills Lab focuses on practice of sounds of language and familiarizes the students with the use of English in everyday situations and contexts. It aims at improving the communicative competence of students and to enrich their power of expression, articulation and persuasiveness. The thrust is on developing competences, both linguistic as well as communicative, in order to improve employability potential.

OBJECTIVES

1. To expose the students to a variety of self-instructional, learner-friendly modes of English language learning and stimulate intellectual and attitudinal exercise.
2. To provide students with the required facility and practice to face computer-based competitive exams such GRE, TOEFL, IELTS etc.
3. To enable them to learn better pronunciation through emphasis on word accent, intonation, and rhythm.
4. To train them to use language effectively to face interviews, group discussions, public speaking.
5. To develop necessary attitudes and behaviors so as to improve their employability quotient.

SYLLABUS

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

1. Dimensions of Phonetics: Phonetic Transcription, Sounds, Stress, Intonation, Rhythm, Varieties of Spoken English: Indian, British and American
2. Oral Presentations -- Prepared and Extempore -- JAM
3. Role Play
4. Describing Objects / Situations / People
5. Information Transfer
6. Debates
7. Group Discussions

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T119 - APPLIED MATHEMATICS – II

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1 Period/Week**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

UNIT - I

Laplace transforms of standard functions –Shifting Theorems, Transforms of derivatives and integrals – Unit step function –Dirac's delta function. Inverse Laplace transforms– Convolution theorem - Applications of Laplace transforms to ordinary differential equations

UNIT - II

Fourier Series: Determination of Fourier coefficients – Fourier series – even and odd functions – Fourier series in an arbitrary interval– Half-range sine and cosine series.

UNIT - III

Fourier integral theorem (only statement) – Fourier sine and cosine integrals – Fourier transform – sine and cosine transforms – properties – inverse transforms – Finite Fourier transforms.

UNIT - IV

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions –solutions of first order linear (Lagrange) equation. Method of Separation of Variables - Applications to wave equation one dimensional, heat equation and Laplace Equation.

UNIT - V

Z-transform – properties – Damping rule – Shifting rule – Initial and final value theorems - Inverse z-transform -Convolution theorem – Solution of difference equation by z-transforms.

TEXT BOOKS

1. Higher Engineering Mathematics by Dr. B.S. Grewal
2. Higher Engineering Mathematics by Dr. B. V. Ramana – TMGH

REFERNCES

1. Advanced Engineering Mathematics by Michael D. Greenberg – TMGH
2. Advanced Engineering Mathematics by Erwin Krezig - John Wiley & sons

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T198 - ENGLISH-II

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
		External Marks	**: 75**
Credits	**: 3**	**External Examination**	**: 3 Hrs**

English Language continues to be regarded as an important tool for global communication and employability. Hence, it is imperative that students need to acquire communicative competence besides their core skills. The syllabus has been designed to develop linguistic and communicative competence of Engineering students with special emphasis on professional and functional aspects of English language i.e., on Listening, Speaking, Reading and Writing (LSRW Skills).

OBJECTIVES

- To improve the language proficiency of the students in English with emphasis on LSRW skills.
- To develop the study skills and Communication skills of the students in both formal and informal situations.
- To enable the students to face the academic and professional challenges of the present day scenario.
- To help students acquire the ability to speak effectively in English in the real life situations.
- To inculcate reading as a habit and to develop reading skills among students.
- To train students to improve their active and passive vocabulary.
- To familiarize the students with different rhetorical functions of Technical English.
- To enable the students write letters and reports effectively in formal and professional situations.

UNIT - I

Chapter 4: "Disaster Management" from *Step by Step* (Pearson)
Extensive reading – *Masterminds* - The institution builders - **MeghanadSaha** *(*Orient Longman*)*

UNIT - II

Chapter 5: "Health" from *Step by Step* (Pearson)
Extensive reading – *Masterminds*- The New Age – **HomiJehangirBhabha** *(*Orient Longman*)*

UNIT - III

Chapter 6: "Sports" from *Step by Step* (Pearson)
Extensive reading – *Masterminds* - The New Age – **Vikram Sarabhai** *(*Orient Longman*)*

UNIT - IV

Grammar – Articles, Prepositions, Voice, Speech, Concord, Correction of Sentences
Vocabulary – Phrasal verbs, Gerunds, Infinitives, One word Substitutes.

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UNIT - V

Analytical writing – Comprehension, Technical dialogue writing,
Presentation skills - Note making, Information transfer / Data interpretation (Tables, Pie-charts, Bar graphs, Tree diagrams, Pictograms, etc.), Report writing

TEXTBOOK

Step by Step, Pearson Education, New Delhi 2010.
Master Minds, *(*Orient Longman*).*

REFERENCES

1. KoneruAruna. *Professional Communication:* Tata McGraw-Hill, New Delhi, 2007.
2. Effective Technical Communication, Rizvi, Tata McGraw-Hills, New Delhi, 2009.
3. Basic Communication Skills for Technology, Andrea J. Rutherford, Pearson Education.
4. GRE and TOEFL, Kaplan and Baron's, Latest editions.

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T264 - NUMERICAL METHODS

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1 Period/Week**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

UNIT - I

Linear systems of equations: Rank-Echelon form, Normal form – Solution of Linear Systems – Direct Methods- Gauss Elimination - Gauss Jordon and Gauss Seidal Methods. Eigen values – Eigen Vectors – Properties – Cayley Hamilton Theorem – Inverse and Powers of a matrix by using Cayley Hamilton Theorem.

UNIT - II

Quadratic forms – Reduction to Canonical form – Rank and Nature of Quadratic form. Solution of Algebraic and Transcendental Equations: Introduction – The Method of False Position – Newton-Raphson Method.

UNIT - III

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 – Lagrange's Interpolation formula.

UNIT - IV

Numerical Differentiation and Integration – Differentiation using finite differences – Trapezoidal rule – Simpson's 1/3 Rule –Simpson's 3/8 Rule.

UNIT - V

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- Milne's Method. Curve fitting: Fitting a straight line –Second degree curve-exponential curve by method of least squares.

TEXT BOOKS

1. Higher Engineering Mathematics by Dr. B.S. Grewal
2. Higher Engineering Mathematics by Dr. B. V. Ramana – TMGH

REFERENCES

1. Introductory Methods of Numerical Analysis by S. S. Sastry – PHI
2. Numerical Methods for Engineers with programming and software application by Steven .C. Chopra and Ra. P. Canale – TMGH
3. Numerical Methods for scientific and engineering by M. K. Jain, S. R. K. Iyengar – New Age International ltd.

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T179- ELECTRICAL CIRCUIT ANALYSIS – I

Lecture	: 4 Periods/week	Internal Marks	: 25
Tutorial	: 1 Period/Week	External Marks	: 75
Credits	: 3	External Examination	: 3 Hrs

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 magnetic circuits Single phase circuits etc.

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-KCL-KVL – network reduction techniques – series, parallel, series parallel, star-to-delta or delta-to-star transformation.

UNIT - II

NETWORK TOPOLOGY

Definitions – Graph – Tree, Basic cut-set and Basic Tie-set matrices for planar networks – Loop and Nodal analysis of Networks with independent voltage and current sources - Duality & Dual networks

UNIT - III

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. Hysteresis and eddy currents

UNIT - IV

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

UNIT - V

***RESONANCE* & LOCUS DIAGRAMS**

Resonance – series, parallel circuits, concept of band width and Q factor

Locus diagrams- Series R-L, R-C, R-L-C and parallel combination with variation of various parameters

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TEXT BOOKS

1. Engineering circuit analysis – by William Hayt and Jack E. Kimmerly, Mc Graw Hill Company, 6th edition
2. Electric circuits, 3rd edition – Joseph Edminister & mahmood Nahvi -schaums outline series – Tata Mc Graw Hill

REFERENCES

1. Network Analysis by Vanvalkenburg, PHI.
2. Electric Circuits by A. Chakrabarthy, Dhanipat Rai & Co.
3. Network Theory:- N.C. Jagan & C.Lakshminarayana, B.S Publications.
4. Problems in Electrical Engineering 9th edition N. N. Parker smith

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T188 – ELECTRONIC DEVICES AND CIRCUITS

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1 Period/Week**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

UNIT - I

JUNCTION DIODE CHARACTERISTICS : Review of semi conductor Physics – n and p –type semi conductors, Mass Action Law, Continuity Equation, Hall Effect, Fermi level of semiconductors, Energy band diagram of PN diode, PN diode-biasing, The current components, Diode equation, V-I characteristics, Temperature dependence of VI characteristic, Transition and Diffusion capacitances, Breakdown Mechanisms in p-n Diode, Zener diode, Tunnel Diode, Varactar Diode, LED, LCD. And photo diode

UNIT - II

RECTIFIERS AND FILTERS : Half wave rectifier, ripple factor, full wave rectifier, Harmonic components in a rectifier circuit, Inductor filter, Capacitor filter, L- ?section filter, Π- section filter, Multiple L- section and Multiple Πsection filter, and comparison of various filter circuits? in terms of ripple factors, basics of regulators.

UNIT - III

TRANSISTOR and FET CHARACTERISTICS : Junction transistor, Transistor current components, Transistor as an amplifier, Transistor construction, Current components in a transistor, Input and Output characteristics of transistor in Common Base, Common Emitter, and Common collector configurations, Relation between Alpha,Beta and gama, FET- JFET characteristics, Small signal model of JFET, MOSFET characteristics (Enhancement and depletion mode), Comparison of Transistors, Introduction to SCR and UJT.

UNIT - IV

BIASING AND STABILISATION : BJT biasing, DC equivalent model, criteria for fixing operating point, Fixed bias, Collector to base bias, Self bias techniques for stabilization, Stabilization factors, (S, S', S''), Compensation techniques, (Compensation against variation in V_{BE}, I_{co},) Thermal run away, Thermal stability.

UNIT - V

AMPLIFIERS: Small signal low frequency transistor amplifier circuits: h-parameter representation of a transistor, Analysis of single stage transistor amplifier using h-parameters: voltage gain, current gain, Input impedance and Output impedance. Comparison of transistor configurations in terms of A_I , R_i , A_v , R_o, Introduction to feedback Amplifier and Oscillators.

TEXT BOOK

Electronic Devices and Circuits – J.Millman, C.C.Halkias, and Satyabratha Jit Tata McGraw Hill, 2nd Ed., 2007.

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REFERENCES

1. Electronic Devices and Circuits – R.L. Boylestad and Louis Nashelsky, Pearson/Prentice Hall,9th Edition,2006.
2. Electronic Devices and Circuits – S Salivahanan, N.Suresh Kumar and A Vallavaraj, McGraw Hill, 5th edition, 2010.
3. Electronic Devices and Circuits – T.F. Bogart Jr., J.S.Beasley and G.Rico, Pearson Education, 6th edition, 2004.
4. Principles of Electronic Circuits – S.G.Burns and P.R.Bond, Galgotia Publications, 2nd Edn.., 1998.
5. Microelectronics – Millman and Grabel, Tata McGraw Hill, 1988.
6. Electronic Devices and Circuits – Dr. K. Lal Kishore, B.S. Publications, 2nd Edition, 2005.
7. Electronic Devices and Circuits- Prof GS N Raju I K International Publishing House Pvt. Ltd 2006.

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T153 – DATA STRUCTURES

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1 Period/Week**	**External Marks**	**: 75**
Credits	**: 3**	**External Examination**	**: 3 Hrs**

UNIT - I

Algorithm Analysis:
Mathematical Background, Model, Analysis and Run Time Calculations, **Lists:** Abstract Data Types, the List ADT, Singly Linked, Doubly Linked, Circular Linked List ADTs, Polynomial ADT.

UNIT - II

Stacks And Queues: The Stack ADT and applications; Infix to postfix expression conversion, Evaluation of Postfix expressions. The Queue ADT and Applications.

UNIT - III

Searching: Linear and Binary Searching. **Internal Sorting:** Insertion Sort, Shell Sort, Heap Sort, Merge Sort, Quick Sort, Bucket Sort. **External Sorting:** Model for External Sorting Algorithm, Multiway Merge, Poly Phase Merge, Replacement Selection. Comparison of Sorting Timing Complexities.

UNIT - IV

Binary Trees: Implementation, Expression Tress. **Search Trees:** Binary Search Trees, Implementation. **AVL Trees:** Single Rotations, Double Rotations. **Splay Trees:** Splaying, B-Trees.

UNIT - V

Hashing: Hash Function, Separate Chaining, Open Addressing, Rehashing, and Extendible Hashing.

TEXT BOOK

Mark Allen Weiss: "Data Structures and Algorithm Analysis in C", 2 nd ed, AW.

REFERENCES

1. Langson, Augenstein & Tenenbaum, 'Data Structures using C and C++', 2nd ed, PHI.
2. Robert L.Kruse, Leung and Tando, 'Data Structures and Program Design in C', 2nd ed, PHI.

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P829 - ENGINEERING DRAWING THROUGH AUTOCAD LAB.

		Internal Marks	**: 25**
Lab/Practicals	**: 3 Period/Week**	**External Marks**	**: 75**
Credits	**: 2**	**External Examination**	**: 3 Hrs**

UNIT - I

Introduction to Engineering Drawing and its importance -Introduction to Computer Aided Drafting, Auto CAD commands, Setup Commands, Drawing Commands, Editing Commands, Dimensioning Commands -Theory of Projection – Elements of projection, planes of projection, and methods of projection. Orthographic Projection - Lines used in general engineering drawing, types of surfaces, invisible lines, precedence of lines, selection of views, principles of multi view drawing, steps to draw orthographic views, orthographic projection of different objects.

UNIT - II

Isometric Drawing- Theory of isometric projection-Isometric view and Isometric projection Isometric projection from Orthographic views for simple objects.

UNIT - III

Projections of points - Projection of straight Lines –Various positions of straight lines w.r.t reference planes, inclined to both planes.

UNIT - IV

Projections of Planes –Introduction, Planes parallel to reference planes, inclined to one reference plane and perpendicular to other, planes perpendicular to both reference planes, planes inclined to both reference planes.

UNIT - V

Projections of Solids –Types of solids, Polyhedra, solids of revolution, Projection of solids in simple position, projection of solids with axis inclined to one reference plane and parallel to other.

TEXT BOOKS

1. Engineering Graphics with AutoCAD by Bethune PHI Learning Private Limited, New Delhi, 2009.
2. Engineering Graphics with AutoCAD by M. Kulkarni, A.P Rastogi, and A.K. Sarkar; PHI Learning Private Limited, New Delhi, 2009
3. Engineering Drawing by N.D. Bhatt, Charitor publications.

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P827 – ELECTRONIC DEVICES USING CIRCUITS AND LAB VIEW

Lecture	**: 3 Periods/week**	**Internal Marks**	**: 25**
		External Marks	**: 75**
Credits	**: 2**	**External Examination**	**: 3 Hrs**

List of Experiments

1. Signal Generation
2. PN junction diode characteristics
3. Zener diode characteristics
4. Full wave rectifier without & with filters
5. Transistor CE characteristics
6. Transistor CB characteristics
7. FET characteristics
8. CE Amplifier
9. CC Amplifier
10. Common Source FET Amplifier

Additional Experiments

11. Feedback amplifier (Voltage Series)
12. Feedback amplifier (Current Series)

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T180 – ELECTRICAL CIRCUIT ANALYSIS - II

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1 Period/Week**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

OBJECTIVE

This course introduces the basic concepts of circuit analysis which is the foundation for all subjects of the Electrical and Electronics 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

Network theorems (both ac & dc networks)
Superposition, Reciprocity, Thevenin's, Norton's, Maximum Power Transfer, Millman's and Compensation and Tellegen's theorems- Statements of theorems and steps for solving networks.

UNIT - II

Three Phase Circuits
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 - III

Two Port Network Parameters
Open circuit impedance(Z) network parameters, Short circuit admitance(Y) network parameters –Transmission(ABCD), Inverse transmission($A^1B^1C^1D^1$) and hybrid parameters – Relationship between each two port network parameters – Reciprocity and Symmetry concepts of two port network parameters network.

UNIT - IV

Transient Analysis (both ac & dc networks)
Introduction - Initial conditions of all elements-Transient response of Series R-L, R-C and R-L-C circuits – Solution using differential equation approach and Laplace transform methods of solutions.

UNIT - V

Network Synthesis
Hurwitz Polynomials, Positive Real Functions, Frequency Response of Reactive One-Ports, Synthesis of Reactive One Port by Foster 'S Method, Synthesis of Reactive One Port By Cauer Method, Synthesis of RL, RC and LC One Port Networks by Foster and Cauer Methods.

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TEXT BOOK

Engineering circuit analysis – by William Hayt and Jack E. Kimmerly, Mc Graw Hill Company, 6th edition.

REFERENCES

1. 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.
2. Network Analysis by Vanvalkenburg, PHI.
3. Electrical Circuits: S.Sudhakar, P.S.M.Satyanarayana, TMH Publication.
4. Electric Circuits by A. Chakrabarthy, Dhanipat Rai & Co.
5. Electrical circuits-schauem series

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T186 – ELECTROMAGNETIC FIELDS

Lecture	: 4 Periods/week	Internal Marks	: 25
Tutorial	: 1 Period/Week	External Marks	: 75
Credits	: 4	External Examination	: 3 Hrs

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, div(D) =ρv

UNIT - II

Conductors and Dipole
Laplace's and Poison'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. 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 - III

Magneto Statics
Static magnetic fields – Biot-Savart's law – Oesterd'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, div(B)=0.
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 – Curl (H)=Jc, Field due to a circular loop, rectangular and square loops.

UNIT - IV

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

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UNIT - V

Time Varying Fields

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

TEXT BOOKS

"Engineering Electromagnetics" by William H. Hayt & John. A. Buck Mc. Graw-Hill Companies, 7th Editon.2006.

REFERENCES

1. "Introduction to Electro Dynamics" by D J Griffiths, Prentice-Hall of India Pvt.Ltd, 2nd editon
2. "Electromagnetics" by J P Tewari.
3. "Electromagnetics" by J. D Kraus Mc Graw-Hill Inc. 4th edition 1992.
4. "Electro magnetic Fields" by Sadiku, Oxford Publications

T320 – SWITCHING THEORY AND DIGITAL LOGIC

Lecture	: 4 Periods/week	Internal Marks	: 25
Tutorial	: 1	External Marks	: 75
Credits	: 4	External Examination	: 3 Hrs

UNIT - I

NUMBER SYSTEMS & BOOLEAN ALGEBRA : Philosophy of number systems – complement representation of negative numbers-binary arithmetic-binary codes-error detecting & error correcting codes – hamming codes.
Fundamental postulates of Boolean Algebra - Basic theorems and properties - switching functions–Canonical and Standard forms-Algebraic simplification of digital logic gates, properties of universal gates-Multilevel NAND/NOR realizations.

UNIT - II

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

UNIT - III

COMBINATIONAL LOGIC DESIGN: Design using conventional logic gates, Encoder, Decoder, Multiplexer, De-Multiplexer, Modular design using IC chips MSI & LSI: MUX Realization of switching functions, Parity bit generator, Code-converters.
PROGRAMMABLE LOGIC DEVICES Basic PLD's-ROM, PROM, PLA, PLD. Realization of Switching functions using PLD's.

UNIT - IV

SEQUENTIAL CIRCUITS: 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.
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 - V

ALGOROTHIMIC STATE MACHINES: Salient features of the ASM chart-Simple examples-System design using data path and control subsystems-control implementations-examples.

TEXT BOOKS

Digital Design – Morris Mano, PHI, 3rd Edition, 2006.

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REFERENCES

1. Digital Design, J F Wakerly, Prentice Hall 2000
2. Digital Electronics, 3rd Edition, RP Jain, Modern TMH, 2000
3. Switching & Finite Automata theory – Zvi Kohavi, TMH,2nd Edition.
4. An Engineering Approach To Digital Design – Fletcher, PHI.
5. Digital Integrated Electronics, Taub and Schilling, Mc-Graw Hill, 1977.
6. Fundamentals of Logic Design – Charles H. Roth, Thomson Publications, 5th Edition, 2004.
7. Digital Logic Applications and Design – John M. Yarbrough, Thomson Publications, 2006.

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T181 – ELECTRICAL MACHINES - I

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

OBJECTIVE

This course introduces the concepts of various AC & DC machines in Electrical Engineering discipline. The emphasis of this course is laid on the machines which include D.C. Generators, D.C Motors, Single phase transformers, Auto transformers & Poly phase transformers.

UNIT - I

D.C. Generators

Construction & Principle of Operation of D.C. Generators – E.M.F Equation- Types of D.C Generators –Armature reaction –Methods of decreasing the effects of armature reaction– Compensating winding-Commutation– Methods of improving commutation.– O.C.C-Voltage build up in generators-Critical field resistance and critical speed - Causes for failure to self excite and Remedial measures–Load characteristics of shunt, series and compound generators.

UNIT - II

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–Speed control-3 point and 4 point starters–Constant and Variable losses-calculation of efficiency – condition for maximum efficiency – brake test – Swinburne's test –Hopkinson's test.

UNIT - III

Single phase transformers

Types - constructional details-emf equation - operation on no load and on load - phasor diagrams– Equivalent circuit - losses and efficiency-regulation. All day efficiency-effect of frequency & supply voltage on core losses- minimization of hystersis and eddy current losses.

UNIT - IV

Testing of Single Phase Transformer

O.C and S.C tests - Sumner's test - predetermination of efficiency and regulation-separation of losses test-Parallel operation with equal and unequal voltage ratios.

UNIT - V

Auto transformers & Poly-phase transformers

Auto transformers- comparison with two winding transformers-Poly-phase transformers – Poly-phase connections - Y/Y, Y/Δ, Δ/Y, Δ/Δ - open Δ-Scott connection -three winding transformers-tertiary windings-determination of Zp, Zs and Zt transients in switching - off load and on load tap changing.

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TEXT BOOK

Electric Machines –by I.J.Nagrath & D.P.Kothari,Tata Mc Graw Hill, 7th Edition.2005

REFERENCES

1. Electric Machinery – A. E. Fitzgerald, C. Kingsley and S. Umans, Mc Graw-Hill Companies, 5th editon
2. Electrical Machines – P.S. Bimbra. Khanna Publishers
3. Electric Machines –by Ashfaq Husain, Danapati Rai&Co, New Delahi, 2002 edition.

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T280 – POWER SYSTEMS - I

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

OBJECTIVE

Electrical power plays significant role in day to day life of entire mankind. This course concerns with various types of power generation (renewable and non-renewable) along with its economic aspects.

UNIT - I

THERMAL AND NUCLEAR POWER STATIONS

Thermal Power Station: Line diagram of thermal power station showing paths of coal, steam, water, air, ash and flue gasses- Brief description of TPS components: Boilers, super heaters, Economizers, turbines, condensers, cooling towers and chimney.

Nuclear Power Stations: Working principle, nuclear fuels, nuclear reactor components: Moderators, control rods, Reflectors and coolants. Types of nuclear reactors and brief description of PWR, BWR and FBR. Radiation hazards and shielding.

UNIT - II

GAS AND SOLAR POWER GENERATION

Gas power station: Principle of operation and components (block diagram approach only).

Solar power generation: Line diagram of solar energy storage, solar energy collector, point focusing collector, solar power generation.

UNIT - III

WIND AND BIO-MASS ENERGY

Wind Energy: Basic principles of WEC,site selection consideration, basic components of WECS,classification of WECS,Wind energy collectors.

Bio-Mass Energy: 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 - IV

ECONOMIC ASPECTS OF POWER GENERATION

Load curve, load duration and integrated load duration curves, discussion on economic aspects: connected load, maximum demand, demand factor, load factor, diversity factor, capacity factor, capacity, utilization and plant use factors – Numerical problems.

UNIT - V

TARIFF METHODS

Costs of generation and their division into fixed, semi-fixed and running costs. Desirable characteristics of a Tariff Methods, Tariff Methods: simple rate, flat rate, block rate, two-part, three-part, and power factor tariff methods.

TEXT BOOK

"Power Generation Technologies" – Paul Breeze, Elsevier Ltd, 2005 edition

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REFERENCES

1. Generation, Distribution and Utilization of Electrical Energy" by C.L.Wadhwa, New Age International (P) Ltd, 1999 edn.
2. "Principles of Power Systems" by V.K.Mehta & Rohit Mehta, S.Chand & Co. Ltd.
3. "Non-Conventional Energy Sources" by G.D.Rai, Khanna Publications.
4. "A Text Book on Power system Engineering" by A.Chakrabarti, M.L.Soni, P.V.Gupta & U.S.Bhatnagar, Dhanpat Rai & Co.
5. "Electrical power systems" by J.B.Gupta, S. K. Kataria & Sons, 2009

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T205 – FLUID MECHANICS AND HYDRAULIC MACHINERY

Lecture	: 4 Periods/week	Internal Marks	: 25
Tutorial	: 1 Period/Week	External Marks	: 75
Credits	: 4	External Examination	: 3 Hrs

OBJECTIVE

To understand the structure and the properties of the fluid. To know the complexities involved in solving the fluid flow problems. To study the energy exchange process in fluid mechanics handling incompressible fluids.

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.
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 - II

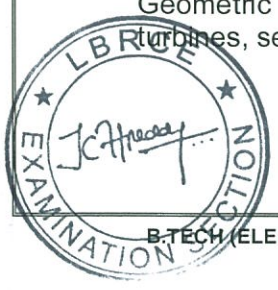
Closed conduit flow
Reynold's experiment- Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel- total energy line-hydraulic gradient line.
Measurement of flow: pilot tube, venturimeter, and orifice meter, Flow nozzle, Turbine flow meter .
Basics of turbo machinery
Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work don and efficiency, flow over radial vanes.

UNIT - III

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.
Hydraulic Turbines
Classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies , hydraulic design –draft tubetheoryfunctions and efficiency.

UNIT - IV

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.



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UNIT - V

Centrifugal pumps
Classification, working, work done – manomertic 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.

REFERENCES

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)..

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P822 – ELECTRICAL CIRCUITS LAB.

Lab.	**: 3 Periods/week**	**Internal Marks**	**: 25**
		External Marks	**: 75**
Credits	**: 2**	**External Examination**	**: 3 Hrs**

PART-A: ELECTRICAL CIRCUITS

1) RMS Value of complex waveform
2) Verification of superposition Theorem and maximum power transfer theorem
3) Verification of Thevenin's and Norton's Theorem
4) Verification of Compensation & Reciprocity Theorem
5) Measurement of parameters of a choke coil
6) Determination of Self, Mutual Inductances and Coefficient of coupling
7) Z and Y Parameters, Transmission and hybrid parameters
8) Measurement of Active & Reactive power and pf for Star and Delta connected balanced loads

PART-B: PSPICE SIMULATION

09) Transient response of RL and RC circuits for DC Input
10) Loop and Nodal Analysis

Additional experiments

11) Series and parallel resonance
12) Measurement of power by two wattmeter method for 3- phase unbalanced loads

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P834 – FLUID MECHANICS AND HYDRAULIC MACHINES LAB.

Lecture	**: 3 Periods/week**	**Internal Marks**	**: 25**
		External Marks	**: 75**
Credits	**: 2**	**External Examination**	**: 3 Hrs**

LAB EXPERIMENTS LIST

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

ADDITIONAL EXPERIMENTS

11. Performance Test on Reciprocating Pump.
12. Turbine flow meter.

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T199 – ENVIRONMENTAL STUDIES

Lecture	**: 3 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1**	**External Marks**	**: 75**
Credits	**: 3**	**External Examination**	**: 3 Hrs**

UNIT - I

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

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 modem 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. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles. **[11 Lectures]**

UNIT – II

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.

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. - India as a mega diversity 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.

[11 Lectures]

UNIT – III

Environmental Pollution: Definition, Types, 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. **[11 Lectures]**

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UNIT – IV

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. **[11 Lectures]**

UNIT – V

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. 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. **[11 Lectures]**

TEXT BOOKS

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

REFERENCES

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

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T281 – POWER SYSTEMS - II

Lecture	: 4 Periods/week	Internal Marks	: 25
Tutorial	: 1 Period/Week	External Marks	: 75
Credits	: 4	External Examination	: 3 Hrs

OBJECTIVES

It deals with basic theory of transmission lines modeling and their performance analysis. It also deals with AC distribution systems, classification & types and about underground cables.

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, 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, Sag calculations and numerical problems.

UNIT - II

Performance 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, Shunt compensation. 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 . Skin effect, Proximity effect and Ferranti effect, P.U. system and examples.

UNIT - III

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.

UNIT - IV

AC Distribution Systems
Tie Lines, Sectionalization lines, Radial and Meshed lines, distribution line power flow, loss calculations, reconfiguring the system for loss minimization, conductor selection, loadability, SCADA. Power factor control: Different types of power capacitors, shunt and series capacitors, effect of shunt capacitors power factor correction and capacitor location.
Voltage control: Equipment for voltage control, effect of series capacitors, effect of AVB/AVR, line drop compensation.

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UNIT - V

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, Failure of GIS.

TEXT BOOK

Transmission And Distribution Electrical Energy By Colin Bayliss

REFERENCES

1. "Power System Analysis" by John J Grainger, William D Stevenson, TMH Company, 4th edn.
2. "Generation,Distribution and Utilization of Electric Energy" by C.L.Wadhawa New age International (P) Limited, 2002 edn.

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T294 – PULSE AND DIGITAL CIRCUITS

Lecture	: 4 Periods/week	Internal Marks	: 25
Tutorial	: 1	External Marks	: 75
Credits	: 4	External Examination	: 3 Hrs

OBJECTIVE

The course has been designed to give an overall view of I/O signals,RC networks as integrator,differentiator and attenuators.The students get familiarized with diode,clippers and transistors and their characteristics.The students will be able to analyse and design multivibrators.They also get familiarized with time based generators and sampling gates.

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 ofdiode 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.

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

UNIT - IV

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.

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.

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UNIT - V

SAMPLING GATES

Basic operating principles of sampling gates, Unidirectional and Bi-directional sampling gates, Reduction of pedestal in gate circuits, Applications of sampling gates. 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, 4th 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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T196 – ENGINEERING THERMO DYNAMICS

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1 Period/Week**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

OBJECTIVE

In this subject students are able to understand Laws of Thermodynamics, energy exchange processes, and cycle analysis to simple heat engine cycles to estimate thermal efficiency as a function of pressures and temperatures at various points in the cycle

UNIT - I

Basic Concepts and Definitions: Introduction, Macroscopic and Microscopic View Point, System, Control Volume, Properties of System, State and Equilibrium-Thermodynamic Equilibrium, Processes –Quasi static process, Cycle,Temperature, Zeroth law of Thermodynamics, Energy-Forms of Energy, Heat, Work, Mechanical forms of Work, Path and Point Functions.

UNIT - II

First Law of Thermodynamics: Introduction, Energy Change of System, First Law Analysis of Closed System- Moving Boundary Work -Polytrophic Process, Internal Energy, Specific Heat
First Law Analysis of Control Volume: Volume-Conservation of Mass, Conservation of Energ Principle-Flow work, Total Energy of Flowing Fluid, The Steady Flow Process-Steady Flow Energy Equation, Steady Flow Engineering Devices-Nozzles, Diffusers, Turbine, Compressors, Throttling Valves.

UNIT - III

Second Law of Thermodynamics: Introduction, Thermal Energy Reservoirs, Heat Engines, Kelvin-Plank & Clasius Statements of Second law of Thermodynamics, Refrigerators, Heat Pumps, Equivalence of Kelvin-Plank and Clasius Statements, Perpetual Motion Machines, Reversible and Irreversible Process, Carnot Cycle, Carnot Principles.
Entropy: Introduction, Clasius Inequality, Property Diagrams, Isentropic relations for ideal gases, Principle of Increase of Entropy-Closed and Control Volumes. Third Law of Thermodynamics.

UNIT - IV

Pure Substance: Introduction, Phases of Pure Substance, Phase Change Processes, Property Diagrams (T-v, P-v, P-T), P-v-T Surface.
Vapor Power Cycles- Analysis of Carnot Vapor Cycle, Simple Rankine Cycle

UNIT - V

Gas Power Cycles: Introduction, Analysis of Power Cycles- Carnot, Otto, Diesel, Dual and Brayton.
Refrigeration Cycles –Reversed Carnot Cycle, Bell-Coleman Cycle, Simple Vapor Compression Cycle.

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TEXT BOOK

Fundamentals of Engineering Thermodynamics- Second Edition, E. Rathakrishnan-PHI

REFERENCES

1. Thermodynamics: An Engineering Approach—Cengel, Y.A and Boles, M.A. McGraw-Hill
2. Fundamentals of Classical Thermodynamics -- G.J.Van Wylen & Sonntag.TMH
3. Engineering Thermodynamics -- P.K.Nag, TMH

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T266 - OBJECT ORIENTED PROGRAMMING (C++)

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1 Period/Week**	**External Marks**	**: 75**
Credits	**: 4**	**External Examinations**	**: 3 Hrs**

UNIT - I

Introduction:
OOP Paradigm ,OOPS principles, Merits of OOP languages, Demerits of Procedure Oriented Programming languages C++ Overview, Data types, Identifers,Operators,Type casting, C++ Characteristics, Difference between class and structure, declaration of variables, dynamic initialization of variables, new and delete operators, I/O Manipulators.

UNIT - II

Classes and Objects:
Defining Classes in C++, accessing class members, access specifies(Public and Private),defining member functions, static data members, static member functions, friend functions, friend classes, inline functions, nested classes, passing objects to functions, returning objects, object assignment, Array of objects, constructor and destructor, Constant and volatile keywords, constant and volatile member functions

UNIT - III

Inheritance:
Base class, derived class, access specifier (Protected), scope rules, abstract base class, virtual base class, single inheritance, multiple inheritance, multilevel inheritance, hierarchical inheritance and hybrid inheritance, calling base class constructors.
String class-Usage of standard library *string class* with example programs.

UNIT - IV

Polymorphism:
Pointers, Pointers to objects, 'this' Pointer, Pointers to derived Classes. Concept of Polymorphism, Compile time Polymorphism: Operator Overloading, Overloading Unary Operators, and Overloading Binary Operators, Function Overloading,
Run time Polymorphism: Virtual functions, Pure Virtual Functions.
Templates: Introduction, Class Templates, Function Templates.

UNIT - V

Files and Exception Handling:
Exception Handling: Introduction, Mechanism, try, throw, catch, specifying Exceptions.
I/O Streams: C++ Streams, C++ Stream classes, Unformatted I/O Operations, Formatted I/O Operations, Formatting using Manipulators.
C++ Files: Introduction, Classes for file stream Operations, Opening and closing a file, detecting end-of-file, I/O Operations, command line arguments.

TEXT BOOK

Herbert Schildt, The Complete Reference C++, Fourth Edition, Tata McGraw Hill.

REFERENCES

1. E.Balaguru Swamy, Object Oriented Programming with C++, Third Edition, TMH.
2. Deitel & Deitel, C++ How to Program, Third Edition, Pearson Education.
3. Ashok N Kamthane, Object Oriented Programming with ANSI& Turbo C++.

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T182 – ELECTRICAL MACHINES - II

Lecture	: 4 Periods/week	Internal Marks	: 25
Tutorial	: 1 Period/Week	External Marks	: 75
Credits	: 4	External Examination	: 3 Hrs

OBJECTIVE

This subject facilitates to study and the performance of induction motors which is main drive for industrial applications. This subject also introduces the study and performance of synchronous machines.

UNIT - I

Poly-phase induction motors:
Poly-phase induction motors-construction details-Production of a rotating magnetic field - principle of operation - rotor emf and rotor frequency - rotor reactance, rotor current and power factor- equivalent circuit - phasor diagram - crawling and cogging-power stages

UNIT - II

Performance 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 characteristics - condition for maximum torque– relation between torque and slip – losses and efficiency –no load and blocked rotor test –equivalent circuit – circle diagram – induction generator.

UNIT - III

Single phase induction motors:
Single phase induction motors – principle of operation - double revolving field theory -split phase induction motor, capacitor start induction run motor, shaded pole induction motor– equivalent circuit.

UNIT - IV

Synchronous Generators:
Synchronous generator – construction, working principle- emf equation–armature reaction – regulation methods – EMF, MMF,ZPF methods – synchronizing to infinite bus bars – two reaction theory – parallel operation of synchronous generators.

UNIT - V

Synchronous Motors:
Synchronous motor – constructional features, principle of operation of synchronous motor – methods of starting – power developed by a synchronous motor –synchronous motor with different excitations – effect of increased load with constant excitation, effect of changing excitation constant load – torque equation – V curve and inverted V curve – hunting..

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TEXT BOOK

Electric Machines –by I.J.Nagrath & D.P.Kothari,Tata Mc Graw Hill, 7th Edition.2005

REFERENCES

1. Electric Machinery – A. E. Fitzgerald, C. Kingsley and S. Umans, Mc Graw-Hill Companies, 5th editon
2. Electrical Machines – P.S. Bimbra. Khanna Publishers
3. Electric Machines –by Ashfaq & Hussain

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P823 – ELECTRICAL MACHINES – I LAB.

Lecture	**: 3 Periods/week**	**Internal Marks**	**: 25**
		External Marks	**: 75**
Credits	**: 2**	**External Examination**	**: 3 Hrs**

LIST OF EXPERIMENTS

S.No	Name of the Experiment
1	O.C & S.C tests on 1-phase transformer
2	Sumpner's test on a pair of 1-phase transformers
3	Load Test on 1-phase Transformer
4	Scott Connection
5	Polarity Testing of a transformer
6	Magnetization characteristics of a D.C. shunt generator
7	Swinburne's test on D.C. shunt machine & Speed control of D.C. motor
8	Brake test on D.C. shunt motor
9	Hopkinson's test
10	Separation of stray losses in a D.C. motor.
	Additional Experiments
11	Load characteristics of a separately excited D.C. motor using Lab- view
12	Calculation of voltage regulation for a 1-phase transformer using lab-view

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P861 – OBJECTED ORIENTED PROGRAMMING (C++) LAB

Lab.	**: 3 Periods/week**	**Internal Marks**	**: 25**
		External Marks	**: 75**
Credits	**: 2**	**External Examination**	**: 3 Hrs**

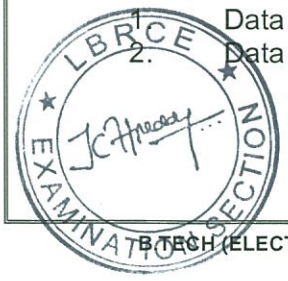
Objectives:

- To make the students familiar with the concepts of Object Oriented Programming using C++

1. Write a C++ program to find the sum of individual digits of a positive integer.
2. Write a C++ program to generate the first 'n' terms of the sequence. A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are formed by adding the preceding two terms in the sequence.
3. Write a C++ program to generate all the **prime numbers** between 1 and n. Where 'n' is a value supplied by the user.
4. Write a C++ programs that use both **recursive** and **non-recursive** functions
   a) To find the factorial of a given integer.
   b) To find the GCD of two given integers.
   c) To find the n^{th} Fibonacci number.
5. Write a C++ program to perform addition, subtraction and multiplication operations on two complex numbers using **classes and objects.**
6. Write a C++ program to find out the total and average marks of 10 students using **Classes and objects?**
7. Write a C++ program to implement **static data members** and **static member functions**
8. Write a C++ program to implement the **matrix ADT using** a class. The operations Supported by this ADT are:
   a) Reading a matrix. c) Addition of matrices.
   b) Displaying a matrix d) Multiplication of matrices.
9. Write a C++ program to illustrate the usage of following:
   Default Constructor, **Parameterized** Constructor, **Copy** Constructor and **Destructor**
10. Write a C++ program that illustrates the following:
    a) **Friend** Function b) **inlin**e function
11. Write C++ programs that illustrates the usage of following forms of **inheritance.** (Exercise the access specified *protected* also)
    a) Single Inheritance b) Multiple Inheritance
    c) Multi level Inheritance d) Hierarchical Inheritance
12. Write a C++ program to count the lines, words and characters in a given text using standard library **string object.**
13. Write a C++ program that illustrates the concept of **Function over loading**?
14. Write a C++ program that overloads the **binary + operator** to concatenate two strings and to add two complex numbers.
15. Write a C++ program that overloads the **unary ++ operator** to increment each element of the given one dimensional array by '1'?
16. Write a C++ program that illustrates **run time polymorphism** by using virtual functions.
17. Write a **template** based C++ program to check whether the given item is existed in the array or not.
18. Write an example C++ program to illustrate the procedure of **exceptions handling.**
19. Write a C++ program to display the contents **of a text file.**
20. Write a C++ program which **copies the contents of one file to another.**

TEXT BOOKS

1. Data Structures and Algorithms in C++, Third Edition, Adam Drozdek, Thomson.
2. Data Structures using C++, D.S. Malik.



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V-SEMESTER

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T235 – LINEAR AND DIGITAL IC APPLICATIONS

Lecture	: 4 Periods/week	Internal Marks	: 25
Tutorial	: 1 Period/Week	External Marks	: 75
Credits	: 4	External Examination	: 3 Hrs

OBJECTIVE

To teach the basic concepts in the design of electronic circuits using linear integrated circuits and their applications in the processing of analog signals.

UNIT - I

OPERATIONAL AMPLIFIER

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.

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 - II

ACTIVE FILTERS & OSCILLATORS

Introduction, 1^{st} 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 - III

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.

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 - IV

LOGIC FAMILIES

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 .

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.

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UNIT - V

SEQUENTIAL CIRCUITS & MEMORIES

74XX & CMOS 40XX series of IC counters.
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, 2nd Ed., 2003.
2. Digital Fundamentals – Floyd and Jain, Pearson Education, 8th 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, 3rd Ed., 2002.
4. Applications and Design with Analog Integrated Circuits by J.Michael Jacob 2nd Edition, PHI, 2000.
5. Op-Amps & Linear ICs – Ramakanth A. Gayakwad, PHI, 1987.

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T183 – ELECTRICAL MEASUREMENTS AND INSTRUMENTATION

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1 Period/Week**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

OBJECTIVE

To make the student have a clear knowledge of the basic laws governing the operation of the instruments, relevant circuits and their working. Introduction to general instrument system, error, calibration etc.Emphasis is laid on analog and digital techniques used to measure voltage, current, energy and power etc.

UNIT - I

Measuring Instruments
Classification of measuring instruments, Essentials of indicating instruments: deflecting, controlling and damping systems. Construction, working, torque equation, various advantages and disadvantages of MI (attraction and repulsion), and PMMC. Ammeter and Voltmeter theory: Extension of range of ammeters and voltmeters using shunt, multiplier. Universal shunt, Universal multiplier.

UNIT - II

Measurement of R, L, C
Measurement of Resistance:Voltmeter-ammeter method. Kelvin's Double Bridge, Megger. A.C. Bridges: sources & detectors for A.C bridge, General equation for bridge at balance. Measurement of Inductance: Maxwell's Inductance – Capacitance Bridge, Andersons Bridge. Measurement of Capacitance: Schering Bridge.

UNIT - III

Special purpose measuring instruments:
Instrument Transformers: Construction, connection of CT & PT in the circuit, advantages of CT / PT over shunt and multipliers for range extension, transformation ratio, turns ratio, nominal ratio, burden etc, and ratio and phase angle error. Power factor meter, Frequency meter. Potentiometers: Principle of D.C. & A.C. Potentiometer (only Crompton's type) & its applications.

UNIT - IV

Measurement of power and Energy
Wattmeter theory: Construction, working, torque equation, errors and their compensation in dynamometer type wattmeter, low power factor wattmeter, poly-phase wattmeter. Measurement of reactive power, determination of power factor of the load and its nature in terms of two wattmeter readings. Energy meter theory: Construction, working, torque equation, errors and adjustments of single phase conventional (induction type) energy meter. Three phase energy meters.

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UNIT - V

INSTRUMENTATION

Transducers, classification & selection of transducers, strain gauges, inductive transducers, LVDT, capacitive transducers, piezoelectric and Hall-effect transducers, photo-voltaic & photo-conductive cells.

TEXT BOOKS

1. Electrical measurement & measuring instrument by E. W. Golding & widing, Fifth edition,
   A. H. Wheeler & Co. ltd.
2. A Course in Electrical and Electronic measurements & Instrumentation – by A. K. Sawhaney, Dhanpat Rai & Suns

REFERENCES

1. A Course in Electronic and Electronic measurements by J. B. Gupta, S. K. Kataria & Sons.
2. Instrumentation: Measurement and Analysis by Nakra & Chaudhari Sixth Reprint, Tata McGraw Hill, New Delhi.
3. Introduction to Measurements and instrumentation by Ghosh, Second Edition PHI Publication.
4. Introduction to Measurements and instrumentation by Anand PHI Publication.

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T148 – CONTROL SYSTEMS

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1 Period/Week**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

OBJECTIVE

In this course it is aimed to introduce to the students the principles and applications of control systems in everyday life. The basic concepts of the 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

Control system modeling
Concepts of control systems- Open loop and closed loop control systems. Characteristics of feedback control systems: System concept, differential equations and transfer functions. Modeling of electric systems, translational and rotational mechanical systems, and Simple electromechanical systems. Block diagram representation of systems – Block diagram reduction methods – Closed loop transfer function, determination of signal flow graph. Mason's gain formula. Control System Components: Stepper motors – AC servo motor - DC servo motor – Synchros.

UNIT - II

Time domain analysis
Test signals – time response of first order and second order systems – time domain specifications – types and order of systems – generalized error co-efficient – steady state errors – concepts of stability – Routh-Hurwitz stability – root locus.

UNIT - III

Frequency domain analysis
Introduction – correlation between time and frequency response – stability analysis using Bode plots, Polar plots, Nichols chart and Nyquist stability criterion – Gain margin – phase margin.

UNIT - IV

Compensators
Realization of basic compensators – cascade compensation in time domain and frequency domain and feedback compensation – design of lag, lead, lag-lead compensator using Bode plot and Root locus. Introduction to P, PI and PID controllers.

UNIT - V

State variable analysis
State variable methods - introduction to the state variable concept - state space models - physical variable - phase variable and diagonal forms from time domain –diagonalisation - solution of state equations – homogenous and non homogenous cases - properties of state transition matrix - relation between transfer function and state space models , Controllability and Observability.

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TEXT BOOKS

Modern Control Engineering, Ogata.K, Prentice Hall of India, 5th Edition.

REFERENCES

1. Automatic Control Systems, Benjamin.C.Kuo, 7th Edition – Prentice Hall of India, 2002.
2. Control Systems, M.Gopal, Tata McGraw-Hill, 1997.
3. "*Modern Control Systems*", Dorf R.C. & Bishop R.H., Addison Wesley.
4. Control System Engineering, 3rd Edition, Nagrath & Gopal, New Age International Edition, 2002.

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T146 – COMPUTER ORGANIZATION

Lecture	: 4 Periods/week	Internal Marks	: 25
Tutorial	: 1 Period/Week	External Marks	: 75
Credits	: 4	External Examination	: 3 Hrs

UNIT - I

Register Transfer Language And Microoperations: Register Transfer language, register Transfer Bus and memory transfers, Arithmetic Mircrooperatiaons, logic micro operations, shift micro operations, Arithmetic logic shift unit.

Basic Computer Organization And Design: Instruction codes. Computer Registers ,Computer instructions– Instruction cycle. Memory – Reference Instructions. Input – Output and Interrupt.

UNIT - II

Micro Programmed Control: Control memory, Address sequencing, microprogram example, design of control unit Hard wired control. Micro programmed control **Central Processing Unit:** STACK organization. Instruction formats. Addressing modes. DATA Transfer and manipulation. Program control. Reduced Instruction set computer.

UNIT - III

Pipelining And Vector Processing: parallel processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC pipeline, Vector Processing

Computer Arithmetic : Data Representation. Fixed Point Representation. Floating – Point Representation ,Addition and subtraction, multiplication Algorithms, Division Algorithms, Floating – point Arithmetic operations. Decimal Arithmetic unit Decimal Arithmetic operations

UNIT IV

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory. Associative Memory Cache Memory, Virtual Memory

UNIT V

INPUT-OUTPUT ORGANIZATION : Peripheral Devices, Input-Output Interface, Asynchronous data transfer Modes of Transfer, Priority Interrupt, Direct memory Access, Input –Output Processor (IOP) Serial communication

TEXT BOOK

Computer Systems Architecture – M.Moris Mano, IIIrd Edition, Pearson/PHI

REFERENCES

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

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T140 – COMMUNICATION SYSTEMS

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**:**	**External Marks**	**: 75**
Credits	**: 3**	**External Examination**	**: 3 Hrs**

OBJECTIVE

To understand theory and principles of modern communication systems that addresses the variety, reality, complexity, and pervasiveness of today's communication systems Topics included are AM modulation transmission and reception, FM modulation transmission and reception, single sideband communication (SSB) communication technique, Digital, wi communication and wireless digital communication.

UNIT - I

AMPLITUDE MODULATION SYSTEMS

Need for modulation, normal AM, generation and demodulation (envelop & synchronous detection), modulation index, SSB: Generation using filter and phasing method, detection. Frequency division multiplexed systems using SSB.

UNIT - II

ANGLE MODULATION SYSTEMS

Concept of frequency and phase modulation, frequency deviation and modulation index, FM spectra, Carson's rule, narrowband FM, generation of wideband FM Armstrong method, direct FM generation. Demodulation of FM discriminatory, PPL.

UNIT - III

SAMPLING AND DISCRETE TIME MODULATIONS

Sampling theorem – low pass and band pass, Pulse Amplified Modulation (PAM), Pulse width Modulation (PWM), Pulse Position Modulation (PPM) their generation and detection-phase time division multiplying

Review of random signals and noise, signal to noise ratio in amplitude and angle modulated systems. Thermal shot noise.

UNIT - IV

DIGITAL COMMUNICATION

PCM, Quantization noise, bandwidth, advantages over analog communication, PCM system, Differential PCM, Delta Modulation, Digital Modulation – Concepts of ASK, and Concepts of FSK, and Concepts of PSK , and Concepts of DPSK, Digital Multiplexing.

UNIT - V

SATELLITE & FIBRE OPTIC COMMUNICATIONS

Transmit and Receive Antennas, Line of sight systems, satellite link-GT ratio of earth station, VSATS and Concepts of FDMA, and Concepts of TDMA, Concepts of CDMA.

OPTICAL COMMUNICATION SYSTEMS-Types of optical fibres – step index & graded index, Numerical aperture, multimode and single mode. Attenuation and dispersion in fibers. Optical transmitters LEDS and Laser Diode. Optical Receivers – PIN and APDs.

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TEXT BOOKS

1. "Communication Systems", 3rd Edition, Haykins Simon, John Wiley, Singapore, 1984.
2. "Modern Communication Systems", Couch Lenon, W. Prentice Hall, India 1998.

REFERENCES

1 "Optical Fiber Communications", 2nd Edition, Keiser Gerd, McGraw Hill (international Student Edition), 1991.
2. "Modern Digital & Analog Communication System", Lathi, Oxford University

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T344 – LINEAR SYSTEM ANALYSIS

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

OBJECTIVE

This course covers Fourier series and transform, and their applications, Laplace transform applications to electrical circuits, sampling of systems and Z-transforms and its inverse. Students will get knowledge on signals and systems and their applications.

UNIT–I
FOURIER SERIES AND FOURIER TRANSFORM REPRESENTSATION
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-II
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 – III
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-IV
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-V
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
3. "Communication Systems", 3rd Edition, Haykins Simon, John Wiley, Singapore, 1984.
4. "Modern Communication Systems", Couch Lenon, W, Prentice Hall, India 1998.

REFERENCE BOOKS:

1. Optical Fiber Communication", 2nd Edition, Keiser Gard, McGraw Hill (International Student Edition). 1991.
2. Modern Digital & Analog Communication System", Lathi, Oxford University

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T290 – PROFESSIONAL ETHICS

Lecture	: 4 Periods/week	Internal Marks	: 25
Tutorial	: 1 Period/Week	External Marks	: 75
Credits	: 3	External Examination	: 3 Hrs

UNIT - I

ENGINEERING ETHICS

Senses of 'Engineering Ethics' variety of moral issued types of inquiry moral dilemmas moral autonomy Kohlberg's theory Gilligan's theory consensus and controversy – Models of Professional Roles theories about right action Selfinterest customs and religion uses of ethical theories.

UNIT - II

HUMAN VALUES

Morals, Values and Ethics – Integrity – Work Ethic – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – caring – Sharing – Honesty – Courage – Valuing Time – Cooperation – Commitment – Empathy – SelfConfidence – Character – Spirituality

UNIT - III

ENGINEERING AS SOCIAL EXPERIMENTATION

Engineering as experimentation engineers as responsible experimenters codes of ethics a balanced outlook on law the challenger case study

UNIT - IV

SAFETY, RESPONSIBILITIES AND RIGHTS

Safety and risk assessment of safety and risk risk benefit analysis and reducing risk the three mile island and chernobyl case studies. Collegiality and loyalty respect for authority collective bargaining confidentiality conflicts of interest occupational crime professional rights employee rights Intellectual Property Rights (IPR) discrimination.

UNIT - V

GLOBAL ISSUES

Multinational corporations Environmental ethics computer ethics weapons development engineers as managersconsulting engineersengineers as expert witnesses and advisors moral leadershipsample code of Ethics (Specific to a particular Engineering Discipline).

TEXT BOOKS

1. Mike Martin and Roland Schinzinger, "Ethics in engineering", McGraw Hill, New York 1996.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, " Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCES

1. Charles D. Fleddermann, "Engineering Ethics", Pearson Education/ Prentice Hall, New Jersey,2004 (Indian Reprint now available)
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, " Engineering Ethics – Concepts and Cases", Wadsworth Thompson Leatning, United States, 2000 (Indian Reprint now available)
3. John R Boatright, " Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.
4. Edmund G Seebauer and Robert L Barry, " Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.

P824 – ELECTRICAL MACHINES LAB – II

Lab.	**: 3 Periods/week**	**Internal Marks**	**: 25**
		External Marks	**: 75**
Credits	**: 2**	**External Examination**	**: 3 Hrs**

LIST OF EXPERIMENTS

1. Brake test on squirrel cage induction motor
2. Regulation of 3-phase alternator by synchronous impedance & MMF method
3. Regulation of 3-phase alternator by ZPF method
4. No load & blocked rotor test on 3-phase induction motor
5. V & inverted V curves of a synchronous motor
6. Equivalent circuit of 1-phase induction motor
7. Determination of x_d and x_q of a salient pole synchronous machine
8. Load test on of 3-phase alternator
9. Break test on of single phase induction motor
10. Load test on of slip ring induction motor

ADDITIONAL EXPERIMENTS

11 Torque-Speed characteristics of induction motors using Lab- view

12 Speed control of Induction motor using MATLAB / Simulink

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P814 – CONTROL SYSTEMS AND INSTRUMENTATION LAB.

Lab.	**: 3 Periods/week**	**Internal Marks**	**: 25**
		External Marks	**: 75**
Credits	**: 2**	**External Examination**	**: 3 Hrs**

LIST OF EXPERIMENTS

CONTROL SYSTEMS LAB

1. Time Response of Second Order System.
2. Effect of P, PD, PI, PID controller on second order systems.
3. Characteristics of AC servo motor.
4. Lag and lead compensation – Magnitude & phase plot
5. Determination of transfer function and effect of feedback on dc servo motor.
6. Design of controller for 2nd order system by using MATLAB.

INSTRUMENTATION LAB

7. Measurements of unknown resistance, inductance, and capacitance using Bridges
8. To plot the displacement –voltage characteristics of the given LVDT
9. Measurement of ratio and Phase angle error by using CT & PT
10. Plot the output characteristics of a torque transducer.

ADDITIONAL EXPERIMENTS

11. PLC- study and verification of truth tables of logic gates simple Boolean expressions and application of speed control of motor
12. Stepper motor control using LABVIEW.

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T279 – POWER SYSTEM PROTECTION AND SWITCHGEAR

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

OBJECTIVES

This course deals with relays and circuit breakers for protection of generators, transformers, and feeder bus bars from over current, over voltage and other hazards.

UNIT - I

Protection
Importance of protective relaying- Causes and consequences of dangerous currents; faults, overloads and switching over currents, fundamental requirements of good protection scheme-Primary & back up protection- speed of operation of a relay, upper and lower limits for the time of relay operation.

UNIT - II

Switch Gear
Physics of arc phenomena – maintenance of the arc – losses – arc interruption theories – circuit breaker rating – characteristics of restriking voltage – current chopping – Classification of C.Bs: AC & DC Circuit breakers-types of circuit breakers – air break CB, Air blast CB, Oil CB, Vacuum CB,SF6 CB- and their constructional features.

UNIT - III

Classification of Relays
Relay classification –principle types of electromagnetic relays – theory of induction disc relay– general equation for electromagnetic relays.

UNIT - IV

Generator Protection: Protection against stator and rotor faults and abnormal operating conditions such as unbalanced loading, loss of excitation, Over speeding.
Transformer Protection: Types of faults, Over current protection, Differential protection, Protection against high resistance ground faults, Interturn faults, Bucholz relay,CT's ratio selection.
Bus bars and Feeder Protection: differential protection of bus bars
Over Current relays: Instantaneous, DMT and IDMT and Directional relay applications, differential protection of lines, translay relay protection, Distance protection.

UNIT - V

Over Voltage Protection
Causes of over voltages: lightning, switching, insulation failure and arching grounds, methods of protection-ground wire, Peterson coils, surge absorbers and diverters , location of protective apparatus – insulation coordination- neutral earthing.

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TEXT BOOKS

Power System Protection by PM Anderson

REFERENCES

1. "Art and Science of Protective Relaying" by C.L. Mason.
2. "Power System Stability", by E.W .Kimbark, vol-II John Wiley & Sons.
3. "Power System Engineering", by Nagarath and Kothari, TMH publishing company Ltd.
4. "Electrical power systems", by C. L. Wadhawa, Wiley Eastern Ltd.
5. "A Text Book on Power System Engineering", by A. Chakrabarthi, M.L. Soni, P.V. Gupta and U.S. Bhatnagar, Dhanpat Rai & Co.
6. "Switch Gear Protection and Power Systems", by Sunil S Rao, Khanna Publications.

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T221 - INDUSTRIAL MANAGEMENT

Lecture	: 4 Periods/week	Internal Marks	: 25
Tutorial	:	External Marks	: 75
Credits	: 3	External Examination	: 3 Hrs

AIM

To make the student to understand concepts and contributions of Management, types of Organizations and also prepare them to have knowledge of several types of managements conducted in Industrial Organizations.

UNIT - I

Introduction

Management- Definition, Nature, importance and Functions of Management-Taylor's Scientific Management Theory, Fayol's Principles of Management, Contribution of Elton Mayo, Maslow, Herzberg, Douglas Mc Gregor. Basic concepts of Organization – Authority, Responsibility, Delegation of Authority, Span of Control, Departmentation and Decentralization-Organization Structures (Line organization, Line and staff organization, functional organization, Committee organization, matrix organization)

UNIT - II

Operations Management

Plant Location, Factors influencing location, Principles and Types of Plant Layouts-Methods of production (Job, batch and Mass Production), Work Study -Basic procedure involved in Method Study and Work Measurement.

UNIT - III

Quality and Materials Management

Statistical Quality Control-Meaning, variables and attributes- X chart, R chart, C chart, P chart, (simple Problems), Acceptance Sampling, Sampling plans, Deming's contribution to quality. Materials Management-Objectives, Need for Inventory control, Purchase Procedure, Store records, EOQ, ABC Analysis, stock levels.

UNIT - IV

Human Resource Management

HRM : Concepts of HRM, Basic functions of HR Manager: Manpower planning, Recruitment, Selection, Training and Development, Placement, Wage and Salary Administration, Promotion, Transfer, Separation, Performance Appraisal, Job Evaluation and Merit Rating.

UNIT - V

Project Management

Early techniques in Project Management- 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).

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TEXT BOOK

Dr. Aryasri: Management Science, TMH, 4th edition, 2009.

REFERENCES

1. Koontz and Weihrich – Essentials of Management, TMH, 8th edition, 2010
2. Stoner, Freeman, Gilbert, Management, 6th Ed, Pearson Education, New Delhi, 2004
3. O.P.Khana, Industrial Engineering and Management
4. L.S. Srinath, PERT & CPM

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T163 – DIGITAL SIGNAL PROCESSING

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**:**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

OBJECTIVE

To introduce the concept of DFT and its computation.To study the properties of DFS and FFS. To study the Z-transforms and its applications.To understand the basic structures of IIR and FIR systems. This course will help to understand the design techniques for digital filters.

UNIT - I

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. Introduction to Digitals and Signals.

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. 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 - III

Realization of Digital Filters
Review of Z-transforms, Applications of Z – transforms, Relation between Z-transform and DFS 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, MULTIRATE DIGITAL SIGNAL PROCESSING Introduction to Decimation, interpolation, sampling rate conversion, Implementation of sampling rate conversion.

UNIT - IV

FIR& IIR 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. Analog filter approximations – Butter worth and Chebyshev, Design of IIR Digital filters from analog filters, Design Examples: Analog-Digital transformations.

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UNIT - V

Architecture of TMS320XXX

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.
Introduction –Architectural overview – Memory and I/O spaces -Internal architecture – Central Processing Unit (CPU) – Program control.

Addressing Modes and Assembly Language Instructions of C2xxx

Data formats – Addressing modes – groups of addressing mode – Assembly language instructions

TEXT BOOK

Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris G. Manolakis, Pearson Education / PHI, 2007

REFERENCES

1. Discrete Time Signal Processing – A.V.Oppenheim and R.W. Schaffer, PHI

2. Digital Signal Processing: Andreas Antoniou, TATA McGraw Hill , 2006
3. Digital Signal Processing: MH Hayes, Schaum's Outlines, TATA Mc-Graw Hill, 2007.
4. DSP Primer - C. Britton Rorabaugh, Tata McGraw Hill, 2005.
5. Fundamentals of Digital Signal Processing using Matlab – Robert J. Schilling, Sandra L.Harris, Thomson, 2007.
6. Fundanentals of DSP by Lonnie – C LUDEMAN by john willey & sons

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T255 – MICROPROCESSORS AND MICRO CONTROLLERS

Lecture	: 4 Periods/week	Internal Marks	: 25
Tutorial	: 1	External Marks	: 75
Credits	: 4	External Examination	: 3 Hrs

Objective :
The objective of the Microprocessor and Microcontrollers is to familiarize with the architecture of 8086 processor, assembling language programming and interfacing with various modules. Microcontroller concepts helps the student to do any type of industrial and real time applications by knowing the concepts of Microprocessor and Microcontrollers.

UNIT-I 8086 ARCHITECTURE
Introduction, Functional Diagram, Register Organization, Addressing modes, Instructions, Minimum and Maximum mode operations of 8086, 8086 Control signal interfacing, Timing Diagrams.

UNIT-II ASSEMBLY LANGUAGE PROGRAMMMING OF 8086
Assembly Directives, Macro's, Simple Programs using Assembler, Implementation of FOR Loop, WHILE, REPEAT and IF-THEN-ELSE Features.

UNIT-III INTERFACE
Memory and I/O Interfacing with 8086, 8255 PPI and interface to 8086, A/D, D/A Converter Interfacing. 8257 (DMA Controller),. USART, RS-232, 8259 (Interrupt Priority Control).

UNIT-IV 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- V INTERFACING AND INDUSTRIAL APPLICATIONS OF 8051
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. D.V.Hall, "Micro Processor and Interfacing ", Tata McGraw-Hill.
2. Microcontrollers-Raj Kamal, Pearson Education
3. Ajay V. Deshmukh, "Microcontrollers – theory applications", Tata McGraw-Hill Companies –2005.

REFERENCE BOOKS:

1. Ray and BulChandi, " Advanced Micro Processors", Tata McGraw-Hill.
2. Kenneth J Ayala, " The 8086 Micro Processors Architecture, Programming and Applications",Thomson Publishers, 2005.
3. Microcomputer Systems: The 8086/8088 Family: Architecture, Programming and Design, 2nd ed.,Liu & Gibson.
4. Kenneth J Ayala, " The 8051 Micro Controller Architecture, Programming and Applications", Thomson Publishers, 2nd Edition.

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T275 – POWER ELECTRONICS

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

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

Power semiconductor switches– SCR-GTO–power transistor-Power MOSFET-IGBT -Two transistor analogy of SCR- terminal characteristics–Turn on and Turn off methods-firing circuits–Dynamic characteristics–series and parallel operation- Rating and protection - Snubber circuits.

UNIT - II

PHASE-CONTROLLED CONVERTERS

Single phase controlled Half wave, Full wave rectifiers with R, RL and RLE loads–Single phase semi converter–Effect of Source impedance performance–Three phase half wave, Full wave rectifiers with R& RL-Load–3-phase semi converter–RMS, Average value.

UNIT - III

DC TO DC CONVERTERS

Chopper–Introduction, Principle of operation control Strategies, Step-up and step-down chopper–two quadrant chopper & four quadrant choppers-Chopper configurations–Type A,B,C,D & E choppers.

UNIT - IV

AC TO AC CONVERTERS & CYCLOCONVERTERS

AC voltage regulators–1-phase ac voltage controller with R and RL loads– Single phase to single phase cyclo-converters -basic principle of operation–Step up and step-down cycloconverter.

UNIT - V

INVERTERS

Single phase inverter–Voltage Source Inverter (VSI) -Analysis with R & RL loads- 3-phase inverters–180 and 120 mode of operation-PWM Techniques, Single Pulse Width Modulation, Multiple Pulse Width Modulation, Sinusoidal & Modified Sinusoidal PWM-Hysterysis Current Controlled PWM techniques– and Current Source Inverter(CSI)

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TEXT BOOK

Power Electronics: Circuits, Device and Applications, 2nd Edition, M.H. Rashid, PHI, New Jersey, 1993.

REFERENCES

1. Power Electronics Converters, Applications and Design, 3rd Edn., 2003, Mohan, Underland, Robbins; John Wiley & Sons Pte. Ltd.
2. Power Electronics control of AC motors – MD Murphy & FG Turn Bull Pergman Press -1st edition-1998

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T285 – PROBABILITY AND STATISTICS

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**:**	**External Marks**	**: 75**
Credits	**: 3**	**External Examination**	**: 3 Hrs**

UNIT - I

Probability: Sample space and events – Probability – The axioms of probability – Some Elementary theorems - Conditional probability – Baye's theorem.

UNIT - II

Random variables – Discrete and continuous distributions - Distribution function. Binomial, Poisson, normal distribution – related properties. Moment generating function, Moments of standard distributions, Evaluation of mean, standard, variance, kurtosis and skewness.

UNIT - III

Population and samples. Sampling distribution of mean (with known and unknown variance), proportion, variances. - Sampling distribution of sums and differences. Point and interval estimators for mean, variance and proportions.

UNIT - IV

Statistical Hypothesis – Errors of Type I and Type II errors and calculation. One tail and two-tailed tests. Testing of hypothesis concerning means, proportions and their differences using Z-test.

Tests of hypothesis using Student's t-test, F-test and χ^2 test. Applications of decision making using the above tests.

UNIT - V

Simple Correlation and Regression.

Queuing Theory: Pure Birth and Death Process M/M/1 Model and Simple Problems related to the evaluation of waiting time, length of the queue etc. ,

TEXT BOOK

Probability and Statistics for Engineers, Miller ,John E. Freund, PHI

REFERENCES

1. Probability and Statistics, Gupta & Kapoor
2. Probability, Statistics and Queuing theory applications for Comp. Sciences, 2/e, Trivedy, John Wiley

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T298 – RENEWABLE ENERGY SYSTEMS

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1**	**External Marks**	**: 75**
Credits	**: 3**	**External Examination**	**: 3 Hrs**

OBJECTIVE

Renewable Energy Systems are an important technology that has the potential to advance environmental goals and eventually support a sustainable future. In this subject students are exposed to solar, wind, fuel cells and biomass energy systems.

UNIT - I

ALTERNATIVE SOURCES OF ENERGY: Renewable Sources of Energy, Renewable Energy versus Alternative Energy, Planning and Development, Renewable Energy Economics, Modern Electronic Controls of Power Systems.

UNIT - II

WIND POWER PLANTS: Introduction, Appropriate Location, Wind Power, General Classification of Wind Turbines, Generators and Speed Control Used in Wind Power Energy Analysis of Small Generating Systems.

UNIT - III

THERMOSOLAR POWER PLANTS: Water Heating by Solar Energy, Heat Transfer Calculation of Thermally Isolated Reservoirs, Heating Domestic Water, Thermo solar Energy, Economical Analysis of Thermo solar Energy.

UNIT - IV

PHOTOVOLTAIC POWER PLANTS AND FUEL CELLS : Generation of Electricity by Photovoltaic Effect ,Dependence of a PV Cell Characteristic on Temperature , Solar Cell Output Characteristics, Photovoltaic Systems, Applications of Photovoltaic Solar Energy, The Fuel Cell, Constructional Features of Proton Exchange Membrane Fuel Cells and Solid Oxide Fuel Cells

UNIT - V

MICROPLANTS AND MICROTURBINES: Fuel from Biomass, Biomass for Biogas, Biological Formation of Biogas, Construction of Biodigester, Characteristics of Biodigesters, Micro turbine Fuel, Control and Operation of Micro turbine, Control of Micro turbines, Storage Systems: Lead–Acid Batteries, Ultra capacitors, Flywheels, Superconducting Magnetic Storage System.

TEXT BOOK

Integration of Alternative Sources of Energy, Felix a. Farret, M. Godoy simoes, a John Wiley & sons, inc., publication.

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REFERENCES

1. Biomass Renegerable Energy, D.O.hall and R.P. Overeed, John Wiley and Sons, Newyork, 1987.
2. Wind Turbine Technology: Fundamental concepts of wind turbine technology, Spera D.A, ASME Press, NY, 1994.
3. Renewable Sources of Energy and Conversion Systems, N.K.Bansal and M.K.Kleeman.
4. Handbook: Batteries and Fuel cell – Linden, Mc.Graw Hill.

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T316 – SPECIAL MACHINES

Lecture	: 4 Periods/week	Internal Marks	: 25
Tutorial	: 1	External Marks	: 75
Credits	: 3	External Examination	: 3 Hrs

OBJECTIVE

This course introduces the concepts of various advanced machines in Electrical Engineering discipline. The emphasis of this course is laid on the machines which includes Stepper Motors, Switched Reluctance Motors, Brushless DC Motors, Servomotors and Linear Motors.

UNIT - I

Stepper Motors
Constructional features, Principle of operation, Variable Reluctance (VR) stepping motor, Characteristics of Step Motor in Open Loop Drive, open loop and closed loop control of step motor. Areas of Application of Stepping Motors.

UNIT - II

Switched Reluctance Motors
Constructional features, Principle of operation. Torque equation, Torque-speed Characteristics, Power Converter for SR Motor, Drive and power circuits, Control of SR Motor for Traction-Type Load.

UNIT - III

Brushless DC Motors
Construction ,principle of operation of BLDM, Sensing and logic switching scheme, basic drive circuit ,power converter circuit, Transient analysis , methods of reducing torque pulsations , control strategies for BLDM.

UNIT - IV

Permanent Magnet Materials and Motors
Minor hysteresis loops and recoil line, stator frames of Conventional PM dc Motors, Equivalent circuit of a PM, Development of Electronically Commutated dc motor from Conventional dc motor.

UNIT - V

Linear Induction Motors and Linear Synchronous Motors
Types of linear motors, linear induction motor: Construction details, LIM Equivalent Circuit, Steps in design of LIM, Linear Synchronous Motor: Principle and Types of LSM, LSM Control.

TEXT BOOKS

1. Special electrical Machines by Venkataratnam, University press
2. "Linear Electric Motors: Theory, Design and Practical application", Naser A and Boldea I, Prentice Hall Inc., New Jersey,1987

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REFERENCES

1. "Brushless Permanent Magnet and Reluctance Motor Drives", Miller, T.J.E. Clarendon Press, Oxford, 1989.
2. Generalized Theory of Electrical Machines – P.S.Bimbra-Khanna publications-5th edition-1995
3. Electric Machines-Theory, operation, Applications and control-Charles I. Hubert-Pearson Publications.

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T300 – ROBOTICS

Lecture	: 4 Periods/week	Internal Marks	: 25
Tutorial	: 1	External Marks	: 75
Credits	: 3	External Examination	: 3 Hrs

OBJECTIVE

The course has been so designed to give the students an overall view of the mechanical components. The mathematics associated with the same. Actuators and sensors necessary for the functioning of the robot.

UNIT - I

Introduction : Basic concepts – Robot anatomy –Components of robots- Robot motions – Number of D.O.F – Work volume – Robot drive systems – Classification of robots by control method – Specifications of robots..
End Effectors: Introduction – Types of end effectors – Mechanical grippers – Vacuum cups, magnetic grippers, adhesive gripers and others – Robot / End effectors interface – Considerations in gripper selection and design

UNIT - II

Manipulator Kinematics: Introduction – The direct kinematics problem: Rotation matrices, composite rotation matrix about on arbitrary axis , rotation matrix with euler angle representation – Geometric interpretation of rotation matrices, homogeneous coordinates and transformation matrix, geometric interpretation of homogeneous transformation matrices, composite H.T matrix ,Problems- D-H representation – problems on forward kinematics problems on forward kinematics.

UNIT - III

Manipulator jacobian – problems – **Dynamics**: Introduction , Lagrange Euler formulation , Problems

UNIT - IV

Trajectory Planning: Introduction – considerations on trajectory planning – joint Interpolated trajectory – Cartesian path trajectory – problems
Robot Programming :- Methods of robot programming – Lead through method.-Textual robot languages – Generations of programming languages – Robot language structure – Motion commands – End effector and sensor commands – VAL II programming language.

UNIT - V

Sensors: Position sensors: Potentiometers, resolvers, encoders – velocity sensors
Robot Application in Manufacturing: Material transfer and machine loading/ unloading applications – Processing operations – Assembly and inspection – Future applications.

TEXT BOOK

Mikell P.Groover, MITCHELL WEISS, ROGER N. Nagel& NICHOLAS G. Odrey; Industrial Robotics, McGraw- HILL International Editions.

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REFERENCES

1. R.K.Mittal and IJ Nagrath, robotics andcontrol ,Tata Mc Graw – Hill publishing company Limited, New Delhi.
2. Robert J.Schilling, Fundamentals of robotics analysis & control, PHI learning private limited, New Delhi
3. Saeed B.Niku, Introduction to robotics analysis systems Application, PHI learning private limited, New Delhi
4. K.S.Fu, R.C Gonzalez and C.S.G.Lee, Robotics control, Sensing, vision, and intelligence; Mc Graw HILL International Editions

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P863 – POWER ELECTRONICS LAB.

Lab.	**: 3 Periods/week**	**Internal Marks**	**: 25**
		External Marks	**: 75**
Credits	**: 2**	**External Examination**	**: 3 Hrs**

LIST OF EXPERIMENTS

1. Characteristics of SCR, IGBT & Power MOSFET.
2. Single phase AC voltage controller with R & RL Loads.
3. Single phase fully controlled bridge converter With R & RL Loads.
4. Single phase IGBT inverter.
5. Micro Controller based PWM pulse generation.
6. Three phase fully controlled bridge converter with R Load.
7. Single phase dual converter with RL load.
8. Single Phase ac to dc converter with LC filter using MATLAB/SIMULINK
9. Single phase inverter with current controlled PWM technique using MATLAB/SIMULINK

ADDITIONAL EXPERIMENTS

10. SCR circuit simulation & the possible circuit states using LabVIEW.
11. Single phase fully controlled PWM rectifier with R & RL loads using PSCAD.

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P846 – LDIC LAB.

Lab.	**: 3 Periods/week**	**Internal Marks**	**: 25**
		External Marks	**: 75**
Credits	**: 2**	**External Examination**	**: 3 Hrs**

LIST OF EXPERIMENTS

1. Study of OP AMPS – IC 741, IC 555, IC 565, IC 566, IC 1496 – functioning, Parameters and Specifications.
2. Op Amp Applications – Adder, Subtractor, Comparator circuits.
3. Integrator and Differentiator circuits using IC 741.
4. Active filter Applications – LPF, HPF (first order).
5. Active filter Applications – BPF, Band Reject (wide band) and Notch filters.
6. IC 741 Oscillator circuits – Phase shift and Wien Bridge Oscillators.
7. Function Generator using Op Amp.
8. IC 555 timer – Monostable operation circuits.
9. IC 555 timer – Astable operation circuits.
10. Schmitt trigger circuits - using IC 741 and IC 555.

ADDITIONAL EXPERIMENTS

11. Three terminal voltage Regulators – 7805,7809,7912.
12. 4-bit DAC using Op Amp.

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T315 – SOLID STATE DRIVES

Lecture	: 4 Periods/week	Internal Marks	: 25
Tutorial	: 1	External Marks	: 75
Credits	: 4	External Examination	: 3 Hrs

OBJECTIVE

This course is an extension of Power Electronics applications to DC and AC 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. After going through this course student will understand the control of industrial drives.

UNIT - I

Rectifier Controlled DC Motor Drives

Controlled rectifiers circuits- Single phase fully controlled rectifier fed separately excited DC motors – single phase semi converter and single phase full converter for continuous and discontinuous modes of operation – freewheeling diode operation-speed torque characteristics.

Three phase semi converter and three phase full converter for continuous and discontinuous modes of operation– Addition of Freewheeling diode.

UNIT - II

Chopper controlled DC motor drives

Principle of operation and control techniques – motoring operation of separately excited dc motor- motoring control of series motor-regenerative braking of dc motors-dynamic and composite braking of dc motors-current control- multiquadrant control of chopper fed dc motors.

UNIT - III

Control of Induction motor drives

Control of induction motor by voltage source inverter- control of induction motor by current source inverters- comparison of voltage source and current source inverter drives- stator voltage control-stator frequency control-Open loop volts/Hz control.

UNIT - IV

Slip power controlled wound rotor Induction motor Drives

Static rotor resistance control-Slip-power recovery Drives- Static scherbius drive- Phasor diagram-Torque expression –power factor considerations-equivalent circuit and analysis-closed loop speed control of static scherbius drive-Modes of operation- Static Kramer drive.

UNIT - V

Control of Synchronous motor drives:

Synchronous motors – Operation of self controlled synchronous motors-by VSI, CSI and Cycloconverters. Load commutated CSI fed Synchronous Motor speed torque characteristics, Closed Loop control operation of synchronous motor drives (Block Diagram Only), variable frequency control.

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TEXT BOOKS

1. Fundamentals of Electric Drives – by G K Dubey Narosa Publications
2. Power Electronics and Motor Control – Shepherd, Hulley, Liang – II Edition, Cambridge University Press

REFERENCES

1. Semiconductor Controlled drives – G. K. Dubey-prentice hall
2. Power Electronics control of AC motors – MD Murphy & FG Turn Bull Pergman Press -1st edition-1998
3. Electric Motor Drives Modeling, Analysis and Control – R. Krishnan, Prentice Hall India.
4. Modern Power Electronics and AC Drives –B. K. Bose-Pearson Publications

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T283 – POWER SYSTEM OPERATION AND CONTROL

Lecture	: 4 Periods/week	Internal Marks	: 25
Tutorial	: 1	External Marks	: 75
Credits	: 4	External Examination	: 3 Hrs

OBJECTIVE

This course contains the essentials of system operation and includes topics like Economic Operation, Hydrothermal scheduling and modeling of turbines, generators and automatic controllers. It emphasizes on single area and two area load frequency control, voltage collapse and reactive power control.

UNIT –I

Economic Operation

Optimal operation of Generators in Thermal Power Stations, - heat rate Curve – Cost Curve –Incremental fuel and Production costs, input-output characteristics, Optimum generation allocation without line losses, Optimum generation allocation including the effect of transmission line losses – Loss Coefficients, General transmission line loss formula

UNIT – II

Hydro Thermal Scheduling

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

UNIT - III

Modelling of Turbine, Generator and Governor

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).

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

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UNIT - IV

Load Frequency Control

Necessity of keeping frequency constant.

Single Area Load Frequency Control

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

Two-Area Load Frequency Control

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

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 – V

Voltage Collapse and Reactive Power Control

Comparison of angle stability with voltage stability, reactive power flow and voltage collapse, V-Q sensitivity analysis, 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. "Modern Power System Analysis" – by I.J.Nagrath & D.P.Kothari Tata M Graw – Hill Publishing Company Ltd, 2nd edition.
2. Electrical Power Systems by C.L.Wadhwa, Newage International-3rd Edition.

REFERENCES

1. "Electric Energy Systems Theory: An Introduction", by O.I. Elgerd, McGraw-Hill Inc.,1971
2. "Power Generation, Operation and Control", by A.J. Wood and B.F. Wollenberg, John Wiley & sons, 1984.
3. Power System Analysis and Design by J.Duncan Glover and M.S.Sarma., THOMPSON, 3rd Edition.
4. "Power System Analysis", by John J Grainger, W D Stevenson Jr., T M H , 2003
5. Power System Analysis by Hadi Saadat – TMH Edition.

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T262 – NEURAL NETWORKS AND FUZZY LOGIC

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

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 networks and fuzzy network systems 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, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN.

UNIT - II

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

Feed Forward Neural Networks
Introduction, Perceptron Models:Perceptron Convergence theorem, Limitations of the Perceptron Model.Generalized Delta Rule, Derivation of Back propagation (BP) Training, Kolmogorov Theorem, Learning Difficulties and Improvements.
Associative Memories
Hebbian Learning, Bidirectional Associative Memory (BAM) Architecture and training algorithms. Architecture of Hopfield Network ,Stability Analysis.

UNIT - IV

Fuzzy Logic- I
Introduction to Fuzzy sets & classical sets - properties, Operations,relations and cardinalities, Fuzzy membership functions- different types.
Fuzzification, Membership value assignment, development of rule base and Implication methods.

UNIT - V

Fuzzy Logic- II
Defuzzification methods. Defuzzification to crisp sets. Hard C-means and Fuzzy C-means.
Fuzzy logic applications: Fuzzy classification, Fuzzy logic control and fuzzy decision making.

TEXT BOOKS

1. Neural Networks – James A Freeman and Davis Skapura, Pearson Education, 2002.
2. Neural Networks – Simon Hakins, Pearson Education

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REFERENCES

1. Fuzzy logic with engineering application by Timothy J Ross, Wiley publications
2. Neural Engineering by C.Eliasmith and CH.Anderson, PHI

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T338 – VLSI DESIGN

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

UNIT –I

IC TECHNOLOGY

MOS, PMOS, NMOS, CMOS & BiCMOS technologies, Photolithography and Pattern Transfers , Basic Electrical Properties of MOS and CMOS Circuits: Ids-Vds relationships, MOS transistor threshold Voltage, gm, gds, figure of merit ; Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design.

UNIT-II

VLSI CIRCUIT DESIGN PROCESSES

VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, 2 micro meter CMOS Design rules for wires, Contacts and Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits, NAND and NOR Gates – Complex Logic Gates.

UNIT -II

CMOS Logic Gates Design and Layout

Basic circuit concepts, Sheet Resistance RS and its concept to MOS, Area Capacitance Units, Calculations of Delays, Driving large Capacitive Loads, Wiring Capacitances, Alternate gate circuits, Tri state circuits, Transmission Gate and Pass Transistor Logic.

UNIT-IV

SUBSYSTEM DESIGN

Subsystem Design,4-by-4 barrel Shifters, carry look ahead Adder, ALUs, 4x4 array Multipliers, Parity generators, Comparators, Zero/One Detectors, binary Counters, Memory Elements: SRAM,DRAM,basic ROM.

UNIT-V

VHDL SYNTHESIS

VHDL Synthesis, Circuit Design Flow, Circuit Synthesis, Simulation, Layout, Design capture tools, Design Verification Tools, need for testing, manufacturing test principles:D-algoritham .

TEXTBOOK :

1. Essentials of VLSI circuits and systems – Kamran Eshraghian, Eshraghian Dougles and A. Pucknell, PHI, 2005 Edition.

REFERENCES :

1. Chip Design for Submicron VLSI: CMOS Layout & Simulation, - John P. Uyemura, Thomson Learning.
2. Principles of CMOS VLSI Design - Weste and Eshraghian, Pearson Education, 1999.
3. Modern VLSI Design - Wayne Wolf, Pearson Education, 3rd Edition, 1997.

T282 – POWER SYSTEM ANALYSIS

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1 Period/Week**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

OBJECTIVES

This course introduces the methods of power system network modeling and analysis under different operating conditions. It uses the concepts developed earlier under power systems and mathematics and derives necessary tools for system analysis under systems approach. The methods developed here become basic tools in system operation and control. It also deals with short circuit analysis and analysis of power system for steady state and transient stability.

UNIT - I

Power System Network Matrices

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

Formation of Z_{Bus}: Partial network, Algorithm for the Modification of Z_{Bus} Matrix for addition element for the following cases (without mutual coupling): Addition of element from a new bus to reference node, Addition of element from a new bus to an old bus, Addition of element between an old bus to reference node and Addition of element between two old buses (Derivations and Numerical Problems)- Z_{bus} modifications (Problems)

UNIT - II

Power Flow Methods

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 - III

Power Flow Techniques Continued:

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 (only Theory) - Comparison of Different Methods.

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UNIT - IV

Network Faults and Fault Calculations:

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, Numerical Problems.

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 - V

Power System 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

Derivation of Swing Equation, Determination of Transient Stability by Equal Area Criterion, Application of Equal Area Criterion, Critical Clearing Angle Calculation, Point-by-Point Method, Methods to improve Steady State and Transient Stability.

TEXT BOOKS

1. "Power System Analysis", John J Grainger, W D Stevenson Jr., T M H , 2003
2. "Modern Power System Analysis", D.P. Kothari, I.J. Nagrath, T M H New Delhi, 2003

REFERENCES

1. "Power system Stability and Control", Prabhat Kundur, T M H Edition, 2006.
2. " Computer techniques in Power System Analysis" by M.A. Pai, TMH.
3. "Power System Analysis, Operation and Control", AbhijitChakraborty and SunitaHalder, (III Ed.), PHI Learning Pvt Ltd., New Delhi, 2010.
4. "Power System Analysis" by HadiSaadat – TMH Edition.

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T213 – HIGH VOLTAGE ENGINEERING

Lecture	: 4 Periods/week	Internal Marks	: 25
Tutorial	: 1	External Marks	: 75
Credits	: 3	External Examination	: 3 Hrs

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
Electric Field Stresses–Gas/Vaccum 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–Conduction and Breakdown in Gases– Gases as insulating medi– Ionization process–Townsend's criteria for breakdown–Paschen's law.

UNIT - II

Break Down in Liquid Dielectrics
Liquid as Insulator– pure and commercial liquids–conduction and breakdown in pure liquids and conduction and breakdown in commercial liquids–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 - III

Generation of high voltages, currents and testing
Generation of High DC Voltages–Generation of High AC voltages–Generation of Impulse Voltages–Generation of Impulse currents–Tripping and control of impulse generators. Testing of Insulators and bushings–Testing of Isolators and circuit breakers–Testing of cables–Testing of Transformers–Testing of Surge Arresters–Radio Interference measurements. Short circuit testing.

UNIT - IV

Measurement of high voltages and currents
Measurement of High DC voltages–Measurement of High AC and impulse voltages-Measurement of High DC, AC and Impulse currents–Oscilloscope for impulse voltage and current measurements.

UNIT - V

Insulation Co-ordination and Grounding of EHV Systems
Principles of Insulation Coordination on High voltage and Extra High Voltage power systems. Resistance of Grounding Systems, Impulse Impedance of Grounding Systems, Grounding Grids.

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TEXT BOOK

High Voltage Engineering: Fundamentals by E.Kuffel, W.S.Zaengl, J.Kuffel by Elsevier, 2nd Edition.

REFERENCES

1. High Voltage Engineering by M.S.Naidu and V. Kamaraju – TMH Publications, 3rd Edition
2. High Voltage Engineering by C.L.Wadhwa, New Age Internationals (P) Limited, 1997.
3. High Voltage Insulation Engineering by Ravindra Arora, Wolfgang Mosch, New Age International(P) Limited, 1995.
4. High voltage technology – LL Alston,Oxford University press, 1968
5. High voltage engineering m. S. Naidu,v. Kamaraju , Tata mcgraw-hill education, 2009.
6. Extra High Voltage A. C. Transmission Engineering , R D Begamudre , Publisher: New Age International
7. High Voltage Engineering, Mazen Abdel-Salam, Hussein Anis, Marcel Dekker publishers.

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T270 – OPTIMIZATION TECHNIQUES

Lecture	: 4 Periods/week	Internal Marks	: 25
Tutorial	: 1	External Marks	: 75
Credits	: 3	External Examination	: 3 Hrs

OBJECTIVE

This course is a basic mathematical tool in solution of number of system operational methods and design of components and systems. The course also contains non-traditional optimization techniques like Genetic Algorithms and Particle Swarm methods. The contents of this course are also widely used in operations research in systems planning and management.

UNIT - I

Linear Programming (LP)
Introduction through engineering applications, standard form of LP problem (LPP), Geometrical interpretation, simplex method and algorithm, two phases of simplex method, Numerical problems, Revised simples method, Duality in LP, Dual simplex method, sensitivity analysis.

UNIT - II

Applications and extensions of LP
Transportation problem, Assignment problem, Karmarkar's method, Quadratic programming and Engineering Applications.

UNIT - III

Non-linear Programming – Unconstrained minimization
Interpolation methods, quadratic and cubic interpolation methods, Newton's method.Gradient Methods – Steepest descent, conjugate gradient, Newton's and quasi Newton methods, Davidon-Flecher-Powell method, numerical problems.

UNIT - IV

Non-linear Programming – Constrained Minimization
Legrangian multipliers, Kuhn-Tucker conditions, sequential LP method, methods of feasible directions, Rosen's gradient projection method, Generalized reduced gradient method, Interior and exterior penalty function methods.

UNIT - V

Dynamic Programming & Non-traditional Optimization
Principle of optimality, computational procedure, applications from engineering. Evolutionary Programming Techniques – Genetic Algorithm (GA), the three parameters of GA, computational procedure for both binary and analogue coded inputs. Introduction to Particle swarm Optimization. Numerical examples.

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TEXT BOOKS

1. "Engineering Optimization – Theory and Practice", S.S. Rao, III Edition, John Wiley & Sons 1996 and New Age International Pvt Ltd., New Delhi, 2002.
2. "Optimization for Engineering Design - Algorithms and Examples", Kalyanmoy Deb, PHI Learning Private Ltd, New Delhi, 1995.

REFERENCES

1. "Optimization Methods in Operations Research and Systems Analysis", K.V. Mittal and C Mohan, II edition 1983, New Age International Publishers, New Delhi.
2. "Combinatorial Optimization – Algorithms and Complexity", Christos H Papadimitriou and Kenneth Steiglitz, Prentice Hall of India 1997.
3. "Introduction to Optimization & Operations Research", J C Pant, IV Edition, Jain Brothers, New Delhi.
4. "Genetic Algorithms in Search, optimization and machine learning: Reading, Mass", D.E. Goldberg, Addison-Wesley, 1989.
5. "Swarm Intelligence", Kennedy, J. and Eberhart, R.C., 2001, Morgan Kaufmann.

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T145 – COMPUTER NETWORKS

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1**	**External Marks**	**: 75**
Credits	**: 3**	**External Examination**	**: 3 Hrs**

UNIT - I

Introduction: Use of Computer Networks- Network Hardware- Network software-Reference models Example Networks- Network Standardization. Physical Layer: The theoretical basis for Data communication- Guided Transmission Media.

UNIT - II

Data link layer: design issues- framing, error detection and correction, CRC, Elementary data link protocols- sliding window protocols. Medium Access Control Sub layer: Channel allocation problem- multiple access protocols- Ethernet- Data link layer switching.

UNIT - III

Network layer: Network layer design issues- Routing algorithms- congestion control algorithms-Quality of service- Internetworking- network layer in the Internet.

UNIT - IV

Transport layer: Transport service- Elements of transport protocols- Internet transport protocols: TCP & UDP.

UNIT - V

Application Layer: Domain Name System- Electronic Mail -the World Wide Web, Network Security.

TEXT BOOK

Andrews S. Tanenbaum; "Computer Networks"; Fourth Edition, PHI.

REFERENCES

1. William Stallings; "Data and Computer Communications"; seventh Edition, Pearson Education.
2. Behrouz A .Fourouzan; "TCP/IP Protocol Suite"; Fourth Edition, Tata McGraw-Hill.3. James F.Kurose, Keith W.ROSS; "Computer Networking A Top-Down Approach featuring the Internet"; Pearson Education.

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T161 – DIGITAL IMAGE PROCESSING

Lecture	**: 3 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1 Period/Week**	**External Marks**	**: 75**
Credits	**: 3**	**External Examination**	**: 3 Hrs**

UNIT - I

DIGITAL IMAGE PROCESSING: Fundamental & Applications of Image Processing, Fundamental Steps & Components of an Image Processing System, Concept of gray levels, Gray level to binary image conversion, Sampling and quantization, Relationship between pixels ,Imaging Geometry.

UNIT - II

IMAGE TRANSFORMATION: 2-D FFT , Properties. Walsh transform, Hadamard Transform, Discrete cosine Transform, Haar transform, Slant transform, KL Transform.

UNIT - III

IMAGE ENHANCEMENT IN SPIATIAL,FREQUENCY DOMAIN : Spatial domain Enhancement, Point processing , Gray Level Transformations, Histogram Processing, Smoothing Spatial Filters & Sharpening Spatial Filters, Frequency domain Enhancement, Smoothing Frequency Domain Filters & Sharpening Frequency Domain Filters, Laplacian in the Frequency Domain, Image Restoration Degradation model, Noise Models, Restoration in the Presence of Noise Only–Spatial Filtering, Mean Filters ,Least mean square filters, Order-Statistics Filters, Constrained Least Squares Restoration.

UNIT - IV

IMAGE SEGMENTATION &IMAGE COMPRESSION : Image segmentation: Detection of discontinuities, Thresholding, Region oriented segmentation, Edge Linking and Boundary Detection, Local Processing, Global Processing via the Hough Transform& Graph-Theoretic Techniques, Thresholding, The Role of Illumination, Basic Global Thresholding, Basic Adaptive Thresholding, Region-Based Segmentation, Region Growing, Region Splitting and Merging,

Image compression: Introduction, Image compression Redundancies and their removal methods, Image Compression Models, The Source Encoder and Decoder, The Channel Encoder and Decoder, Error-Free Compression, Lossy Compression.

UNIT - V

COLOR IMAGE PROCESSING: Introduction, Color Models, Pseudocolor Image Processing, Intensity Slicing , Gray Level to Color Transformations, Basics of Full-Color Image Processing, Color Transformation, Histogram Processing.

TEXT BOOK

Digital Image processing – R.C. Gonzalez & R.E. Woods, Addison Wesley/ Pearson education,3nd Education, 2002.

REFERENCES

Fundamentals of Digital Image processing – A.K.Jain , PHI

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P853 – MICROPROCESSOR AND MICRO CONTROLLERS LAB.

Lab.	**: 3 Periods/week**	**Internal Marks**	**: 25**
		External Marks	**: 75**
Credits	**: 2**	**External Examination**	**: 3 Hrs**

I . Programming

1. Write a program using 8086 and verify for
   (a) Addition and subtraction of two Multi–byte numbers.
   (b) Addition and subtraction of two ASCII numbers.
   (c) Packed BCD to unpacked BCD and BCD to ASCII conversion.
2. Write a program using 8086 for
   (a.) Multiplication of two 16-bit numbers by repeated addition method. Check for minimum number of additions and test for typical data.
   (b.) Division of two 16-bit numbers by repeated subtraction method and test for typical data.
3. Write a program using 8086 for finding square root of a given number and verify.
4. Write a program using 8086 and verify for finding:
   (a.) The largest number of an array.
   (b.) The smallest number from an array.
5. Write the program using 8086 for arranging an array of numbers in
   (a.) Descending order.
   (b.) Ascending order.
6. Write a program using 8086 for string operations
   (a.) String comparison.
   (b.) Reverse the string.

II. INTERFACING

7. Interfacing and programming of 8251 and 8259
8. Interfacing and programming of 8279.
9. Programming and verifying of Timer, Interrupts and USART operations in 8051 Microcontroller.
10. Write a program to control the operation of stepper motor using 8086 microprocessor.

III. Additional Experiments

11. Traffic light interface.
12. Program to generate firing pulses for rectifier using PIC Microcontroller.

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P864 – POWER SYSTEMS LAB.

Lab.	**: 3 Periods/week**	**Internal Marks**	**: 25**
		External Marks	**: 75**
Credits	**: 2**	**External Examination**	**: 3 Hrs**

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1. Determination of Transmission Line Parameters
2. Determination of Breakdown strength of oil by Variable Distance Electrodes
3. Fault Analysis (LL, LG, LLL) of transmission Lines
4. Formulation of admittance matrix
5. Solution of load flows using Gauss-seidal method
6. Power Flow using newton-rapson method
7. Power Flow using fast decoupled method with MATLAB
8. Time domain and frequency domain testing of a single phase transmission line using Matlab/Simulink.
9. To plot the power angle characteristics of a generator using Matlab/Simulink
10. Transient and small signal stability analysis

ADDITIONAL EXPERIMENTS

11. No load and short circuit test of 3 phase alternator using PSCAD.
12. . Determination of Earth resistance under various conditions

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VIII-SEMESTER

T215 – HVDC AND FACTS

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

OBJECTIVE

High Voltage DC Transmission (HVDC), Flexible AC Transmission Systems (FACTS) and control aspects of HVDC and FACTS systems for voltage control & reactive power control etc will be studied.

UNIT - I

HVDC 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
Configurations of converters-characteristics of 6 pulse and 12 pulse converters, operation as an inverter, Principal of DC Link Control – Converters Control Characteristics – Firing angle control and extinction angle control – Starting and stopping of DC link; Power Control.

UNIT - III

Power Flow Analysis in AC/DC Systems
Modeling of DC Links-DC Network-DC Converter-Controller Equations-Solution of DC load flow – P.U. System for d.c. quantities-solution of AC-DC Power flow-Simultaneous method-Sequential method.

UNIT - IV

Modeling of FACTS controllers:
FACTS, inherent limitations of transmission systems, basic types of FACTS controllers. Controllers based on conventional thyristors - Thyristor Controlled Reactor, Static VAR Compensator.

UNIT - V

Power flow including FACTS Controllers
Introduction, Power flow solutions including FACTS Controllers-Static VAR Compensator, Thyristor Controlled Series Compensator, Static Series Compensator and Unified Power Flow Controller.

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TEXT BOOKS

1. "Understanding FACTS" N.G.Hingorani and L.Guygi, IEEE Press.Indian Edition is available:--Standard Publications, 2001.
2. Power System Stability and Control- P.Kundur, TMH Publication.

REFERENCES

1. FACTS modeling and simulation in Power Networks-Enrique Acha, Claudio R. Fuerte- Esquivel, Hugo Ambriz-Perez & Cesar Angeles-Camacho, Wiley Publications.
2. "Flexible a c transmission system (FACTS)" Edited by YONG HUE SONG and ALLAN T JOHNS, Institution of Electrical Engineers, London.
3. FACTS Controllers in Power Transmission Distribution- K. R. Padiyar, New Age International , 2008.
4. HVDC transmission - J.Arrillaga, Peter Peregrinus
5. HVDC power transmissions systems: Technology and system interactions by K.R.padiyar, New age International (P) Ltd.
6. Direct Current transmission by E.W.Kimbark, John Wiley.
7. HVDC transmission - Adamson and Hingorani.

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T278 – POWER QUALITY

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1**	**External Marks**	**: 75**
Credits	**: 3**	**External Examination**	**: 3 Hrs**

OBJECTIVE

This subject deals with the Basic Concepts of Power Quality issues. In addition to the basic Concepts, Power Frequency Disturbances, Voltage Sags and Interruptions, Fundamentals of Harmonics, and Power Quality Monitoring are also discussed

UNIT - I

Introduction to Power Quality
What is Power Quality?, Voltage Quality, Why are we concerned about power quality?, The power quality evaluation procedure-Need for a consistent-Vocabulary, General classes of power quality problems, Transients, Long-Duration voltage variations, Short-Duration voltage variations, Voltage Imbalance, waveform distortion, voltage fluctuation, Power frequency variations, Power quality terms, Ambiguous Terms.

UNIT - II

Power Frequency Disturbances
Introduction-Common power frequency disturbances-Cures for low frequency disturbances-Voltage tolerance criteria

UNIT - III

Voltage Sags and Interruptions
Sources of sags and interruptions-Estimating Voltage sag performance-Fundamental principles of protection-Solutions at the End-User level-Evaluating the economics of different ride_ through alternatives-Motor_ starting sags-Utility system fault_ clearing issues

UNIT - IV

Fundamentals of Harmonics
Harmonic Distortion-Voltage versus current distortion-Harmonic versus Transients-Power system Quantities under non sinusoidal conditions-Harmonic indices-Harmonic sources from commercial loads-Harmonic sources from industrial loads-Locating harmonic sources-System response characteristics-Effects of harmonic distortion- Inter harmonics

UNIT - V

Power Quality Monitoring
Monitoring considerations-Historical perspective of power quality measuring instruments-Power quality measurement equipment-Assessment of power quality measurement data-Application of intelligent systems-Power quality monitoring standards

TEXT BOOKS

1. Electrical power systems quality-Roger C.Dugan- McGraw- Hills
2. Power quality- C.Sankaran, CRC Press

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REFERENCES

1. "Understanding Power Quality Problems" by Math H J Bollen. IEEE Press.
2. Power Quality Primer, Barry W. Kennedy, McGraw-Hill Publishers

LBRCE EXAMINATION SECTION

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Dept. of Electrical and Electronics Engg.
Lakireddy Bali Reddy College of Engineering
MYLAVARAM-521230, KRISHNA (DT), A.P

T190 – EMBEDDED SYSTEMS

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1**	**External Marks**	**: 75**
Credits	**: 3**	**External Examination**	**: 3 Hrs**

OBJECTIVE

This subject deals with the Fundamentals of Embedded systems, information about Devices and Buses for Devices network. In addition to the fundamentals, embedded programming and Real time operating systems are also discussed.

UNIT - I

EMBEDDED SYSTEM INTRODUCTION: Embedded systems overview, design challenge, processor technology, IC technology, Design Technology, Trade-offs. Single purpose processors RT-level combinational logic, sequential logic (RTlevel), custom single purpose processor design (RT-level), optimizing custom single purpose processors.

UNIT - II

STATE MACHINE AND CONCURRENT PROCESS MODELS : Introduction, models Vs. languages, finite state machines with data path model (FSMD), using state machines, program state machine model (PSM), concurrent process model, concurrent processes, communication among processes, synchronization among processes, Implementation, data flow model, real-time systems.

UNIT - III

EMBEDDED / RTOS CONCEPTS : Architecture of the Kernel, Tasks and Task scheduler, Interrupt service routines, Semaphores, Mutex, Mailboxes , Message Queues, Event Registers, Pipes, Signals, Timers, Memory Management, Priority inversion problem, Embedded operating systems Embedded Linux, Real-time operating systems, RT Linux, Handheld operating systems, Windows CE.

UNIT - IV

HARDWARE–SOFTWARE CO-DESIGN IN AN EMBEDDED SYSTEM: Embedded System Project Management Embedded System Design and Co-Design Issues in System Development Process.

UNIT - V

DESIGN CYCLE IN THE DEVELOPMENT PHASE FOR AN EMBEDDED SYSTEM: Use of Target Systems, use of Software Tools for Development of an Embedded System, use of Scopes and Logic Analysis for System, Hardware Tests. Issues in Embedded System Design.

TEXT BOOK

Embedded System Design – A Unified Hardware/Software Introduction - Frank Vahid, Tony D. Givargis, John Wiley, 2002.

REFERENCES

1. An Embedded Software Primer – David E. Simon, Pearson Ed., 2005.
2. Embedded / Real Time Systems – KVKK Prasad, Dreamtech Press, 2005.
3. Microcontrollers Architecture, Programming, Interfacing and System Design – Raj Kamal, Pearson Education, 2005

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T335 – UTILIZATION OF ELECTRICAL ENERGY

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**:**	**External Marks**	**: 75**
Credits	**: 3**	**External Examination**	**: 3 Hrs**

UNIT - I

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 , rheostat braking and regenerative braking., trapezoidal and quadrilateral speed time curves.

UNIT - II

ELECTRIC TRACTION – II

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

UNIT - III

ILLUMINATION: laws of illumination, polar curves photometry sources of light, Discharge lamps, MV and SV lamps, Basic principles of light control, Types and design of lighting and flood lighting, LED lighting systems.

UNIT - IV

ELECTRIC HEATING AND WELDING: Methods of Electric Heating, Resistance Heating, Induction Heating Dielectric Heating. Electric welding, resistance and arc welding, electric welding equipment, comparison between A.C. and D.C. Welding.

UNIT - V

UPS AND BATTERIES: UPS, configuration off-line and online UPS, selection and design considerations of UPS. Batteries- Primary and Secondary batteries, Primary batteries - definition and examples, Dry cell- construction and working. Secondary batteries–definition-examples- Lead acid storage cell - Nickel/Cadmium battery, lithium-ion battery, Ultra-capacitors.

TEXT BOOKS

1. Art & Science of Utilization of electrical Energy – by Partab, Dhanpat Rai & Sons.
2. Battery Reference Book- T.R.Crompton, Reed Educational and Professional Publishing Limited.

REFERENCES

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

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T308 – SOFTWARE ENGINEERING

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1**	**External Marks**	**: 75**
Credits	**: 3**	**External Examination**	**: 3 Hrs**

UNIT - I

Introduction to software engineering : The evolving role of Software, software, changing nature of software, legacy software, software myths
Software process: layered technology, process frame work, CMMI, process patterns, assessment, personal and team process models, process technology, product and process

UNIT - II

Process models: Prescriptive models, water fall model, incremental, evolutionary and specialized process models, unified process
Software engineering practice: communication practices, planning practices, modeling practices, construction practice and deployment.

UNIT - III

Requirements Engineering : A bridge to design and construction, RE tasks, initiating the RE process, Eliciting Requirements, developing use cases, building the analysis models, negotiating and validating requirements.
Building the analysis model: requirements analysis, analysis modeling approaches, data modeling concepts, OOA, scenario based modeling, flow rated modeling, class based modeling, creating a behavior model

UNIT - IV

Design Engineering: Design within the context of software engineering, design process and software quality, design concepts, design model, pattern based software design
Creating an architectural design: software architecture, data design, architectural styles and patterns, architectural design

UNIT - V

Testing Strategies: A strategic to software testing, strategic issues, test strategies for conventional software, object oriented software, validation testing, system testing, the art of debugging
Testing tactics : software testing fundamentals, white box testing: basis path testing, control structure testing. Black box testing, OO testing methods

TEXT BOOK

Roger S.Pressman, Software engineering- A practitioner's Approach, McGraw-Hill International Edition, 6th edition, 2005.

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REFERENCES

1. Ian Sommerville, Software engineering, Pearson education, 8th edition, 2008.
2. Ali Behforooz and Frederick J Hudson, "Software Engineering Fundamentals", Oxford University Press, New Delhi, 1996.
3. Stephan Schach, Software Engineering, Tata McGraw Hill, 2007
4. Pfleeger and Lawrence Software Engineering: Theory and Practice, Pearson education, second edition, 2001.

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T168 DISTRIBUTION SYSTEMS AND AUTOMATION

Lecture	: 4 Periods/week	Internal Marks	: 25
Tutorial	: 1	External Marks	: 75
Credits	: 3	External Examination	: 3 Hrs

OBJECTIVES

The objective of Distribution Automation Function is to enhance the reliability of power system service, power quality, and power system efficiency by automating the following three processes of distribution operation control: data preparation in near-real-time; optimal decision-making; and the control of distribution operations in coordination with transmission and generation systems operations

UNIT - I

Distribution Automation and the utility system
Introduction to Distribution Automation (DA), control system interfaces, control and data requirements, centralized (Vs) decentralized control, DA System (DAS), DA Hardware, DAS software. DA capabilities, Automation system computer facilities, management processes, Information management, system reliability management, system efficiency management, voltage management, Load management.

UNIT - II

Communication Systems for DA
DA communication requirements, Communication reliability, Cost effectiveness, Data rate Requirements, Two way capability, Ability to communicate during outages and faults, Ease of operation and maintenance, Conforming to the architecture of data flow
Distribution line carrier (Power line carrier), Ripple control, Zero crossing technique, telephone, cable TV, Radio, AM broadcast, FM SCA, VHF Radio, UHF Radio, Microwave satellite. fiber optics, Hybrid Communication systems, Communication systems used in field tests.

UNIT - III

Technical Aspects
DA benefit categories, Capital deferred savings, Operation and Maintenance savings, Interruption related savings, Customer related savings, Operational savings, Improved operation, Function benefits, Potential benefits for functions, function shared benefits, Guidelines for formulation of estimating equations
Parameters required, economic impact areas, Resources for determining benefits impact on distribution system, integration of benefits into economic evaluation.

UNIT - IV

Economic Evaluation Methods
Development and evaluation of alternate plans, Select study area, Select study period, Project load growth, Develop Alternatives, Calculate operating and maintenance costs, Evaluate alternatives.

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UNIT - V

Economic comparisons

Economic comparison of alternate plans, Classification of expenses and capital expenditures, Comparison of revenue requirements of alternative plans, Book Life and Continuing plant analysis, Year by year revenue requirement analysis, short term analysis, end of study adjustment, Break even analysis, Sensitivity analysis computational aids.

TEXT BOOK

"Control and Automation of Electric Power Distribution Systems", James Northcote-Green and Robert Wilson, Taylor and Francis.

REFERENCES

1. IEEE Tutorial Course "Distribution Automation".
2. IEEE Working Group on "Distribution Automation".
3. "Over view of Advanced Distribution Automation", by EPRI IntelliGrid. (Available at http://www.intelligrid.info).

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T102 – ADVANCED CONTROL SYSTEMS

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1**	**External Marks**	**: 75**
Credits	**: 3**	**External Examination**	**: 3 Hrs**

OBJECTIVE

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

UNIT - I

DESCRIBING FUNCTION ANALYSIS

Introduction to Non Linear Systems , behavior of nonlinear systems, properties of Nonlinear Systems, Types of Nonlinearities – Saturation – Dead Zone – Hysteresis-Relay-Backlash etc, Introduction to Linearization of nonlinear systems, Describing function (DF)– Derivation of general DF, DF for different nonlinearities -saturation, Dead-Zone-Dead-Zone and Saturation, Hysteresis-Backlash ,Stability analysis of Non – Linear systems through describing functions

UNIT - II

PHASE PLANE ANALYSIS

Introduction to phase plane analysis, singular points , and their classification, limit cycle and behavior of limit cycle. Analytical method ,Isocline method, and delta method for constructing Trajectories, phase plane analysis of nonlinear control systems.

UNIT - III

STABILITY ANALYSIS

Introduction ,Stability in the sense of Lyapunov, Lyapunov's stability and Lyapunov's instability theorems ,Stability Analysis of the Linear Continuous time invariant systems by Lyapunov second method ,Generation of Lyapunov functions using– Krasovskii method, variable gradient method

UNIT–IV

Introduction to Adaptive Control System

Definition of adaptive control system, functions of adaptive control, gain scheduling, model reference, series and parallel schemes and their industrial applications.

UNIT–V

Introduction to Sliding mode Control

Introduction, concept of variable structure control (VSC), ideal sliding motion and chattering, switching function, reachability condition, properties of sliding motion

Text Book

1. Modern Control System Theory by M. Gopal – New Age International – 1984

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Reference books

2. Modern Control Engineering, Ogata.K, Prentice Hall of India, 5th Edition
3. Karl J. Astrom, B. Wittenmark, .Adaptive Control., 2nd Edition, Pearson Education Asia, First Indian Reprint, 2001
4. Christopher Edwards, Sarah K. Spurgeon, .Sliding Mode control: Theory and Application., 1998.

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T155 – DATABASE MANAGEMENT SYSTEMS

Lecture	: 4 Periods/week	Internal Marks	: 25
Tutorial	: 1	External Marks	: 75
Credits	: 3	External Examination	: 3 Hrs

UNIT - I

Introduction: An overview of database management system, database system Vs file system, Database system concepts and architecture, data models schema and instances, data independence and data base language and interfaces, Data definitions language, DML, Overall Database Structure.

Data modeling using the Entity Relationship Model: ER model concepts, notation for ER diagram, mapping constraints, keys, Concepts of Super Key, candidate key, primary key, Generalization, aggregation, reduction of an ER diagrams to tables, extended ER model, relationships of higher degree.

UNIT - II

Relational data Model and Language: Relational data model concepts, integrity constraints: entity integrity, referential integrity, Keys constraints, Domain constraints, relational algebra.

Introduction to SQL: Characteristics of SQL, Advantage of SQL. SQL data types and literals. Types of SQL commands. SQL operators and their procedure. Tables, views and indexes. Queries and sub queries. Aggregate functions. Insert, update and delete operations. Joins, Unions, Intersection, Minus, Cursors in SQL.

UNIT - III

Normalization: Functional dependencies, normal forms, first, second, third normal forms, BCNF, inclusion dependences, loss less join decompositions, normalization using FD, MVD, and JDs, alternative approaches to database design.

UNIT - IV

Transaction Processing Concepts: Transaction system, Testing of serializability, Serializability of schedules, conflict & view serializable schedule, recoverability, Recovery from transaction failures, log based recovery, checkpoints, deadlock handling.

UNIT - V

Concurrency Control Techniques: Concurrency control, locking Techniques for concurrency control, Time stamping protocols for concurrency control, validation based protocol, multiple granularity, Multi version schemes, Recovery with concurrent transaction.

TEXT BOOK

Korth, Silbertz, Sudarshan, "Database Concepts", McGraw Hill

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REFERENCES

1. Elmasri, Navathe, "Fundamentals Of Database Systems", Addision Wesley
2. Raghu Ramakrishnan, "Database Management System", McGraw Hill
3. Maheshwari Jain, "DBMS: Complete Practical Approach", Firewall Media, New Delhi.
4. Date C. J, "An Introduction To Database System", Addision Wesley

EXAMINATION SECTION

T128– BIOMEDICAL INSTRUMENTATION

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1**	**External Marks**	**: 75**
Credits	**: 3**	**External Examination**	**: 3 Hrs**

OBJECTIVES

To study different types of electrodes used in bio-potential recording.
- To understand the characteristics of bio-amplifiers and different types of recorders.
- To understand how to measure various biochemical and nonelectrical parameters of human system.
- To study the instrumentation concerned with measuring the blood flow volume, velocity and number of particles in the blood.

UNIT - I

Components of medical instrumentation system, Bio signals, Static & Dynamic Characteristics ,Bio amplifier, Problems with components of Medical system, Cell structure, Nernest equation, Action & Resting potentials.

UNIT - II

Bio-potential electrodes ,Bio chemical electrodes, Internal Electrodes, External electrodes.

UNIT - III

ECG –Heart cardiac cycle, Electrical & Mechanical activities of heart, Cardiovascular system, ECG Recorder, Enthoven triangle (12-Lead configuration) , Blood Pressure measurement, Blood flow measurement, Electrodes for ECG.

UNIT - IV

Pacemaker, Defibrillators , Short wave Diathermy ,Hemo-Dialysis ,EEG-Anatomy ,Recorders Electrodes for EEG ,Electrode-Placement, MG-Introduction ,Recorder ,Electrodes for EMG.

UNIT - V

Respiration, Spirometry ,Pnuemotachograph ,Ventilators.

TEXT BOOK

Bio medical instrumentation & measurements – 2nd edition by leslie chromwell, fred j. Weibell, erich a. Pfeiffer – phi publisher

REFERENCES

1. Bio medical instrumentation—Armugam.
2. Medical instrumentation application & design – 3rd edition by jhon g.webster, editor jhon wiley.

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