ANNA UNIVERSITY COIMBATORE

Faculty of Electrical Engineering

Full Time 4 year B.E. – EEE Regulations – 2008

CURRICULAM

(For the candidates admitted from the academic year 2008 – 2009 onwards)

Semester I

S.No.	Course Code	Course Title	L	T	P	C
Theory						
1.		Technical English I	3	1	0	3
2.		Mathematics I	3	1	0	4
3.		Engineering Physics I	3	0	0	3
4.		Engineering Chemistry I	3	0	0	3
5.		Engineering Graphics	2	0	3	4
6.		Fundamentals of Computing and Programming	3	0	0	4
Practical						
7.		Computer Practice Laboratory I	0	0	3	2
8.		Engineering Practices Laboratory	0	0	3	2
9.		Physics and Chemistry Laboratory	0	0	3	-
		Total	**17**	**02**	**12**	**25**

Semester II

S.No.	Course Code	Course Title	L	T	P	C
Theory						
1.		Technical English II	3	0	0	3
2.		Mathematics II	4	2	0	4
3.		Engineering Physics II	4	0	0	3
4.		Engineering Chemistry II	4	0	0	3
5.		Circuit Theory	4	0	0	4
6.		Basic Civil & Mechanical Engineering	4	0	0	3
Practical						
7.		Computer Practice Laboratory II	0	1	2	2
8.		Physics and Chemistry Laboratory	0	0	3	2
9.		Electrical Circuits Laboratory	0	0	3	2
		Total	**23**	**03**	**08**	**26**

Semester III

S.No.	Course Code	Course Title	L	T	P	C
Theory						
1.		Transforms and Partial Differential Equations	3	1	0	4
2.		Measurements & Instrumentation	3	0	0	3
3.		Electromagnetic Theory	3	1	0	4
4.		Environmental Science and Engineering	3	0	0	3
5.		Electronic Devices & Circuits	3	0	0	3
6.		Data Structures and Algorithms	3	1	0	4
Practical						
7.		Electron Devices & Circuits Lab	0	0	3	2
8.		Measurements & Instrumentation Laboratory	0	0	3	2
9.		Data Structures and Algorithms Laboratory	0	0	3	2
		Total	**18**	**03**	**09**	**27**

Semester IV

S.No.	Course Code	Course Title	L	T	P	C
Theory						
1.		Numerical Methods	3	1	0	4
2.		Electrical Machines – I	3	1	0	4
3.		Power Plant Engineering	3	1	0	4
4.		Control Systems	3	1	0	4
5.		Linear Integrated Circuits and Applications	3	0	0	3
6.		Digital Logic Circuits	3	1	0	4
Practical						
7.		Control Systems Laboratory	0	0	3	2
8.		Linear and Digital Integrated Circuits Laboratory	0	0	3	2
9.		Electrical Machines Laboratory – I	0	0	3	2
		Total	**18**	**05**	**09**	**29**

Semester V

S.No.	Course Code	Course Title	L	T	P	C
Theory						
1.		Network Analysis and Synthesis	3	1	0	4
2.		Electrical Machines – II	3	1	0	4
3.		Transmission and Distribution	3	1	0	4
4.		Object Oriented Programming	3	1	0	4
5.		Microprocessor and Microcontrollers	3	1	0	4
6.		Communication Engineering	3	0	0	3
Practical						
7.		Electrical Machines Laboratory – II	0	0	3	2
8.		Object Oriented Programming Laboratory	0	0	3	2
9.		Microprocessor and Microcontrollers Laboratory	0	0	3	2
		Total	**18**	**05**	**09**	**29**

Semester VI

S.No.	Course Code	Course Title	L	T	P	C
Theory						
1.		Principles of Management	3	0	0	3
2.		Electrical Machine Design	3	1	0	4
3.		Power Electronics	3	1	0	4
4.		Power System Analysis and Stability	3	1	0	4
5.		Digital Signal Processing	3	1	0	4
6.		Computer Architecture	3	0	0	3
Practical						
7.		Power Electronics Laboratory	0	0	3	2
8.		Power System Simulation Laboratory	0	0	3	2
9.		Digital Signal Processing Laboratory	0	0	3	2
		Total	**18**	**04**	**09**	**28**

Semester VII

S.No.	Course Code	Course Title	L	T	P	C
Theory						
1.		Disaster Management	3	0	0	3
2.		Power System Protection and Switchgear	3	0	0	3
3.		Electric Drives and Control	3	1	0	4
4.		Embedded Systems	3	0	0	3
5.		Elective I	3	0	0	3
6.		Elective II	3	0	0	3
Practical						
7.		Electric Drives and Control Laboratory	0	0	3	2
8.		Electronics Design Laboratory	0	0	3	2
		Total	**18**	**01**	**06**	**23**

Semester VIII

S.No.	Course Code	Course Title	L	T	P	C
Theory						
1.		Electric Power Utilization and Energy Auditing	3	0	0	3
2.		Professional Ethics	3	0	0	3
3.		Elective III	3	0	0	3
4.		Elective IV	3	0	0	3
Practical						
5.		Project Viva-Voce	0	0	9	6
		Total	**12**	**00**	**09**	**18**

LIST OF ELECTIVES

GROUP A (For VII Semester)

S.No.	Course Code	Course Title	L	T	P	C
1.		VLSI Design	3	0	0	3
2.		Neural Networks and Fuzzy Systems	3	0	0	3
3.		Power Quality Engineering	3	0	0	3
4.		Power System Operation and Control	3	0	0	3
5.		Total Quality Management	3	0	0	3
6.		Computer Networks	3	0	0	3
7.		Virtual Instrumentation	3	0	0	3
8.		Computer Aided Analysis and Design of Electrical Apparatus	3	0	0	3
9.		Electrical System Design and Estimation	3	0	0	3
10.		Microprocessor based System Design	3	0	0	3

GROUP B (For VIII Semester)

S.No.	Course Code	Course Title	L	T	P	C
1.		High Voltage Engineering	3	0	0	3
2.		Modern Control Engineering	3	0	0	3
3.		Special Electrical Machines	3	0	0	3
4.		Digital Image Processing	3	0	0	3
5.		Renewable Energy Sources	3	0	0	3
6.		Medical Instrumentation	3	0	0	3
7.		Optical Communications	3	0	0	3
8.		Robotics and Automation	3	0	0	3
9.		Artificial Intelligence and Expert Systems	3	0	0	3
10.		HVDC Transmission	3	0	0	3

SEMESTER - 5

NETWORK ANALYSIS AND SYNTHESIS 3 1 0 4

UNIT – I TIME RESPONSE OF CIRCUITS 9

Time response of RL, RC, LC and RLC circuits for zero input, step and sinusoidal inputs using Laplace Transform method - Natural frequency and damping ratio - decrement and logarithmic decrement - response to non-sinusoidal periodic inputs.

UNIT - II APPLICATION OF COMPLEX FREQUENCY AND POLE – ZERO CONCEPTS 9

Concept of complex frequency - complex impedance and admittance - poles and zeros - frequency response from pole-zero configuration - Fourier series representation of periodic inputs - Trigonometric and complex forms - Fourier integral and Fourier transforms.

UNIT - III ONE PORT AND TWO PORT NETWORKS 9

Driving point impedance and admittance of one port networks - open circuit impedance and short circuit admittance of two port networks - transfer impedance and admittance - voltage and current ratio transfer functions - ABCD parameters - image impedance - impedance matching - equivalent networks.

UNIT - IV FILTERS 9

Characteristics of ideal filters - low pass and high pass filters - Attenuation and phase shift - Constant K and M - derived filters - Band pass filters.

UNIT - V ELEMENTS OF NETWORK SYNTHESIS 9

Reliability of one port networks - Hurwitz polynomials - PR function - Necessary and sufficient conditions of PR function - Properties of driving point impedance - Synthesis of LC,RL and RC driving point impedance

Lecture: 45, Tutorial: 15, TOTAL: 60

REFERENCE BOOKS

1 ShyamMohan S.P., Sudhakar A, “Circuits and Network Analysis &Synthesis”, Tata McGraw Hill, 2007.
2 Arumugam .M and Premkumar .N, Electric circuit theory, Khanna & Publishers, 1989.
3 Soni M.L and Gupta J.C, “Electrical circuit Analysis”, Dhanpat Rai and Sons, Delhi, 1990.

ELECTRICAL MACHINES – II 3 1 0 4

UNIT – I ALTERNATOR 11

Constructional details – Types of rotors – EMF equation – Synchronous reactance – Armature reaction – Voltage regulation – EMF, MMF and ZPF methods – Synchronizing and parallel operation – Synchronizing power - Change of excitation and mechanical input – Blondel's theory – Determination of X_d and X_q using slip test.

UNIT - II SYNCHRONOUS MOTOR 9

Principle of operation – Torque equation – Starting methods -Operation on infinite bus bars – V and inverted V curves – Power input and power developed equations – Power/power angle relations – Hunting - synchronous condenser - Applications.

UNIT - III THREE PHASE INDUCTION MOTOR 10

Constructional details – Types of rotors – Principle of operation – Slip – Equivalent circuit – Torque equations -Slip-torque characteristics – Losses and efficiency – Load test - No load and blocked rotor tests - Circle diagram – Separation of no load losses – Crawling and cogging – Double cage rotors – Induction generator.

UNIT - IV STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR 7

Need for starting – Types of starters – Stator resistance and reactance, rotor resistance, autotransformer and star-delta starters – Speed control by changes of voltage, frequency, poles and rotor resistance – Cascaded connection.

UNIT - V SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES 8

Constructional details – Double revolving field theory – Equivalent circuit – Starting methods – Types and applications – Working principles of shaded pole induction motor, reluctance motor, repulsion motor, Hysteresis motor, stepper motor and universal motor.

Lecture: 45, Tutorial: 15, TOTAL: 60

REFERENCE BOOKS

1. D.P. Kothari and I.J. Nagrath, 'Electric Machines', Tata McGraw Hill Publishing Company Ltd, 2002.
2. A.E. Fitzgerald, Charles Kingsley, Stephen.D.Umans, 'Electric Machinery', Tata McGraw Hill Publishing Company Ltd, 2003.
3. K.Murugesh Kumar, 'Induction & Synchronous Machines', Vikas Publishing House Pvt. Ltd, 2000.

TRANSMISSION AND DISTRIBUTION 3 1 0 4

UNIT – I POWER GENERATION 8

Structure of electric power system; Sources of Electric Energy; Load Characteristics and Economic Aspects; Power Plants: Steam, Hydroelectric, Nuclear, Gas, Wind and Solar (Qualitative Treatment Only).

UNIT - II TRANSMISSION LINE PARAMETERS 9

Parameters of single and three phase transmission lines with single and double circuits: Resistance, inductance and capacitance of solid, stranded and bundled conductors: Symmetrical and unsymmetrical spacing and transposition; application of self and mutual GMD; skin and proximity effects; interference with neighboring communication circuits.

UNIT - III ANALYSIS OF TRANSMISSION LINES 11

Classification of lines: Short line, medium line and long line; equivalent circuits, attenuation constant, phase constant, surge impedance; transmission efficiency and voltage regulation; real and reactive power flow in lines: Power-angle diagram; surge-impedance loading, loadability limits based on thermal loading, angle and voltage stability considerations; shunt and series compensation; Ferranti effect and corona loss - Calculation of sag and tension.

UNIT - IV INSULATORS AND CABLES 8

Insulators: Types, voltage distribution in insulator string and grading, improvement of string efficiency. Underground cables: Constructional features of LT and HT cables, capacitance, dielectric stress and grading, thermal characteristics.

UNIT - V DISTRIBUTION SYSTEM & FACTS TECHNOLOGY 9

Radial and ring-main distributors; inter-connectors; AC distribution: AC distributor with concentrated load; three-phase, four-wire distribution system; DC distribution; sub-mains; stepped and tapered mains.

FACTS (qualitative treatment only): TCSC, SVC, STATCOM, UPFC.

Introduction, Application, Merits & Demerits of HVDC and EHV AC transmission

Lecture: 45, Tutorial: 15, TOTAL: 60

REFERENCE BOOKS

1. M.L. Soni, Gupta, Bhatnagar, Chakrabarthy, “A Text book on Power Systems Engineering”, Danpat Rai & Sons, 2007.
2. Wadhwa, C.L., ‘Electrical Power Systems’, Wiley Eastern Limited India, 1985.
3. S.N. Singh, ‘Electric Power Generation, Transmission and Distribution’, Prentice Hall of India Pvt. Ltd, New Delhi, 2002.
4. B.R. Gupta, “Generation of Electrical Energy”, Eurasia Publishing House (Pvt.) Ltd., Ramnagar, New Delhi, 1983

OBJECT ORIENTED PROGRAMMING 3 1 0 4

UNIT – I INTRODUCTION 9

Object oriented paradigm-Elements of object oriented programming –Merits and demerits of OO Methodology - C++ fundamentals-Data types-Operators and Expressions-Control flow - Arrays-Strings-Pointers

UNIT - II PROGRAMMING IN C++ 9

Classes and Objects-Functions in C++-Constructors and destructors-Parameterized constructors-Multiple constructors-Constructor with default arguments-Dynamic initialization of objects-Copy constructor-Dynamic constructor.

UNIT - III INHERITANCE AND POLYMORPHISM 9

Inheritance-A derived class-Types of Inheritance-Typing conversion and visibility-Virtual functions-Abstract base class-Function overloading - Operator Overloading.

UNIT - IV BASICS OF JAVA 9

Java features - Comparison with C and C++ – Java program structures – Java tokens – Java statements – Java virtual machine – Command line arguments - Constants – Variables – Data types – Scope of variables – Operators.

Defining a class – Adding variables and methods – Creating objects – Accessing class members – Constructors – Method overloading – Static members – Inheritance: Extending a class – Overriding methods – Final variables and methods – Final classes – Abstract methods and classes – Visibility control.

UNIT - V PROGRAMMING USING ARRAYS AND STRING INTERFACES AND PACKAGE 9

Arrays – One dimensional array – Creating an array – Two-dimensional arrays – Strings – Vectors – Defining interfaces – Extending interfaces – Implementing interfaces – Accessing interface variables – Java API packages – Using system packages – Creating, accessing and using a package – Adding a class to a package.

Lecture: 45, Tutorial: 15, TOTAL: 60

REFERENCE BOOKS

1. E. Balagurusamy, “Object Oriented Programming with C++”, 3rd edition, Tata McGraw Hill (I) Pvt. Ltd., NewDelhi.
2. Yeshwant Kanetkar, “Let Us C++” BPB Publications, 2004.
3. Venugopal, “Mastering C++”, Tata McGraw Hill, New Delhi, 2004.
4. E. Balagurusamy, ‘Programming with JAVA – A Primer’, Second edition, Tata McGraw Hill, 2007.

MICROPROCESSOR AND MICROCONTROLLERS 3 1 0 4

UNIT – I **8085 PROCESSOR** **9**

8085 Architecture – Functional block diagram - Instruction set – Addressing modes – Timing diagrams – Assembly language programming – Interrupts

UNIT - II **PERIPHERAL INTERFACING WITH 8085** **9**

Architecture and programming of ICs: 8255 PPI, 8259 PIC, 8251 USART, 8279 Key board display controller and 8253 Timer/ Counter – Interfacing with 8085

UNIT - III **8086 PROCESSOR** **9**

8086 Architecture – Functional block diagram - Instruction set – Addressing modes – Assembly language programming – Interrupts.

UNIT - IV **8051 MICRO CONTROLLER** **9**

Functional block diagram - Instruction set - addressing modes – Interrupt structure – Timer – I/O ports – Serial communication.

UNIT - V **MICRO CONTROLLER APPLICATIONS** **9**

Interfacing: LCD, ADC, DAC, Sensors, Stepper Motor, Keyboard and DC motor speed control

Lecture : 45, Tutorial : 15, TOTAL : 60

REFERENCE BOOKS

1 R.S. Gaonkar, "Microprocessor Architecture, Programming, and Applications with the 8085", 5th Edition, Prentice Hall, 2002.
2 John E Uffenbeck, The 80x86 Family, Design, Programming and Interfacing, Third Edition. Prentice Hall, 2001.
3 A.K. Ray and K.M. Bhurchandi, "Advanced Microprocessors and peripherals", 2nd Edition, Tata McGraw-Hill, 2006.
4 Muhammad Ali Mazidi, Janice Gillispie Mazidi & Rolin McKinlay, 'The 8051 Micro Controller and Embedded Systems', Prentice Hall, 2005.
5 Kenneth J Ayala, "The 8051 Micro controller", Thomson Delmer Learning, 2004
6 William Kleitz, 'Microprocessor and Micro Controller Fundamental of 8085 and 8051 Hardware and Software', Pearson Education, 1998.

COMMUNICATION ENGINEERING 3 0 0 3

UNIT – I MODULATION SYSTEMS 9

Modulation – Need – Types – Analog Modulation – AM – FM – Modulation and Demodulation – Comparison – Receivers – TRF – Super heterodyne receiver – FM Receivers (Block Diagram Only)

UNIT - II TRANSMISSION MEDIUM 9

Transmission lines – Types, equivalent circuit, losses, standing waves, impedance matching, bandwidth; radio propagation – Ground wave and space wave propagation, critical frequency, maximum usable frequency, path loss, white Gaussian noise.

UNIT – III DIGITAL COMMUNICATION 9

Time Division Multiplexing, Digital T-carrier System – Pulse code modulation – Digital radio system. Digital modulation: Frequency and phase shift keying – Modulator and demodulator, bit error rate calculation.

UNIT - IV DATA COMMUNICATION AND NETWORK PROTOCOL 9

Data Communication codes, error control. Serial and parallel interface, telephone network, data modem, ISDN, LAN, ISO-OSI seven layer architecture for WAN.

UNIT – V SATELLITE AND OPTICAL FIBRE COMMUNICATIONS 9

Orbital satellites, geostationary satellites, look angles, satellite system link models, satellite system link equations; advantages of optical fibre communication – Light propagation through fibre, fibre loss, light sources and detectors

Lecture : 45, Tutorial : 0, TOTAL : 45

REFERENCE BOOKS

1 Wayne Tomasi, 'Electronic Communication Systems', Pearson Education, Third Edition, 2001.
2 Louis E. Frenzel, "Principles of Electronics Communication Systems", Tata McGraw Hill, 3rd Edition, 2008.
3 Anokh Singh, "Principles of Communication Engineering" S.Chand & Co., 1999.
4 G. Kennedy, 'Electronic Communication Systems', McGraw Hill, 4th edition, 2002.
5 Miller, 'Modern Electronic Communication', Prentice Hall of India, 2003.
6 Roy Blake, 'Electronic Communication Systems', Thomson Delmar, 2nd Edition, 2002.

ELECTRICAL MACHINES LABORATORY - II 0 0 3 2

LIST OF EXPERIMENTS

1. Regulation of three-phase alternator by EMF, MMF and ZPF methods.
2. Load test on three-phase alternator.
3. Regulation of three-phase salient pole alternator by slip test.
4. V and Inverted V curves of Three Phase Synchronous Motor.
5. Load test on three-phase squirrel cage induction motor.
6. Load test on three-phase slip ring induction motor.
7. No load and blocked rotor test on three-phase induction motor.
8. Separation of No-load losses of three-phase induction motor.
9. Loss summation method on three-phase induction motor.
10. Load test on single-phase induction motor
11. Determination of Equivalent circuit of single-phase induction motor
12. Speed control of three phase induction motor by V/f method

P = 45 Total = 45

OBJECT ORIENTED PROGRAMMING LABORATORY **0 0 3 2**

LIST OF EXPERIMENTS

1. String concatenation using dynamic memory allocation concept.
2. Implementation of arithmetic operations on complex numbers using constructor overloading.
3. To read a value of distance from one object and add with a value in another object using friend function
4. Implementation of + and - operator overloading and implementation of addition operation of octal object with integer using operator overloading.
5. Implementation of addition and subtraction of two polynomial objects using operator overloading.
6. Managing bank account using inheritance concept.
7. To compute the area of triangle and rectangle using inheritance and virtual function.
8. Writing simple programs in Java.
9. Use of interfaces in Java.
10. Developing packages in Java

P = 45 Total = 45

MICROPROCESSOR AND MICROCONTROLLERS LABORATORY **0 0 3 2**

LIST OF EXPERIMENTS

1. Study of 8085 microprocessor, 8086 microprocessor, 8051 microcontroller kit

2. Programming for 8/16 bit Arithmetic operations Using 8085
   - Addition / subtraction / multiplication / division.

3. Programming with control instructions Using 8085
   - Increment / Decrement.
   - Ascending / Descending order.
   - Maximum / Minimum of numbers.
   - Rotate instructions.
   - Hex. / ASCII / BCD code conversions.

4. Programming for Arithmetic operations Using 8086
   - Addition / subtraction / multiplication / division.

5. Programming with control instructions Using 8086
   - Increment / Decrement.
   - Ascending / Descending order.
   - Maximum / Minimum of numbers.
   - Rotate instructions.
   - Hex. / ASCII / BCD code conversions.

6. Interface Experiments:
   - A/D Interfacing.
   - D/A Interfacing.
   - Traffic light controller.

7. Interface Experiments:
   - Simple experiments using 8251, 8279, 8254.

8. Programming for 8/16 bit Arithmetic operations Using 8051
   - Addition / subtraction / multiplication / division.

9. Interfacing and Programming of DC Motor Speed control using 8085.

10. Interfacing and Programming of Stepper Motor control using 8085.

P = 45 Total = 45

SEMESTER – 6

PRINCIPLES OF MANAGEMENT 3 0 0 3

UNIT – I HISTORICAL DEVELOPMENT 8

Management: Definition - nature - scope and functions -Evolution of management thought - Relevance of management to modern industries.

UNIT - II PLANNING 8

Planning: Nature and importance - procedure - types of planning, Techniques & strategic consideration - Objectives - MBO - Forecasting - Decision-making - policy and strategy.

UNIT - III ORGANISING 8

Organizing: Nature - purpose - organizational structure - Theories of organization - span of control - Line & staff functions. Authority & Responsibility - centralization and decentralization -delegation of authority - span of control – Pros & cons, factors to be considered in the establishment of organization.

UNIT - IV DIRECTING 8

Directing & coordination:- Nature of directing - leadership qualities - styles - motivation - morale and discipline - Incentives for motivation - Nature & purpose of coordination - Techniques of coordination.

UNIT - V CONTROLLING 13

Controlling: The objectives and process of control - Role of information in control- Performance standard – Measurement of performance, remedial act – Integrated control system in an organization - Case Analysis

Lecture : 45, Tutorial : 0, TOTAL : 45

REFERENCE BOOKS

1 Koontz.H and Weihrich, “Essentials of Management: An International Perspective” Tata McGraw Hill, 7th Edition, 2007.
2 L.M.Prasad – Principles & Practices of Management, Sultan Chand & Sons, New Delhi
3 Stoner J.A.F and Freeman R.E, Management, 1992, Prentice Hall, New Delhi.
4 Weihrich & Koontz, Management: A Global Perspective, 1993, McGraw Hill, New Delhi.
5 Peter Drucker – Management of Non-Profit Organizations, 1972 New Delhi: Allied Publishers.

ELECTRICAL MACHINE DESIGN 3 1 0 4

UNIT – I INTRODUCTION 9

Considerations and limitations in design; choice of specific electric and magnetic loadings.

Concept of magnetic circuit – MMF calculation for various types of electrical machines – real and apparent flux density of rotating machines – leakage reactance calculation for transformers, induction and synchronous machine.

UNIT - II D.C. MACHINES 9

Output equation – main dimensions – choice of number of poles – armature design – design of air gap - design of field poles and field coil – design of commutator and brushes.

UNIT - III TRANSFORMERS 9

Output rating of single phase and three phase transformers – optimum design of transformers – design of core, yoke and windings for core and shell type transformers – design of tanks and cooling tubes of transformers.

UNIT - IV THREE PHASE INDUCTION MOTORS 9

Output equation – main dimensions – design of stator – design of squirrel cage and slip ring rotor – performance calculation from designed data.

UNIT - V SYNCHRONOUS MACHINES 9

Output equation – main dimensions – short circuit ratio – design of stator and rotor of cylindrical pole and salient pole machines – design of damper winding - design of field coil – cooling of large alternators

Lecture: 45, Tutorial: 15, TOTAL: 60

REFERENCE BOOKS

1 A.K. Sawhney, ‘A Course in Electrical Machine Design’, Dhanpat Rai and Sons, New Delhi, 2003.

2 S.K. Sen, ‘Principles of Electrical Machine Design with Computer Programmes’, Oxford and IBH Publishing Co.Pvt Ltd., New Delhi, 1987

3 R.K. Agarwal, ‘Principles of Electrical Machine Design’, S.K.Kataria and Sons, Delhi, 2002.

4 V.N. Mittle and A. Mittle, ‘Design of Electrical Machines’, Standard Publications Distributors, Delhi, 2002

5. Shanmugasundaram, A., Gangadharan G. and Palani R., "Electrical Machine Design Data Book", Wiley Eastern Ltd., New Delhi, 1979.

POWER ELECTRONICS 3 1 0 4

UNIT – I POWER SEMI-CONDUCTOR DEVICES 9

Construction, Principle of operation - Static and dynamic characteristics of Power diodes, SCR, TRIAC, GTO, power BJT, power MOSFET and IGBT – Safe operating Area – protection circuits – series and parallel connections.

UNIT - II PHASE CONTROLLED CONVERTERS 9

AC to DC converters: single phase and three phase controllers with R, RL and RLE load – Estimation of RMS load voltage, RMS load current and input power factor – AC voltage controllers (using thyristors and Triacs) Three phase AC voltage controllers (No analysis) – single phase to single phase cycloconverter - effect of source inductance and firing circuits.

UNIT - III DC TO DC CHOPPERS 9

DC to DC converters: DC choppers using devices other than thyristors – Principle of step up and step down operation – single quadrant DC chopper with R, RL and RLE load – Time ratio control – Estimation of average load voltage and load current for continuous current operation – two quadrant and four quadrant DC choppers. Voltage, current and load-commutated choppers and firing circuits. Step up and step down cycloconverter - three phase to single phase and three phase to three phase cycloconverter.

UNIT - IV INVERTERS 9

DC to AC converters: Inverters– Types – voltage source and current source inverters – single phase bridge inverters – three phase bridge inverters – - PWM inverters - Series inverter control of AC output voltage – Harmonic reduction

UNIT - V CONTROL CIRCUITS AND APPLICATIONS 9

Control circuits: Functional requirements of the switching control circuits – generation of control signals for single phase AC to DC converters – Cosine wave crossing control, ramp comparator approach, Generation of timing pulses for DC choppers – PWM techniques for DC to AC converters – Introduction to power converter control using PLC's, microprocessor and micro controllers.

Applications: UPS – HVDC systems – Tap changing of transformers

Lecture : 45, Tutorial : 15, TOTAL : 60

REFERENCE BOOKS

1 Rashid, M.H., 'Power Electronics - Circuits Devices and Applications', Prentice Hall of India, 1995.

2 Singh.M.D and Kanchandani-'Power Electronics'-Tata McGraw-Hill & Hill publication Company Ltd New Delhi-2002.

3 Joseph Vithayathil, "Power Electronics", Mc Graw Hill series in Electrical and Computer Engineering , USA., 1995

4 Dubey, G.K., Doradia, S.R., Joshi, A. and Sinha, R.M., 'Thyristorised Power Controllers', Wiley Eastern Limited, 1986.

5 Lander,W., 'Power Electronics', McGraw Hill and Company, Third Edition, 1993

6 J. Gnanavadivel and V. Malathy, "Power Electronics", Anuradha Publications.

POWER SYSTEM ANALYSIS AND STABILITY 3 1 0 4

UNIT – I INTRODUCTION 7

Need for system analysis in planning and operation of power system – distinction between steady state and transient state – per phase analysis of symmetrical three-phase system. General aspects relating to power flow, short circuit and stability analysis - per unit representation.

UNIT - II MODELING OF VARIOUS COMPONENTS / ACCESSORIES 8

Primitive network and its matrices – bus incidence matrix – bus admittance and bus impedance matrix formation. Formation of bus impedance by two-rule method – Z-bus building algorithm - π-equivalent circuit of transformer with off-nominal-tap ratio. Modeling of generator, load and transmission line for power system analysis.

UNIT - III POWER FLOW ANALYSIS 10

Problem definition – bus classification – derivation of power flow equation – Solution by Gauss–Seidel and Newton–Raphson methods - P-V bus adjustments for both methods - computation of slack bus power, transmission loss and line flow.

UNIT - IV SHORT CIRCUIT ANALYSIS 10

Need for short circuit study- Approximations in modeling – Fault MVA- Symmetrical short circuit analysis – Thevenin's equivalent representation - Unsymmetrical Fault Analysis - Symmetrical component transformation – sequence impedances – sequence networks – Types of unsymmetrical fault - unsymmetrical fault analysis on an Unloaded generator- unsymmetrical analysis on power system.

UNIT - V Stability analysis 10

Concept of stability in power system - Swing equation - stability limits - methods of improving stability limits- Solution of swing equation by Euler's method and Runge-Kutta method – power angle equations - Equal area criterion - critical clearing angle and time

Lecture : 45, Tutorial : 15, TOTAL : 60

REFERENCE BOOKS

1 John J. Grainger and Stevenson Jr. W.D., 'Power System Analysis', Tata McGraw Hill, 1st Edition, 2003.

2 Nagrath. I.J, Kothari. D.P, "Modern Power system Analysis", Tata McGraw Hill Pub. Co. Ltd., 3rd Edition, 2003.

3. E.W. Kimbark, "Electric Power system stability", IEEE Press, 1995.

4. C.L. Wadhwa-Electrical Power systems, Second edition, Wiley Eastern Limited, 1993.

5. Stagg, G.W. and El-Abaid, A. H. 'Computer Methods in Power System Analysis', McGraw-Hill International Book Company 1993.

6. Nagrath, I.J., and Kothari, D.P., 'Modern Power System Analysis', Tata McGraw Hill Publishing Company, 1990.

DIGITAL SIGNAL PROCESSING 3 1 0 4

UNIT – I INTRODUCTION 9

Need and advantages of Digital Signal Processing; Classification of systems: Continuous, discrete, linear, causal, stable, dynamic, recursive, time variance; classification of signals: continuous and discrete, energy and power; signal representation by singularities; Typical signal processing operations: convolution, correlation ant transformation; Typical DSP system: ADC/DAC - sampling, quantization, quantization error, Nyquist rate, aliasing effect.

UNIT - II DISCRETE TIME SYSTEM ANALYSIS 9

Z-transform and its properties, inverse z-transforms; difference equation – Solution by z-transform, application to discrete systems - Stability analysis, frequency response– Fourier transform of discrete sequence – Discrete Fourier series– Convolution using Z-transform and Fourier transform.

UNIT - III DISCRETE TRANSFORMS 9

DFT – Definition - properties, Computation of DFT using FFT algorithm – DIT & DIF - FFT using radix 2 – Butterfly structure; Computation of IDFT using DFT. Wavelet transform: MRA by the Wavelet method.

UNIT - IV DESIGN OF DIGITAL FILTERS 9

IIR design: Approximation of analog filter design - Butterworth and Chebyshev; digital design using impulse invariant and bilinear transformation - Warping, prewarping - Frequency transformation.

FIR design: Windowing Techniques – Need and choice of windows – Linear phase characteristics. FIR & IIR filter realization – Parallel & cascade forms.

UNIT - V DSP HARDWARE 9

Architecture for signal processing - Van Neumann and Harvard architecture; Architecture and features of TMS 320C54 signal processing chip.

Lecture : 45, Tutorial : 15, TOTAL : 60

REFERENCE BOOKS

1 J.G. Proakis and D.G. Manolakis, ‘Digital Signal Processing Principles, Algorithms and Applications’, Pearson Education, New Delhi, 2003 / PHI.

2 S.K. Mitra, ‘Digital Signal Processing – A Computer Based Approach’, Tata McGraw Hill, New Delhi, 2001.

3 Alan V. Oppenheim, Ronald W. Schafer and John R. Buck, ‘Discrete – Time Signal Processing’, Pearson Education, New Delhi, 2003.

4 B. Venkataramani, M. Bhaskar, ‘Digital Signal Processors, Architecture, Programming and Applications’, Tata McGraw Hill, New Delhi, 2003.

5 S. Salivahanan, A. Vallavaraj, C. Gnanapriya, ‘Digital Signal Processing’, Tata McGraw Hill, New Delhi, 2003.

COMPUTER ARCHITECTURE **3 0 0 3**

UNIT – I DATA REPRESENTATION, MICRO-OPERATIONS, ORGANIZATION AND DESIGN **13**

Data representation: Data types, complements, fixed–point representation, floating-point representation, other binary codes, error detection codes.

Register transfer and micro operations: Register transfer language, register transfer, bus and memory transfers, arithmetic micro-operations, logic micro-operations, shift micro-operations, arithmetic logic shift unit.

Basic computer organization and design: Instruction codes, computer registers, computer instructions, timing and control, instruction cycle, memory reference instructions, input-output and interrupt. Complete computer description, design of basic computer, design of accumulator logic.

UNIT - II CONTROL AND CENTRAL PROCESSING UNIT **8**

Micro programmed control: Control memory, address sequencing, micro-program example, design of control unit.

Central processing unit: General register organization, stack organization, instruction formats, addressing modes, data transfer and manipulation, program control, reduced instruction set computer.

UNIT - III COMPUTER ARITHMETIC, PIPELINE AND VECTOR PROCESSING **8**

Computer arithmetic: Addition and subtraction, multiplication algorithms, division algorithms, floating-point arithmetic operations, decimal arithmetic unit, decimal arithmetic operations.

Pipeline and vector processing: Parallel processing, pipelining, arithmetic pipeline, instruction pipeline, RISC pipeline, vector processing array processors.

UNIT - IV INPUT-OUTPUT ORGANIZATION **8**

Input-output organization: Peripheral devices, input-output interface, asynchronous data transfer, modes of transfer, priority interrupt, direct memory access, input-output processor, serial communication.

UNIT - V MEMORY ORGANIZATION **8**

Memory organization: Memory hierarchy, main memory, auxiliary memory, associative memory, cache memory, virtual memory, memory management hardware.

Lecture : 45, Tutorial : 0, TOTAL : 45

REFERENCE BOOKS

1 Morris Mano, 'Computer System Architecture', 3rd Edition, Pearson Education, 2002 / PHI.

2 Vincent P.Heuring and Harry F.Jordan, 'Computer Systems Design and Architecture', Pearson Education Asia Publications, 2002.

3 John P.Hayes, 'Computer Architecture and Organization', Tata McGraw Hill, 1988.

4 Andrew S.Tanenbaum, 'Structured Computer Organization', 4th Edition, Prentice Hall of India/Pearson Education, 2002.

5 William Stallings, 'Computer Organization and Architecture', 6th Edition, Prentice Hall of India/Pearson Education, 2003.

POWER ELECTRONICS LABORATORY

0 0 3 2

LIST OF EXPERIMENTS

1. VI and Switching characteristics of SCR.
2. VI and Switching characteristics of MOSFET.
3. VI and Switching characteristics of TRIAC.
4. VI and Switching characteristics of IGBT.
5. Single phase and Three phase half controlled Rectifiers.
6. Single phase and Three phase fully controlled Rectifiers
7. Step up and step down chopper.
8. Single phase IGBT inverter.
9. Three phase IGBT inverter.
10. Resonant dc-to-dc converter
11. Voltage and current commutated chopper.
12. Four quadrant chopper
13. Three phase AC voltage controllers
14. Single-phase cycloconverter.
15. Series and parallel inverter.

P= 45 Total = 45

POWER SYSTEM SIMULATION LABORATORY

0 0 3 2

LIST OF EXPERIMENTS

1 Computation of Parameters and Modeling of Transmission Lines

2 Formation of Bus Admittance and Impedance Matrices and Solution of Networks.

3 Load Flow Analysis - I : Solution of Load Flow And Related Problems Using Gauss-Seidel Method

4 Load Flow Analysis - II: Solution of Load Flow and Related Problems Using Newton-Raphson and Fast-Decoupled Methods

5 Fault Analysis

6 Transient and Small Signal Stability Analysis: Single-Machine Infinite Bus System

7 Transient Stability Analysis of Multi-machine Power Systems

8 Electromagnetic Transients in Power Systems

9 Load – Frequency Dynamics of Single- Area and Two-Area Power Systems

10 Economic Dispatch in Power Systems.

P= 45 Total = 45

DIGITAL SIGNAL PROCESSING LABORATORY

0 0 3 2

LIST OF EXPERIMENTS

USING TMS320C5X/54XX:

1. Generation of Signals
2. Linear Convolution
3. Implementation of a FIR filter
4. Implementation of an IIR filter
5. Calculation of FFT

USING MATLAB CODES

1. Representation of basic signals.
2. Verification of sampling theorem.
3. Computation of Circular Convolution.
4. Checking stability of LTI systems.
5. Finding Fast Fourier Transform.
6. Design Chebyshev analog and Digital filters.
7. Design of Butterworth analog and Digital filters.
8. Design and analysis of FIR filter using windows.

P= 45 Total = 45

SEMESTER - 7

DISASTER MANAGEMENT

3 0 0 3

Unit I: Introduction
Introduction – Disaster preparedness – Goals and objectives of ISDR Programme- Risk identification – Risk sharing – Disaster and development: Development plans and disaster management –Alternative to dominant approach – disaster-development linkages -Principle of risk partnership

Unit II: Application of Technology in disaster risk reduction
Application of various technologies: Data bases – RDBMS – Management Information systems – Decision support system and other systems – Geographic information systems – Intranets and extranets – video teleconferencing. Trigger mechanism – Remote sensing – an insight – contribution of remote sensing and GIS - Case study.

Unit III: Awareness of Risk reduction
Trigger mechanism – constitution of trigger mechanism – risk reduction by education – disaster information network – risk reduction by public awareness

Unit IV: Development planning on disaster
Implication of development planning – financial arrangements – areas of improvement – disaster preparedness – community based disaster management – emergency response.

Unit V: Seismicity
Seismic waves – Earthquakes and faults – measures of an earthquake, magnitude and intensity – ground damage – Tsunamis and earthquakes

Lecture : 45, Tutorial : 0, TOTAL : 45

Text Books:

1. Pardeep Sahni, Madhavi malalgoda and ariyabandu, “Disaster risk reduction in south asia”, PHI
2. Amita sinvhal, “Understanding earthquake disasters” TMH, 2010.

Reference:

1. Pardeep sahni, Alka Dhameja and Uma medury, “Disaster mitigation: Experiences and reflections”, PHI

POWER SYSTEM PROTECTION AND SWITCHGEAR

3 0 0 3

UNIT – I PROTECTIVE RELAYS 9

Principles and need for protective schemes – nature and causes of faults – types of faults – Power system earthing - Zones of protection and essential qualities of protection – Protection scheme – construction and characteristics of relays – over current relays – directional, distance and differential relays – under frequency relays – negative sequence relays – static relays – microprocessor based relays.

UNIT - II APPARATUS PROTECTION 9

Apparatus protection – generator and transformer protection – protection of bus bars, transmission lines, CT's & PT's and their application in protective schemes

UNIT - III THEORY OF CIRCUIT INTERRUPTION 9

Physics of arc phenomena and arc interruption. Restriking voltage & Recovery voltage, rate of rise of recovery voltage, current chopping, interruption of capacitive current, resistance switching – DC circuit breaking.

UNIT - IV CIRCUIT BREAKERS 9

Switch gear – fault clearing process – interruption of current – Types of Circuit Breakers – Air blast, oil, SF_6 and Vacuum circuit breakers – comparative merits of different circuit breakers – Testing of circuit breakers – Circuit breaker ratings.

UNIT - V PROTECTION AGAINST OVER VOLTAGES 9

Causes of over voltages – methods of protection against over voltages – ground wires, Peterson coil, surge absorbers, surge diverters – relay co-ordination – selection of protective system – Insulation co-ordination.

Lecture : 45, Tutorial : 0, TOTAL : 45

REFERENCE BOOKS

1 Sunil S. Rao, 'Switchgear and Protection', Khanna publishers, New Delhi, 1986.
2 C.L. Wadhwa, 'Electrical Power Systems', New Age International (P) Ltd., 2000.
3 M.L. Soni, P.V. Gupta, V.S. Bhatnagar, A. Chakrabarti, 'A Text Book on Power System Engineering', Dhanpat Rai & Co., 1998.
4 Badri Ram, Vishwakarma, 'Power System Protection and Switchgear', Tata McGraw Hill, 2001.
5 B. Ravindranath, and N. Chander, 'Power System Protection & Switchgear', New Age Publishers, 1977.

ELECTRIC DRIVES AND CONTROL 3 1 0 4

UNIT – I CHARACTERISTICS OF ELECTRIC DRIVES 9

Speed - Torque characteristics of various types of loads and drive motors - Joint speed - Torque characteristics - Selection of power rating for drive motors with regard to thermal overloading and load variation factors – load equalization – Starting, braking, and reversing operations.

UNIT - II DC DRIVES 9

Speed control of DC motors - Ward - Leonard scheme - drawbacks - Thyristor converter fed dc drives: - Single, two and four quadrant operations - Chopper fed DC drives : - Time ratio control and current limit control - Single, two and four quadrant operations - Effect of ripples on the motor performance.

UNIT - III THREE PHASE INDUCTION MOTOR DRIVES 10

Speed control of 3 phase Induction Motors - Stator control: Stator voltage and frequency control - AC chopper, Inverter and cycloconverter fed Induction Motor drives, rotor control - Rotor resistance control and slip power recovery schemes - Static control of rotor resistance using DC chopper - Static Krammer and Scherbius drives – Introduction to Vector Controlled Induction Motor Drives

UNIT - IV THREE PHASE SYNCHRONOUS MOTOR DRIVES 9

Speed control of 3 phase Synchronous Motors - True synchronous and self controlled modes of operations - Inverter fed Synchronous Motors – Commutator-less DC motors - cycloconverter fed Synchronous Motor - Effect of harmonics on the performance of AC motors

UNIT - V DIGITAL CONTROL AND DRIVE APPLICATIONS 8

Digital techniques in speed control - Advantages and limitations - Microprocessor/Microcontroller and PLC based control of drives - Selection of drives and control schemes for Steel rolling mills, Paper mills, Lifts and Cranes.

Lecture : 45, Tutorial : 15, TOTAL : 60

REFERENCE BOOKS

1 Dubey G.K., "Fundamentals of Electrical Drives", Narosa Publishing House, New Delhi, 2003.

2 Bose, B.K., “Modern Power Electronics and AC Drives", Pearson Education (Singapore) Pvt.. Ltd, New Delhi, 2003

3 Vedam Subramanyam, “ Electric Drives: Concepts and Applications”, Tata McGraw hill Pvt. Ltd, New Delhi, 2002

4 Bose, B.K., "Power Electronics and Variable frequency Drives – Technology and Applications", IEEE, Press, Inc. New York, 1997.

5 Krishnan R, “ Electric Motor Drives: Modeling, Analysis and Control, Prentice Hall of India, Pvt. Ltd, New Delhi, 2002

6 Ion Boldea and S. A. Nasar”, Electric Drives”, CRC Press LLC, New York, 1999.

7 J. Gnanavadivel, “Electrical Drives and Control”, Anuradha Publications.

EMBEDDED SYSTEMS 3 0 0 3

UNIT – I INTRODUCTION TO EMBEDDED SYSTEM 9

Introduction to functional building blocks of embedded systems – Register, memory devices, ports, timer, interrupt controllers using circuit block diagram representation for each categories.

UNIT - II PROCESSOR AND MEMORY ORGANIZATION 9

Structural units in a processor; selection of processor & memory devices; shared memory; DMA; interfacing processor, memory and I/O units; memory management – Cache mapping techniques, dynamic allocation - Fragmentation.

CASE STUDY:

Required Memory devices for an Automatic Washing machine, Chocolate vending machine and for a Digital Camera and Voice recorder.

UNIT - III DEVICES & BUSES FOR DEVICES NETWORK 6

I/O devices; timer & counting devices; serial communication using I^2C, CAN, USB buses; parallel communication using ISA, PCI, PCI/X buses, arm bus; interfacing with devices/ports, device drivers in a system – Introduction.

UNIT - IV I/O PROGRAMMING AND SCHEDULE MECHANISM 12

Intel I/O instruction – Transfer rate, latency; interrupt driven I/O - Non-maskable interrupts; software interrupts, writing interrupt service routine in C & assembly languages; preventing interrupt overrun; disability interrupts.

Multi threaded programming – Context switching, premature & non-premature multitasking, semaphores.

Scheduling – Thread states, pending threads, context switching, round robin scheduling, priority based scheduling, assigning priorities, deadlock, watch dog timers.

UNIT - V REAL TIME OPERATING SYSTEM (RTOS) 9

Introduction to basic concepts of RTOS, RTOS – Interrupt handling, task scheduling; embedded system design issues in system development process – Action plan, use of target system, emulator, use of software tools.

Lecture : 45, Tutorial : 0, TOTAL : 45

REFERENCE BOOKS

1 P. Rajkamal, 'Embedded System – Architecture, Programming, Design', Tata McGraw Hill, 2003.

2 Daniel W. Lewis 'Fundamentals of Embedded Software', Prentice Hall of India, 2004.

3 Frank Vahid, 'Embedded System Design – A Unified Hardware & Software Introduction', John Wiley, 2002.

4 Sriram V. Iyer, Pankaj Gupte, 'Embedded Real Time Systems Programming', Tata McGraw Hill, 2004.

5 Steve Heath, 'Embedded System Design', II edition, Elsevier, 2003.

ELECTRIC DRIVES AND CONTROL LABORATORY

0 0 3 2

LIST OF EXPERIMENTS

1. Simulation of closed loop control of converter fed DC motor.
2. Simulation of closed loop control of chopper fed DC motor.
3. Simulation of VSI fed 3ϕ induction motor.
4. Simulation of 3ϕ synchronous motor drive.
5. Speed control of DC motor using 3ϕ Rectifier.
6. Speed control of 3ϕ induction motor using PWM inverter.
7. DSP based closed loop drive for induction motor.
8. Induction motor speed control using FPGA.
9. Speed control of Brush Less DC motor.
10. DSP based chopper fed DC motor drive.
11. Switched Reluctance Motor Drive using DSP.
12. PLC based drives.

P= 45 Total = 45

ELECTRONIC DESIGN LABORATORY

0 0 3 2

LIST OF EXPERIMENTS

(Any Three of the following must be developed like a commercial product)

1. Design and Fabrication of 5V Constant Voltage Power supply
2. Design and Fabrication of 0-12 V, 1A Variable Power Supply
3. Design and Fabrication of Driver Circuit to drive an Electromagnetic relay using Microprocessor with required Protection.
4. Design and Fabrication of an isolation circuit using opto coupler which is required for Microcontroller interfacing
5. Design and Fabrication of Domestic UPS.

P= 45 Total = 45

SEMESTER - 8
ELECTRIC POWER UTILISATION AND ENERGY AUDITING

3 0 0 3

UNIT – I ILLUMINATION, HEATING AND WELDING 9

Nature-of radiation –definition – laws photometry – polar curves – lighting calculations-design of illumination systems (for residential, industrial, commercial and street lightings) - types of lamps-energy efficiency lamps. Methods of heating requirement of heating material-design of heating element-furnaces – Welding generator-welding transformer and its characteristics

UNIT - II ELECTRIC TRACTION 9

Introduction – requirements of an ideal traction system – supply systems – mechanics of train movement – tractive effort – Specific energy consumption – traction motors and control – multiple units – braking methods - current collection systems-recent trends in electric traction.

UNIT - III DRIVES AND THEIR INDUSTRIAL APPLICATIONS 9

Introduction – motor selection and related factors – types of loads – characteristics – load equalization – industrial applications – modern methods of speed control of industrial drives.

UNIT - IV ELECTROLYTIC PROCESS AND STORAGE OF ELECTRICITY 9

Electrolysis – Polarization factor – Preparation of work for electroplating – tanks and other equipment – Method of charging and maintenance – Nickel – iron and Nickel – cadmium batteries – components and materials – capacity rating of batteries – battery chargers.

UNIT - V ENERGY CONSERVATION 9

Economics of generation – definitions – load curves – number and size of units – cost of electrical energy – tariff – need for electrical energy conservation-methods – energy efficient equipment – energy management – energy auditing.

Economics of power factor improvement – design for improvement of power factor using power capacitors – power quality – effect on conservation

Lecture : 45, Tutorial : 0, TOTAL : 45

REFERENCE BOOKS

1 E. Openshaw Taylor, “Utilization of Electrical Energy in SI Units” Orient Longman Private Limited, 2003.

2 B.R. Gupta, “Generation of Electrical Energy”, Eurasia Publishing House Private Limited, New Delhi, 2003.

3 M.L. Soni, P.V. Gupta, V.S. Bhatnagar, A. Chakrabarti, ‘A Text Book on Power System Engineering’, Dhanpat Rai & Co., 1998.

4 S.L. Uppal, “Electrical Power”, Khanna Publishers, 1988

5 Albert Thumann, William J. Younger, “HandBook of Energy Audits”, The Fairmont

Press, Inc., 2003

PROFESSIONAL ETHICS 3 0 0 3

UNIT – I HUMAN VALUES 10

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

UNIT - II ENGINEERING ETHICS 9

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 - Self-interest - customs and religion - uses of ethical theories.

UNIT - III ENGINEERING AS SOCIAL EXPERIMENTATION 9

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 9

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 8

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-sample code of Ethics (Specific to a particular Engineering Discipline).

Lecture : 45, Tutorial : 0, TOTAL : 45

REFERENCE 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.

3 Charles D. Fleddermann, "Engineering Ethics", Pearson Education/ Prentice Hall, New Jersey, 2004 (Indian Reprint now available)

4 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)

5 John R Boatright, " Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.

6 Edmund G Seebauer and Robert L Barry, " Fundamentals of Ethics for Scientists and

Engineers", Oxford University Press, Oxford, 2001 .

Electives

Group A (Seventh Semester)

VLSI DESIGN 3 0 0 3

UNIT – I MOS TRANSISTOR THEORY 9

Basic MOS Transistor- MOSFET Threshold Voltage-Enhancement and Depletion mode operation- Saturation and linear mode operation-CMOS Fabrication: P well, N Well and Twin Tub process – Sub micron technology

UNIT - II MOS CIRCUIT DESIGN PROCESS 9

MOS Layers- Stick Diagrams- Design rules and layout –Sheet resistance –Area capacitance of layers –NMOS Inverter –CMOS inverter -Switching characteristics. Rise time. Fall time –Latch-up problem in CMOS Circuits.

UNIT - III CMOS CIRCUIT AND LOGIC DESIGN 9

Pass Transistor and Transmission gates- NMOS and CMOS Logic gates- CMOS Combinational Logic Design-Clocked Sequential Logic Circuits

UNIT - IV PROGRAMMABLE LOGIC DEVICES 9

Read Only Memory (ROM)- PLA, PAL- Complex Programmable Logic Devices (CPLD)- Field Programmable Logic Devices(FPGA)- Xilinx 4000 Series FPGA:CLB,I/O Blocks – FPGA Design Flow

UNIT - V CIRCUIT DESIGN USING VHDL 9

EDA Tools – VHDL Code structures – Data types – concurrent code – sequential code – signals and variables – simple design examples

Lecture : 45, Tutorial : 0, TOTAL : 45

REFERENCE BOOKS

1 Douglas a. Pucknell and K.Eshragian., "Basic VLSI Design" 3rd Edition. Printice Hall India Pvt Ltd, 2000.

2 Volnei A Pedroni,"Circuit design with VHDL",Printice Hall India Pvt Ltd, 2005

3 Charles H Roth,"Digital System Design Using VHDL", PWS Publishing company.

NEURAL NETWORKS AND FUZZY SYSTEMS 3 0 0 3

UNIT – I ARTIFICIAL NEURAL NETWORKS 9

Introduction to Artificial Neural Networks-Fundamental concepts, weights, biases and thresholds-Artificial models-Linear capability-Common activation functions-Learning rules and Learning methods of ANN-Single Layer, Multilayer Feed forward network-Recurrent network.

UNIT - II NEURAL NETWORK ARCHITECTURES AND ALGORITHMS 9

Mcculloh Pitts neuron-Hebbnet-Perceptron-Adaline-Hopfield net-Maxnet-Mexican Hat-Hamming net-Kohonen self-organizing map-Adaptive resonance theory-Back propagation neural net.

UNIT - III NEURAL COMPUTING 9

Terminology-Adaptive co-efficient connection-Learning law-processing element-scheduling function-Transfer function-Transformations-Weights-Application of neural computing for pattern classification and recognition.

UNIT - IV FUZZY THEORY 9

Fuzzy set theory- Fuzzy relations-Linguistic variables-Membership functions-fuzzy to crisp conversions-fuzzy rule base-choice of variables-derivation of rules-Defuzzification methods-Fuzzy logc control-Structure of FLC-Mamdani and sugeno Fuzzy systems.

UNIT - V NEURO FUZZY CONTROL 9

Cognitron and Neocognitron Architecture-Training Algorithm and application-Fuzzy associative memories-fuzzy and neural function estimators-FAM system Architecture-Comparison of Fuzzy and Neural systems-Adaptive neuro, Adaptive Fuzzy, Adaptive Neuro-Fuzzy interface systems-Neuro Controller, Fuzzy logic Controller for a temperature process and aircraft landing problem.

Lecture : 45, Tutorial : 0, TOTAL : 45

REFERENCE BOOKS

1 Lawrene Fausset, “Fundamentals of neural networks”, Prentice Hall, 1994.
2 D.Drainkov, H.Hellendoorn arrow, M.Reinfrank, “An Introduction to Fuzzy control”, Narosa publishing Co., New Delhi, 1996.
3 Timothy J.Ross, “Fuzzy logic with Engineering Applications”, Mc Graw Hill, Newyork, 1996.
4 S.N. Sivanandam, S.N.Deepa, “Principles of Soft Computing”, Wiley India Pvt. Ltd., New Delhi, 2007.
5 J.M.Zurada, “Introduction to Artificial Neural Systems”, Jaico Publishing House, Delhi, 1994.

POWER QUALITY ENGINEERING 3 0 0 3

UNIT – I INTRODUCTION 6

Definitions – Power quality, Voltage quality – Power quality issues : Short duration voltage variations, Long duration voltage variations, Transients, Waveform distortion, Voltage imbalance, Voltage fluctuation, Power frequency variations – Sources and Effects of power quality problems – Power quality terms – Power quality and Electro Magnetic Compatibility (EMC) , IEEE and IEC Standards.

UNIT - II SHORT AND LONG INTERRUPTIONS 12

Short Interruptions: Introduction – Origin of short interruptions: Voltage magnitude events due to re-closing, Voltage during the interruption – Monitoring of short interruptions –Influence on induction motors, Synchronous motors, Adjustable speed drives, Electronic equipments – Single phase tripping: Voltage during fault and post fault period, Current during fault period – Prediction of short Interruptions.

Long Interruptions: Definition – Failure, Outage, Interruption – Origin of interruptions – Causes of long interruptions – Principles of regulating the voltage – Voltage regulating devices, Applications: Utility side, End-User side –Reliability evaluation – Cost of interruptions.

UNIT - III VOLTAGE SAG AND TRANSIENTS 9

Voltage Sag: Introduction – Definition – Magnitude, Duration – Causes of Voltage Sag –Load influence on voltage sags on Adjustable speed drives, Power electronics loads, Sensitive loads - Stochastic assessment of voltage sags - Overview of mitigation methods.

Transients: Definition – Power system transient model – Principles of over voltage protection - Types and causes of transients – Devices for over voltage protection - Capacitor switching transients –Lightning transients – Transients from load switching.

UNIT - IV WAVEFORM DISTORTION 9

Introduction – Definition and terms – Harmonics, Harmonics indices, Inter harmonics, Notching – Voltage Vs Current distortion – Harmonics Vs Transients – Sources and effects of harmonic distortion – System response characteristics – Principles of controlling harmonics – Standards and limitation

UNIT - V POWER QUALITY SOLUTIONS 9

Introduction – Power quality monitoring : Need for power quality monitoring, Evolution of power quality monitoring, Deregulation effect on power quality monitoring – Brief introduction to power quality measurement equipments and power conditioning equipments – Planning, Conducting and Analyzing power quality survey – Mitigation and control techniques - Active Filters for Harmonic Reduction

Lecture : 45, Tutorial : 0, TOTAL : 45

REFERENCE BOOKS

1 Roger C. Dugan, Mark F. McGranaghan and H.Wayne Beaty, "Electrical Power Systems Quality", McGraw-Hill, New York, 2nd Edition, 2002.

2 Barry W.Kennedy, “Power Quality Primer”, McGraw-Hill, New York, 2000.

3 Sankaran.C, "Power Quality", CRC Press, Washington, D.C., 2002

4 Math H.J.Bollen, "Understanding Power Quality Problems: Voltage Sags and Interruptions", IEEE Press, New York, 2000.

5 Arrillaga.J, Watson.N.R and Chen.S, "Power System Quality Assessment", John Wiley & Sons Ltd., England, 2000

POWER SYSTEM OPERATION AND CONTROL 3 0 0 3

UNIT – I INTRODUCTION 9

System load variation: System load characteristics, load curves - daily, weekly and annual, load-duration curve, load factor, diversity factor. Reserve requirements: Installed reserves, spinning reserves, cold reserves, hot reserves. Overview of system operation: Load forecasting, unit commitment, load dispatching. Overview of system control: Governor control, LFC, EDC, AVR, system voltage control, security control.

UNIT - II SYSTEM OPERATION 9

System load forecasting – components of system load – classification of base load - forecasting the base load – forecasting procedure.

Economic dispatch – Incremental cost curve, co-ordination equations without loss and with loss, solution by direct method and λ-iteration method. (No derivation of loss coefficients.) Base point and participation factors. Economic dispatch controller added to LFC.

Statement of Unit Commitment (UC) problem; constraints in UC: spinning reserve, thermal unit constraints, hydro constraints, fuel constraints and other constraints; UC solution methods: Priority-list methods, forward dynamic programming approach, numerical problems only in priority-list method using full-load average production cost.

UNIT - III SYSTEM CONTROL – REAL POWER – FREQUENCY CONTROL 9

MW – frequency interaction – load-frequency mechanism – load frequency control – Q-$|V|$ control – interaction between P – f and Q - $|V|$ channels – Basic control loops

Fundamentals of speed governing – Transfer function model – speed governing system – Turbo generator - Static response – Feedback control – static and dynamic response of ALFC – secondary ALFC loop

AGC in isolated power systems - AGC in interconnected power systems – Two area system – modeling of tie line – representation of two area system – static and dynamic response – tie line bias control - Frequency bias tie line control - Basis for selection of bias

UNIT - IV SYSTEM CONTROL – REACTIVE POWER – VOLTAGE CONTROL 9

Reactive power and voltage control - Production and absorption of reactive power -

Methods of voltage control - Shunt reactors, Shunt capacitors, Series capacitors, synchronous condensers - Static VAR Systems - Types of SVC - Application of Static VAR compensators

Excitation systems requirements - Elements of an excitation system - Types of excitation systems - DC, AC, Static and recent developments and future trends – Modeling of exciter, generator – static performance – dynamic performance – AVR root loci

UNIT - V COMPUTER CONTROL OF POWER SYSTEMS 9

Energy control centre: Functions – Monitoring, data acquisition and control. System

hardware configuration – SCADA and EMS functions: Network topology determination, state estimation, security analysis and control. Various operating states: Normal, alert, emergency, in-extremis and restorative.

Lecture : 45, Tutorial : 0, TOTAL : 45

REFERENCE BOOKS

1 Prabha Kundur - Power System stability and control - EPRI Series - McGraw Hill Inc., 1994

2 O.I.Elgerd - Electrical Energy System Theory : An introduction - Tata McGraw Hill Publication, 1983 Edition.

3 PSR Moorthy - Power System Operation & Control, Tata McGraw Hill publication,1992

4 Dr S Mukhopadhyaya - Modern power system control and operation, Roorkee Publishing House, Roorkee, 1983Edition

5 Hadi Saadat, Power system analysis, WCB, McGraw Hill International Edition, 1999

TOTAL QUALITY MANAGEMENT 3 0 0 3

UNIT – I INTRODUCTION 9

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

UNIT - II TQM PRINCIPLES 9

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

UNIT - III STATISTICAL PROCESS CONTROL (SPC) 9

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

UNIT - IV TQM TOOLS 9

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

UNIT - V QUALITY SYSTEMS 9

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, QS 9000, ISO 14000 – Concept, Requirements and Benefits.

Lecture : 45, Tutorial : 0, TOTAL : 45

REFERENCE BOOKS

1 Dale H.Besterfiled, et al., Total Quality Management, Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6.

2 James R.Evans & William M.Lidsay, The Management and Control of Quality, (5^{th} Edition), South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5).

3 Feigenbaum.A.V. “Total Quality Management, McGraw Hill, 1991.

4 Oakland.J.S. “Total Quality Management Butterworth – Hcinemann Ltd., Oxford. 1989.

5 Narayana V. and Sreenivasan, N.S. Quality Management – Concepts and Tasks, New Age International 1996.

6 Zeiri. “Total Quality Management for Engineers Wood Head Publishers, 1991.

COMPUTER NETWORKS 3 0 0 3

UNIT – I INTRODUCTION 6

Computer Networks - A perspective - Goals - Applications - Switching techniques - Circuit switching - Message switching - Packet switching - Network components existing network - ARPANET - Concepts of network protocol - OSI reference model.

UNIT - II BASICS OF QUEUING THEORY 6

Queuing models - Poisson statistics - M/M/1 Queues - Little's formula - Applications to M/M/1 queue.

UNIT - III LAN ACCESS TECHNIQUES 8

Topologies - Star, Ring, Bus - Ethernet - Transmission media – protocols - Polling - Contention - ALOHA - CSMA - CSMA/CD - Token Bus and Token Ring protocols - Delay throughput characteristics - Token Ring and CSMA/CD Bus - Performance comparisons.

UNIT - IV DATA COMMUNICATION TECHNIQUES 8

Asynchronous and Synchronous communication - BISYNC, SDLC, HDLC - X 2.5 procedures - Error control coding, frame relay : Introduction – operation.

UNIT - V INTER-NETWORKING 9

Principles – Repeaters – Bridges Routers – Gateways – other devices – Routing algorithms – Distance Vector routing – Link state routing TCP/IP - Protocol structure - Internet Protocol - Transmission control Protocol - Applications.

UNIT - VI BROADBAND NETWORKS 8

ISDN - User Access - Transmission structure - ISDN protocol - Limitations - B-ISDN - ATM concepts and principles - Introduction to VSAT networks.

Lecture : 45, Tutorial : 0, TOTAL : 45

REFERENCE BOOKS

1 Behrouz Forouzan, "Introduction to Data Communications and Networking", Tata McGraw Hill, New Delhi, Third edition, 2004.
2 Andrew S. Tannenbaum., "Computer Networks", Pearson Education, New Delhi, 4th edition 2003/ Prentice Hall of India, New Delhi
3 Keiser, G.E., "Local Area Networks", Tata McGraw Hill, New Delhi, 2nd edition 2002.
4 William, Stallings., "Data and Computer Communication", Prentice Hall India, New Delhi , 1994 / Pearson Education. New Delhi.
5 Vijay, Ahuja., "Design and Analysis of Computer Communication Networks", McGraw Hill, New Delhi, 1985.

VIRTUAL INSTRUMENTATION 3 0 0 3

UNIT – I REVIEW OF DIGITAL INSTRUMENTATION 8

Representation of analog signals in the digital domain – Review of quantization in amplitude and time axes, sample and hold, sampling theorem, ADC and DAC.

UNIT - II GRAPHICAL PROGRAMMING AND LABVIEW 9

Concepts of graphical programming – LabVIEW software – Concept of VIs and sub VI - Display types – Digital – Analog – Chart and Graphs. Loops -structures - Arrays –Clusters. Local and global variables – String and file I/O. Timers and dialog controls.

UNIT- III INSTRUMENT INTERFACES AND PROTOCOLS 10

RS232, RS 422, RS 485 and USB standards - IEEE 488 standard – Introduction to bus protocols of MOD bus and CAN bus. Electronic standards for signals – noise and EMI effects. Signal conditioning chassis and extension modules. Image acquisition cards.

UNIT- IV PC BASED DATA ACQUISITION 9

Concept of PC based data acquisition – Typical on board DAQ card – Resolution and sampling frequency - analog inputs and outputs – Single-ended and differential inputs –DAQ cards terminal boxes - Use of timer-counter and analog outputs on the universal DAQ card.

UNIT - V SIGNAL PROCESSING AND NETWORK BASED AUTOMATION 9

Mathematical tools for statistical calculation – Signal processing tools- Windowing and filtering tools –Control system tools – PID controller – CRO – function generator –illustration and case study – Web publishing tool –configuring VI server.

Lecture : 45, Tutorial : 0, TOTAL : 45

REFERENCE BOOKS

1 Sanjeev Gupta, 'Virtual Instrumentation using LabVIEW' TMH, 2004

2 Gary W. Johnson, Richard Jennings, 'Lab-view Graphical Programming', McGraw Hill Professional Publishing, 2001.

3 Peter W. Gofton, 'Understanding Serial Communications', Sybex International.

4 Robert H. Bishop, 'Learning with Lab-view', Prentice Hall, 2003.

5. Kevin James, 'PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control', Newness, 2000.

Note: To offer this elective, multi-user licensed copy of Lab-view software should be available.

COMPUTER AIDED DESIGN OF ELECTRICAL APPARATUS **3 0 0 3**

UNIT – I INTRODUCTION **9**

Conventional design methodology overview – computer aided design aspects – need for CAD – nature of design problems- analysis and synthesis approaches-advantages.

UNIT - II FINITE ELEMENT ANALYSIS **9**

Mathematical formulation – discretisation – shape functions – stiffness matrix – solution techniques – post processing.

UNIT - III CAD PACKAGES 9

Recent developments – preprocessing – modeling - meshing – boundary conditions – material characteristics – problem formulation – solution – post processing.

UNIT - IV CAD SOFTWARE 9

Program files – Installation – Screen menu structure_ Fixing the size of a drawing – set up option- on line help- text fonts, shapes – Blocks – copy – array- Erasing facilities - editing – fill – zoom pan – hatching – isoplane – elevation – view point – dimension techniques – introduction to 3D drawing.

UNIT - V DESIGN EXAMPLES 9

Design of actuator – solenoid - transformer - induction motor – synchronous machines - switched reluctance motor.

Lecture : 45, Tutorial : 0, TOTAL : 45

REFERENCE BOOKS

1 P.P. Silvester and Ferrari, 'Finite Element for Electrical Engineers', Cambridge University Press, 1984.
2 M.V.K. Chari and P.P. Silvester, “Finite Elements in Electric and Magnetic Field Problems”, John Wiley, 1980.
3 D.A. Lowther and P.P. Silvester, 'Computer Aided Design in Magnetics', Springer Verlag, Newyork, 1986.
4 M Ramamoorthy, “ Computer Aided, Analysis and Design of Electrical equipment”
5 George, Omura, “Mastering AutoCAD”, BPB Publications, New Delhi, 1988.
6 Sham Tickoo, “AutoCAD 2002 with applications” Tata McGraw Hill Publishing Company limited, New Delhi, 2001.

Note: To offer this elective, multi-user licensed copy of CAD software should be available.

ELECTRICAL SYSTEM DESIGN AND ESTIMATION 3 0 0 3

UNIT – I INTRODUCTION AND PLANT MOTOR LIST 6

General power distribution of an industry and its basic specifications– Plant motor list

from the mechanical supplier – typical examples of motor list and analysis of the same - arriving at the overall power requirement and the various voltage levels for distribution in various HT levels and the LT levels.

UNIT - II DETAILING OF THE POWER DISTRIBUTION AND ESTIMATION **12**

Segregation of the plant requirements based on main mill equipment, auxiliary mill equipment and utility equipment- Deciding the loading and voltage levels and calculation of fault levels for the specific plant at all the different locations - arriving at the single line diagrams - Power redundancy for critical loads - HT power distribution and loads on HT- LT power distribution and loads on LT - Power distribution boards- main equipment power requirements – Auxiliary and utility equipment and Motor control centers (MCC-s) - listing various MCC-s- use software like E-plan for generating information for estimation - assignment for detailing overall power distribution for typical plants.

UNIT - III SPECIFICATION OF VARIOUS ELECTRICAL EQUIPMENT AND ESTIMATION **9**

Preparing specification of the various electrical power equipment - General requirements for the various equipment and the standards- IS and introduction to the relevant IS standards for the major power equipment- other important standards like IEC, IEEE, DIN, BSS, JS - HT power distribution boards including breakers and HT isolators- HT cables and Bus ducts- HT transformers at MRSS and for the other medium voltages- LT transformers for main and auxiliary power electronic loads, auxiliary distribution – LT power distribution boards and MCC-s- Motors for the main and auxiliary loads – Introduction to standard equipment data sheets from manufacturers and understanding their significance- assignment for preparing specification for typical major electrical equipment .

UNIT - IV CONTROL EQUIPMENT AND INTEGRATION OF THE SAME WITH POWER EQUIPMENT **12**

Analysis of plant control list from the mechanical supplier- standard control items and their functions-Estimation of number of inputs and outputs for a overall plant PLC based on central or distributed control system for the plant main and auxiliary power equipment– feedback sensors for the above- Identifying and incorporating protection and other monitoring requirements for the above.

UNIT - V MISCELLANEOUS ELECTRICAL EQUIPMENT OF THE PLANT **6**

Various utility equipments like UPS, control desks and stations, pulpits, HMI-s, plant lighting, material handling equipment like cranes, communication systems, CCTV-s, fire alarm system, safety equipment including earthing; specifying and Estimating of the same

Lecture : 45, Tutorial : 0, TOTAL : 45

REFERENCE BOOKS

1 “Electrical Engineering Handbook - Siemens Handbook”, Wiley Eastern Limited, 1988
2 “ABB - Switchgear Manual”, - 10th revised edition.

MICROPROCESSOR BASED SYSTEM DESIGN 3 0 0 3

UNIT – I THE ROLE OF MICRO-PROCESSORS 9

Evolution of Microprocessors- Microprocessor based systems- current trends- Types and selection-Application example.

UNIT - II INTERFACE STANDARDS 9

S-100 Bus, IEEE 488 interface bus, IBM PC bus, Serial interface-RS232, RS422 and RS 423 serial interface-current loop

UNIT - III MICROPROCESSOR BASED APPLICATIONS 9

Microprocessor development system-applications-Temperature controller-stepper motor controller

UNIT - IV MICROPROCESSOR BASED SYSTEM DEVELOPMENT 9

68000 Architecture – Functional block diagram - Instruction set – Addressing modes
History of design methodology – System Component Analysis - Altera FPGA Design Tools

UNIT - V DEVELOPMENT TOOLS 9

Altera Max 7000 CPLD -Hardware - CPLD- Data sheets and Specifications –Design Methodology-ISP in system programmability
Altera MAX+PLUS II FPGA Digital Logic design Software / Xilinix Software Creating a Graphic design File - Creating a Text design File- Design Compiler - Project Hierarchy - Floor Plan editor - Back Annotation – Simulation

Lecture : 45, Tutorial : 0, TOTAL : 45

REFERENCE BOOKS

1 M.Rafiquzzaman,'Microprocessors and Microcomputer based system design'CRC press-Inc,Boca rattan,Florida,1990
2 John Uffenbeck, The 80x86 Family, Design, Programming and Interfacing, Third Edition. Pearson Education, 2002.
3 Altera Max + Plus II Programmable Logic Development Altera Corporation –Manual
4 Walter Triebel/Avatar Singh ,'The 68000 and 68020 Microprocessors, Architecture, Software, and Interfacing Techniques, Prentice Hall , Inc. Publishing Company, 1991
5 http://www.altera.com/html/literature/lsoft.html

Electives
Group B (Eighth Semester)

HIGH VOLTAGE ENGINEERING 3 0 0 3

UNIT – I TRANSIENT OVERVOLATGES IN ELECTRIC POWER SYSTEMS **9**

Natural causes of over voltages - Lightning phenomena - Over voltages due to switching surges - System faults and other abnormal conditions – Traveling waves on transmission lines (lines terminated with open end, short circuited end, apparatus and cables)

UNIT - II ELECTRICAL BREAKDOWN IN GASES, SOLIDS AND LIQUIDS **9**

Classical gas laws - Ionization processes – Townsend's Criterion - Paschen's law - Streamer theory - Breakdown in non-uniform fields and corona discharges – Practical considerations in using gases for insulation purposes - Vacuum insulation. Conduction and breakdown in pure and commercial liquids. Intrinsic breakdown in solids - Electromechanical breakdown - Thermal breakdown - Breakdown in composite dielectrics.

UNIT - III GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS **9**

Generation of high DC voltage, alternating voltages, impulse voltages and impulse currents – Tripping and control of Impulse Generators

UNIT - IV MEASUREMENT OF HIGH VOLTAGE AND HIGH CURRENTS **9**

Measurement of high DC voltages, high AC voltages and impulse voltages - Measurement of high DC currents, high AC currents and impulse currents - CRO for impulse voltage and current measurement - Digital techniques in high voltage measurement.

UNIT - V HIGH VOLTAGE TESTING OF ELECTRICAL POWER APPARATUS **9**

Testing of Insulator, Bushings, Isolators, Circuit breakers, Cables, Transformers, Surge Arresters – Tan Delta measurement – Partial Discharge measurement – Radio interference measurement – International and Indian Standards.

Lecture : 45, Tutorial : 0, TOTAL : 45

REFERENCE BOOKS

1 M.S. Naidu and V.Kamaraju, 'High Voltage Engineering', McGraw Hill, 2nd Edition, 1996.

2 Kuffel, E and Zaengl, W.S, 'High Voltage Engineering Fundamentals', Pergamon Press, Oxford, London, 1986.

3 Kuffel, E and Abdullah, M., 'High Voltage Engineering', Pergamon Press, Oxford, 1970.

4 C.L. Wadhwa, "High voltage Engineering" New Age Publishers, 2007.

MODERN CONTROL ENGINEERING 3 0 0 3

UNIT – I STATE SPACE ANALYSIS 9

Introduction to state space analysis – Physical variable, Phase variable and Canonical variables forms - State transition matrix- controllability and observability.

UNIT - II STATE VARIABLE DESIGN 9

Design by state feedback – output feedback – Pole assignment technique – Design of state and output feedback controllers – Design of reduced and full order observers – PI feedback – Dynamic state feedback.

UNIT - III SAMPLED DATA CONTROL SYSTEM 8

Introduction to Sample data control systems –Sampling process, signal reconstruction, difference equation, Z-transform, Z-transfer function – Inverse Z transform, Z-transform analysis of sampled data control system, Z and S domain Relationship

UNIT - IV NON-LINEAR SYSTEMS 9

Types of non-linearity – Typical examples – Equivalent linearization - Phase plane analysis – Limit cycles – Describing functions- Analysis using Describing functions.

UNIT - V STABILITY 9

Stability concepts – Equilibrium points – BIBO and asymptotic stability – Direct method of Liapunov – Application to non-linear problems – Frequency domain stability criteria – Popov's method and its extensions.

Lecture : 45, Tutorial : 0, TOTAL : 45

REFERENCE BOOKS

1 M.Gopal, "Digital control and state variable methods" Tata McGraw Hill Publishing Company Ltd., 2nd Edition 2007.
2 I.J. Nagarth and M. Gopal - Control systems engineering - Wiley Eastern Ltd., 1993.
3 M.Gopal - Modern control system theory - Wiley Easter Ltd., 1989.
4 K. Ogata - Digital control systems - Prentice Hall of India Pvt. Ltd,1997.
5 B.C. Kuo, "Automatic Control systems", Pearson Education, 1995.

SPECIAL ELECTRICAL MACHINES 3 0 0 3

UNIT – I PERMANENT MAGNET SYNCHRONOUS MOTORS 12

Permanent Magnet Motors – Classifications – PMSM - Principle of operation – EMF and torque equations – Reactance – Phasor diagram – Power controllers - Converter - Volt-ampere requirements – Torque speed characteristics - Microprocessor based control.

UNIT - II PERMANENT MAGNET BRUSHLESS D.C. MOTORS 9

Principle of operation – Types – Magnetic circuit analysis – EMF and torque equations – Power controllers – Motor characteristics and control.

UNIT - III SYNCHRONOUS RELUCTANCE MOTORS 6

Constructional features – Types – Axial and Transverse laminated motors – Operating principle – Reluctance – Phasor diagram - Characteristics – Vernier motor.

UNIT - IV SWITCHED RELUCTANCE MOTORS 9

Constructional features – Principle of operation – Torque prediction – Analysis - Power controllers – Microprocessor based control - Characteristics – Computer control.

UNIT - V STEPPING MOTORS 9

Constructional features – Principle of operation – Variable reluctance motor – Hybrid motor – Single and multi stack configurations – Theory of torque predictions – Linear and non-linear analysis – Characteristics – Drive circuits – Microprocessor based control

Lecture : 45, Tutorial : 0, TOTAL : 45

REFERENCE BOOKS

1 T.J.E. Miller, ‘Brushless Permanent Magnet and Reluctance Motor Drives’, Clarendon Press, Oxford, 1989.

2 T. Kenjo and S. Nagamori, ‘Permanent Magnet and Brushless DC Motors’, Clarendon Press, London, 1988.

3 P.P. Aearnley, ‘Stepping Motors – A Guide to Motor Theory and Practice’, Peter Perengrinus, London, 1982.

4 T. Kenjo, ‘Stepping Motors and Their Microprocessor Controls’, Clarendon Press London, 1984.

DIGITAL IMAGE PROCESSING 3 0 0 3

UNIT – I DIGITAL IMAGE FUNDAMENTALS 9

Elements of digital image processing systems, Elements of visual perception, psycho visual model, brightness, contrast, hue, saturation, mach band effect, Color image fundamentals - RGB, HSI models, Image sampling, Quantization, dither, Two-dimensional mathematical preliminaries.

UNIT - II IMAGE TRANSFORMS 9

1D DFT, 2D transforms – DFT, DCT, Discrete Sine, Walsh, Hadamard, Slant, Haar, KLT, SVD and Wavelet Transform.

UNIT - III IMAGE ENHANCEMENT AND RESTORATION 9

Spatial domain enhancement: gray level transformations - histogram modification and specification techniques, Noise distributions, Spatial averaging, Directional Smoothing, Median, Geometric mean, Harmonic mean, Contraharmonic and Yp mean filters, Homomorphic filtering, Color image enhancement**.**

Image Restoration – degradation model, Unconstrained and Constrained restoration, Inverse filtering – removal of blur caused by uniform linear motion, Wiener filtering, Geometric transformations – spatial transformations, Gray-Level interpolation,

UNIT - IV IMAGE SEGMENTATION AND REPRESENTATION 9

Point, line and edge detection. Image segmentation by region growing, region splitting and merging, edge linking. Image representation: chain codes – polygonal approximations – signatures – boundary segments – skeletons.

UNIT - V IMAGE COMPRESSION 9

Need for data compression, Huffman, Run Length Encoding, Arithmetic coding. Transform Coding – DCT and Wavelet. JPEG, MPEG Standards.

Lecture : 45, Tutorial : 0, TOTAL : 45

REFERENCE BOOKS

1 Rafael C. Gonzalez, Richard E.Woods, 'Digital Image Processing', Pearson Education, Inc., Second Edition, 2004.

2 Anil K. Jain, 'Fundamentals of Digital Image Processing', Prentice Hall of India, 2002.

3 David Salomon : Data Compression – The Complete Reference, Springer Verlag New York Inc., 2nd Edition, 2001

4 Rafael C. Gonzalez, Richard E.Woods, Steven Eddins, ' Digital Image Processing using MATLAB', Pearson Education, Inc., 2004.

5 William K.Pratt, ' Digital Image Processing', John Wiley, NewYork, 2002.

6 Milman Sonka, Vaclav Hlavac, Roger Boyle, 'Image Processing, Analysis and Machine Vision', Brooks/Cole, Vikas Publishing House, II ed., 1999.

7 Sid Ahmed, M.A., 'Image Processing Theory, Algorithms and Architectures', McGraw-Hill, 1995.

RENEWABLE ENERGY SOURCES 3 0 0 3

UNIT – I INTRODUCTION 9

Energy Conservation and Energy Efficiency – Needs and Advantages, Different types of Renewable Energy Sources - Energy Resources Availability in World –Environmental aspects of energy utilization – Energy Conservation Act 2003 - Statistical Report on Renewable energy scenario in India - Applications.

UNIT - II SOLAR ENERGY 9

Solar Flat plate and concentrating collectors – Solar heating and cooling techniques – Solar desalination – Solar Pond – Solar cooker – Solar Drying – Solar pumping - Solar thermal power plant – Solar photo voltaic conversion – Solar cells – PV applications.

UNIT - III WIND ENERGY 9

Wind energy estimation in World and in India – Types of wind energy systems – Performance of Wind energy System– Details of wind turbine generator – Safety and Environmental Aspects.

UNIT - IV BIOMASS ENERGY 9

Biomass direct combustion – Biomass gasifier – Biomass: Types – Advantages & Drawbacks - Biogas plant – Ethanol production – Bio diesel – Cogeneration: steam turbine cogeneration systems, gas turbine cogeneration systems, reciprocating IC engine cogeneration systems, combined cycle cogeneration systems – Applications of Cogeneration in utility sector – Biomass applications.

UNIT - V OTHER RENEWABLE ENERGY SOURCES 9

Tidal energy – Wave energy – Open and closed OTEC Cycles – Small hydro – Geothermal energy – Fuel cell systems - Stirling Engines

Lecture : 45, Tutorial : 0, TOTAL : 45

REFERENCE BOOKS

1 G.D. Rai, Non Conventional Energy Sources, Khanna Publishers, New Delhi, 1999.

2 S.P. Sukhatme, Solar Energy, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.

3 G.N. Tiwari, Solar Energy – Fundamentals Design, Modelling and applications, Narosa Publishing House, New Delhi, 2002.

MEDICAL INSTRUMENTATION 3 0 0 3

UNIT – I BIO-POTENTIAL ELECTRODES 9

Electrode electrolyte interface, half-cell potential, polarisation and non- polarisable electrode, calomel electrode, needle and wire electrode, microelectrode-metal micropipete.

UNIT - II RECORDING SYSTEM 9

Low-Noise preamplifier, main amplifier and driver amplifier, inkjet recorder, thermal array recorder, photographic recorder, magnetic tape recorder, X-Y recorder, medical oscilloscope.

UNIT - III BIO-CHEMICAL MEASUREMENT 9

pH, pO_2, pCO_2, $pHCO_3$, Electrophoresis, colorimeter, spectro photometer, flame photometer, auto analyzer.

UNIT - IV NON-ELECTRICAL PARAMETER MEASUREMENTS 9

Respiration, heart rate, temperature, pulse blood pressure, cardiac output, O_2, CO_2 measurements, manual and automatic counting of RBC, WBC and platelets.

UNIT - V COMPUTERS IN BIO-MEDICAL INSTRUMENTATION 9

ECG, EEG, EMG – machine description - methods of measurement – three equipment failures and trouble shooting, ECG Analysis. Basic ideas of CT scanner – MRI and ultrasonic scanner.

Lecture : 45, Tutorial : 0, TOTAL : 45

REFERENCE BOOKS

1 Leslie Cromwell, “Biomedical Instrumentation and measurement”, Prentice hall of India, New Delhi, 1997.

2 John G. Webster, “Medical Instrumentation Application and Design”, John Wiley and sons, New York, 1998.

3 Khandpur R.S, “Handbook of Biomedical Instrumentation”, Tata McGraw-Hill, New Delhi, 1997.

4 Joseph J.carr and John M. Brown, “Introduction to Biomedical equipment technology”, John Wiley and sons, New York, 1997.

OPTICAL COMMUNICATIONS 3 0 0 3

UNIT – I INTRODUCTION TO OPTICAL FIBERS 9

Evolution of fiber optic system- Element of an Optical Fiber Transmission link- Ray Optics-Optical Fiber Modes and Configurations - Linearly Polarized Modes –Single Mode Fibers-Graded Index fiber structure.

UNIT - II SIGNAL DEGRADATION OPTICAL FIBERS 9

Attenuation – Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Wave guides-Information Capacity determination – Group Delay-Material Dispersion, Wave guide Dispersion, Signal distortion in SM fibers-Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in GI fibers-Mode Coupling –Design Optimization of SM fibers-RI profile and cut-off wavelength.

UNIT - III FIBER OPTICAL SOURCES AND COUPLING 9

Direct and indirect Band gap materials-LED structures –Light source materials –Quantum efficiency and LED power, Laser Diodes, Temperature effects, Introduction to Quantum laser, Fiber amplifiers- Lencing schemes, Fibre –to- Fibre joints, Fibre splicing.

UNIT - IV FIBER OPTICAL RECEIVERS 9

PIN and APD diodes – Detector Response time, Avalanche Multiplication–Comparison of Photo detectors –Fundamental Receiver Operation – preamplifiers, Error Sources – Receiver Configuration –Quantum Limit.

UNIT - V DIGITAL TRANSMISSION SYSTEM 9

Point-to-Point links System considerations –Link Power budget –Rise - time budget –- Operational Principles of WDM, Solitons-Erbium-doped Amplifiers. Basic on concepts of SONET/SDH Network. .

Lecture : 45, Tutorial : 0, TOTAL : 45

REFERENCE BOOKS

1 Gerd Keiser, “Optical Fiber Communication” McGraw –Hill International, Singapore, 3rd ed., 2000

2 J.Senior, “Optical Communication, Principles and Practice”, Prentice Hall of India, 1994.

3 J.Gower, “Optical Communication System”, Prentice Hall of India, 2001.

ROBOTICS AND AUTOMATION **3 0 0 3**

UNIT – I FUNDAMENTAL CONCEPTS OF ROBOTICS **4**

Present status and future trends in Robotics and automation - Laws of Robotics - Robot definitions - Robotics systems and robot anatomy - Specification of Robots - resolution, repeatability and accuracy of a manipulator. Robotics applications.

UNIT - II ROBOT DRIVES AND POWER TRANSMISSION SYSTEMS 9

Robot drive mechanisms, hydraulic – electric – servomotor- stepper motor - pneumatic drives, Mechanical transmission method - Gear transmission, Belt drives, cables, Roller chains, Link - Rod systems - Rotary-to-Rotary motion conversion, Rotary-to-Linear motion conversion, Rack and Pinion drives, Lead screws, Ball Bearing screws, End effectors – Types.

UNIT - III SENSORS 10

Sensor characteristics, Position sensors – Potentiometers – Encoders – Resolvers – LVDT, Velocity sensors – Tachogenerators - Encoders - Proximity sensors, Limit switches – Tactile sensors - Touch sensors - Force and torque sensors

UNIT - IV VISION SYSTEMS FOR ROBOTICS 10

Robot vision systems, Image capture- cameras – vidicon and solid state, Image representation - Gray scale and colour images, image sampling and quantization - Image processing and analysis - Image data reduction - Segmentation - Feature extraction - Object Recognition- Image capturing and communication - JPEG, MPEGs and H.26x standards, packet video, error concealment.- Image texture analysis. Motion generation - Manipulator dynamics - Jacobian in terms of D-H matrices - Controller architecture.

UNIT - V PLC AND AUTOMATION 12

Building blocks of automation, Controllers – PLC- Role of PLC in FA - Architecture of PLC - Advantages - Types of PLC - Types of Programming - Simple process control programs using Relay Ladder Logic and Boolean logic methods - PLC arithmetic functions Flexible Manufacturing Systems concept - Automatic feeding lines, ASRS, transfer lines, automatic inspection - Computer Integrated Manufacture - CNC, intelligent automation. Industrial networking, bus standards, HMI Systems, DCS and SCADA, Wireless controls..

Lecture : 45, Tutorial : 0, TOTAL : 45

REFERENCE BOOKS

1 Richard D Klafter, Thomas A Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Eastern Economy Edition, Prentice Hall of India P Ltd., 1989.

2 Fu K.S., Gomalez R.C., Lee C.S.G., "Robotics : Control, Sensing, Vision and Intelligence", McGraw Hill Book Company, 1987.

3 Mikell P Groover et. al., "Industrial Robots - Technology, Programming and Applications", McGraw Hill, New York, 1986.

4 Saeed B Niku,"Introduction to Robotics Analysis,Systems,Applications"'PHI Pvt Ltd New Delhi,2003.

5 Deh S R., "Robotics Technology and Flexible Automation", Tata McGraw Hill Publishing, Company Ltd., 1994.

ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS **3 0 0 3**

UNIT – I ARTIFICIAL INTELLIGENCE 9

The state of art-Intelligent Agents-Structure-Environment-Definition of AI-AI problems-AI techniques-Defining a problem as state space search-production systems-Problem characteristics-production system characteristics.

UNIT - II SEARCH STRATEGIES OF AI 9

Heuristic search techniques-depth first search-depth limited search-Uniform cost search-breadth first search-hill climbing and best first search techniques-Comparing search techniques.

UNIT - III KNOWLEDGE AND REASONING 9

Knowledge representation-Logic-Propositional logic-unification algorithm-Using predicate logic-symbolic reasoning under uncertainty – non-monotonic reasoning – stastical reasoning-probability and Baye's theorem.

UNIT - IV LANGUAGE PROCESSING AND LEARNING 9

Phases-Syntactic Processing-Semantic analysis-Discourse and pragmatic processing-Learning by taking advice-learning in solving problem-Inductive learning-learning decision trees-Explanation based learning-Formal lerning-learning in Neural and Belier networks.

UNIT - V EXPERT SYSTEMS 9

Introduction-Stages in development-Structure-Knowledge based structure—Languages-Components of an Expert system-features of an Expert System- categories of an Expert System- Developing and using an Expert System- Model based Expert System.

Lecture : 45, Tutorial : 0, TOTAL : 45

REFERENCE BOOKS

1 Elaine Rich and , Kevin knight, "Artificial Intelligence", TMH,2003
2 Dan W Peterson, "Introduction to AI and expert systems", PHI,2004
3 Rolston D W, "Principles of AI and ES development",TMH, 1998
4 Stuart Russell and Peter Norvig, "Artificial Intelligence-A Modern Approach", PHI/Pearson Education, New Delhi, 2003.
5 Eugene Charniak, Drew Mc Dermott, "Introduction to Artificial Intelligence". Pearson Education, Fifth Indian Report, New Delhi, 2002.
6 Nils J Nilsson, "Principles of Artificial Intelligence", Narosa Publishing House, New Delhi, 2001.

HVDC TRANSMISSION 3 0 0 3

UNIT – I GENERAL ASPECTS 9

Historical development of HVAC and DC links – kinds of DC links-HVDC projects in India and abroad – advantages and disadvantages of HVDC transmission - Applications of DC transmission – economic factors – development of power devices for HVDC transmission – thyristors – light activated thyristors – MOS controlled thyristors (MCTs) –Switching and steady state characteristics–Cooling of Thyristors Problem.

UNIT - II THYRISTOR CONVERTERS 9

Three phase fully controlled thyristor bridge converters – operation as rectifiers and line commutated inverters – converter equivalent circuits – parameters and characteristics of rectifiers and inverters – series and parallel arrangement of thyristors – multibridge converters.

UNIT - III CONTROL OF CONVERTERS AND REACTIVE POWER CONTROL 9

Gate control – basic means of control and modes of operation – power reversal – desired features of control – control characteristics – constant current control – constant extinction angle control – stability of control – tap changer control – power control and current limits. Reactive Power Requirements – Reactive Power Control during Steady State and Transients

UNIT - IV PROTECTION OF HVDC SYSTEMS, HARMONICS, FILTERS AND GROUND RETURN 9

Basics of protection of HVDC systems – DC reactors – voltage and current oscillations – DC line oscillations – clearing line faults and re-energizing the line – circuit breakers – over voltage protection -Characteristics and uncharacteristic harmonics – troubles caused by harmonics – means of reducing harmonics –– harmonic filters – Corona and Radio interference- ground return and ground Electrodes

UNIT - V SIMULATION OF HVDC SYSTEMS 9

Introduction – System Simulation: Philosophy and Tools – HVDC System Simulation – Modeling of HVDC Systems for Digital Dynamic Simulation – Digital Dynamic Simulation of Converters and DC Systems

Lecture : 45, Tutorial : 0, TOTAL : 45

REFERENCE BOOKS

1 Kimbark E.X., “Direct Current Transmission”, Vol. I, Wiley Interscience, New York 1971

2 Allan Greenwood, ‘Electrical Transients in Power Systems’, John Wiley and Sons New York, 1992

3 Kory(ed) B. J., “ High Voltage Direct Current Converters and Systems”. Macdonald & Co, London 1995

4 Adamson and Hingorani N.G., “High Voltage Direct Current Power Transmission”, Garraway ltd., England, 1960.