SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI
P. G. DEPARTMENT OF APPLIED ELECTRONICS
Faculty of Science and Technology

PROGRAMME OUTCOMES (POs)

Programme: M. Sc. (Applied Electronics)

PO1: At the time of completion of the programme, the student will able to develop extensive knowledge in various areas of Electronics.

PO2: Apply the knowledge of mathematics, science, engineering fundamentals and electronics to the solution of engineering problems.

PO3: Identify, formulate, research literature, and analyse science and engineering problems using the first principles of mathematics and engineering sciences.

PO4: Understand solutions for electronic and allied systems and design system modules or processes that meet the specified needs with appropriate societal consideration.

PO5: Choose and apply appropriate modern tools/frameworks/platforms, software simulators, techniques, resources, and modern engineering and IT tools for solving engineering problems with an understanding of the limitations.

PO6: Function effectively as an individual, and as a member or leader in diverse teams.

PO7: Communicate effectively on engineering activities with the science and engineering community and with the society at large, such as, being able to comprehend and write effective reports and make effective presentations.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1: At the end of the two-year M. Sc. Applied Electronics programme, the student will understand and be able to explain different branches of Electronics such as Electronic Devices and Circuits, Linear and Digital Integrated Circuits, Communication Engineering, Analog and Digital Electronics, Microprocessors, Microcontrollers, VLSI, Embedded Systems, Smart Sensors, Digital Signal Processing, Microwave Engineering, Embedded System Design, Computer Organization, Optical Fiber Communications, Mobile Communications, etc.

PSO2: Courses in foundational subjects like Electrical Engineering and Network Analysis, Electronic Devices and Circuits, Linear Integrated Circuits, Linear and Digital Integrated circuits, Microprocessors and Microcontrollers, Digital Signal Processing, Microwave Engineering, Optical Fiber Communication Engineering, Embedded System Design, etc. have a prominent lab component, offering hands-on training and exercises on numerous practical aspects of crucial importance.

A postgraduate of the M. Sc. Applied Electronics Program will demonstrate:

PSO3: An ability to understand the basic concepts in Electronics & Communication Engineering and to apply them to various areas, like Electronics, Communications, Signal processing, VLSI, Embedded systems etc., in the design and implementation of systems.

PSO4: An ability to solve Electronics and communication Engineering problems, using latest hardware and software tools, along with analytical skills to arrive at cost effective and appropriate solutions.

PSO5: Skill development by undertaking supervised projects by students with a flexibility to balance between research- and application-oriented work that require innovative approaches.

Scheme of Teaching and Examination M.Sc.
(Applied Electronics) SEMESTER PATTERN
SEMESTER: FIRST

T: Lectures, P: Practical, TU: Tutorial/Assignment

SN	Subject Code	Name of Subject	Hrs/ Week		Credits		Examination Scheme								
							Theory					Practical			
			T	P/ TU	Theory	Practical	Paper Hrs	Max Theory	Max Internal	Total	Min Passing Grade Points	Max Marks Practical	Max Marks Int. Ass	Total	Min Passing Grade Points
1	1AE1	Electrical Engineering & Network Analysis	04	01	05		3	80	20	100	4	--	--	--	--
2	1AE2	Electronic Devices and Circuits	04	01	05		3	80	20	100	4	--	--	--	--
3	1AE3	Object Oriented Programming C++	04	01	05		3	80	20	100	4	--	--	--	--
4	1AE4	Electric & Magnetic Fields	04	01	05		3	80	20	100	4	--	--	--	--
5	1AE5	Communication Skills	02	--	02		2	40	10	50	4	--	--	--	--
6	1AE6	Electrical Engineering & Network Analysis Laboratory		P 02		01	-	--	--	--	--	25	25	50	5
7	1AE7	Electronic Devices and Circuits Laboratory		P 02		01	-	--	--	--	--	25	25	50	5
8	1AE8	Object Oriented Programming C++ Laboratory		P 02		01	-	--	--	--	--	25	25	50	5
9	1AE9	Communication Skills Laboratory		P 02		01	-	--	--	--	--	15	10	25	5
10	1AE10x	Free Elective (Audit)	--	--	--	--	--	--	--	--	--	--	--	--	--
		TOTAL	18	12	22	04	-	--	--	450	--	--	--	175	--

Total Credits: 26

1AE10x Free Elective (Audit): 1AE101 Electronic Devices & Components, 1AE102 Introduction to Lab Electronic Instruments

Scheme of Teaching and Examination M.Sc.
(Applied Electronics) SEMESTER PATTERN
SEMESTER: SECOND

T: Lectures, P: Practical, TU: Tutorial/Assignment

SN	Subject Code	Name of Subject	Hrs/ Week		Credits		Examination Scheme								
							Theory					Practical			
			T	P/ TU	Theory	Practical	Paper Hrs	Max Theory	Max Internal	Total	Min Passing Grade Points	Max Marks Practical	Max Marks Int. Ass	Total	Min Passing Grade Points
1	2AE1	Linear Integrated Circuits	04	01	05		3	80	20	100	4	--	--	--	--
2	2AE2	Communication Engineering	04	01	05		3	80	20	100	4	--	--	--	--
3	2AE3	Digital Integrated Circuits	04	01	05		3	80	20	100	4	--	--	--	--
4	2AE4	Microprocessor and Microcontroller	04	01	05		3	80	20	100	4	--	--	--	--
5	2AE5x	Professional Elective	04	01	05		3	80	20	100	4	--	--	--	--
6	2AE6	Integrated Circuits Laboratory		P 02		01	-	--	--	--	--	25	25	50	5
7	2AE7	Professional Elective Laboratory		P 02		01	-	--	--	--	--	25	25	50	5
8	2AE8	Microprocessor and Microcontroller Laboratory		P 02		01	-	--	--	--	--	25	25	50	5
9	2AE9	Basic Electronic Workshop		P 02		01	-	--	--	--	--	25	25	50	5
10	2AE10x	Free Elective (Audit)	--	--	--	--	--	--	--	--	--	--	--	--	--
		TOTAL	20	13	25	04	-	--	--	500	--	--	--	200	--

Total Credits: 29

2AE5x Professional Elective: 2AE51 Electronic Instrumentation, 2AE52 Control Systems

2AE10x Free Elective (Audit): 2AE101 Environmental Studies **2**AE102 Introduction to MATLAB

Scheme of Teaching and Examination M.Sc.
(Applied Electronics) SEMESTER PATTERN
SEMESTER: THIRD

T: Lectures, P: Practical, TU: Tutorial/Assignment

S N	Subject Code	Name of Subject	Hrs/ Week		Credits		Examination Scheme								
							Theory					Practical			
			T	P/ TU	Theory	Practical	Paper Hrs	Max Theory	Max Internal	Total	Min Passing Grade Points	Max Marks Practical	Max Marks Int. Ass	Total	Min Passing Grade Points
1	3AE1	Digital Communications	04	01	05		3	80	20	100	4	--	--	--	--
2	3AE2	Digital Signal Processing	04	01	05		3	80	20	100	4	--	--	--	--
3	3AE3	VLSI Design	04	01	05		3	80	20	100	4	--	--	--	--
4	3AE4x	Professional Elective#1	04	01	05		3	80	20	100	4	--	--	--	--
5	3AE5x	Professional Elective#2	04	01	05		3	80	20	100	4	--	--	--	--
6	3AE6	Digital Signal Processing Laboratory		P 02		01	-	--	--	--	--	25	25	50	5
7	3AE7	Professional Elective#1 Laboratory		P 02		01	-	--	--	--	--	25	25	50	5
8	3AE8	Project and Seminar		P 06		--	-	--	--	--	--	--	--	--	--
9	3AE9x	Free Elective (Audit)	--	--	--	--	-	--	--	--	--	--	--	--	--
10	3AE10	Industrial visit/tour	--	--	--	--	--	--	--	--	--	--	--	--	--
		TOTAL	20	15	25	2	-	--	--	500	--	--	--	100	--

Total Credits: 27

3AE4x Professional Elective#1: 3AE41 Embedded System Design, 3AE42 Electronic Circuit Design

3AE5x Professional Elective#2: 3AE51 Introduction to Neural Networks and Fuzzy Logic, 3AE52 Computer Organization

3AE9x Free Elective (Audit): 3AE91 Industrial Management, 3AE92 IPR and Patents

Scheme of Teaching and Examination M.Sc.
(Applied Electronics) SEMESTER PATTERN
SEMESTER: FOURTH

T: Lectures, P: Practical, TU: Tutorial/Assignment

SN	Subject Code	Name of Subject	Hrs/ Week		Credits		Examination Scheme								
							Theory					Practical			
			T	P/ TU	Theory	Practical	Paper Hrs	Max Theory	Max Internal	Total	Min Passing Grade Points	Max Marks Practical	Max Marks Int. Ass	Total	Min Passing Grade Points
1	4AE1	Microwave Engineering	04	01	05		3	80	20	100	4	--	--	--	--
2	4AE2	Optical Fiber Communications	04	01	05		3	80	20	100	4	--	--	--	--
3	4AE3	Mobile Communications	04	01	05		3	80	20	100	4	--	--	--	--
4	4AE4x	Professional Elective#1	04	01	05		3	80	20	100	4	--	--	--	--
5	4AE5x	Professional Elective#2	04	01	05		3	80	20	100	4	--	--	--	--
6	4AE6	Microwave Engineering and Optical Fiber Communications Laboratory		P 02		01	-	--	--	--	--	25	25	50	5
7	4AE7	Professional Elective#1 Laboratory		P 02		01	-	--	--	--	--	25	25	50	5
8	4AE8	Project and Seminar		P 06		12	-	--	--	--	--	100	100	200	5
9	4AE9x	Free Elective (Audit)	--	--	--	--	-	--	--	--	--	--	--	--	--
		TOTAL	20	15	25	14	-	--	--	500	--	--	--	300	--

Note: 3AE8/4AE8 Project and Seminar Maximum Marks Internal Assessment: 75 (project) + 25 (Seminar) = 100 (Total)

Total Credits: 39

Grand Total of Credits: 121 for four semesters

4AE4x Professional Elective#1: 4AE41 DSP with TMS 320C54xx, 4AE42 Digital Image Processing

4AE5x Professional Elective#2: 4AE51 Smart Sensors, 4AE52 Biomedical Engineering

4AE9x Free Elective (Audit): 4AE91 Engineering Ethics, 4AE92 Technical Writing

SYLLABUS PRESCRIBED FOR TWO YEAR P.G. DEGREE COURSE MASTER OF SCIENCE (APPLIED ELECTRONICS) SEMESTER PATTERN SEMESTER : FIRST

1AE1 ELECTRICAL ENGINEERING AND NETWORK ANALYSIS

COs (Course Outcomes)

After successfully completing the course, the students will be able to

1. Analyze electrical circuits using mesh and node analysis.
2. Apply suitable network theorems to analyze electrical circuits.
3. Apply Laplace Transform for circuit analysis.
4. Draw oriented graph of network to determine their currents and voltages.
5. Relate various two port network and apply two-port network theory for network analysis

Unit I : Fundamentals of Electrical Engineering
Basic concept of voltage, current, work, power and energy, relationships between them, Resistance, resistivity, conductivity, Ohm's law, series and parallel connections of resistors, voltage and current division, Star to delta and delta to star transformations, Kirchhoff's laws applied to dc circuits, single phase AC Circuits (sinusoidal waveforms only), R-L-C series circuits and parallel circuits, phasor diagram, impedance triangle, active reactive power.

Unit II : Single phase transformer
Principle of operation, construction, EMF equation of transformer, voltage transformation ratio, transformer on no load, transformer on load, losses in transformer, voltage regulation of transformer, efficiency of transformer, condition for maximum efficiency. Basic Network Elements and sources Network elements, circuit components, assumptions for circuit analysis, voltage and current sources, Standard input signals, source transformations, mesh and node analysis.

Unit III : Graph theory and network equations
Graph of a network, Trees, co trees and loops, Incidence matrix, Cut-set matrix, Tie set matrix and loop currents, possible trees, analysis of a network using Kirchoff's laws, network equilibrium equation and Duality network transformations.

Unit IV : Laplace Transformation and its applications
Laplace transformations, basic theorems, Laplace transform of some important functions, initial and final value theorem, gate function, impulse function, Solutions of linear differential equations with constant coefficients, Heaviside's partial fraction expansion.

Unit V : Network Theorems
Introduction, Superposition theorem, Reciprocity theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem applied to DC and AC circuits.

Unit VI : Two-Port Network
Open circuit impedance parameters, short circuit admittance parameters, Transmission or chain parameters, Hybrid parameters, Interrelationships between the parameters, Interconnection of two port networks, Input impedance in terms of two port parameters, Output impedance in terms of two port parameters.

Text Books:

1) De Carlo Lin : Linear Circuit Analysis, 2e, Oxford University Press
2) D. Roy Choudhary : Network and Systems (New Age International/ Wiley eastern ltd)
3) V .N. Mittle : Basic Electrical Engineering, (TMGH)

Reference Books:

1) M.E. Van Valkenburg : Network analysis 3rd Ed. (PHI)
2) Iskv Iyer : Circuit Theory, (TMGH)
3) Edminister : Electric Circuits, Schaum Outline Series

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1AE2 ELECTRONIC DEVICES AND CIRCUITS

COs (Course Outcomes)

After successfully completing the course, the students will be able to

1. Comprehend the knowledge of diode and its applications in rectifier and regulator circuits.
2. Understand basics of BJT, JFET, MOSFET, UJT and their operational parameters.
3. Understand feedback concept, topologies and their applications.
4. Implement and analyze various electronic circuits such as oscillators, multistage amplifiers and power amplifiers using BJT.
5. Design and analyze electronic circuits.

Unit I : P-N Junction diode theory, Rectifiers - Half wave, full wave and bridge, Filters-C, LC and their analysis, analysis of clipping and clamping circuits using diodes, Zener diode and its application. (10 Periods)

Unit II : Theory and Analysis of Bipolar Junction transistor, Configurations, transistor as a switch,'Q' and stability factor, Methods of biasing, their needs, 'h' Parameter (CE, CB, CCanalysis)

(10 Periods)

Unit III : FETs (JFET & MOSFET): Types, Characteristics and parameters (μ , gm, Rds), Biasing of FET, MOS capacitor, Equivalent circuits of JFET and MOSFETs, CMOS characteristics. (08 Periods)

Unit IV : Study of typical transistor amplifier circuits: BJT: RC coupled amplifier, Transformer coupled amplifier, Direct coupled amplifier, Cascode stage, Emitter follower, Darlington emitter follower, Bootstrap emitter follower, Feedback amplifiers. FET Amplifier-Common Source & Common Drain. (10 Periods)

Unit V : Class 'A', 'B', 'AB' and 'C' amplifiers, Calculations of power gain, efficiency, power dissipation and distortion, Oscillators, their criteria, Hartley, Colpitts and R-C Oscillators, Crystal Oscillator. (08 Periods)

Unit VI : Theory, Construction and applications of Schottky diode, Tunnel diode, Varactor diode, LED, Photo diode, Phototransistor, PIN diode. (08 Periods)

Text Books:

1) Electronic Devices and : David A.Bell, Oxford University Press
2) Electronic Devices and Circuits : Millman and Halkias, TMGH
3) Integrated Circuits : Millman and Halkias, TMGH
4) Microelectronics : Millman and Halkias, TMGH
5) Millman and Taub : Pulse, Digital and Switching wave forms (TMGH,

Reference Books:

1) Microelectronic Circuits : Sedra/Smith,5e,Oxford University Press
2) Electronic Devices & Circuit Theory : R.L.Baylestad & L.Nashlsky (6th Edition), Pearson Education
3) Semiconductor Devices and Circuits : Aloke K.Dutta, Oxford University, Press

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1AE3 OBJECT ORIENTED PROGRAMMING C++

COs (Course Outcomes)

After successfully completing the course, the students will be able to

1. Justify the basics of object-oriented programming concepts such as data types, functions, classes, objects, constructors, inheritance, overloading etc.
2. Design, implement, test, and debug simple programs in an object-oriented programming language.
3. Describe how the class mechanism supports encapsulation and information hiding.
4. Design and test the implementation of C++ programming concepts

Unit-I : Introduction to object-oriented programming, comparison with structured programming object oriented terminology data abstraction, Inheritance, polymorphism.

Unit-II : New keywords, type compatibility, scope operator, function in C++, function prototype, In line function, Default argument, Overloading, Operator overloading, Unary operator, Binary operator.

Unit-III : Class: definition, Object, Data member and instance variable methods, Implicit object, class scope, Access specifier, Operator method, Constructor, Copy constructor, Destructor, Assignment calls, Static member, Dynamic objects, Array of objects, Friend functions, Pointer to member.

Unit-IV : Inheritance and polymorphism**:** simple inheritance, constructor and destructor in inheritance, protected access, specifier, class conversions, multiple inheritance, multiple base classes, and virtual base classes.

Unit-V : Polymorphism**:** Virtual function, abstract base classes, Using polymorphism with example, Generic function, generic classes.

Unit-VI : Stream in C++: Inserter, Extractor, Formatting, Manipulator, Error handling, user defined streams, defining Insertion and extractor operator.

TEXT BOOKS

1) Object oriented Programming with C++, Sahay, Oxford University Press
2) Programming with ANSI C++, Trivedi, Oxford University Press
3) Object Oriented Programming with C++ by E. Balaguruswamy, Tata Mc-Graw Hill publishing Co.Ltd., New Delhi,1995.

REFFERENCE BOOKS:

1) Object Oriented Programming in Turbo C++ by Rober Lofore, Galgotia Publications Pvt..Ltd., New Delhi,1995
2) The C++ Programming Language by Bjame Stroustrup Pub.Co.,New York, 1995 (Addison Wesley)
3) C++ Primer by Lipman Stanley B., New York, Addison Wesely Pub.Company, 1995
4) Data Structure using c and C++ by Langsam, Augenstein and Tenenbaum; PhI, New Delhi.
5) Joyce Farrell - Object Oriented Programming using C++, Cengage Learning Pub. Company

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1AE4 ELECTRIC AND MAGNETIC FIELDS

COs (Course Outcomes)

After successfully completing the course, the students will be able to

1. Apply vector calculus to understand the behavior of static electric/magnetic fields.
2. Formulate and solve problems in electrostatics and magnetostatics in dielectric media.
3. Describe and analyze electromagnetic wave propagation in free-space.
4. Analyze plane electromagnetic waves at boundaries between homogeneous media.
5. Analyze the electromagnetic radiation from localized charges considering retardation effects

Unit-I Coordinate systems and Transformations**:** Scalars and vectors, unit vector, vector addition and subtraction, vector multiplication, components of a vector, orthogonal coordinate systems and their transformations, differential length, Area, and Volume, Del operator, Gradient, curl, divergent of a vector.

Unit-II Electrostatic: Coulomb's law and Electric field intensity, Electric flux density, Gauss's law, divergent theorem, Electric vector potential, Electric energy stored in static electric field, potential gradient.

Unit-III Magneto static**:** current density and continuity equation, Biot-Savert's law, stokes theorem, Ampere's circuital law and applications, magnetic flux density, scalar and vector magnetic potential, Energy stored in static magnetic field, Maxwell equations for steady fields.

Unit-IV Maxwell equation and boundary conditions**:** Maxwell equation for time varying fields, Electric boundary conditions for conductor-dielectric interface, magnetic boundary condition for two different magnetic materials.

Unit-V Electromagnetic waves**:** Electromagnetic wave equation in homogeneous medium, wave propagation in a perfect dielectric(free space), solution of electromagnetic wave equation, Intrinsic impedance, Poynting vector and Poynting theorem, Reflection and Refraction of plane waves, Field analysis of transmission lines, characteristic impedance.

Unit-VI Radiation: Retarded potential, Electric and magnetic fields due to oscillating dipole (Alternating current element), power radiated and radiation resistance, linear arrays, Endfire and broad side array, pattern multiplication.

TEXT BOOK:

1. Matthew N.O. Sadiku.: "Elements of Electromagnetic", Oxford University Press (FourthEdition,2008
2. Jordan E.C. and Balman K.C. : " Electromagnetic Waves and Radiating system" Prentice Hall of India Private Limited, (Second Edition), 1985.

REFFERENCE BOOKS:

1. Hayt W.H.: " Engineering Electromagnetics", Tata Mc-Graw Hill
2. Krauss J.D. : Electromagnetics", Mc-Graw Hill Books co.(Third Edition), 1984

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1AE5 COMMUNICATION SKILLS

COs (Course Outcomes)

Upon successful completion of this course, the student will be able to:

1. Acquire knowledge about the various principles of communication.
2. Learn the importance of verbal and non-verbal communication in the professional world.
3. Imbibe the knowledge of effective classroom speaking and presentation.
4. Learning the nuances of effective writing by using short and crisp sentences.
5. Synthesize and apply appropriate and effective conflict management strategies.

Unit I : Comprehension - word study: -
Synonym, antonym, meanings, matching words, adjectives, adverbs, prefix and suffix, correct forms of commonly misspelled words, understanding of the given passage. Skimming for general ideas, Contextual vocabulary, Error detection, Note making and Location of argument from text, Ability to answer inferential, factual and personal response.

Unit-II Comprehension - Structure study:-
Simple and compound sentences, types of conjunctions, singular and plural, tenses and their effect on verb forms, Use of - not only - but also, if clause, since, may, can, could, would, too etc. Active and passive forms, negative and interrogative, punctuation and capitalization.

Unit III Theoretical background - importance of communication, its process, model of communication its components & barriers. Types of written communication, organization of a text (Titles, summaries, headings, sequencing, signaling, cueing etc.), important text factors (length of paragraph, sentences, words, clarification and text difficulty). Evaluation of written communication for its effectivity and subject content.

Unit IV Specific formats for written communication like – business correspondence, formal reports, technical proposals, research papers and articles, advertising and graphics. Format for day to- day written communication like applications, notices, minutes, quotations, orders, enquiries etc. Letter writing, messages telegrams, telex, fax and e-mail Writing memos, agendas and notices of meetings, Preparing advertisements.

Unit-V Oral communications - Important objectives of interpersonal skills, Verbal communication, its significance, face to face communications, group discussion and personal interviews. Voice modulation and logical argument, Comprehension of text at normal reading speed. Listening skill and timely response, Participation and contribution to discussion, Command over language Formal and informal style of communication, Body language.

Unit-VI Non-verbal communication, types of graphics and pictorial devices. Meaning and purpose of meetings, seminars, symposia, conference and workshop. Methodology of conduction of meetings, seminars, symposia, conference and workshop. Brochure preparation for seminars, symposia, conference and workshop. Preparation of minutes of meeting.

TEXT BOOKS :

1) Technical Communication-Principles and Practice, Raman, Oxford University Press
2) Technical Communications-English Skills for Engineers, Raman, Oxford University Press

REFERENCE BOOKS :

1) Curriculum Development Centre, TTTI WR, Bhopal : A Course in Technical English, Somaiya Publication Pvt. Ltd.
2) F.Frank Candlin : General English for Technical Students, University of London Press Ltd
3) Krishna Mohan, Meera Banerjee : Developing Communication Skills, MacMillan India Limited.
4) Chrissie Wright (Editor) : Handbook of Practical Communication Skills, Jaico Publishing House.

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1AE6 ELECTRICAL ENGINEERING & NETWORK ANALYSIS LABORATORY

COs (Course Outcomes)

By the end of the course the student will be able to:

1. Analyze and solve the Electric circuits
2. Understand different transformer connections
3. Incorporate knowledge on different testing methods for Transformers
4. Apply the fundamental concepts in solving and analyzing different Electrical networks
5. Estimate the performance of a particular network from its analysis

Minimum 10 experiments based on the syllabus of 1AE1, that are preferably uniformly distributed over the syllabus

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1AE7 ELECTRONIC DEVICES AND CIRCUITS LABORATORY

COs (Course Outcomes)

By the end of the course the student will be able to:

1. Acquire basics of parameters and operation of various semiconductor devices.
2. Implement basic circuits using electronic devices.
3. Verify and analyze performance of electronic circuits.

Minimum 10 experiments based on the syllabus of 1AE2, that are preferably uniformly distributed over the syllabus

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1AE8 OBJECT ORIENTED PROGRAMMING C++ LABORATORY

COs (Course Outcomes)

After successfully completing the course, the students will be able to

1. Justify the basics of object-oriented design and the concepts of encapsulation, abstraction, inheritance, and polymorphism
2. Design, implement, test, and debug simple programs in an object-oriented programming language.
3. Describe how the class mechanism supports encapsulation and information hiding.
4. Design and test the implementation of C++ programming concepts

Minimum 10 experiments based on the syllabus of 1AE3, that are preferably uniformly distributed over the syllabus

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1AE9 COMMUNICATIONS SKILLS LABORATORY

COs (Course Outcomes)

On completion of this course the student should be able to:

1. Accomplish sound vocabulary and its proper use contextually.
2. Speak clearly, confidently, comprehensibly.
3. Listen/view and comprehend different spoken discourses/excerpts in different accents
4. Write cohesively and coherently and flawlessly avoiding grammatical errors

Objective:

On completion of this laboratory the candidate should be able to demonstrate adequate skills in oral and written communication for technical English language, actively participate in group discussions and interviews and exhibit the evidence of vocabulary building. Candidates should be assessed through continuous monitoring and evaluation. The sample list of experiments is given below. This list can be used as guideline for problem statements but the scope of the laboratory should not be limited to the same. Aim of the list is to inform about minimum expected outcomes.

1. Assignments and tests for vocabulary building
2. Technical report writing
3. Group discussions
4. Interview techniques
5. Projects and tasks such as class news letter
6. Writing daily diaries and letters
7. Interactive language laboratory experiments.

Text Book : Norman Lewis : Word Power Made Easy
http://www.teachingenglish.org.uk

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1AE10x FREE ELECTIVE AUDIT#1
1AE101 ELECTRONIC DEVICES & COMPONENTS

COs (Course Outcomes)
After successfully completing the course, the students will be able to
1. Understand component symbol, working principle, classification and specification.
2. Handle basic electrical and electronics equipment.
3. Understand all the fundamental concepts involving electronics engineering
4. Understand Function of PCB and PCB lay-out
5. Understand the IC fabrication technology, classification, packaging and SMD.

Unit I : Construction, selection and failures of · Resistors: Fixed type, Variable Type , Network and Chip type · Capacitors: fixed and variable Type

Unit II : Switches & Relays: Types, Construction and Testing · Fuses, Cables and Connectors: Types, Construction, Specification and Application · Introduction to Heat sink, Choke and Transformer

Unit III : Basics of Electronic Component layout, PCB material, Properties and specifications, Basic manufacturing process of PCB , Soldering and De- soldering Techniques.

Unit IV : P-N Junction diode theory-, Temperature dependency, Diode Resistance, Diode capacitances, Zener diode : characteristics, Avalanche & Zener breakdown, Testing of diode using Ohmmeter and CRO

Unit V : Theory of PNP and NPN Transistor, Transistor Configurations, Their Characteristics and current Components. Transistor as an amplifier, Testing of Transistor using Ohmmeter and CRO

Unit VI: Introduction to IC and SMD, IC Fabrication Steps, Classification of ICs, monolithic IC, advantages, disadvantages of ICs, thick film and thin film IC, linear IC, digital IC, IC packages – SIP, TO 5, flat, DIP, pin identification, temperature ranges, device identification, Concept of SMT and SMD, advantages and disadvantages of SMD, SMD resistor, capacitor, IC, transistor, land pattern of SMD resistor, capacitor, transistor and ICs, SMD packages (SOT, PLCC)

Text Books:
1. Madhuri Joshi, " Electronic Component and Material" 3rd Edition, Shroff Publication
2. Millman H Halkies, " Integrated Electronics" TMH Co. New Delhi

Reference Books:
1. Bosshart, " Printed Circuit Board" TMH
2. David Bell' " Electronic Devices and Circuits" Oxford University Press, 2010
3. Boylestad R, "Electronic Devices and Circuits" Prentice Hall of India Pvt. Ltd. New Delhi.
4. S. K. Bhattacharya, "Electrical and Electronics Engineering Materials Components, Khanna Publishers
5. Dhir, "Electronic Components and Materials", Tata McGraw Hill
6. Charles A. Harper, "Handbook of components for electronics", Laxmi Enterprise
7. Thomas H. Jones, "Electronic Components Handbook", Reston Publishing Co.

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1AE10x FREE ELECTIVE AUDIT # 2
1AE102 INTRODUCTION TO LAB ELECTRONIC INSTRUMENTS

COs (Course Outcomes)
After successfully completing the course, the students will be able to
1. Understand the testing of electronic devices and components using ohmmeter, multimeter.
2. Understand Function specification and usage of CRO, function generator, multimeter
3. Understand the analog signal analysis using spectrum analyser and network analyser
4. Understand logic analyser

Unit I Analog meters, digital meters, dc voltmeter, ac voltmeters, RF probes, ammeters, ac ammeters, ohm-meters, 4-wire ohm measurements, multi-meters, meter range, other multi-meter functions: continuity indicators, diode , transistor tests, capacitance and inductance measurements, specifications.

Unit II : Floating and grounded outputs, sine wave sources, imperfections in sine wave sources,: frequency accuracy, frequency stability, amplitude accuracy, distortion, spurious responses, close-in-sidebands , Function Generators: Arbitrary waveform generators, arbitrary waveforms, Frequency sweep, sync output, phase locking, pulse generators, RF signal generators.

Unit III : Oscilloscopes: the concept of oscilloscope, digital scope block diagram, sample rate, real time and repetitive sampling, triggering, acquisition/sweep control, vertical amplifier, vertical resolution, ac and dc coupling, bandwidth limit, X-Y display mode, High impedance inputs, 50 ohm inputs, digital acquisition and display techniques, specifications of oscilloscopes, mixed signal oscilloscope, oscilloscope probes, probe compensation, active probes, differential measurements, high voltage probes, current probes, digital storage oscilloscope.

Unit IV : Oscilloscope measurements, basic waveform measurements, voltage gain measurements, phase measurements, frequency measurements, digital signal measurements, frequency response measurements, square wave tests, linearity measurements, curve tracer measurement techniques, diode I-V and resistor I- V characteristics, amplitude modulation measurements, power measurements, FFT measurements, basic time domain reflectometry.

Unit V : Spectrum and network analyser: Spectrum analyser, bank-of-filters spectrum analyzer, FFT spectrum analyzers, wave meters, resolution bandwidth, narrow band and broad band measurements, swept spectrum analyzer measurements, Network analyser, distortion analyzers, RF power measurements, RF power meter.

Unit VI : Logic Analyzers: logic probes, oscilloscope logic measurements, logic analyzers, timing analyzers, glitch detect, state analyzers, data formats, state displays, timing displays, microprocessor based measurements, trigger events and sequencing, microprocessor program flow, logic analyser probing, combined scope and logic analyser, PC-hosted logic analysers.

Text Book:

1] Electronic Test Instruments: Analog and Digital by Robert A. Witte, Second Edition, Pearson Education

2] Digital Measurement Techniques by Rathore T S

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SEMESTER: SECOND

2AE1 LINEAR INTEGRATED CIRCUITS

COs (Course Outcomes)

After successfully completing the course, the students will be able to

1. Comprehend the knowledge of basic concepts and performance parameters of Op-Amp.
2. Analyze and design electronic circuits for various linear and non-linear applications
3. Comprehend the knowledge of PLL, its applications and data converters.
4. Acquire and apply knowledge for design of voltage regulator circuits using ICS and discrete components.
5. Design Electronic circuits using different ICs and sensors.

Unit I : Operational Amplifier: Differential amplifier: gain expression using H parameters, transfer-characteristics, constant current source, level shifting, block diagram of op-amp, frequency response, frequency compensation methods, study of IC , measurement of parameters of op-amp, off set nulling and their importance.

Unit II : Linear Applications of Op-amp Inverting and non-inverting amplifiers, voltage followers (ACDC),integrator, differentiator, Differential amplifier, bridge amplifier, Instrumentation amplifiers, precision rectifier, RMS to DC converter, voltage to current converter, sinusoidal RC oscillators, constant voltage sources, frequency to voltage and voltage to frequency converter.

Unit III : Non-Linear Applications of Op-Amp and Filter Circuits Clipping and clamping circuits, comparator, astable, monostable and bistable multivibrator, Schmitt Trigger, voltage sweep generator, active filters: Butterworth, Chebyshev filters using op-amp,

Unit IV : Voltage Regulator Transistorized series and shunt voltage regulators, Block schematic of regulator IC 723, regulated power supply using IC 723, short circuit protection, switch mode power supply, dual tracking regulators, regulator using 78xx, 79xx, and LM 317.

Unit V : Timers: Block schematic of regulator IC 555, application of timer 555 as astable, monostable and bistable multivibrator, Delayed timer, sawtooth generators, function generator using 8038, Sample & Hold circuit

Unit VI : Phase Locked Loops Operation of phase lock loop system, transfer characteristics, lock range and capture range, study of PLL IC-LM 565 and its application as AM detector, FM detector and Frequency translator.

Text Books:

1) Gayakwad R.A. : Op-Amps and Linear Integrated Circuits, Prentice Hall of India Pvt. Ltd., New Delhi (2nd edition)
2) Robert F. Coughlin : Operational Amplifiers & Linear Integrated Circuits, and F.F.Driscoll Pearson Education

Reference Book:

Sedra/Smith : Microelectronics Circuits, 5e, Oxford University Press

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2AE2: COMMUNICATION ENGINEERING

COs (Course Outcomes)

After successfully completing the course, the students will be able to

1. Understand the necessity of modulation and identify the various components of analog communication systems.
2. Comprehend the knowledge of different modulation and demodulation schemes in analog and pulse communication systems.
3. Analyze the performance of analog communication systems in presence of noise.
4. Develop the ability to compare and contrast the strengths and weaknesses of various communication systems.

Unit I : **Basics of Electronic Communication**
The importance of electronic communication, Definition: Analog signal, Digital signal, Baseband signal, block diagram of basic electronic communication system and explanation of each block, Noise in communication system and types, The electromagnetic spectrum, Concept of transmission bandwidth, modulation, need for modulation, different modulation techniques, Difference between CW and pulse modulation techniques. (Fundamental concepts)

Unit II : **Wave Propagation**
Fundamentals of Electromagnetic waves, ground waves, space waves propagation, ionosphere layer, sky waves propagation, concept of actual and virtual height, Definitions of critical frequency, maximum usable frequency, skip distance and skip zone, concept of fading.

Unit III: **Antennas**
Antenna fundamentals, concept of Radiation pattern, polarization, bandwidth, beam width, antenna resistance, directivity, power density, antenna gain, Structure, radiation pattern & applications of -Half wave dipole antenna (resonant antenna), folded dipole antenna, Yagi-Uda antenna.

Unit IV : **AM transmitters**
Amplitude Modulation, Modulation index-definition, its effect on modulated signal, Mathematical representation of amplitude modulated wave & its meaning, concepts of side band (SSB,DSB), Power relations in AM wave, simple numerical, Circuit and operation of AM modulator using FET, Block diagram of AM transmitter and its operation, advantages, disadvantages, applications of AM.

Unit V : **AM receivers**
Block diagram of Tuned Radio Frequency receiver and its working, Block diagram of AM super heterodyne receiver and its working, Characteristics of AM radio receiver- Sensitivity, selectivity, fidelity definitions, Image frequency and its rejection, Demodulation of AM signal, Diode detector, Need of AGC & its types – simple, delayed.

Unit VI : **FM transmitter and Receiver**

Frequency Modulation, mathematical representation of FM & its meaning, direct FM Generation using FET, Armstrong circuit diagram and its working, Concept of Pre-emphasis & De-emphasis
FM receiver: Block diagram and explanation of FM Super heterodyne radio receiver, Balanced slope detector.

Text Books: 1) Kennedy G. : Electronic communication system (Mc-Graw Hill) 4th Ed

2) Dennis Roddy & John Coolen : Electronic communication (PHI) 2ND Ed

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2AE3 DIGITAL INTEGRATED CIRCUITS

COs (Course Outcomes)

After successfully completing the course, the students will be able to

1. Use Boolean algebra to solve logic functions, number systems and its conversion.
2. Understand digital logic families and their characteristics.
3. Identify, analyze and design combinational and sequential circuits.
4. Use the knowledge of semiconductor memories, programmable logic devices in digital design
5. Analyze, design and implement sequential logic circuits.

Unit I : Number systems, Gray codes, Arithmetic operations, 2's complements, floating point arithmetic and its representation, Logic gates, Boolean algebra, standard form of logical function, K-map up to five variables, Quine Mc-Clusky method, Don't care conditions and their effects, Synthesis using AND- OR gates

Unit II : Study and analysis of digital logic families: TTL, ECL, MOS, CMOS and their characteristics, Tri-state logic, TTL and CMOS IC series , Latches, Flip-Flops R-S, J-K, Master slave J-K, D-type, T-type, registers and counters, Adders and subtractors using logic gates.

Unit III : Combinational Logic Design using 74/54 MSI chip series concerning to multiplexers, De-multiplexers, decoders, encoders, comparators, code converters, priority encoders, parity generator/ checker & BCD-to-seven segment decoder.

Unit IV : Combinational Logic Design using ROM array, PLA, PAL, Preliminary design concepts using FPGAs, N-bit binary adder using 7480. carry Look ahead adder construction.

Unit V : Types of semiconductor memories, sequential memories, 2 and 4 phase ratio- less shift registers, CMOS registers stages, static shift registers, implementation of ROM (ROM, PROM, EPROM, EEPROM) BJT RAM cell, MOS-RAM, CCD memories.

Unit VI : Design of sequential networks: Analysis of clocked sequential networks, General models of sequential machines, 13 14 Equivalence and minimization networks, Deviation or state graph and tables, reduction of state assignments, S.M. chart.

Text Books:

1) M. Mano. : Digital Design 3rd ed (Pearson Education)
2). R.P.Jain : Modern Digital Electronics 3rd ed (TMH)
3) Ken Martin : Digital Integrated Circuit Design, Oxford University Press

Reference Book:

1) Sedra/Smith : Microelectronics Circuits, 5e, Oxford University Press

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2AE4 MICROPROCESSORAND MICROCONTROLLER

COs (Course Outcomes)

Upon completion of this course, students will demonstrate the ability to :

1. Understand architectural difference between Microprocessor and Microcontroller.
2. Understand Assembly Language Programming concepts of Microprocessor & Microcontroller.
3. Comprehend interfacing of different peripheral devices with Microprocessor and Microcontroller

Unit I : An introduction to 8085: Address decoding technique, 8085 architecture, Register structure,, memory addressing and addressing modes. Instruction set of 8085 microprocessors. Interrupt system of 8085.

Unit II : An introduction to 8051 : Overview of the 8051 family, Architecture of 8051, Signal description of 8051, Internal Memory, Internal RAM, External Memory, Register structure, stack and stack pointer, SFR, I/O port structure, Timer structure and their modes. serial data input and output, serial data transmission and reception. (10 Periods)

Unit III : Instruction set of 8051, Addressing modes of 8051, Data moves, PUSH, POP, and Data exchange instruction, Logical bit and Byte level operation, Arithmetic operation ,Jump and Call instruction, time delay generation and calculation , Interrupts and returns , programming using 8051, Timer / counter programming, serial communication programming & Interrupt programming. (10 Periods)

Unit IV : Architecture, modes, and programming of PPI 8255, DMA data transfer concepts. Internal architecture, interfacing of 8255 with 8051 & Programming.

Unit V : Analog to digital and digital to analog conversion techniques and its interfacing with 8085: Case study of ADC0800V and ADC1210, Case study of DAC 0808 and DAC 1008/8051. Interfacing of Analog to Digital Converter, digital to analog converter. Application of DAC for generating different waveforms. (10 Periods)

Unit VI : 8051 interfacing to external memory, Interfacing LCD & stepper motor with 8051, interfacing of seven segment display to 8051 and programming. Interfacing of keyboard to 8051.

TEXTBOOKS:

1) Han-Way Huang, Using the MCS-51 Microcontroller, Oxford University Press
2) K.J.Ayala: "The 8051 Microcontroller", Penram Int. Pubs., 1996
3) Mazidi & Mazidi: "8051 Micro-controller & Embedded System", Pearson Edu., 2nd Edition.
4) Rajkamal: Arch. Prog. Interfacing & system design. Pearson Edu.

REFERENCE BOOKS :

1) A. K. Ray and K. M. Bhurchandi : Advanced Microprocessor and Peripherals, Architecture Programming and Interfacing, Tata McGraw Hill Publishing Co. Ltd., New Delhi (TMH)

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2AE5x PROFESSIONAL ELECTIVE # 1
2AE51 ELECTRONIC INSTRUMENTATION

COs (Course Outcomes)

After successfully completing the course, the students will be able to

1. Identify various sensors, transducers and their brief performance specifications.
2. Understand working principle of various transducers used to measure Temperature, Displacement, Level, Pressure, Strain etc.
3. Make comparative study of various transducers and understand their applications in industry.
   Understand Data Acquisition System

Unit I : Transducer & Instrumentation systems (1)Transducer classification: Active/Passive. Primary/Secondary. Analog/Digital and transduction Principles. Basic Signal conditioning Circuits. Resistive/Capacitive/Inductive reactance bridge. Current/Voltage Sensitive Wheatstone bridges & Generalized instrumentation system with particular examples (9 Hrs)

Unit II : Static characteristics, errors & statistical parameters: (1) Static characteristics: Accuracy, Precision, Sensitivity, Threshold, Resolution, Repeatability and Hysteresis. Errors: Gross error, Systematic error, Random error, Limiting error. Statistical Parameters: Arithmetic mean Average deviation Standard deviation. Probable error, Histogram, Normal & Gaussian curve of errors. (7 Hrs)

Unit III : Electronics Instrumentation: (1,2,3):Analog & Digital data acquisition system, Analog electronic multimeter, Introduction to digital voltmeter & universal counter. Strip chart & X-Y recorders. Optical Encoders. Seismic mass vibration transducer. (3)Introduction to microphones & loud speaker. (9 Hrs.)

Unit IV : Measurement of Temperature & Strain (1,3) Temperature Sensors: LM335, RTD. THERMISTORS, Thermocouples, Thermocouples laws & its compensation, methods. Pyrometers: Total/Partial radiation & optical pyrometers. Strain Gauges, Gauge factor. Strain measurement & temperature compensation methods.

Unit V : Measurement of Displacement. Pressure & Level. Displacement Measurement: (1) using resistive, capacitive, inductive (LVDT & RVDT) & Eddy current. Pressure Measurement: (1) Elastic, Inductive, Piezoelectric & capacitive transducers, Low pressure measurement using ionization gauge, pirani gauge, thermocouple vacuum gauge. Level Measurement: (1, 3) Using ultrasonic, capacitive, inductive, resistive with float, gamma rays & eddy currents techniques. (8 Hrs.)

Unit VI : Measurement of Flow, Humidity, Velocity (1) Flow Measurement: using ultrasonic, electro aquatic & hotwire Anemometer. Humidity Measurement : using resistive, Capacitive & Crystal transducers. Velocity Measurement: Using photo detectors (both linear & angular velocity). Introductory block diagram of smart sensors, Wave analyzer & spectrum analyzers.

Text Books:

1) Sawhney A.K.: A course in Electrical/Electronic Measurement & Instrumentation, Dhanpat Rai & Sons., Delhi.
2) Rangan C.S., Sharma G.R. , & Mani V.S.V.: Instrumentation Devices & System, Tata Mc- Graw Hill.
4) R. K. Rajput: Electrical & Electronics Measurement & Instrumentation.

Reference Books:

1) Patranbis D. : ' Sensors & Transducers', A.H.Wheeler & Company, Prayag, India.
2) H. S. Kalsi : Electronics Instrumentation, Tata McGraw Hill, 2nd Edition
3) U.A. Bakshi & A. V. Bakshi : Electronics Instrumentation, Technical Publication
4) Robert A. Witte: Electronics Test Instrumentation : Analog & Digital Measurement.

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2AE5x PROFESSIONAL ELECTIVE # 2
2AE52 CONTROL SYSTEMS

COs (Course Outcomes)

At the end of the course the student will be able to:

1. Determine transfer function models of electrical, mechanical and electromechanical systems.
2. Determine transient response and steady state response parameters.
3. Analyze stability/relative stability of the LTI system.

4. Determine the state model and the response of the system using state variable method.
5. Analyze the response of the discrete time system.

Unit I : Basic definitions, Closed and open loop systems, transfer functions, block diagrams, Derivation of transfer functions (only electrical systems), signal flow graphs, basic control action.

Unit II : Time response Analysis, Impulse response function, Analysis of first, second and higher order system, stability of control system, Routh Hurwitz's stability criterion, static and dynamic errors coefficients, error criteria

Unit III : Root locus method, introduction, root locus plots, rules for constructing root loci, Root locus analysis of control systems, effect of zeros, derivative control and velocity feedback.

Unit IV : Frequency response, Bode Plots, Determination of static Position, Velocity and acceleration error coefficients. Polar plots, Nyquist stability criterion, stability analysis, relative stability.

Unit V : State space representation of systems, solutions of state equations, transition matrix, diagonalisation, controllability and observability.

Unit VI : Sampled data control system; Introduction, difference equations, Z-transform and properties, Inverse Z-transforms. Analysis of sampler and Zero-order hold, transfer function of sampled data systems (Block diagrams)

TEXT BOOKS:

1) I.J. Nagrath & M. Gopal (3/e) : Control systems Engineering (WEL)

2) Stefani, Shahian, Savant, Hostetter : Design of Feedback Control Systems, 4e, Oxford University Press

3) B.C. Kuo (7/e):Automatic Control Systems (PHI)

4) Ogata : Modern Control Engineering (PHI)

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2AE6 INTEGRATED CIRCUITS LABORATORY

COs (Course Outcomes)

After successfully completing the course, the students will be able to

1. Design various linear and non linear applications by using IC 741.
2. Design voltage regulators using discrete components and ICs.
3. Implement various waveform generators using IC555, IC565, IC566, IC8038
4. Apply practically the concepts of digital electronics.
5. Understand the operation of various logic gates and their implementation using digital IC's.
6. To design and implement various combinational logic circuits and sequential logic circuits.

Minimum 10 experiments based on the syllabi of 2AE1: Linear Integrated Circuits and 2AE3: Digital Integrated Circuits, that are preferably uniformly distributed over the syllabi.

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2AE7x PROFESSIONAL ELECTIVE LABORATORY

Minimum 10 experiments each based on the syllabus of subjects included in 2AE5x, that are preferably uniformly distributed over the syllabus. A student, after choosing anyone of the following subjects, has to conduct minimum 10experiments based on the syllabus. Professional Elective group is comprised of the following subjects.
2AE51: Electronic Instrumentation and 2AE52: Control Systems

2AE71 ELECTRONIC INSTRUMENTATION LABORATORY

COs (Course Outcomes)

After successfully completing the course, the students will be able to
1.link theoretical principles with practical issues of electronic instrumentation
2. get exposed to a set of multidisciplinary aspects, both theoretical and practical, providing them with the ability of integrating blocks in which they have practically worked into a full instrumentation system.
Minimum 10 experiments each based on the syllabus of 2AE51: Electronic Instrumentation, that are preferably uniformly distributed over the syllabus.

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2AE72 CONTROL SYSTEMS LABORATORY

COs (Course Outcomes)

After successfully completing the course, the students will be able to

1. familiarize with the modeling of dynamical systems and the characteristics of control components like ac servo motor, synchro and magnetic

amplifier.

2. simulate and analyze the stability using MATLAB software and design the compensators.

3. analyze the physical systems represented in transfer function.

4. apply the control components like ac servo motor, synchro and magnetic amplifier.

5. Design controllers, compensators using MATLAB software

Minimum 10 experiments each based on the syllabus of 2AE52: Control Systems, that are preferably uniformly distributed over the syllabus.

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2AE8 MICROPROCESSOR AND MICROCONTROLLER LABORATORY

COs (Course Outcomes)

After successfully completing the course, the students will be able to

1. Develop skill of writing programs in ALP for various applications of 8085 & 8051.
2. Interface various peripherals with 8085 & 8051.

Minimum 10 experiments based on the syllabus of 2AE4, that are preferably uniformly distributed over the syllabus.

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2AE9 BASIC ELECTRONICS WORKSHOP

COs (Course Outcomes)

After successfully completing the course, the students will be able to

1. Identify and handle the basic electronics components
2. Understand the electronics components and their data sheets and characteristics.
3. Have knowledge of fabrication technology for semiconductor devices and integrated circuits
4. Understand Function of PCB and PCB lay-out.
5. Analyze the circuit and troubleshoot errors if any.

Minimum 10 Experiments will be based on the following.

1. Understanding transformers, Calculation of value of Resistor/Capacitor from its colour/bar code, Identification of Electronic passive components Resistors, Capacitors, inductors- types. Testing of these devices

2. Identification and Testing of devices - diode, Zener diode, Tunnel diode, LED, Silicon Controlled Rectifier, bipolar junction transistor, FET, MOSFET, etc.

3. Switches and relays- types, specifications, applications and testing.

4. Fuses, Cables and connectors - types, construction, specifications, testing and applications.

5.PCB layout design using any standard software package (ORCAD/PROTEL)

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2AE10x FREE ELECTIVE (AUDIT)

2AE101 ENVIRONMENTAL STUDIES

COs (Course Outcomes)

After successfully completing the course, the students will be able to

1. Understand modern environmental concepts like equitable use of natural resources, more sustainable life styles etc.
2. Change their approach so as to perceive our own environmental issues correctly, using practical approach based on observation and self learning.
3. Identify and analyze environmental problems as well as the risks associated with these problems and efforts to be taken to protect the environment from getting polluted.
4. Think in terms of sustainable envelopment based on the knowledge they have in different subjects of science and engineering

1. The Multidisciplinary nature of environmental studies

. Definition, scope and importance.

. Need for public awareness.

2. Social Issues and the Environment

. From Unsustainable to Sustainable development

. Urban problems related to energy

. Water conservation, rain water harvesting, watershed management

. Resettlement and rehabilitation of people; its problems and concerns. Case studies.

. Environmental ethics : Issues and possible solutions.

. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.

. Wasteland reclamation.

. Consumerism and waste products.

. Environment Protection Act.

. Air (Prevention and Control of Pollution) Act.

. Water (Prevention and Control of Pollution) Act.

. Wildlife Protection Act.
. Forest Conservation Act.
. Issues involved in enforcement of environmental legislation.
. Public awareness.

3. Human Population and the Environment

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

4. Natural resources :

. **Renewable and non-renewable resources:**
. Natural resources and associated problems.

- Forest resources : Use and over exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
- Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
- Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
- Food resources : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer - pesticide problems, water logging, salinity, case studies.
- Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, Case studies.
- Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources.
Equitable use of resources for sustainable lifestyles.

5. Ecosystems

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

- Forest ecosystem
- Grassland ecosystem
- Desert ecosystem
- Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

6. Biodiversity and its conservation

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

7. Environmental Pollution

. Definition
. Causes, effects and control measures of :-

- Air pollution
- Water pollution
- Soil pollution
- Marine pollution
- Noise pollution

- Thermal pollution
- Nuclear hazards

. Solid Waste Management : Causes, effects and control measures of
. Role of an individual in prevention of pollution.
. Pollution case studies.
Disaster management : floods, earthquake, landslides. cyclone and

LIST OF REFERENCES :-

1) Agarwal, K.C., 2001, Environmental Biology, Nidi Publ. Ltd., Bikaner.
2) Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad - 380 013, India, Email : mapin@icenet.net **(R)**
3) Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p.
4) Clark R.S., Marine Pollution, Clanderson Press Oxford **(TB)**
5) Cunningham, W.P.Cooper, T.H.Gorhani, E & Hepworth, M.T., 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p.
6) De A.K., Environmental Chemistry, Wiley Eastern Ltd.
7) Down to Earth, Certre for Science and Environment **(R)**
8) Gleick, H.P. 1993, Water in Crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press. 473p.
9) Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Mumbai **(R)**
10) Heywood, V.H. & Watson, R.T. 1995, Global Biodiversity Assessment, Cambridge Univ. Press 1140p
11) Jadhav, H & Bhosale, V.M. 1995, Environmental Protection and Laws, Himalaya Pub. House, Delhi. 284p.
12) Mckinney, M.L. & Schoch, R.M. 1996, Environmental Science Systems & Solutions, Web Enhanced Edition. 639p.
13) Mhaskar A.K., Matter Hazardous, Techno-Science Publications **(TB)**
14) Miller T.G.. Jr., Environmental Science, Wadsworth Publishing Co. **(TB)**
15) Odum, E.P., 1971, Fundamentals of Ecology, W.B.Saunders Co., U.S.A., 574p.
16) Rao M.N. & Datta A.K.,1987, Waste Water Treatment, Oxford & IBH Publ. Co. Pvt. Ltd. 345p.
17) Sharma B.K., 2001, Environmental Chemistry, Goel Publ. House, Meerut.
18) Survey of the Environment, The Hindu **(M)**
19) Townsend C., Harper J., and Michael Begon, Essentials of Ecology, Blackwell Science **(TB)**
20) Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II,Enviro Media **(R)**
21) Trivedi R.K. and P.K. Goel, Introduction to Air Pollution, Techno-Science Publications **(TB)**
22) Wagner K.D., 1998, Environmental Management, W.B.Saunders Co., Philadelphia, USA 499p.
23) b÷Éì. Ê´Éaö±É PÉÉ®ú{ÉÚ®äú : {ÉªÉÉÇ´É®úhÉ¶ÉÉºjÉ- Ë{É{É³ýÉ{ÉÚ®äú +ìxb÷ EÆò{ÉxÉÒ {É¤±ÉÒ¶ÉºÉÇ, xÉÉMÉ{ÉÚ®ú.(R)
24) Dr. Deshpande, A.P.Dr. Chudiwale, A.D., Dr. Joshi, P.P., Dr. Lad, A.B.: Environmental Studies, Pimpalapure & Co., Publishers, Nagpur.(R)

(M) Magazine
(R) Reference
(TB) Textbook

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2AE10x FREE ELECTIVE (AUDIT)
2AE102 INTRODUCTION TO MATLAB

COs (Course Outcomes)

After successfully completing the course, the students will be able to :

1. Understand the main features of the MATLAB development environment
2. Use the MATLAB GUI effectively
3. Design simple algorithms to solve problems
4. Write simple programs in MATLAB to solve scientific and mathematical problems

UNIT I : Matrices and Matrix Operations Referencing individual entries Matrix operators Matrix division (slash and backslash) Entry-wise operators Relational operators Complex numbers Strings other datatypes Sub-matrices and Colon Notation Generating vectors Accessing sub-matrices

UNIT II : MATLAB Functions Constructing matrices Scalar functions Vector functions and data analysis Matrix functions The line solve function The find function Control Flow Statements The for loop The while loop The if statement The switch statement The try/catch statement Matrix expressions (if and while) Infinite loops

UNIT III : M-files M-file Editor/Debugger window Script files Function files Multiple inputs and outputs Variable arguments Comments and documentation MATLAB's path Advanced M-file Features Function handles and anonymous functions Name resolution Error and warning messages User input Performance measures Efficient code

UNIT IV : Calling from MATLAB Calling C from MATLAB : A simple example C versus MATLAB arrays A matrix computation in C MATLAB mx and mex routines Online help for MEX routines Calling Fortran from MATLAB: Solving a transposed system A Fortran mex Function with %val Calling Java from MATLAB:A simple example Encryption/decryption MATLAB's Java class path Calling your own Java methods Loading a URL as a matrix

UNIT V : Two and Three Dimensional Graphics Planar plots Multiple figures Graph of a function Parametrically defined curves Titles, labels, text in a graph Control of axes and scaling Multiple plots Line types, marker types, colours Subplots and specialized plots Graphics hardcopy Three-Dimensional Graphics Curve plots Mesh and surface plots Parametrically

defined surfaces Volume and vector visualization Colour shading and colour profile Perspective of view Advanced Graphics Handle Graphics, introduction to Graphical user interface Images

UNIT VI : Advanced Topics Sparse Matrix Computations Storage modes Generating sparse matrices Computation with sparse matrices Ordering methods Visualizing matrices Calculus Variable precision arithmetic Numeric and symbolic substitution Algebraic simplification Two-dimensional graphs Three- dimensional surface graphs Three-dimensional curves Symbolic matrix operations Symbolic linear algebraic functions Solving algebraic equations Solving differential equations

TEXT BOOK:

1 Getting Started with MATLAB 7, Rudra Pratap, Oxford University Press
2. MATLAB Primer Seventh Edition, BY Timothy A Davis Kermit Sigmon

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THIRD SEMESTER

3AE1: DIGITAL COMMUNICATIONS

COs (Course Outcomes)

Upon successful completion of this course, the student will be able to:

1. Understand basic building blocks of digital communication system and formatting of digital signal.
2. Analyze performance of different digital modulation techniques.
3. Understand methods to mitigate inter symbol interference in baseband transmission system.
4. Implement different error control coding schemes for the reliable transmission.
5. Understand various multiple access schemes and spreading techniques.

Unit I : **DIGITAL COMMUNICATION SYSTEM**

Comparison of analog and digital communication System, advantages- disadvantages of digital communication System, block diagram of digital communication System, source encoder, decoder, Channel encoder, decoder, modulator, demodulator and their important parameters, Concepts of synchronization.

Unit II : **INFORMATION THEORY AND CHANNEL CODING**

Digital Signal, Bits, bit rate and baud rate, Probability, laws of probability, joint and conditional probability, information content, rate of information, entropy, joint entropy & conditional entropy, Theoretical Concepts of Binary communication channel, discrete communication channel, Channel capacity, Shannon's theorem on channel capacity, Hartley's law, Source coding, Huffman coding algorithm, and simple numerical.

Unit III : **DIGITAL MODULATION TECHNIQUES**

Digital carrier modulation Schemes, fundamental concepts of coherent Amplitude Shift Keying (ASK), Frequency shift keying (FSK), Phase shift keying (PSK), their transmitter and receiver block diagram and working, bandwidth and probability of errors (only theoretical concepts), comparison of digital modulation systems, block diagram of Differential Phase shift keying (DPSK) transmitter - receiver and working.

Unit IV: **ERROR CONTROLLING AND CODING**

Introduction to error controlling and coding, Methods of controlling errors, type of errors and codes, linear block codes, Matrix description of linear block code, error detection and error correction capabilities of linear block code and simple numerical.

Unit V : **BASE BAND TRANSMISSION**

Concept of Base band signals, Sampling process, Nyquist sampling theorem, Base band PAM system, inter symbol interference, Nyquist criterion, pulse shaping, eye diagram (Theoretical concepts only), scrambler and unscramble concepts and design.

Unit VI : **MODERN TECHNIQUES OF COMMUNICATION**

Access techniques: Need of Multiplexing, Time Division Multiple Access (TDMA) and Frequency Division multiple Access (FDMA), Code Division Multiple access (CDMA), comparison of TDMA, FDMA, CDMA. Introduction to spread spectrum (SS), Pseudo Noise (PN) sequence: definition, generation, Model of Spread Spectrum digital Communication system, D.S. spread spectrum transmitter, receiver and frequency hopping spread spectrum transmitter, receiver, **Theoretical concepts only**.

Text Books:

1) Shanmugam K.S. Digital & analog Communication Systems, John Willey & Sons, New York

2) Lathi B. P. Modern Digital and Communication Systems, Oxford University Press

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3AE2 DIGITAL SIGNAL PROCESSING

COs (Course Outcomes)

By the end of the course the student will be able to:

1. Identify the discrete time signals and identify the type system.
2. Compute the z-transform of a sequence, identify its region of convergence, and compute the inverse z-transform.
3. Evaluate the Fourier transform of a signal.
4. Design FIR and IIR filters.
5. Understand the concepts of Multirate Digital Signal Processing and need of Filter banks.

Unit I : Introduction to DSP, Frequency domain description of signals& systems, Discrete time sequences systems, Linearity, unit sample response, Convolution, Time invariant system, Stability criteria for discrete time systems, Solution of linear difference equations.

Unit II : Introduction to Fourier transform of Discrete Time Signal and its properties, Inverse Fourier transform, Sampling of continuous time signal, Reconstruction of continuous time signal from sequences, Z-Transform and its properties, complex Z-plane, ROC, Determination of filter coefficients, relationship between Fourier transform and Z-Transform, Inverse Z-Transform.

Unit III: DFT and its properties, Circular convolution, linear convolution from DFT, FFT, and Decimation in time and frequency algorithm, and Introduction to wavelet transform.

Unit IV: Filter categories, Direct form I, Direct form II, Cascade and parallel structure for IIR and FIR Filter, Frequency sampling structures for F.I.R. filter, Steps in Filter Design, Design by pole zero placements, FIR filter design by Windowing method, Rectangular, Triangular and Blackman window

Unit V: Analog filter types: Butterworth, Elliptic and Chebyshev filter, Filter Specifications, formulae, filter order, Methods to convert analog filter into digital filters, Mapping of differential, impulse invariant, Bilinear, Matched Z

transformation.

Unit VI: Multi rate DSP, Introductory concept of multi rate signal processing, Design of practical sampler, Rate converters, Decimators and Interpolator, Filter bank application and examples

Text books:

1. Proakis and Manolakis:Digital Signal Processing, 3/e, Pearson Education
2. S. Salivahan, A. Vallavaraj: Digital Signal Processing (TMH)

Reference Book:

B. P. Lathi: Signal Processing and Linear Systems, Oxford University Press

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3AE3 VLSI DESIGN

COs (Course Outcomes)

On completion of this course the student should be able to:

1. Demonstrate a clear understanding of CMOS fabrication flow and technology scaling.
2. Analyze CMOS based logic circuit
3. Realize logic circuits with different design styles
4. Understand Front & Back end design aspects of simple VLSI Digital circuits
5. Model digital circuits with VHDL, simulate, synthesize and prototype in PLDs.

Unit I : Digital Design Fundamentals: Review of techniques of using a truth table, canonical forms to develop the AND/OR or OR/AND combinational circuit models, minimization techniques, Hazards and Hazard free circuits. Difference between combinational and sequential circuits. General model of sequential machine, timing and triggering considerations

Unit II : Basic HDL Constructs: VLSI Design flow, Overview of different modelling styles in VHDL, Data types and data objects in VHDL, Dataflow Modelling, Behavioural Modelling, using VHDL for combinational Circuits and sequential Circuits.

Unit III : Hardware Description Language: Structural Modelling, Subprograms, Packages and Libraries, Generics, Configurations, attributes. Comparison of various Hardware Description Languages.

Unit IV : Programmable Logic Devices: Introduction to CPLDs: Function block architecture, input/output block, switch matrix, Study of architecture ofCPLDs of Altera /Xilinx. Introduction to FPGAs: Configurable logic block, input/output block and interconnect, Study of architecture of FPGAs of Xilinx /Actel/Altera.

Unit V: CMOS Circuits: Different logic families, MOS Transistor, MOS as an inverter, propagation delay, power consumption/dissipation issues, simple circuits using CMOS.

Unit VI: CMOS Processing & Digital Circuit Verification: CMOS Fabrication: Different steps of fabrication, CMOS p-well, n-Well and twin tub processes, CMOS Layout and Design rules. Simple Test Bench, Simulation and Synthesis issues, case study of ALU/ Sequence Detector.

Text Books:

1) Neil H.Weste and Kamran Eshraghin, "Principles of CMOS VLSI design".
2) J Bhasker," VHDL Primer". Addison Wesley
3) Douglas Perry," VHDL" Tata McGraw HILL
4) William I. Fletcher "An Engineering approach to Digital Design", Prentice Hall India.5) Digital Integrated Circuit Design, K. Martin, Oxford University Press

Reference Books:

1) Stephen Brown and Zvonko Vranesic, *"Fundamentals* of Digital Logic with VHDL
2) Design". Tata McGRAW HILL3) Wayne Wolf: "VLSI Technology"
3) Allen & Homberg : "CMOS design"
4) Basics of CMOS cell design by Sicord & Bhendiya*5)* John Yarbrough, BROOKS /COLE, "Digital Logic Applications and Design".

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3AE4x PROFESSIONAL ELECTIVE # 1
3AE41 EMBEDDED SYSTEMS DESIGN

COs (Course Outcomes)

After completion of the course the students will be able to:

1. Distinguish real-time embedded systems from other systems.

2. Describe fundamentals of embedded based firmware design.
3. Evaluate the need for real-time operating system.
4. Interpret real-time algorithm for task scheduling.
5. Summarize technique used for product enclosure design and development.

Unit I : **Architecture of Microcontroller 89C51:**
Architecture, GPR, SFR, Address, Data & Control bus generation, Memory structure (Data and Program memory), IO Ports, Interrupts, Timer/Counter, serial communication, Block diagram and description of architectures of Processors: Von Neumann, Harvard, RISC , CISC, DSP, Multi Core Processor.

Unit-II: **Introduction to Embedded System:**
Embedded Systems versus General Computing Systems, History, advantages and disadvantages, Classification of Embedded System: Small scale, medium scale, sophisticated, stand-alone, real time, Networked, Mobile, major application areas.

Unit-III: **Embedded System Design:**
Embedded System block diagram, Components of embedded system, characteristics of embedded system, Memories for embedded systems, Design Metrics/Specifications- General Purpose and Domain Specific Processors, Processor power, memory, operating system, Reliability, power consumption, flexibility, time-to prototype.

Unit-IV: **Software Development Tools:**
Operation and selection, Integrated Development Environment (IDE), Cross- Complier, Assembler, compiler, cross compiler, Emulator and Flash/OTP Programmer. In-Circuit Emulator (ICE), debugger, Embedded C- Assembly Language V/S Embedded C, Programming Microcontroller 89C51 with C.

Unit-V: **Communication Protocols-**
Need of communication interface in embedded system, Serial V/S Parallel Communication, Synchronous V/S Asynchronous Communication, RS232, MAX 232, 8051 connection with RS232 , Concepts of Communication protocols- Serial Communication Protocol: I2C, CAN, USB, Wireless Communication Protocol: IrDA, Bluetooth, Zigbee, IEEE802.11

Unit-VI: **Real Time Operating System**
Operating System, Comparison between general purpose OS and RTOS, Architecture of RTOS, functions of RTOS, concepts of various task scheduling algorithms of RTOS, Inter-task Communication, Share data problem- Semaphore, Mutex, Dead lock

Text books:

1) The 8051 Microcontroller and Embedded System Using Assembly and C, Mazidi, Mazidi & McKinlay, Prentice Hall
2) Introduction to Embedded Systems, Shibu K. V., McGraw-Hill

Reference books:

1) The 8051 Microcontroller by K. J. Ayala, Penram International
2) Embedded Systems by Raj Kamal, TMH
3) Microcontrollers Theory and Applications, Ajay V. Deshmukh, Tata McGraw Hill

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3AE4x PROFESSIONAL ELECTIVE # 2
3AE42 ELECTRONIC CIRCUIT DESIGN

COs (Course Outcomes)

By the end of the course the student will be able to:

1. Design electronic circuits using different ICs and sensors.
2. Understand Front & Back end design aspects of simple VLSI Digital circuits
3. Model digital circuits with VHDL, simulate, synthesize and prototype in PLDs.
4. Design of combinational blocks/digital circuits.

UNIT-I : Design of regulated power supply using transistor, design of DC amplifier, comparator, window detectors, scaling and summing amplifier using IC 741 / IC 324 or equivalent.

UNIT-II : Design of waveform generator using IC 741, IC 8038, IC 566. Design of sweep generator, voltage controlled oscillator. Design of first and second order filters, design of notch filter.

UNIT-III : Design of instrumentation amplifier, Temperature controller /indicator using thermocouple, resistance thermal detector , thermo sensors AD590, LM35

UNIT-IV : Introduction to CMOS / VLSI circuits, MOS Transistor switch, Realization of universal gates and compound gates using MOS transistors, basic physical design of simple logic gates.

UNIT-V : VHDL : Design flow, EDA tools, code structures, data types, operators and attributes. Signals & Variables, concurrent code, sequential code, packages and components, configuration, Introduction to VERILOG.

UNIT-VI : Design of combinational blocks such as multi-bit adders, ALU, MUX, DEMUX , encoders, decoders, Design of sequential circuits, asynchronous and synchronous design issues, state machine modeling (Moore and Mealy machines).

TEXT BOOKS :

1. R.A. Gayakwad : "OP-AMP and Linear Integrated Circuits"
2. Volnei Pedroni, " Circuit Design with VHDL", PHI , 2005 edition

REFERENCE BOOKS:

1. Sergio Franco : Design with Linear Integrated Circuits & opamps.
2. Douglas L. Perry : VHDL (3rd Ed.) , McGraw Hill.
3. Brown & Vranesic : "Digital Logic Design using VHDL", TMH
4. Paul Horowitz-W.Hill:"The art of Electronics" (Cambridge publications)
5. Neil Weste- K.Eshraghian :Principles of CMOS/VLSI design (Pearson Education)
6. J. Bhaskar "VHDL Primer" (Pearson Education)

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3AE5x PROFESSIONAL ELECTIVE # 1

3AE51 INTRODUCTION TO NEURAL NETWORK AND FUZZY LOGIC

COs (Course Outcomes)

By the end of the course the student will be able to:

1. Understand algorithms for supervised and unsupervised ANN.
2. Implement the ANN concepts to solve real life problems.
3. Analyze the ANN network.
4. Understand algorithms in fuzzy logic for applications such as pattern recognition.
5. Implement the fuzzy logic concepts to solve real life problems.

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

Unit- II: Essentials of Artificial Neural Networks: Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN - Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Application

Unit-III: Single Layer Feed Forward Neural Networks Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks, Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications.

Unit- IV: Multilayer Feed forward Neural Networks Credit Assignment Problem, Generalized Delta Rule, Derivation of Backpropagation (BP) Training, Summary of Backpropagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements.

Unit - V: Classical & Fuzzy Sets Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions.

UNIT VI: Fuzzy Logic System Components Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods

TEXT BOOKS:

1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by Rajasekaran and Pai, 2013, PHI Publication.
2. Principles of Soft Computing, Sivanandam, Deepa, Second Edition, Wiley India, 2011
3. Introduction to Neural Networks using MATLAB 6.0 - S.N.Sivanandam, S.Sumathi, S.N.Deepa, TMH, 2006

REFERENCE BOOKS:

1. Neural Networks - James A Freeman and Davis Skapura, Pearson Education, 2002.
2. Neural Networks and Learning Machines - Simon Haykin , Third Edition, Pearson Education
3. Neural Engineering by C. Eliasmith and CH. Anderson, PHI
4. Neural Networks and Fuzzy Logic System by Bart Kosko, PHI Publications
5. Computational Intelligence Paradigms: Theory and Applications using MATLAB, Sumathi, CRC Press, 2010

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3AE5x PROFESSIONAL ELECTIVE # 2

3AE52 COMPUER ORGANIZATION

COs (Course Outcomes)

On completion of this module the student should be able to:

1. Understand basics of computer organization
2. Know functions of memory management unit
3. Comprehend Instruction pipeline, ALU and CPU structure
4. Appreciate differences between the CISC and RISC

5. Familiarize with the multi-processor organizations: SMP, NUMA, Clusters

UNIT I : Organization and architecture, structure and function, Computer evolution and performance: Brief history of computer, designing for performance , computer components, computer function , bus interconnection, PCI

UNIT II : External devices, I/O modules, I/O Channels and lOPs, SCSI and firewire interfaces, operating system overview, memory management, swapping, partitioning , paging , virtual memory.

UNIT III : ALU: Machine instruction characteristics , operand types, operation types, Addressing modes, instruction formats, CPU structure, processor organization register organization, instruction cycle, instruction pipelining.

UNIT IV : RISC machine, instruction execution characteristics, register file concept, compiler based register optimization , RISC architecture, RISC pipelining, RISC vs CISC, case study of power PC 620.

UNIT V : Control unit operation: Micro operation, control of processor Hardwired implementation, micro program control : Concepts, microinstructions sequencing and execution, application of microprogramming.

UNIT VI : Multiple processor organizations, symmetric multiprocessors, Mainframe SMP, Cache coherence and MESI protocol, clusters . Non uniform memory access. Vector computation

Text books:

1) William Stallings" Computer organization and architecture". 6/e (Pearson education)
2) A.S. Tanenbaum" Structured computer organization" 4/e McGraw Hill (ISE)

Reference Books:

1) C. Hamecher, R. Zaky Computer Organization. 5/e McGraw Hill (ISE)
2) J.P. Hayes Computer architecture and organization. 4/e McGraw Hill (ISE)
3) M. Mano & Kime Logic & Computer design fundamentals, 2/e (Pearson education)

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3AE6 DIGITAL SIGNAL PROCESSING LABORATORY

COs (Course Outcomes)

On completion of this course the student should be able to:

1. Generate different plots and explore results to draw valid conclusions and inferences in DSP problems.
2. Approach for requirement of digital signal processing and digital system design using simulation tools.
3. Familiarize with the concepts of Multirate Digital Signal Processing.
4. Understand the architecture of digital filter.

Minimum 10 experiments based on the syllabus of 3AE3, that are preferably uniformly distributed over the syllabus.

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3AE7x PROFESSIONAL ELECTIVE#1 LABORATORY

Minimum 10 experiments each based on the syllabus of subjects included in 3AE4x, that are preferably uniformly distributed over the syllabus. A student, after choosing any one of the following subjects, has to conduct minimum 10 experiments based on the syllabus. Professional Elective group is comprised of the following subjects.3AE41 Embedded System Design, 3AE42 Electronic Circuit Design

3AE71 Embedded System Design Laboratory

COs (Course Outcomes)

On completion of this course the student should be able to:

1. get familiarized with Embedded system Design Tools and Hardware
2. understand about the basic functions and structure of embedded systems
3. understand about the basic concepts of embedded systems
4. know about the applications of embedded systems
5. understand about the development of embedded software

Minimum 10 experiments based on the syllabus of3AE42 Electronic Circuit Design, that are preferably uniformly distributed over the syllabus.

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3AE72 Electronic Circuit Design Laboratory

COs (Course Outcomes)

On completion of this course the student should be able to:

1. verify the theoretical concepts through laboratory experiments
2. To understand the design procedure of different power supplies.
3. To know to design transreceiver and voltage regulator.

4. To understand the working of Microprocessor and DSP based system design

Minimum 10 experiments based on the syllabus of 3AE41 Embedded System Design, that are preferably uniformly distributed over the syllabus.

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3AE8 PROJECT AND SEMINAR

Seminar Course Outcomes

After completion of the course the students will be able to:
1. study research papers for understanding of a new field, in the absence of a textbook, to summarise and review them.
2. identify promising new directions of various cutting edge technologies
3. impart skills in preparing detailed report describing the project and results
4. effectively communicate by making an oral presentation before an evaluation committee

Project Course Outcome:

After completion of the course the students will be able to:
1. Demonstrate a sound technical knowledge of their selected project topic.
2. Undertake problem identification, formulation, objectives and solution.
3. design the system incorporating hardware or software or a hybrid approach
4. inculcate the ability to synthesize the results of the detailed analytical studies conducted, lay down validity and design criteria, interpret the result for application to the problem, develop the concept and detailed design solution and to effectively communicate the Project Report rationale
5. Demonstrate the knowledge, skills and attitudes of a professional engineer.

Project (including 4AE8). The project work should be either hardware and/or software based. A project report should be submitted in three copies. Every student has to submit seminar report and deliver a seminar on advance state-of the-art topics.

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3AE9x FREE ELECTIVE AUDIT # 1
3AE91 INDUSTRIAL MANAGEMENT

COs (Course Outcomes)
On completion of this course the student should be able to:

1. Student is able to apply principles of management in his / her extra and co-curricular activity in college and in industrial in-plant training.
2. Student is able to understand management of manufacturing.
3. Student is able to apply work improvement techniques in an organization where he undergoes for in-plant training.
4. Student is able to find out and reduce work content of the job.
5. Student is able to express leadership and entrepreneurial attributes.

Unit I: Principles and Techniques of Management: Meaning of and differences among business, management, administration and organisation, Principles of management, functions of management, planning, organisation structure and relationships, direction, coordination, control, motivation, delegation and decentralisation, communication, leadership and decision making.

Unit II: Market and Materials Management: A) Marketing strategy, market research, consumer behaviour, advertising and sales promotion, channels of distribution, pricing of products. B) Classes of material, scope of material control, scope of purchasing department, purchasing procedures, order procedures, inventory control, introduction to production, planning and control.

Unit III: Personnel Management: Meaning and functions of personnel management, recruitment, selection, promotion, wages and salary administration, training and development, functions and scope of trade unions in Indian industries. Welfare of labour, Problems of labour turn over & retention.

Unit IV: Project and Financial Management: A) Case studies of project report, preparation of profit and loss statement and balance sheet, ratio analysis. B) Principles of costing, cost sheet preparation, variance analysis, meaning and application of various budgets, types of budgets and their importance.

Unit V: Quality Control :Concept of quality and quality control, elements of quality, factors controlling quality of design and conformance, process control, inspection planning and scheduling, 7QC (Seven Quality Control)techniques, vendor inspection, sampling inspection, sampling plans, Quality audit system.39 40

Unit VI: Quality Management : Concepts and applications of Kaizen, quality circle, ISO 9000 series, just-in-time, quality planning and total quality management, elements of TQM, Quality Circles.

TEXT BOOKS :

1) Koontz H., O'Donnel C. and Whierich : Principles of Management, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
2) Khanna O.P. : Industrial Engineering and Management.
3) Mody Suresh M. : Total Quality Management, D.L.Shah and Trust,Mumbai
4) Sherlekar S.A. : Business, Organisation and Management, HimalayaPub. House Ltd., Mumbai.

5) Gupta P.B. & Sharma P.B. : Industrial Management & Managerial Economics, Ratnasagar Pvt. Ltd., New Delhi.
6) Khanka : Entrepreneurial Development, S.Chand & Co., New Delhi.
7) Mahajan S.M. : Statistical Quality Control.

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3AE9x FREE ELECTIVE AUDIT# 2
3AE92 IPR AND PATENTS

COs (Course Outcomes)

After completion of the course the students will be able to:

1. Understand the basic concepts of Intellectual Property Rights;
2. Learn IPR related issues.
3. deal with the emerging issues in IPR and the rationale for the protection of IPR.

Unit I : **Introduction to Patents and Other Intellectual Property:** Patent and, Types of Patents, Novelty and Unobvious ness Requirement, Patent Filing Deadlines, The Scope of the Patent, Value of a Patent, Offensive Rights, Alternative and Supplementary Offensive Rights, Intellectual Property, Trademarks , Copyright, Trade Secrets, Various Types of IntellectualProperty, Invention Exploitation Flowchart

Unit II: **Documentation and the PPA:** Introduction, Documents Are Vital to the Invention Process, Documentation is Vital to Prove Inventorship, Trade Secret Considerations, Record Conception and the Building and Testing of Your Invention, Record Your Invention, Record Conception or Building and Testing the Invention Disclosure, Provisional Patent Application— A Substitute for Building and Testing.

Unit III: **Patentability:** Patentability Compared to Commercial Viability, Legal Requirements for a Utility Patent, Requirement #1: The Statutory Classes, Requirement #2: Utility, Requirement #3: Novelty, Requirement #4: Unobvious ness, The Patentability Flowchart.

Unit IV: **Specification and Initial Drawings:** What Happens When Your Application Is Received by the PTO, Preliminary Work, Flowchart, Writing Your Patent Specification to Comply With the Full Disclosure Rules, Software, Computer-Related Inventions, and Business Methods, First Prepare Sketches and Name Parts, Drafting the Specification, Review and Abstract, Checklist, Specification of Sample Patent Application

Unit V: **Marketing Your Invention:** Perseverance and Patience Are Essential, Overview Profit, Your Invention, Demonstrate a Working Model of Your Invention to Potential Customers, Finding Prospective Manufacturers/Distributors, The "NIH" Syndrome, The Waiver and Precautions in Signing It,, Presenting Your Invention by Correspondence, Making an Agreement to Sell Your Invention, Manufacturing and/or Distributing the Invention Yourself .

Unit VI: **Patent Issues: Use, Maintenance, and Infringement:** Issue Notification, Press Release, Check Errors, Patent Number Marking, Advertising, Maintenance Fees, Patent Infringement, Product Clearance, Citing Prior Art Against Patent Applications and Patents, The Court of Appeals for the Federal Circuit (CAFC), Using the Re-examination Process to Reduce the Expense of Patent Infringement Suits, Jury Trials, Arbitration, Tax Deductions and Income, Patent Litigation Financing.

TEXTBOOK:

Patent It Yourself, 13th Edition, By Patent Attorney David I Pressman, Nolo, 2008

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3AE10 INDUSTRIAL VISIT/TOUR

COs (Course Outcomes)

After completion of the course the students will be able to:

1. get an insight regarding internal working of companies
2. get an opportunity to learn practically through interaction, working methods and employment practices.
3. Get an exposure to current work practices as opposed to possibly theoretical knowledge being taught at college.
4. combine theoretical knowledge with industrial knowledge.

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FOURTH SEMESTER

4AE1 MICROWAVE ENGINEERING

COs (Course Outcomes)

At the end of the course students will be able to:

1. Understand operations of microwave active and passive devices.
2. Describe characteristics of microwave propagation through waveguides.
3. Use S-parameters for characterization of microwave devices.
4. Measure various parameters of microwave system.
5. Understand various applications of microwave engineering in specific area

Unit I: Microwave tubes: Electromagnetic frequency spectrum, noise in conventional tubes, Two cavity Klystron, Reflex Klystron, Traveling Wave Tube, Magnetron (cylindrical type).

Unit II: Microwave solid state devices: Tunnel diode, negative resistance amplifier, Gunn diode, parametric amplifier, PIN diode, TRAPATT, IMPATT, introduction to MASER.

Unit III: Transmission of microwaves: Rectangular wave guide, TE,TM, wave propagation, cut-off frequency, cut-off wavelength, group and phase velocity, wave impedance, Circular wave guide, types of strip lines, strip line characteristics.

Unit IV: Microwave Passive Components: Microwave terminations, Attenuator, Phase shifter, Faraday's rotation, Devices employing faraday's rotation (Isolator and Circulator),Directional couplers, scattering matrix formulation of N-port junction.

Unit V: Microwave Resonator and Filter: Basic RLC resonant circuit(series and parallel), Quality factor, Rectangular cavity resonator and their Q, TEmnp, TMmnp mode propagations, Re-entrant cavity, and Circular cavity resonator.

Unit VI: Microwave communication system: Microwave link carrier chain, Troposphere scatter link using frequency diversity, LOS (Line Of sight) communication system, microwave absorption (Fading), Noise in microwave communication system.

TEXT BOOKS:

1) M.L. Sisodiya and G.S. Raghuwanshi: "Microwave Circuits and Passive devices", (WEL)
2) K.C. Gupta: " Microwave engineering"(WILEY)
3) M. Kulkarni: "Microwave and Radar Engineering" Umesh Publication

REFERENCE BOOKS:

1) Liao, Samual Y. : "Microwave devices & circuits" Tata McGraw Hill Co. Ltd., New Delhi
2) Collin, Robert E.: "Foundations for microwave Engineering" McGraw Hill, New York.
3) Pozar: Microwave Engg, Wiley Eastern

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4AE2 OPTICAL FIBER COMMUNICATIONS

COs (Course Outcomes)

Upon successful completion of this course, the student will be able to:

1. understand optical fiber communication system
2. Understand functioning of optical sources and detectors.
3. Differentiate losses in optical fiber link and state transmission characteristics of optical fiber.
4. Describe optical fiber communication system and its performance measures.
5. Apply the fundamental principles of optics and light wave to design optical fiber communication systems

Unit I: Optical fiber wave-guide: Total internal reflection, Snell's law, Theory of circular wave guide, Modes in optical fibers, Single mode fiber, Multimode fiber, N.A., Power flow

Unit II: Transmission Characteristics of Fiber: Attenuation, Absorption losses, scattering losses, bending losses, dispersion, and intra modal - inter modal dispersion, bandwidth, and nonlinear effects in single-mode fiber.

Unit III: Optical Sources: Optical emission from semiconductors, LED, efficiency, double hetero junction LED, Basic concept of Lasers, Semiconductor injection lasers.

Unit IV: Optical Fibers: Manufacturing, fiber splicing and connectors, different manufacturing techniques, different splicing techniques and connectors.

Unit V: Detectors: Optical detection principle, absorption, quantum efficiency, responsivity, PIN photo diode, APD and noise in photodiode.

Unit VI: Optical Electronic System: Optical transmitter, receiver, digital system planning consideration, power budgeting coherent and noncoherent systems, modulation demodulation scheme, wavelength division multiplexing.

Text Books:

1. Senior J.M.: "Optical Fiber Communication and Application", Prentice Hall of India Pvt Ltd. New Delhi
2. G.Keiser: "Optical Fiber Communication", Mc-Graw Hill International Book Common. New York
3. R. P. Khare: Fiber Optics and Optoelectronics, Oxford University Press

Reference Books:

1) Gowe : Optical Communication System, Prentice Hall
2) D.K.Mynbaev : Fiber Optic Communication L.I.Scheiner Technology, LPE, Pearson Education

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4AE3 MOBILE COMMUNICATIONS

COs (Course Outcomes)

After completion of the course the students will be able to:

1. understand various generations of mobile communications and the concept of cellular communications
2. understand the basics of wireless communications
3. Know GSM mobile communication standards, its architecture, logical channels, advantages and limitations.
4. Know IS-95 CDMA mobile communication standard, its architecture, logical channels, advantages and limitations.
5. understand multicarrier communication systems.

Unit I: **Introduction to Wireless Communication System**
Evolution of mobile radio communications wireless System -1G, 2G, 2.5G and 3G, Mobile radio system around the world (AMPS, IS 95,GSM, N - AMPS), Applications of wireless communication systems - Paging System, Cordless telephone system, Cellular telephone system, Call processing in cellular telephone system.

Unit II: **Mobile Unit**
Block diagram and operation of mobile Unit, Block Diagram and operation of frequency synthesizer, transmitter, Receiver, Logic Unit and Control unit, Essential features of hand set, Definition of mobile base station, Mobile control station.

Unit III: **The Cellular Concept**
Introduction to cellular system, Frequency reuse concept, Multiple Access Technologies for Cellular systems, Cellular system operation and Planning Principles, System Architecture, Hand off strategies, Interference and system capacity-Co channel interference & system capacity, Channel planning for wireless system, Adjacent channel Interference, Power control for reducing Interference, Improving coverage and capacity in cellular system, Cell splitting, Sectoring, Repeater for range extension, Micro cell zone concept.

Unit IV: **Digital Cellular Mobile System G.S.M.**
Concept of GSM, GSM Standard, features, service aspects, GSM System Architecture, GSM Radio subsystem, air interface specifications, channel types, frame structure, signal processing.

Unit V: **CDMA System (IS-95)**
CDMA Digital Cellular standard, Frequency and channel specifications, CDMA System architecture, features of IS-95, comparison of GSM and IS-95 System

Unit VI: **Modern Wireless Communication System**
Third Generation (3G) Wireless Networks advantages, 3G W-CDMA (UMTS) (Universal mobile Telecommunication system.), features, 3G CDMA 2000, 3G- TD-SCDMA (synchronous), Wireless local loop , advantages, applications, LMDS (local multipoint distribution), Features of Bluetooth.

****(No need of detail mathematical calculation, derivations, numerical for this subject)**

TEXT BOOKS:

1) William CY Lee: "Mobile Cellular Telecommunications"(second Edition) McGraw Hill Inc. (1995)
2) Theodore S. Rappaport: Wireless Communications: Principles & Practice 2nd Edition, Pearson education

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4AE4x **PROFESSIONAL ELECTIVE #1**
4AE41 DSP with TMS 320C54xx

COs (Course Outcomes)

After completion of the course the students will be able to:

1. distinguish between the architectural features of General-purpose processors and DSP processors.
2. Understand the architectures of TMS320C54xx devices.
3. use the DSP processors TMS 320C 54XX for implementation of DSP algorithms & its interfacing techniques with various I/O peripherals.

Unit I: Architectural overview of TMS 320C5X (I):TMS320 Family overview, History, Development and advantages of TMS320 DSP, Key features of TMS320C5X,Bus structure, CPU, Central Arithmetic Logic Unit, Parallel logic unit, Auxiliary register arithmetic unit, registers inTMS3205X and on chip peripherals of TMS320C5X.

Unit II: Architectural overview of TMS 320C5X (II):Program controller, Program counter hardware stack, program memory address generation, status and control registers, conditional operations, single instructions repeat functions, block repeat functions, interrupts, reset and power down mode.

Unit III: Pipeline and Memory structure of TMS320C5X:Pipeline structures, pipeline operations, normal pipeline operations, pipeline operation on branch and subroutine call, pipeline operation on ARAU memory mapped registers, pipeline operation on external memory conflict, Memory space overview, program memory, local data memory, global data memory, input output space, direct memory access, memory management.

Unit IV: Addressing modes in TMS320C5X:Direct addressing, indirect addressing options, bit reverse addressing, immediate addressing, short and long immediate addressing, dedicated register addressing using contents of BMAR, dedicated register addressing using contents of DBMR, memory map register addressing, circular addressing.

Unit V: Instruction set of TMS320C5X (I):Accumulator memory reference instructions: ABS, ADCB,ADD, ADDT, AND, BSAR, CRGT, EXAR, LACB, LAMM,NORM, ORB, SAMM, SBB, SFRB, SUB, SUBT, XORB, ZALR,ZAP
etc. Auxiliary register and data memory page pointer instructions:45 46ADRK, CMPR, LAR, LDP, MAR, SAR, SBRK, LT. Parallel logic unit (PLU) Instructions: APL, CPL, OPL, SPLK,XPL, LPH

Unit VI: Instruction set of TMS320C5X (II):TREGO, PREG, AND, MULTIPLY INSTRUCTION: LTA, MAC,MACD, MPY, SPL, SQRS, ZPR, MPYU, SPH,
LTD, LTP, etc. Branch and Call Instructions: B, BACC, BANZ, CALA, CALL,INTR, NMI, RET, TRAP, XC, etc. I/O and Data memory, control instructions: IN, OUT, BLDP,LMMR, BIT, LST, PUSH, POP, RPT, RPTZ, SETC, SST, etc.

Text Book : TMS320C5X User's guide: Texas Instruments Inc

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4AE4x PROFESSIONAL ELECTIVE # 2
4AE42 DIGITAL IMAGE PROCESSING

COs (Course Outcomes)

On completion of this module the student will be able to:

1. Analyze general terminology of digital image processing.
2. Examine various types of images, intensity transformations and spatial filtering.
3. Understand the methodologies for image segmentation, Compression and restoration etc.
4. Implement image processing and analysis algorithms.
5. Apply image processing algorithms in practical applications.

UNIT-I : Introduction to digital image processing, Digital Image Fundamental, Elements of Visual Perception, Simple Image Model, Sampling and Quantization, Basic Relationships between Pixel Imaging Geometry, Gray scale image representation. (8)

UNIT-II : Image Transforms: Introduction to the Fourier Transform, DFT, Properties of Two Dimensional Fourier Transform, FFT, Hadamard, Haar, DCT, Slant Transform. (8)

UNIT-III : Image Enhancement : Basic Techniques, Enhancement by point processing, Spatial Filtering, Enhancement in Frequency domain, histogram based processing, homomorphic filtering. (8)

UNIT-IV : Image Restoration: Degradation model, Diagonalisation concept, Algebraic approach to Restoration. Inverse filtering, Weiner (CNS) filtering Restoration in Spatial domain, Basic morphological concept, morphological principles, binary morphology, Basic concepts of erosion and dilation. (9)

UNIT-V : Image Compression: Fundamentals, Image compression models, Elements of Information theory, Lossy and predictive methods, vector quantization, Run length coding, Huffman coding, and lossless compression, compression standards. (9)

UNIT-VI : Image Segmentation : Detection of discontinuities, Edge Linking and boundary detection, Thresholding, Regional oriented Segmentation.(8)

TEXT BOOKS :

1) Gonzalez and Woods: "Digital Image Processing", Third Edition, Prentice Hall

2) Milan Sonka, Vaclav Hlavac, Roger Boyle : Image processing Analysis and Machine Vision" , PWS Pub Co, 2nd Edition.

REFERENCE BOOKS:

1) A.K.Jain : "Digital Image Processing", PHI

2) William K. Pratt : "Digital Image Processing", 3rd ed. , John Wiley and Sons Publications.

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4AE5x PROFESSIONAL ELECTIVE # 1
4AE51 SMART SENSORS

COs (Course Outcomes)

By the end of this course, the students shall be able to:

1. Comprehend the basics of smart sensors
2. Incorporate sensor information into the Microcontroller
3. Use MCUs/DSPs to improve the sensor IQ.
4. Discriminate various control techniques for smart sensors
5. Use smart sensors in real-world projects

Unit I: **Smart Sensor and the Nature of Semiconductor Sensor Output:** Mechanical-Electronic Transitions in Sensing, Nature of Sensors, Integration of Micromachining and Microelectronics, Sensor Output Characteristics, Wheatstone bridge, Piezo resistivity in Silicon, Semiconductor Sensor Definitions, Static versus Dynamic Operation, Noise/Interference Aspects

Unit II: **Sensing Technologies:** Capacitive Sensing, Piezoelectric Sensing, Hall Effect, Chemical sensors, Improving Sensor Characteristics, Digital Output Sensors, Incremental Optical Encoders, Digital Techniques, Low-Power, Low-Voltage Sensors, Combined Solution: Micromachining and Microelectronics.

Unit III: **Getting Sensor Information into the MCU :** Amplification and Signal Conditioning, Instrumentation Amplifiers, Switched-Capacitor Amplifier , Barometer Application Circuit, 4- to 20-mA Signal Transmitter , Inherent Power-Supply Rejection, Separate Versus Integrated Signal Conditioning ,Integrated Passive Elements , Integrated Active Elements ,Digital Conversion , A/D Converters , Performance of A/D Converters , Implications of A/D Accuracy and Errors.

Unit IV: **MCUs/DSPs to Increase Sensor IQ :** MCU Control , MCUs for Sensor Interface Peripherals ,Memory , Input/Output ,Onboard A/D Conversion , Power-Saving Capability , Local Voltage or Current Regulation , Modular MCU Design , DSP Control , Algorithms Versus Lookup Tables , Techniques and Systems Considerations ,

Linearization , PWM Control ,Auto zero and Auto range , Diagnostics , Reducing Electromagnetic Compatibility and Radio Frequency Interference , Indirect (Computed, Not Sensed) Versus Direct Sensing , Software, Tools, and Support , Sensor Integration .

Unit V: **Control Techniques:** Programmable Logic Controllers , Open-Versus Closed-Loop Systems, PID Control , State Machines, Fuzzy Logic , Neural Networks , Combined Fuzzy Logic and Neural Networks ,Adaptive Control ,Observers for Sensing, Other Control Areas , RISC Versus CISC , Combined CISC,RISC, and DSP ,The Impact of Artificial Intelligence.

Unit VI: **Transceivers, Transponders, and Telemetry :** The RF Spectrum, Spread Spectrum, Wireless Data and Communications, Wireless Local Area Networks, FAX/Modems, Wireless Zone Sensing, Optical Signal Transmission, RF Sensing Surface Acoustical Wave Devices, Radar, Global Positioning System, Remote Emissions Sensing Remote Keyless Entry, Intelligent Transportation System, RF-ID , Other Remote Sensing Measuring RF Signal Strength, Telemetry, RF MEMS.

Textbook:

Understanding Smart Sensors, Randy Frank, 3e, Artech House

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4AE5x **PROFESSIONAL ELECTIVE # 2**

4AE52 BIOMEDICAL ENGINEERING

COs (Course Outcomes)

By the end of this course, the students shall be able to:

1. Understand the importance and association of engineering with medical field.
2. Understand the significance of various human signals and recording techniques.
3. Get familiarized with various medical imaging systems, various life saving equipment.
4. Understand the conceptualization of patient care & safety requirements and its importance

UNIT-I: **INTRODUCTION TO BIOMEDICAL ENGINEERING**

Physiological system of heart, Man instrument system, Sources of bioelectric potentials, Different bioelectric signals like ECG, EMG and EEG, Biopotential Electrode theory, Basic electrode, Electrodes for EEG, ECG, EMG, Biochemical electrodes. Skin contact Theory : skin contact impedance measurement of skin con tact impedance, motion artifacts, nearest equation Nernst Equation . (9)

UNIT-II : **BIOMEDICAL RECORDER AND MEASUREMENT**

Biomedical recorders for EEG, ECG, EMG, Blood pressure variation as a function of time, relationship of heart sounds to a function of the cardio vascular system, Measurement of Blood Pressure (Direct & Indirect), Blood flow, Heart sound. (8)

UNIT-III : **MEDICAL IMAGING SYSTEM**

Instrumentation for diagnostics X-ray , X- ray basics properties , X-ray machine
, Special imaging technique. Ultrasonic imaging system : Physics of Ultrasound, Biological effect of ultrasound. Ultrasonic A-scan, M-scan,
B-scan, Real-time ultrasonic imaging systems. (8)

UNIT-IV : **THERAPEUTIC EQUIPMENTS**

Need of Physiological and electrotherapy equipment. Cardiac pacemaker machine, Cardiac Defibrillators, Nerve and Muscle stimulators. Diathermy : short wave, microwave, ultrasonic. (8)

UNIT-V : **PATIENT CARE AND MONITORING AND SAFETY**

System concepts, Bedside patient monitors, central monitors, Average reading heart monitor, Intensive care monitoring, Ambulatory monitoring. Biotelemetry
: Single channel and Multichannel biotelementry, telephonic data transmission. PATIENT SAFETY : Electric shock hazards, leakage current. Types of Leakage current, measurement of leakage current, methods of reducing leakage current, precautions to minimize electric shock hazards. Telemedicine. (9)

UNIT-VI : **COMPUTERS IN BIOMEDICAL ENGINEERING**

Computerized Axial Tomography (CAT) Computerized Aided ECG analysis Computerized patient monitoring system. Computerized Catheterization. (8)

TEXT BOOKS:

1. Khandpur R.S. : “Handbook of Biomedical Instrumentation”, Tata Mc-Graw Hill, New Delhi.
2. Cromwell L. & Weibell F.J. : “Biomedical Instrumentation and Measurement”, Prentice Hall of India.

REFERENCE BOOKS:

1. Dr. Lele R.D. : “Computer Applications of Medicine”, Tata Mc-Graw Hill, New Delhi.
2. Webstar J.G. : “Medical Instrumentation”, III ed., John Wiley & Sons.
3. Carr and Brown : Biomedical Equipment Technology.

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4AE6 **MICROWAVE ENGINEERING AND OPTICAL FIBER COMMUNICATIONS LABORATORY**

COs (Course Outcomes)

By the end of the course the student will be able to:

1. Identify various microwave components.
2. Demonstrate characteristics of microwave generated by various microwave sources and propagated through rectangular/circular waveguide.

3. Measure transmission parameters of microwave propagation through rectangular/circular waveguide.
4. Measure various parameters of microwave antenna.
5. Be conversant on optical waveguide components, including single and multimode fiber, fiber couplers, connectors, and fiber amplifiers.
6. Demonstrate basic fiber handling skills, including cleaving and splicing.
7. Operate instrumentation for measuring fiber and optical system properties
8. Measure noise and its effects on system performance.

Minimum 10 experiments based on the syllabus of 4AE1 and 4AE2,that are preferably uniformly distributed over the syllabi of both the subjects.

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4AE7x **PROFESSIONAL ELECTIVE #1 LABORATORY**

Minimum 10 experiments each based on the syllabus of subjects included in 4AE4x, that are preferably uniformly distributed over the syllabus. A student, after choosing any one of the following subjects, has to conduct minimum 10 experiments based on the syllabus. Professional Elective group is comprised of the following subjects.4AE41 DSP with TMS 320C54xx, 4AE42 Digital Image Processing

4AE71 DSP WITH TMS 320C54XX LAB

COs (Course Outcomes)

By the end of the course the student will be able to:

1. distinguish between the architectural features of General purpose processors and DSP processors.
2. Understand the architectures of TMS320C54xx devices.
3. use the DSP processors TMS 320C 54XX for implementation of DSP algorithms & its interfacing techniques with various I/O peripherals.

Minimum 10 experiments based on the syllabus of 4AE41 DSP with TMS 320C54xx,,that are preferably uniformly distributed over the syllabi of both the subjects.

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4AE72 DIGITAL IMAGE PROCESSING LAB

COs (Course Outcomes)

By the end of the course the student will be able to:

1. To study the image fundamentals and mathematical transforms necessary for image processing.
2. To study the image enhancement techniques, image restoration and the image compression procedures.
3. To Review the fundamental concepts of a digital image processing system.
4. To Analyze images in the frequency domain using various transforms.
5. To Categorize various compression techniques.
6. To Interpret Image compression standards and image segmentation and representation techniques

Minimum 10 experiments based on the syllabus of4AE42 Digital Image Processing, that are preferably uniformly distributed over the syllabi of both the subjects.

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4AE8 **PROJECT AND SEMINAR**

Seminar Course Outcomes

After completion of the course the students will be able to:

1. To study research papers for understanding of a new field, in the absence of a textbook , to summarise and review them.
2. To identify promising new directions of various cutting edge technologies
3. To impart skills in preparing detailed report describing the project and results
4. To effectively communicate by making an oral presentation before an evaluation committee

Project Course Outcomes:

After completion of the course the students will be able to:

1. Demonstrate a sound technical knowledge of their selected project topic.
2. Undertake problem identification, formulation, objectives and solution.
3. design the system incorporating hardware or software or a hybrid approach
4. inculcate the ability to synthesize the results of the detailed analytical studies conducted, lay down validity and design criteria, interpret the result for application to the problem, develop the concept and detailed design solution and to effectively communicate the Project Report rationale
5. Demonstrate the knowledge, skills and attitudes of a professional engineer.

Project (including 3AE8). The project work should be either hardware and/or software based. A project report should be submitted in three copies. Every student has to submit seminar report and deliver a seminar on advance state-of-the-art topics.

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4AE9X	**FREE ELECTIVE (AUDIT)**
4AE91	**ENGINEERING ETHICS**
4AE92	**TECHNICAL WRITING**

4AE9x **FREE ELECTIVE (AUDIT) #1**
4AE91 ENGINEERING ETHICS

COs (Course Outcomes)

By the end of the course the student will be able to:

1. Understand Code of Ethics and Standards of Professional Conduct
2. identify and describe ethical dilemmas in the context of historical and developing technology and engineering practice
3. Understand the professional rules of conduct for engineers and how to apply them.
4. Recognize conflicts of interest and develop strategies for handling these.
5. Understand the importance of communication with all stakeholders.

Unit I:	The importance of ethics in science & engineering. Managing ethical issues, The role of codes of ethics. The person and the virtues: Developing a model for a person, Limitation of the model, Habits and morals. The four main virtues. Real life example
Unit II:	Analysing exterior acts: Ethics as a craft, distinguishing exterior & interior morality. Beginning case analysis, Event trees. Analysing interior Intentions: Describing intention, The importance of intention. Efforts & virtues, the role of benevolence, a real life case.
Unit III:	Hierarchy of moral values Hierarchies of values: Moral and Nonmoral, line drawing, Mathematical Analogies, Ranking of virtues, ethical judgment, Moral judgment: The decisive role of intention, evaluating interior goodness, co-operating in the evil of others, Moral responsibility: factors limiting moral responsibility, degrees of responsibility, the sainthood and devil problems.
Unit IV:	Truth: Person to person, truth in actions, truth in words, Harm from deception, harm from withholding truth, whistleblowing, Harm from spreading truth, privacy, Truth, Social. Distinction between science & engineering, Approach to knowledge in technology, intellectual property.
Unit V:	Fairness: Person to person, Conflict of interest, qualitative versus Quantitative fairness, Credit or blame in team projects, authorship questions, fairness in supervising, fairness in contracting with clients. Fairness: Social, Intellectual property& the society, environmental issues, experts & paternalism, social aspects of employment.
Unit VI:	Resource allocation, Defining safety & risk, evaluating risk, making decisions about risk, dealing with different ethical systems, Habit & intuition.

Text Book:

1) Edmond G. Seebauer : Fundamentals of Ethics for Scientists &Robert L. Barry Engineering Oxfords University Press.

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4AE9x **FREE ELECTIVE (AUDIT) # 2**
4AE92 TECHNICAL WRITING

COs (Course Outcomes)

On completion of this course the student should be able to:

1. gain an overview of the technical skills required by professional communicators
2. learn the methodology for planning technical communication projects
3. understand and know when and how to use appropriate writing and formatting conventions
4. learn how to use industry-standard software to produce a project such as a manual
5. be familiar with key trends and issues in the field of technical communication

Unit I	General strategies for writing process, generating ideas, identifying audiences and purposes, constructing arguments, stating problems, Drafting and word processing, testing and revising
Unit II	Visual elements, selecting and creating visual elements, making a visual aid truly visual, deciding when to use a visual aid, the visual aid for describing or clarifying, for highlighting important points, for conventional or easy presentation of data, selecting the best type of visual aid in a given situation, designing the visual aid, making it relevant, clear and truthful, integrating a visual aid into the text, formatting conventions that make reading easier and writing clearer
Unit III	Resumes and Job letters, the business letter, basic features of reports, memos, short informal reports, progress reports, feasibility reports, long reports
Unit IV	Proposals, instructions, procedures, computer documentation, theses, journal articles, oral presentations, meetings and negotiation
Unit V	Readability, general principles, writing paragraphs, using parallelism, maintaining focus, creating flow between sentences, editing for emphasis, choosing appropriate words, proofreading
Unit VI	Review of grammar, style, vocabulary building, indefinite articles, the definite article, verbs: major tense distinctions in scientific and technical English, modal verbs, relative clauses, connectives, noun compounds, vocabulary building

Text Book

1. Technical Writing and Professional Communication for Nonnative Speakers of English, Second Edition, Thomas N. Huckin and Leslie A. Oslen, McGraw-Hill International Editions, Technical Writing Series

Reference Books

1. Technical Communication- Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press,2007, New Delhi.

2. Word Power Made Easy by Norman Lewis, W.R.Goyal Pub. &Distributors, 2009,Delhi.
3. Developing Communication Skills by Krishna Mohan, Mecra Bannerji- Macmillan India Ltd. 1990, Delhi.
4. English Grammar and Usage by R.P.Sinha, Oxford University Press, 2005, New Delhi.
5. Business English by Ken Taylor, Orient Blackswan, 2011, New Delhi.

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