BMS COLLEGE OF ENGINEERING, BANGALORE
(Autonomous College under VTU)

Program: TELECOMMUNICATION ENGINEERING **Semester: III**

Subject Code	Subject Title	Hours/Week			Credits	CIE	SEE	Total
		L	T	P				
09MA3ICMAT	Engineering Mathematics -III	3	2	0	4	50	50	100
09ES3GCNAL	Network Analysis	4	0	0	4	50	50	100
09ES3GCAEC	Analog Electronics Circuits	4	0	2	5	50	50	100
09ES3GCDEC	Digital Electronics	4	0	2	5	50	50	100
09ES3GCFTH	Field Theory	4	0	0	4	50	50	100
09ES3GCMST	Measurement Techniques	3	0	0	3	50	50	100
	Total	22	2	4	25	300	300	600

GE- Group Elective L – Lecture Hours / week; T- Tutorial Lecture Hours / week; P-Practical Lecture Hours / week.
CIE- Continuous Internal Evaluation; SEE- Semester End Examination (of 3 Hours duration)

BMS COLLEGE OF ENGINEERING, BANGALORE
(Autonomous College under VTU)

Program: TELECOMMUNICATION ENGINEERING **Semester: IV**

Subject Code	Subject Title	Hours/Week			Credits	CIE	SEE	Total
		L	T	P				
09MA4ICMAT	Engineering Mathematics -IV	3	2	0	4	50	50	100
09ES4GCLIC	OP-AMPs and Linear ICs	4	0	2	5	50	50	100
09ES4GCMPR	8086 Microprocessor	3	0	2	4	50	50	100
09ES4GCSAS	Signals & Systems	4	0	0	4	50	50	100
09ES4GCCST	Control Systems	4	0	0	4	50	50	100
09ES4GCHDL	Fundamentals of HDL	3	0	2	4	50	50	100
	Total	21	2	6	25	300	300	600

GE- Group Elective L – Lecture Hours / week; T- Tutorial Lecture Hours / week; P-Practical Lecture Hours / week.
CIE- Continuous Internal Evaluation; SEE- Semester End Examination (of 3 Hours duration)

BMS COLLEGE OF ENGINEERING, BANGALORE
(Autonomous College under VTU)

Program: TELECOMMUNICATION ENGINEERING **Semester: V**

Subject Code	Subject Title	Hours/Week			Credits	CIE	SEE	Total
		L	T	P				
10TC5DCDTS	Discrete time signal processing	4	0	2	5	50	50	100
10TC5DCACM	Analog Communication	4	0	2	5	50	50	100
10TC5DCDSS	Digital Switching Systems	3	0	0	3	50	50	100
10TC5DCVLI	Fundamentals of CMOS VLSI	4	0	0	4	50	50	100
10ES5GCMCS	Microcontroller	3	0	2	4	50	50	100
10XX5GE1XX	Cluster Elective -I	4	0	0	4	50	50	100
		3	0	2				
	Total	22 21	0	8 6	25	300	300	600

DC- Department Core , GC- Group Core, GE- Group Elective; L – Lecture Hours / week; T- Tutorial Lecture Hours /week; P-Practical Lecture Hours/week. CIE- Continuous Internal Evaluation; SEE- Semester End Examination (of 3 Hours duration)

BMS COLLEGE OF ENGINEERING, BANGALORE
(Autonomous College under VTU)

Program: TELECOMMUNICATION ENGINEERING **Semester: VI**

Subject Code	Subject Title	Hours/Week			Credits	CIE	SEE	Total
		L	T	P				
10TC6DCDCM	Digital Communication	4	0	2	5	50	50	100
10TC6DCTLA	Transmission Lines & Antennas	4	0	0	4	50	50	100
10TC6DCDAR	DSP Algorithms & Architecture	3	0	2	4	50	50	100
10TC6DCITC	Information Theory & Coding	4	0	0	4	50	50	100
10XX6GE2XX	Cluster Elective -II	4 3	0 0	0 2	4	50	50	100
10XX6GE3XX	Cluster Elective -III	4 3	0 0	0 2	4	50	50	100
	Total	21 22 23	0	8 6 4	25	300	300	600

DC- Department Core , GC- Group Core, GE- Group Elective; L – Lecture Hours / week; T- Tutorial Lecture Hours / week; P-Practical Lecture Hours/week. CIE- Continuous Internal Evaluation; SEE- Semester End Examination (of 3 Hours duration)

BMS COLLEGE OF ENGINEERING, BANGALORE
(Autonomous College under VTU)

Program: TELECOMMUNICATION ENGINEERING **Semester: VII**

Subject Code	Subject Title	Hours/Week			Credits	CIE	SEE	Total
		L	T	P				
11ES7GCHRM	Human Resource management and Development	2	0	0	2	50	50	100
11TC7DCMWR	Microwave & Radar	3	0	0	3	50	50	100
11TC7DCOFC	Optical Fiber Communication	3	0	0	3	50	50	100
11TC7DCWCM	Wireless Communication	3	0	2	4	50	50	100
11XX7GE4XX	Cluster Elective -IV	4 3	0 0	0 2	4	50	50	100
11XX7GE5XX	Cluster Elective -V	4 3	0 0	0 2	4	50	50	100
11XX7IEXXX	Institute Elective -I	4 3	0 0	0 2	4	50	50	100
11TC7DCSMR	Seminar-I	0	0	2	1	100	—-	100
	Total	25	450	350	800			

DC- Department Core , GC- Group Core, GE- Group Elective; L – Lecture Hours / week; T- Tutorial Lecture Hours / week; P-Practical Lecture Hours/week. CIE- Continuous Internal Evaluation; SEE- Semester End Examination (of 3 Hours duration)

BMS COLLEGE OF ENGINEERING, BANGALORE
(Autonomous College under VTU)

Program: TELECOMMUNICATION ENGINEERING **Semester: VIII**

Subject Code	Subject Title	Hours/Week			Credits	CIE	SEE	Total
		L	T	P				
11ES8GCIPR	Intellectual Property Rights	2	0	0	2	50	50	100
11ES8GCPRM	Project Management	2	0	0	2	50	50	100
11XX8IEXXX	Institute Elective -II	4	0	0	4	50	50	100
11TC8DCSMR	Seminar-II	0	0	2	1	50	—	50
11TC8DCPRJ	Project	0	0	24	16	200	100	300
	Total	8	0	26	25	400	250	650

DC- Department Core , GC- Group Core, GE- Group Elective; L – Lecture Hours / week; T- Tutorial Lecture Hours / week; P-Practical Lecture Hours/week. CIE- Continuous Internal Evaluation; SEE- Semester End Examination (of 3 Hours duration)

BMS COLLEGE OF ENGINEERING, BANGALORE
(Autonomous College under VTU)

Group I Electrical Cluster Electives (Programs: EC/TC/IT/EE/ML) **Semester: V**

Subject Code	Subject Title	Hours/Week			Credits	CIE	SEE	Total
		L	T	P				
10ES5GE1OP	Objected oriented programming using C++	4	0	0	4	50	50	100
10ES5GE1DD	Digital System Design using VHDL	4	0	0	4	50	50	100
10ML5GE1DS	Data Structures With C++	3	0	2	4	50	50	100
10ML5GE1BM	Biomechanics	4	0	0	4	50	50	100
10EE5GE1CS	Communication Systems *(EE only)*	4	0	0	4	50	50	100

GE- Group Elective L – Lecture Hours / week; T- Tutorial Lecture Hours / week; P-Practical Lecture Hours / week.

CIE- Continuous Internal Evaluation; SEE- Semester End Examination (of 3 Hours duration)

BMS COLLEGE OF ENGINEERING, BANGALORE
(Autonomous College under VTU)

Group II Electrical Cluster Electives (Programs: EC/TC/IT/EE/ML) **Semester: VI**

Subject Code	Subject Title	Hours/Week			Credits	CIE	SEE	Total
		L	T	P				
10EE6GE2FV	Fundamentals of VLSI *(EE only)*	4	0	0	4	50	50	100
10EE6GE2UP	Utilization of Electrical Power	4	0	0	4	50	50	100
10TC6GE2OS	Operating Systems Concepts	4	0	0	4	50	50	100
10TC6GE2IP	Introduction to Image processing *(Except ML)*	3	0	2	4	50	50	100
10ML6GE2SN	Bio Sensors	4	0	0	4	50	50	100
10ML6GE2BS	Bio Statistics	4	0	0	4	50	50	100
10EC6GE2MC	Advanced Microcontroller and Applications	3	0	2	4	50	50	100
10EC6GE2DA	DSP Architecture and Systems *(Except TC, IT)*	4	0	0	4	50	50	100
10IT6GE2MD	Biomedical DSP *(Except ML)*	3	0	2	4	50	50	100

BMS COLLEGE OF ENGINEERING, BANGALORE
(Autonomous College under VTU)

Group III Electrical Cluster Electives (Programs: EC/TC/IT/EE/ML) **Semester: VI**

Subject Code	Subject Title	Hours/Week			Credits	CIE	SEE	Total
		L	T	P				
10EE6GE3ED	Embedded System Design *(only EE and ML)*	4	0	0	4	50	50	100
10EE6GE3EI	Electronic Instrumentation *(EE only)*	4	0	0	4	50	50	100
10EE6GE3RE	Renewable Energy Resources	4	0	0	4	50	50	100
10TC6GE3RT	Real Time Embedded System *(Except EC)*	4	0	0	4	50	50	100
10TC6GE3SA	Introduction to Speech and Audio Processing	3	0	2	4	50	50	100
10TC6GE3MM	Design of Analog and Mixed mode VLSI circuits *(Except EC)*	4	0	0	4	50	50	100
10ML6GE3BC	Biomedical circuits with VLSI	4	0	0	4	50	50	100
10ML6GE3RE	Rehabilitation Engineering	4	0	0	4	50	50	100
10EC6GE3SP	Adaptive Signal Processing	4	0	0	4	50	50	100
10EC6GE3IP	Image Processing Concepts *(Except ML)*	4	0	0	4	50	50	100
10IT6GE3RB	Robotics	4	0	0	4	50	50	100
10IT6GE3DP	Digital Image Processing *(Except ML)*	3	0	2	4	50	50	100

BMS COLLEGE OF ENGINEERING, BANGALORE
(Autonomous College under VTU)

Group IV Electrical Cluster Electives (Programs: EC/TC/IT/EE/ML) **Semester: VII**

Subject Code	Subject Title	Hours/Week			Credits	CIE	SEE	Total
		L	T	P				
11EE7GE4HV	High Voltage Engineering	4	0	0	4	50	50	100
11EE7GE4PS	Power Systems Operation and Control	4	0	0	4	50	50	100
11EE7GE4ID	Industrial Drives and Applications	4	0	0	4	50	50	100
11TC7GE4MC	Low power Microcontroller	3	0	2	4	50	50	100
11TC7GE4MM	Introduction to Multimedia Communication	3	0	2	4	50	50	100
11TC7GE4SR	Software Defined Radio	4	0	0	4	50	50	100
11TC7GE4SC	Satellite Communication	4	0	0	4	50	50	100
11IT7GE4MI	Medical Imaging Systems *(Except ML)*	4	0	0	4	50	50	100
11ML7GE4HM	Hospital Management Systems	4	0	0	4	50	50	100
11ML7GE4PC	Physiological Control Systems	4	0	0	4	50	50	100
11EC7GE4WC	Wireless Communication *(Except TC)*	4	0	0	4	50	50	100
11EC7GE4ES	Embedded Systems Design	4	0	0	4	50	50	100
11IT7GE4DC	Dstributed Computing	4	0	0	4	50	50	100

BMS COLLEGE OF ENGINEERING, BANGALORE
(Autonomous College under VTU)

Group V Electrical Cluster Electives(Programs: EC/TC/IT/EE/ML) **Semester: VII**

Subject Code	Subject Title	Hours/Week			Credits	CIE	SEE	Total
		L	T	P				
11EC7GE5LP	Low Power VLSI Design	4	0	0	4	50	50	100
11EC7GE5NS	Network Security	4	0	0	4	50	50	100
11EC7GE5MM	Multimedia Communication	4	0	0	4	50	50	100
11TC7GE5EM	EMC -EMI	4	0	0	4	50	50	100
11ES7GE5CN	Computer Communication & Networks *(Except EC)*	4	0	0	4	50	50	100
11TC7GE5AD	ASIC Design *(Except EC)*	4	0	0	4	50	50	100
11EE7GE5MD	Electrical Machine Design and Drawing	4	0	0	4	50	50	100
11EE7GE5SP	Switch Mode Power Supplies	4	0	0	4	50	50	100
11IT7GE5ES	Embedded System and RTOS	4	0	0	4	50	50	100
11ML7GE5SP	Advanced Biomedical Digital Signal Processing	4	0	0	4	50	50	100
11ML7GE5IP	Advanced Medical Image Processing	4	0	0	4	50	50	100

BMS COLLEGE OF ENGINEERING, BANGALORE

(Autonomous College under VTU)

Program: TELECOMMUNICATION ENGINEERING

Summary categorization of Courses Offered (Credit Distribution)

Semester	Humanities	Basic Science	Engineering Science	Professio-nal Core	Professio-Elective	Institu-tion Elective	Project	Seminar	Total Credits
I	02	9.5	13.5	-	-	-	-	-	25
II	02	9.5	13.5	-	-	-	-	-	25
III	-	08	-	17	-	-	-	-	25
IV	-	04	04	17	-	-	-	-	25
V	-	-	-	21	04	-	-	-	25
VI	-	-	-	17	08	-	-	-	25
VII	02	-	-	10	08	04	-	01	25
VIII	04	-	-	—	—	04	16	01	25
Course Total	10	31	31	82	20	08	16	02	200

BMS COLLEGE OF ENGINEERING, BANGALORE
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ENGINEERING MATHEMATICS – III
09MA3ICMAT

OBJECTIVES

The purpose of the course is to make the students well conversant with Fourier-Series, Fourier Transforms, formulate physical problems in terms of Partial Differential Equations, find insight into the physical behavior of systems from mathematical solution and develop computational skills using efficient numerical methods for problems in science and engineering.

UNIT I **[08 hours]**

FOURIER SERIES Periodic function, Dirichlet's conditions, statement of Fourier Theorem, Fourier coefficients, change of interval, Even and odd functions, Half range Fourier series, Complex Fourier series, Practical Harmonic analysis. **[6 L + 2 T]**

UNIT II **[10 hours]**

FOURIER TRANSFORMS Infinite Fourier transform, Fourier Sine and Cosine transforms, properties, Inverse transforms, Convolution theorem (statement only), Parseval's identities. **[8 L + 2 T]**

UNIT III **[12 hours]**

PARTIAL DIFFERENTIAL EQUATIONS Formation of Partial differential equations (PDE) by elimination of arbitrary constants or arbitrary functions. Solution of Lagrange's linear PDE. Solution of PDE by the Method of separation of variables, Derivation of one-dimensional heat equation, wave equation, various possible solutions of these by the method of separation of variables, D'Alembert's solution of wave equation **[9 L + 3 T]**

UNIT IV **[10 hours]**

NUMERICAL METHODS - 1 Finite Difference operators: Forward differences, Backward differences, Shift operator (no relations between the operators).Interpolation: Newton - Gregory forward formula, Newton - Gregory backward formula. Newton's general interpolation formula, Lagrange's interpolation formula (without derivations), Inverse interpolation.Numerical Differentiation: Derivatives using forward and backward Newton Gregory formula.Numerical Integration**:** Trapezoidal rule, Simpson's $1/3^{rd}$ rule, Simpson's $3/8^{th}$ rule, Weddle's rule (without derivations) **[8 L + 2 T]**

UNIT V **[12 hours]**

Z- TRANSFORM Definition, Properties, Transforms of common functions, Inverse transform, solution of difference equations using Z -transforms. **[4 L + 2 T]**

CALCULUS OF VARIATIONS Variation of function and functional, Euler-Lagrange's equation, variational problems, geodesics, Standard variational problems - minimal surface of revolution, hanging chain, Brachistochrone problem. **[4 L + 2 T]**

TEXT BOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, 40th edition, Khanna Publishers
2. Erwin Kreyszig, Advanced Engineering Mathematics, 8th edition, Wiley Publications.

REFERENCE BOOKS:

1. B.V. Ramana, Higher Engineering Mathematics, Tata Mc. Graw Hill.
2. Glyn James, Advanced Modern Engineering Mathematics, 3rd edition, Pearson Education.

Question Paper Pattern

1. Each unit consists of one full question with or without internal choice.
2. Internal choice may be there in maximum of two units.
3. Each full question consists of three or four subdivisions covering the entire syllabus of the Unit
4. One question to be answered in each Unit.

NETWORK ANALYSIS - 09ES3GCNAL

OBJECTIVE: ·

- To understand basic concepts of circuit behavior with DC and AC sources·
- Develop and solve mathematical representation for simple RLC circuits.·
- To study the use of circuit Analysis theorems and two port network.·
- Use Laplace Transformation to Analyze behavior of simple circuits.

UNIT I **[08 hours]**

Basic Concepts: Practical sources, Source transformations, Network reduction using Star – Delta transformation, Loop and node analysis with linearly dependent and independent sources for DC and AC networks, Concepts of super node and super mesh.

UNIT II **[10 hours]**

Network Topology: Graph of a network, Concept of tree and co-tree, incidence matrix, tie-set, tie-set & cut-set schedules, Formulation of equilibrium equations, Principle of duality**. Resonant Circuits:** Series and parallel resonance, frequency response of series and Parallel circuits, Q –factor, Bandwidth

UNIT III **[12 hours]**

Network Theorems : Superposition, Reciprocity, Millman's, Thevinin's and Norton's theorems; Maximum Power transfer theorem

UNIT IV **[14 hours]**

Transient behavior and initial conditions: Behavior of circuit elements under switching condition and their representation, evaluation of initial and final conditions in RL, RC and RLC circuits **04 Hrs**

Laplace Transformation & Applications Review of Laplace transforms, waveform Synthesis, initial and final value theorems, step, ramp and impulse responses, convolution theorem, solution of simple R-L, R-C, R-L-C networks for AC and DC excitations using Laplace transforms. **10 Hrs**

UNIT V **[08 hours]**

Two port network parameters: Definition of z, y, h and transmission parameters, modeling with these parameters, relationship between parameters sets

TEXT BOOKS:

1. **"Network Analysis",** M. E. Van Valkenburg, PHI / Pearson Education, 3rd Edition. Reprint 2002.
2. **"Networks and systems",** Roy Choudhury, 2nd edition, 2006 re-print, New Age International Publications.
3. **Theory and Problems of Electric Circuits** (Schaum Series), 2nd Edition Mc Graw Hill

REFERENCE BOOKS:

1. **"Engineering Circuit Analysis",** Hayt, Kemmerly and Durbin,TMH 6th Edition, 2002
2. **"Network analysis and Synthesis",** Franklin F. Kuo, Wiley
3. **"Analysis of Linear Systems"**, David K. Cheng, Narosa Publishing House, 11th reprint, 2002
4. **"Circuits"**, Bruce Carlson, Thomson Learning, 2000. Reprint 2002

ANALOG ELECTRONIC CIRCUITS - 09ES3GCAEC

Objective:

- To understand the behavior of simple analog electronic circuits involving basic devices like diodes and bipolar junction transistors.
- To learn the characteristics of field effect transistors and its types.

UNIT I **[10 hours]**

Semiconductor Diodes – Semiconductor diode, ideal versus practical, resistance levels, diode equivalent circuits, transition and diffusion capacitance, reverse recovery time, diode testing.

Diode Applications – Introduction, load – line analysis, series diode configurations, parallel and series –parallel configurations, AND/OR gates, half wave rectification, full wave rectification, clippers, clampers, voltage multipliers.

UNIT II **[11 hours]**

DC biasing of BJTs – Introduction, operating point, fixed bias circuit, emitter bias, voltage divider bias, dc bias with voltage feedback, miscellaneous bias configurations, design operations, transistor switching networks, PNP transistors, bias stabilization.

BJT AC Analysis – Introduction, amplification in the ac domain, BJT transistor modeling, r_e transistor model, the hybrid equivalent model, CE fixed bias, voltage divider bias, CE emitter bias, complete hybrid equivalent model, graphical determination of h- parameters, approximate conversion equations.

UNIT III **[11 hours]**

Amplifiers in general – cascade, cascode and Darlington connections **Power amplifiers** – Introduction – definitions and amplifier types, series fed class A amplifier, transformer coupled class A amplifier, class B amplifier operation, class B amplifier circuits. Amplifier distortion, class C and class D amplifiers.

UNIT IV **[10 hours]**

Feedback and Oscillator Circuits – Feedback concepts, feedback connection types, practical feedback circuits, feedback amplifier – phase and frequency considerations, oscillator operation, phase shift oscillator, wein bridge oscillator, tuned oscillator circuit, crystal oscillator, unijunction oscillator.

UNIT V **[10 hours]**

BJT frequency response – Introduction, logarithms, decibels, general frequency considerations, low frequency analysis – bode plot, BJT low frequency response, miller effect capacitance, BJT high frequency response.

FET as amplifiers – Introduction, construction and characteristics of JFETs, transfer characteristics, important relationships, FET small signal model, JFET – fixed bias, self bias and voltage divider bias configuration, JFET common drain and common gate configurations.

LAB Experiments: – Clipping, clamping, half-wave and full-wave rectifiers, RC-coupled amplifiers, Darlington emitter follower, RC phase shift oscillator, crystal oscillator, Hartley & Colpits oscillator, voltage series feedback amplifier.

TEXT BOOK:

Electronic Devices and Circuit Theory- Boylestad and Louis Nashelsky, 9th edition - Pearson

REFERENCE BOOKS:

1. **Electronic Devices and Circuits** - Millman and Halkias, TMH
2. **Electronic Devices and Circuits -** David A Bell - PHI 4th edition

DIGITAL ELECTRONICS - 09ES3GCDEC

OBJECTIVE: The subject covers the specification, analysis and design of digital logic. Digital logic is concerned with interconnection among digital components. Digital systems are used extensively in today's world because of their advantages over their analog counterparts such as better speed of operation, simplicity of design, lower power consumption, better noise margin, good error correction capabilities etc.

UNIT I **[10 hours]**

Introduction : Review of Boolean algebra, logic gates.**Simplification of Boolean functions :** The Map Method, Two and Three Variable Maps, Four Variable Map, Product of sums simplification, NAND and NOR implementation, Other Two level implementations, Don't care conditions, The Tabulation Method, Determination of Prime Implicants, Selection of prime implicants.

UNIT II **[11 hours]**

Combinational Logic circuits: Introduction, Design Procedure, Adders, Subtractors, Code conversion,(Binary to gray, BCD to Excess-3)**Combinational Logic with MSI and LSI:** Introduction, Binary Parallel Adder, Decimal Adder, Magnitude Comparator, Decoders, Multiplexers.

UNIT III **[10 hours]**

Flip-Flops and Simple Flip –Flops Applications: The Basic Bistable Element, Latches, Timing Considerations,Master Slave Flip-Flops(pulse-Triggered Flip-flops), Edge Triggered Flip Flops, Characteristic Equations

UNIT IV **[10 hours]**

Registers, Counters, Design of Synchronous Counters

UNIT V **[12hours]**

Synchronous Sequential circuits: Structure and Operation of Clocked Synchronous sequential Networks, Analysis of clocked synchronous sequential networks, Modeling clocked synchronous sequential network behavior, state table reduction, The state assignment, Completing the design of clocked synchronous sequential networks.

LAB experiments: – Verification of gates, implementation of Boolean expressions using basic gates and universal gates, adders, subtractors, multiplexers, demultiplexers, comparators & code converter, Flip-flops, counters, shift registers

TEXT BOOKS:

1. **Digital logic and computer design**- Morris Mano, Prentice Hall
2. **Digital Principles and Design**- Donald Givone, Tata Mc Graw Hill

REFERENCE BOOKS:

1. **Fundamental of Logic Design-** Charles Roth Jr., Thomas Learning
2. D**igital Logic Applications and principles-** John Yarbrough**, Pearson Education**

FIELD THEORY - 09ES3GCFTH

Course Objectives:

- To introduce basic concepts of static electric and magnetic fields·
- To Understand Maxwell's equation for time varying Electromagnetic waves

UNIT I **[10 hours]**

Coulomb's Law, Electric Field Intensity (EFI):- Experimental Law, EFI due to Line Charge , Surface and Volume Charge.

Electric Flux Density (EFD), Gauss' Law, Divergence:- Electric Flux Density, Gauss' Law, Application, Divergence and Divergence Theorem.

UNIT II **[10 hours]**

Energy and Potential: - Energy spent in moving charge, Definition of Potential Difference (PD), PD due to Point Charge and System of Charge, Energy Density. **Current and current density: -** Current and Current Density, Continuity of Current, Conductor, Properties, and Boundary Conditions.

UNIT III **[10 hours]**

Dielectric and capacitance:- Dielectric materials, boundary conditions, capacitance of different configuration.

Poisson's and Laplace's equations:- Derivations of Poisson's and Laplace's Equations, solution of Poisson's and Laplace's equation for Single Variables.

UNIT IV **[10 hours]**

Steady Magnetic Field:- Biot-Savart Law, Ampere's circuital law, curl, Magnetic Flux, Flux Density, Scalar and Vector Magnetic Potentials.

UNIT V **[12 hours]**

Magnetic forces and Inductance:- Force on a moving charge, Force on different current element, Magnetic Boundary Condition, Inductance and Mutual Inductance. **Time varying fields and Maxwell's equations:-** Faraday's Law, Displacement Current, Maxwell's Equations in Point and Integral Form, Uniform plane waves, Wave equations , solution of wave equation, wave propagation through good dielectric, good conductor, skin depth, Poynting Theorem.

TEXT BOOK:

Engineering Electromagnetics, William J Hayt Jr. and John A Buck, Tata McGraw-Hill, 7th Edition, 2006.

REFERENCE BOOK:

Electromagnetics with Applications, John Krauss and Daniel A Fleisch, McGraw-Hill, 5th Edition, 1999.

MEASUREMENT TECHNIQUES - 09ES3GCMST

Objective:

To study the different components of the electronic instrumentation system such as sensors, Bridges, signal conditioning, measuring instruments, display devices

UNIT I **[07 hours]**

Fundamentals of Measurement: Introduction, Static Characteristics, Dynamic Characteristics, Errors in measurement, Types of errors, Sources of error.**Electrical Measuring Instruments** : Types of Instruments, Principle of Operation, Constructional features of PMMC instrument, shunts & multipliers, universal shunt, multirange voltmeters.

UNIT II **[08 hours]**

Electronic Measuring Instruments: Need for electronic measuring instruments, True RMS responding voltmeter, Digital voltmeters- Ramp Type, Integrating Type, Successive Approximation Type, Q meter, Digital Multimeter - Block Diagram description.

UNIT III **[08 hours]**

Measurement of Resistance, Inductance & Capacitance: Wheatstone's Bridge-Sensitivity analysis, Limitations, Kelvin's Double Bridge, Maxwells Bridge, Schering Bridge, Sources & Detectors, Minimization of AC Bridge Errors.

UNIT IV **[08 hours]**

Transducers -I : Classification & Selection, Principle of operation of Thermocouples, Resistance Temperature Detectors, Thermistors, LVDT, Capacitive Transducers, Piezoelectric Transducers.

UNIT V **[08 hours]**

Transducers -II : Strain Gauges- Types, Expression for gauge factor, Photosensitive Devices. Display Devices & Recorders: Method of Measuring Amplitude, Phase, Frequency & Period using CRO. Use of Lissajous Patterns. LCD & LED displays, Strip Chart & X-Y Recorders. Introduction to Printers.

TEXT BOOKS:

1. **Modern Electronic Instrumentation & Measurement Technique-** Albert D. Helfrick, William D. Cooper, 3/e, Pearson, Prentice Hall.
2. **Electronic Instrumentation-** H. S. Kalsi, Tata McGraw Hill.

REFERENCE BOOKS:

1. **A Course in Electrical & Electronic Measurements & Instrumentation-** A. K. Sawhney, 18/e, Dhanpat Rai & Co., New Delhi.
2. **Electronic Instrumentation & Measurement**- by David A. Bell, 2/e, PHI Publications.

BMS COLLEGE OF ENGINEERING, BANGALORE
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ENGINEERING MATHEMATICS – IV
09MA4ICMAT

Objectives

To prepare students with adequate knowledge in mathematics to succeed in industry and provide necessary platform to pursue academics, keeping pace with global standards. Topics spanned are Probability and Statistics, Complex Analysis and series solution of Differential Equations. The thrust is to identify and clarify concepts of mathematics needed for the graduation program.

UNIT I **[10 hours]**

STATISTICS (5 hours) Curve fitting- Fitting of a straight line, parabola, curves of the form $y = ae^{bx}$, $y = ab^{x}$, $y = ax^{b}$. Correlation and Regression. **[4 L + 1 T]**

PROBABILITY - 1 **(5 hours)**

Probability of an event, axiomatic definition, addition theorem, Conditional probability, multiplication theorem, Bayes's theorem. **[4 L + 1 T]**

UNIT II **[12 hours]**

PROBABILITY - 2 Probability distributions: Random variables, discrete probability distributions – Binomial and Poisson distributions; Continuous probability distributions- Exponential and normal distributions.Joint Probability distributions: Case of discrete random variables, mathematical expectation, correlation, covariance.Markov Chain: Probability vectors, stochastic matrices, fixed points, regular stochastic matrices. Markov chains, higher transition probabilities, stationary distribution of regular Markov chains and absorbing states. **[9 L + 3 T]**

UNIT III **[10 hours]**

COMPLEX ANALYSIS-1 Function of a complex variable, Analytic functions, Cauchy-Riemann equations, construction of analytic functions, Cauchy-Reimann equations in Polar form, Complex integration-Cauchy's theorem, Cauchy's integral formula, Taylor's and Laurent's series, Singular points, poles, residues, residue theorem. **[8 L + 2 T]**

UNIT IV **[10 hours]**

COMPLEX ANALYSIS- 2 (3 hours)

Transformations- $w = z^2,\ w = e^z,\ w = z + \left(a^2/z\right)$ Bilinear transformations. **[2 L + 1 T]**

SERIES SOLUTION OF DIFFERENTIAL EQUATIONS (7 hours)

Series solution-Frobenius method, series solution of Bessel's differential equation leading to Bessel function of first kind, equations reducible to Bessel's differential equation, series solution of Legendre's differential equation leading to Legendre polynomials, Rodrigue's formula. **[6 L + 1 T]**

UNIT V **[10 hours]**

NUMERICAL METHODS - 2 (5 hours) Algebraic and Transcendental Equations: Regula falsi method, Newton Raphson method, Numerical solutions of ordinary differential equations: Taylor's series method, modified Euler's method, Runge-Kutta 4th order method, Milne's method and Adam's - Bashforth method (No derivations of formulae). **[3 L + 2T]**

MATRICES (5 hours) Echelon form of a matrix, Rank of a matrix by elementary row transformations, Consistency of system of linear equations, Gauss elimination method, Gauss – Seidel method, Characteristic values and Characteristic vectors of matrices, Computation of largest eigen value and eigen vector using Rayleigh's power method **[3 L + 2 T]**

TEXT BOOKS:

1. Advanced Engineering Mathematics, Erwin Kreyszig, 8th edition, Wiley Publications.
2. Higher Engineering Mathematics, B.S. Grewal, 40th edition, Khanna Publishers.

REFERENCE BOOKS:

1. Advanced Modern Engineering Mathematics,Glyn James, 3rd edition, Pearson Education.
2. Higher Engineering Mathematics, B.V. Ramana, 5th reprint 2008, Tata Mc. Graw Hill.
3. Probability and Statistics, Murry R Spiegel, John Schiller, Alu Srinivasan, 2nd Edition, Schaumn's outline series.
4. Introductory methods in Numerical Analysis, S.S. Sastry, 4th edition, Prentice Hall of India

Question Paper Pattern

1. Each unit consists of one full question with or without internal choice.
2. Internal choice may be there in maximum of two units.
3. Each full question consists of three or four subdivisions covering the entire syllabus of the Unit

OP-AMPS & LINEAR ICS - 09ES4GCLIC

Objective:

To understand the working principle of linear ICs like opamp 741 and 555 timer and to study the behavior of circuits using the same two ICs

UNIT I **[10 hours]**

Operational Amplifier Fundamentals: Operational Amplifier Description, basic operational Amplifier circuit, input and output voltage, common mode and supply rejection, offset voltages and currents, input and output impedances, slew rate and Frequency limitations **Op-amps as DC and AC amplifiers and its frequency response:** Biasing operational -Amplifiers, Direct coupled voltage followers, Direct coupled non-inverting amplifiers, Direct coupled inverting amplifiers, summing amplifiers, Difference amplifiers.

UNIT II **[10 hours]**

Differentiating and Integrating circuits: Differentiating circuit, Differentiator Design, Differentiating circuit Performance, Integrating Circuit, Integrator Design, Integrating Circuit performance. **Signal Processing Circuits** : Precision Half- wave and Full- wave Rectifiers, Limiting Circuits, Clamping circuits, peak Detectors, sample -and -hold circuit.

UNIT III **[10 hours]**

Op-amp non linear circuits: op-amp and switching circuits, Zero crossing detectors, inverting and non-inverting amplifiers, Schmitt trigger circuits, Astable and Monostable Multivibrator. **Signal Generators:** Triangular/rectangular wave generator, waveform Generator Design, phase shift oscillator, oscillator amplitude stabilization, Wien bridge oscillator, Signal Generator output control.

UNIT IV **[10 hours]**

Active filters: All pass phase shifting circuits, 1st order low-pass active filter, 2nd order low pass filter, 1st & 2nd order high pass filter. **Voltage regulators**: Introduction, Series Op-Amp Regulator, IC voltage Regulators, 723 General purpose Regulator.

UNIT V **[10 hours]**

555 timer : Introduction, Description of Functional Diagram, Monostable and Astable Operation, Schmitt trigger.

A/D and D/A convertors: Introduction, Basic DAC Techniques, A-D Converters, DAC/ADC Specifications.

LAB Experiments : Inverting amplifier, non-inverting amplifier, summing amplifier and voltage follower, precision half-wave and full wave rectifier, differentiator and integrator, Schmitt trigger and zero crossing detector, Wien bridge oscillator, first order low-pass and high pass filter, IC 723 low voltage and high voltage regulator, 555 timer as astable and monostable multivibrator, D/A convertor and A/D convertor.

TEXT BOOKS:

1. **Operational Amplifiers and Linear IC's** - David A.Bell, 2nd ed, PHI/Pearson, 2004.
2. **Linear Integrated circuits-** D.Roy Choudhury and Shail B.Jain,2nd ed, Reprint 2006, New Age International.

REFERENCE BOOK:

Op-Amps and Linear Integrated Circuits- Ramakanth A.Gayakwad,4th ed,PHI.

8086 MICROPROCESSOR - 09ES4GCMPR

Objective

This course focuses on microprocessor architecture, related hardware, introduces programming, interpolates hardware and software in interfacing microprocessor based products. It maintains a balance between basic concepts and skills needed for system design. The theoretical concepts and practical applications using 8086 microprocessor family gives a solid foundation for developing system architecture and embedded applications.

UNIT I **[08 hours]**

Introduction, Microprocessor based computer system, Architecture of 8086 Microprocessor, functions Pin diagram, Clock generator, Minimum /Maximum mode of operation.

UNIT II **[08 hours]**

Read /Write Timing diagrams, Assembly level programming of 8086, 8086 instruction set, addressing modes. Assembler directives, Programming examples.

UNIT III **[08 hours]**

Stacks, Procedures and Interrupts. Interfacing 8086 with Memory devices.

UNIT IV **[08 hours]**

Interfacing 8086 with I/O devices. 8255 PPI device, modes of operation. Interfacing Keyboard, seven segment display, ADC, DAC, Stepper motor and Printer using 8255.

UNIT V **[07 hours]**

Programmable Interval Timer – modes of operation of 8253 and interfacing. 8087 Numeric data processor and interfacing, 8087 Data types.

LAB Experiments - Data and address transfer operations, unsigned and signed arithmetic operations using instructions for add/sub/mul/div, logical operations, linear search and sorting, code conversion programs using procedures, interfacing I/O devices like DAC, stepper motors, Keyboard, 7-segment display to 8086 using 8255 PPI, realization of ALU, Counters and multiplexer using 8086

TEXT BOOKS:

1. **Advanced Microprocessor and Peripherals**- A.K.Ray and K.M. Bhurchandi, Tata McGraw Hill.
2. Microcomputer systems 8086/8088 family, Architecture, Programming and Design - Yu-Cheng Liu & Glenn A Gibson, 2nd ed, July 2003, PHI

REFERENCE BOOKS:

1. **Microprocessor and Interfacing, Programming & Hardware-** Douglas V Hall, 2nd ed, TMH
2. **Microprocessor Architecture, Programming and Applications with the 8085-** Ramesh S Gaonkar, 4th ed, Penram International.

SIGNALS & SYSTEMS - 09ES4GCSAS

Objective:

This course begins with the definition of signals and systems, and then discusses the different types of signals and systems. The time domain and frequency domain representation of both the continuous and discrete time signal is discussed. The emphasis later is on defining the Linear Time invariant system and its representation in different methods.

UNIT I **[10 hours]**

Introduction: Signal definition, signal transformation, signal classification, elementary signals. System definition, system classification, system properties.

UNIT II **[10 hours]**

Frequency domain representation of non-periodic signals : Fourier representation of continuous time non-periodic signals: Continuous-time Fourier transform (FT), Fourier representation of discrete time non-periodic signals: Discrete-time Fourier transform (DTFT); Relating the FT and the DTFT

UNIT III **[10 hours]**

Frequency domain representation of periodic signals : Fourier representation of continuous time periodic signals: Continuous time Fourier series (FS); Fourier representation of discrete time periodic signals: Discrete-time Fourier series (DTFS); Relating the FT and the FS, Relating the FT to the DTFS & DTFT

UNIT IV **[11 hours]**

Time domain analysis of LTI systems : Definition of LTI systems, Continuous time systems and Discrete time systems: Definition of impulse response, development of convolution integral, convolution sum, methods of evaluating the convolution sum & convolution integral, properties of impulse response

UNIT V **[11 hours]**

Representation of LTI systems : Continuous time LTI system representation: Time domain: – impulse response, Differential equation, Block diagram; Frequency domain :– frequency response; Laplace transform domain: – transfer function, pole-zero plot relating the time, frequency and the transform domain (State-space representation not included). **Discrete time LTI system representation:** Time domain: – impulse response, Difference equation, Block diagram; Frequency domain: – frequency response; Z- transform domain: – transfer function, pole-zero plot, Relating the time, frequency and the transform domain (State-space representation not included)

TEXT BOOKS:

1. **Signals and Systems-**Simon Haykin and Barry Van Veen, John Wiley & Sons,2nd ed.
2. **Signals and Systems-** H.P Hsu, Schaums Outline series, TMH.

REFERENCE BOOKS:

1. **Signals and Systems: Analysis of signals through linear systems-** Michel J Roberts,TMH,2003.
2. **Signals and Systems-Alan V Oppenheim,** Alan S Willsky and S.Hamid Nawab**-** Pearson Education Asia, 2nd ed 1997, Indian reprint 2002.

CONTROL SYSTEMS - 09ES4GCCST

Objective:

- Understand the fundamentals of linear control systems in Time and Frequency domain Analysis
- Understand the concepts of transfer function of Open loop / Closed loop control system in Time and Frequency domain analysis

UNIT I **[12 hours]**

Introduction: Examples of Control Systems, open loop vs Closed loop Systems, Classifications of Control Systems.
Mathematical Modeling of Linear Systems: Transfer functions, Mechanical Systems, Analogous Systems, Block diagram, Signal Flow graph (excluding gear trains lever)

UNIT II **[10 hours]**

Time response analysis of Control Systems : Step response of first order, second order systems, response specification , steady state error and error constants.

UNIT III **[10 hours]**

Stability Analysis: Concept of stability, RH criterion, applications of RH criterion with limitations, Nyquist plot, Polar plots, Stability Analysis using Nyquist criterion

UNIT IV **[10 hours]**

Root locus technique: Introduction to root locus concepts, Construction rules, Analysis of stability by root locus plot.

UNIT V **[10 hours]**

Frequency response Analysis: Bode plots, Relative stability, Frequency domain specification.

TEXT BOOK:

Control Engineering by Nagrath & Gopal, New Age International Publishers

REFERENCE BOOKS:

1. **Modern control Engineering-** Ogata, Prentice Hall
2. **Automatic Control Systems-** B.C Kuo, John Wiley and Sons

FUNDAMENTALS OF HDL - 09ES4GCHDL

Objective: The course covers the overview of Logic Design Principles and learning of the programming concepts of hardware description language (VHDL and Verilog). The same is implemented using the simulation tools.

UNIT I **[07 hours]**

Introduction: Why HDL? , A Brief History of HDL, Structure of HDL Module, Operators, Data types, Types of Descriptions, simulation and synthesis, Brief comparison of VHDL and Verilog

UNIT II **[08 hours]**

Data-Flow Descriptions: Highlights of Data-Flow Descriptions, Structure of Data-Flow Description, Data Type – Vectors. Behavioral Descriptions: Behavioral Description highlights, structure of HDL behavioral Description, The VHDL variable –Assignment Statement, sequential statements.

UNIT III **[08 hours]**

Structural Descriptions: Highlights of structural Description, Organization of the structural Descriptions, Binding, state Machines, Generate, Generic, and Parameter statements.

UNIT IV **[08 hours]**

Procedures and Functions: Procedures, Tasks, and Functions: Highlights of Procedures, tasks, and Functions, Procedures and tasks, Functions. Advanced HDL Descriptions: File Processing, Examples of File Processing.

UNIT V **[08 hours]**

Synthesis Basics: Highlights of Synthesis, Synthesis information from Entity and Module, Mapping Process and Always in the Hardware Domain.

LAB Experiments Combinational logic circuits, sequential circuits using data flow (simulation and implementing using FPGA/CPLD) sequential descriptions & structural descriptions. Interfacing experiments : stepper motor, dc motor, relay, waveform generation.

TEXT BOOK:HDL Programming (VHDL and Verilog)-

Nazeih M.Botros- Dreamtech Press (Available through John Wiley – India and Thomson Learning), 2006 Edition

REFERENCE BOOKS:

1. **Verilog HDL –**Samir Palnitkar, Pearson Education
2. **VHDL –**Douglas Perry,TMH
3. **Fundamentals of Digital Logic with Verilog Design-**Stephen Brown, TMH
4. C**ircuit Design with VHDL-**Volnei A.Pedroni, PHI

DISCRETE TIME SIGNAL PROCESSING
10TC5DCDTS

Objective: This course introduces the student to Discrete time signals and systems. Different methods of representing the discrete time LTI systems are discussed. The course later has design and implementation of FIR and IIR filters. To help comprehend concepts there is as associated laboratory component in Matlab. The laboratory exercises takes the student through intial concepts in the course and moves on to test the concepts using audio signals and images. The course concludes with an introduction to wavelet transforms.

UNIT I **[10 hours]**

Discrete-Time Linear systems: Introduction, LTI system, difference equation, frequency response, Z-transform, Digital filter realizations, direct form I and direct form II systems, cascade, lattice and parallel realization. Discrete Fourier Transforms (DFT): Properties of DFT, multiplication of two DFTs- the circular convolution, additional DFT properties, use of DFT in linear filtering, overlap-save and overlap-add method.

UNIT II **[10 hours]**

Fast-Fourier-Transform (FFT) algorithms: Direct computation of DFT, need for efficient computation of the DFT (FFT algorithms). Radix-2 FFT algorithm for the computation of DFT and IDFT–decimation-in-time and decimation-in-frequency algorithms.

UNIT III **[11 hours]**

FIR filter design: Introduction to FIR filters, Design using the window technique, design of FIR filters using – Rectangular, Hamming, Bartlet and Kaiser windows, Design using frequency sampling technique.

UNIT IV **[11 hours]**

IIR filter design: Characteristics of commonly used analog filters – Butterworth and Chebyshev filters, analog to analog frequency transformations. Design of IIR filters from analog filters (Butterworth and Chebyshev) – impulse invariance method. Mapping of transfer functions: Approximation of derivative (backward difference and bilinear transformation) method, Matched z transforms.

UNIT V **[10 hours]**

Finite word length effects in digital filters: arithmetic in digital systems, floating point arithmetic, fixed point arithmetic, round off noise in recursive and non-recursive realizations. Introduction to wavelet transforms, inverse wavelet transforms, approximation and detail coefficients

Laboratory exercises using C/Matlab/LabVIEW: Convolution: linear & circular, Autocorrelation, Cross correlation, difference equation solution, Discrete Fourier Transform and its inverse, FIR filter design, IIR filter design, impulse response, pole-zero plot, sampling theorem.Audio signal: time domain representation, frequency domain representation, filtering. Wavelet transforms.

TEXT BOOK:

Theory and application of Digital signal processing, Lawrence R Rabiner and Bernard Gold, Prentice Hall, Easter Economy Edition

REFERENCE BOOKS:

1. **Discrete Time Signal Processing**, Oppenheim & Schaffer, PHI, 2003.
2. **Digital signal processing** – **Principles Algorithms & Applications**, Proakis & Monalakis, Pearson education, 4th Edition, New Delhi, 2007
3. **Digital Signal Processing**, S. K. Mitra, Tata Mc-Graw Hill, 3rd Edition, 2010.
4. **Digital Signal Processing**, Lee Tan: Elsevier publications, 2007
5. **Digital Signal Processing: Fundamentals and Applications,** Li Tan, Schaum's Outline of Digital Signal Processing ,Monson Hayes

ANALOG COMMUNICATION - 10TC5DCACM

Objective:

The objective of this course is to understand the need for modulation and various methods of performing analog modulation. For each modulation scheme the time domain and frequency domain representation is discussed followed by methods of practical realization and demodulation schemes. To have measure for comparison, the Figure of merit of each modulation scheme is discussed. To help comprehend various concepts in the analog communication domain, an integrated laboratory component is introduced, included hardware circuits and software component using the Matlab programming platform.

UNIT I **[10 hours]**

Convolution, Auto correlation, cross correlation, and their properties, transmission of signals through linear systems, Hilbert transform, band pass signals, in-phase and quadrature-phase components, canonical representation of band pass signals, natural, pre and complex envelop of band pass signals.

UNIT II **[10 hours]**

RANDOM PROCESS: Random variables: Several random variables. Statistical averages: Function of Random variables, moments, Mean, Correlation and Covariance function: Principles of autocorrelation function, cross – correlation functions. Central limit theorem, Properties of Gaussian process.

NOISE: Introduction, shot noise, thermal noise, white noise, Noise equivalent bandwidth, Narrow bandwidth, Noise Figure, Equivalent noise temperature, cascade connection of two-port networks.

UNIT III **[10 hours]**

AMPLITUDE MODULATION: Introduction, AM: Time-Domain description, Frequency – Domain description. Generation of AM wave: square law modulator, switching modulator. Detection of AM waves: square law detector, envelop detector. Receiver model, Figure of merit of AM.Double side band suppressed carrier modulation (DSBSC): Time-Domain description, Frequency-Domain representation, Generation of DSBSC waves: balanced modulator, ring modulator. Coherent detection of DSBSC modulated waves, Figure of merit of DSB-SC

UNIT IV **[11 hours]**

SINGLE SIDE-BAND MODULATION (SSB): Quadrature carrier multiplexing, Canonical representation of SSB, Single side-band modulation, Frequency-Domain description of SSB wave, Time-Domain description. Phase discrimination method for generating an SSB modulated wave. Demodulation of SSB waves, Figure of merit of SSB**VESTIGIAL SIDE-BAND MODULATION (VSB):** Frequency – Domain description, Generation of VSB modulated wave, Time - Domain description, Envelop detection of VSB wave plus carrier, Comparison of amplitude modulation techniques, Frequency translation, **FDM**: Frequency division multiplexing, Application: Radio broadcasting, AM radio.

UNIT V **[11 hours]**

ANGLE MODULATION (FM): Basic definitions, FM, narrow band FM, wide band FM, transmission bandwidth of FM waves, generation of FM waves: indirect FM and direct FM. Demodulation of FM waves, FM stereo multiplexing, Phase-locked loop, Linear model , First order model. Noise in FM receivers, FM threshold effect, Pre-emphasis and De-emphasis in FM. Figure of merit of FM

LAB Experiments

Part A: **Using discrete components** Analog filters; Audio amplifiers; Generation and demodulation of AM, DSB-SC, FM, PM, FM with pre-emphasis and de-emphasis; Generation of SSB;

Part B: Using LabVIEW/ Matlab Generate and demodulate AM, DSB-SC, SSB, FM, PM; study effect of phase and frequency error in local oscillator in each case.

TEXT BOOKS:

1. **Communication Systems**, Simon Haykins, 3rd Edition, John Willey, 1996.
2. **An Introduction to Analog and Digital Communication**, Simon Haykins, John Wiley, 2003.

REFERENCE BOOKS:

1. **Modern digital and analog Communication systems** B. P. Lathi, 3rd ed 2005 Oxford University press.
2. **Communication Systems**, Harold P.E, Stern Samy and A Mahmond, Pearson Edn, 2004.**3. Communication Systems**: Singh and Sapre**:** Analog and digital TMH 2nd, Ed 2007.

Digital Switching Systems - 10TC5DCDSS

Objective

Subject starts with switching networks, fundamental concepts are introduced and explained by means of examples Theory of telecommunication traffic engineering is developed from first principles, using simple probability theory, and examples of lost-call systems and queuing systems are considered. Digital switching system software, Hardware and its maintenance, Reliability Modeling and analysis are dealt in detail

UNIT I **[08 hours]**

Developments of telecommunications, Network structure, Network services, terminology, Regulation, Standards. Introduction to telecommunications transmission, four wire circuits.**EVOLUTION OF SWITCHING SYSTEMS:** Introduction, Message switching, Circuit switching, Functions of switching systems, Distribution systems, Basics of crossbar systems, Electronic switching, Digital switching systems.

UNIT II **[08 hours]**

DIGITAL SWITCHING SYSTEMS: Evolution of digital switching systems, stored program control switching systems, Digital switching system fundamentals, Building blocks of a digital switching system, Basic call processing. **Digital Switching**: Switching functions, SDS, TDS, Two Dimension switching.

UNIT III **[08 hours]**

TELECOMMUNICATIONS TRAFFIC: Introduction, Unit of traffic, Congestion, Mathematical model, lost call systems, Queuing systems.

UNIT IV **[07 hours]**

SWITCHING SYSTEM SOFTWARE: Introduction, Scope, Basic software architecture, Digital switching system software classification, Call models, Software linkages during call, Call features, Recovery strategy, and Analysis report. Reliability analysis

UNIT V **[08 hours]**

Reliability Modeling and analysis: Purpose, system reliability assessment, failures Models, state Transitions Diagram CPC, clock subsystems, N/W Controller subsystem, switching N/W, link and trunk downtimes, call cutoffs.

TEXT BOOKS:

1. **Telecommunication and Switching, Traffic and Networks** - J E Flood**:** Pearson Education, 2002.
2. **Digital Switching Systems**, Syed R. Ali, TMH Ed 2002.
3. **Digital Telephony** - John C Bellamy: Wiley India 3rd Ed, 2000

REFERENCE BOOK:

Thiagarajan Vishwanathan, "Telecommunications Switching Systems and Networks' PHI, 2001

FUNDAMENTALS OF CMOS VLSI
10TC5DCVLI

Objective:

The course covers the basic fabrication process of MOS circuits and design of VLSI circuit parameters like speed, power dissipation. The implementation of simple VLSI systems are also covered in this course.

UNIT I **[12 hours]**

Basic MOS technology: Integrated circuit's era. Enhancement and depletion mode MOS transistors. nMOS fabrication. CMOS fabrication. Thermal aspects of processing. BiCMOS technology. Production of E-beam masks.Circuit design processes: MOS layers. Stick diagrams. Design rules and layout – lambda-based design and other rules. Examples. Layout diagrams. Symbolic diagrams.Basic Physical Design of Simple logic gates

UNIT II **[10 hours]**

CMOS logic structures : CMOS Complementary Logic, Bi CMOS Logic, Pseudo-nMOS Logic, Dynamic CMOS Logic, Clocked CMOS Logic, Pass Transistor Logic, CMOS Domino Logic Cascaded Voltage Switch Logic (CVSL), The Transmission Gate, Tri-state Inverter

UNIT III **[10 hours]**

Basic circuit concepts: Sheet resistance, Area capacitances, Capacitance calculations, The delay unit, Inverter delays, Driving capacitive loads, Propagation delays, Wiring capacitances.Scaling of MOS circuits: Scaling models and factors. Limits on scaling. Limits due to current density and noise.

UNIT IV **[10 hours]**

CMOS subsystem design: Architectural issues. Switch logic. Gate logic. Design examples – combinational logic. Clocked circuits. Other system considerations. Clocking StrategiesCMOS subsystem design processes: General considerations. Process illustration. ALU subsystem. Adders. Multipliers.

UNIT V **[10 hours]**

Memory, registers, and clock: Timing considerations. Memory elements. Memory cell arrays.Testability: Performance parameters. Layout issues. I/O pads. Real estate System delays. Ground rules for design. Test and testability.

TEXT BOOKS:

1. **Douglas A. Pucknell & Kamran Eshraghian**, "Basic VLSI Design" PHI 3rd Edition (original Edition – 1994), 2005.
2. **Neil H. E. Weste and K. Eshragian**," Principles of CMOS VLSI Design: A Systems Perspective," 2nd edition, Pearson Education (Asia) Pvt. Ltd., 2000.

REFERENCE BOOKS:

1. **M. K. Achuthan and K. N. Bhat**, "Fundamentals of Semiconductor Devices", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2007.
2. **Sung-Mo Kang & Yusuf Leblebici**, "CMOS Digital Integrated Circuits: Analysis and Design", 3rd Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2007.
3. **D.A Hodges, H.G Jackson and R.A Saleh**. "Analysis and Design of Digital Integrated Circuits"- 3rd Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2007.

MICROCONTROLLERS
10ES5GCMCS

Objectives: The objective of this course is to learn and interface microcontroller for different applications. Course include assembly and embedded C programs. Assembly Programs will be simulated in lab and as embedded C is used for interfacing experiments. With this hands-on labs students can carry mini projects.

UNIT I **[08 hours]**

INTRODUCTION TO MICROCONTROLLERS:Microprocessors and Microcontroller- Introduction, Difference between Microprocessors and Microcontrollers, RISC & CISC CPU Architectures, Harvard & Von-Neumann CPU architecture. Embedded Electronic Systems and Microcontrollers, comparison of different microcontrollers and applications.**The 8051 Architecture:** Introduction, 8051 Microcontroller Hardware, Input / Output Pins, Ports and Circuits, External Memory.

UNIT II **[08 hours]**

ASSEMBLY LANGUAGE PROGRAMMING IN 8051Addressing Modes and Instruction set: Introduction, Addressing modes, Data transfer instructions, Example Problems, Arithmetic instructions, Logical instructions, Example Problems, JUMP and CALL program range, Jumps, calls and Subroutines, Returns, Example Problems.

UNIT III **[08 hours]**

EMBEDDED 'C' PROGRAMMING :8051 programming in C: Data types and time delays in 8051 C, I/O programming, logic operations, data conversion programs, accessing code ROM space, data serialization.
Timer / Counter Programming in 8051: Counters and timers programming 8051 Timers, Counter Programming, programming timers 0 and 1 in 8051 C.

UNIT IV **[08 hours]**

8051 Serial Communication: Basics of Serial Communication- Serial data input/ output, 8051 connections to RS-232, 8051 Serial communication Programming, **Interrupts Programming:** 8051 Interrupts, Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Interrupt programming in C

UNIT V **[07 hours]**

8051 INTERFACING AND APPLICATIONS: Interfacing 8051 to LCD, Keyboard, DAC, ADC, Stepper motor.

LABORATORY EXPERIMENTS:

A. Data Transfer, Logical-Byte/Bit manipulations, Jump and Subroutine Calls using Assembly language programming

B. Interfacing: Counters and generate delay using timers, LCD Display, Stepper motor control using interrupt, Serial transmission/Receiving of Number of characters using serial interrupt , Temperature Controller interface, Elevator interface and & seven segment display interface.The Experiments will be implemented using 'Keil' software with Embedded IDE. For interfacing 8051 target board is used.

TEXT BOOKS:

1. **"The 8051 Microcontroller Architecture, Programming & Applications",** Kenneth J. Ayala 2e, Thomson Learning 2005
2. **"The 8051 Microcontroller and Embedded Systems – using assembly and C ",** Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; PHI, 2006

REFERENCE BOOKS:

1. **"Programming and Customizing the 8051 Microcontroller",** Predko ;, TMH
2. **"Microcontrollers: Architecture, Programming, Interfacing and System Design"**, Raj Kamal, Pearson Education, 2005
3. **"PIC Microcontrollers", J.B. Peatman;"** PHI, 2006

DIGITAL COMMMUNICATION - 10TC6DCDCM

Objective:

This courses begins with the advantages of digital communication over analog communication, and then takes one through various modulation schemes suitable for base band and band pass transmission. The parameters for comparing various schemes are evaluated. To help comprehend various concepts in digital communication, an integrated laboratory component is introduced, included hardware circuits and software component using the LabVIEW programming platform. This course lays the foundation for wireless communication.

UNIT I **[10 hours]**

Pulse Analog Modulation: Sampling theorem, sampling of band-pass signals, Practical aspects of sampling, Reconstruction of message from its samples, PAM, PWM, PPM, TDM, PAM-TDM, Quantization, Robust quantization, companding.

UNIT II **[11 hours]**

Pulse-Digital Modulation: Elements of PCM, Noise in PCM systems, Measure of information, Channel capacity, Differential PCM, Delta modulation, Adaptive delta modulation, generation and detection of PCM, TDM-PCM, their comparisons with FDM; Typical multiplexed systems: T1 and E1 digital Hierarchy.

UNIT III **[10 hours]**

Base-band Data transmission: Elements of binary PAM, Baseband shaping, Optimum transmitting and receiving filters Correlative coding, Baseband M-ary PAM, Adaptive equalization, Eye pattern, Examples: Line coding

UNIT IV **[10 hours]**

Band-pass data transmission: Time and frequency domain representation of ASK, FSK, PSK, QPSK; their generation and detection; Performance analysis-power and bandwidth, bit error rate

UNIT V **[11 hours]**

Gram-Schmidt orthogonalization procedure, Matched filters, Properties of matched filtersNeed for Spread Spectrum Modulation. PN sequence and its properties, Direct sequence SS system- DS/BPSK Transmitter & Receiver, Processing gain, Jamming margin,

Part A: Using suitable components Generate PAM, PWM, PPM, PAM-TDM, DM, ASK, PSK, FSK, QPSK, PCM, Natural sampling, flat top sampling, PN sequence, SS

Part B: Using Matlab/LabVIEWGeneration and demodulation of PAM, PWM, PPM, PAM-TDM, DM, ASK, PSK, FSK, QPSK; performance in presence of noise;

TEXT BOOK:

Digtal Communications By Simon Haykins –John Wiley 2003

REFERENCE BOOKS:

1. Digital and Analog Communication by K Sam Shanmugham, John Wiley
2. Analog and Digital communications by Simon Haykins –John Wiley

TRANSMISSION LINES & ANTENNAS
10TC6DCTLA

Objective:

To understand the distributed circuit theory of transmission line and solve transmission line problems. Also to study the antenna parameters, types and applications.

Outcome: Transmission line theory is studied and applied to solve problems. Different antenna concepts are studied and patterns analyzed. Design and applications of antenna are studied.

UNIT I **[10 hours]**

TRANSMISSION – LINE THEORY: The transmission Line-general solution, The distortion less Line, Reflection on a Line not terminated in Z_0, Open and short circuited Lines, Reflection loss, Insertion loss, T and PI sections equivalent to Lines, Constant K LPF & HPF, Constants for the Line of zero dissipation, Standing waves; nodes; standing wave ratio.

UNIT II **[10 hours]**

THE LINE AT RADIO FREQUENCIES: Input impedance of open and short circuited Lines, The quarter wave Line; impedance matching, single stub impedance matching on a Line. The smith circle diagram, Application of the Smith chart, Double stub impedance, Open and Short circuit impedances when considering dissipation.

UNIT III **[11 hours]**

ANTENNA BASICS: Introduction, basic Antenna parameters, patterns, beam area, radiation intensity, beam efficiency, directivity and gain, antenna apertures, effective height, radiation efficiency, Friss transmission formula and antenna field zones.
POINT SOURCES AND ARRAYS: Introduction, point sources, power patterns, power theorem, radiation intensity, field patterns, phase patterns. Array of two isotropic point sources, non-isotropic but similar point sources, principles of pattern multiplication, non-isotropic point sources, broad side array with non uniform amplitude distribution, direction of maxima for arrays of n isotropic point sources of equal amplitude and spacing

UNIT IV **[11 hours]**

ELECTRIC DIPOLES, LOOP AND THIN LINEAR ANTENNAS: Introduction, short electric dipole, fields of a short dipole, radiation resistance of short dipole, radiation resistances of lambda/2 Antenna, small loop, comparison of far fields of small loop and short

dipole, loop antenna general case, far field patterns of circular loop, radiation resistance, directivity, thin linear antenna, folded dipole antennas.

UNIT V **[10 hours]**

ANTENNA TYPES: Patch antennas, slot antenna , Babinet's principle and complementary antennas, Horn antennas, Helical Antenna, Yagi-Uda array, corner reflectors, parabolic reflectors, log periodic antenna, lens antenna, Omni directional antennas, embedded antennas, ultra wide band antennas, plasma antenna. antennas for satellite and for ground penetrating radars. (Note: No derivations for the topics in this section).

TEXT BOOKS:

1. Network Lines and Fields - John D Ryder, 2e, PHI, 2003. 2. Antennas, John D. Krauss, III (SEI) edition, McGraw-Hill International edition, 2006.

REFERENCE BOOKS:

1. Antenna Theory Analysis and Design - C A Balanis, 2nd ED, John Wiley, 1997.
2. Antennas and wave propagation - G S N Raju: Pearson Education 2005.
3. Antennas and Wave Propagation - Harish and Sachidananda: Oxford Press 2007.
4. Antennas and wave propagation – K D Prasad,

DSP ALGORITHMS & ARCHITECTURE
10TC6DCDAR

Objectives

This Course is intended to understand the basic differences between general purpose processor and DSP processor and how DSP processor is optimized for signal processing applications. The class covers the architecture and the instruction set of fixed point TI DSP processor, assembly language programming and the implementation of DSP algorithms.

UNIT I **[08 hours]**

INTRODUCTION TO DIGITAL SIGNAL PROCESSING: Introduction, A Digital Signal-Processing System, Review of the Sampling Process, Discrete Time Sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear Time-Invariant Systems and Digital Filters, Decimation and Interpolation, Number formats for signals and coefficients in DSP systems, Dynamic range and precision, Basic Architectural Features, **UNIT II**

[08 hours]

ARCHITECTURES FOR PROGRAMMABLE DIGITAL SIGNAL-PROCESSORS: DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Features for External Interfacing. Speed issues,

UNIT III **[08 hours]**

ADDRESSING MODES AND INSTRUCTION SET Data Addressing Modes of TMS32OC54xx., Detail Study of TMS320C54X & 54xx Instructions and Programming, Memory Space of TMS32OC54xx Processors, Program Control.

UNIT IV **[08 hours]**

Assembler directives, On- Chip peripherals, Interrupts of TMS32OC54XX Processors, Pipeline Operation of TMS32OC54xx Processor. Implementation of basic DSP algorithms**-** Introduction, The Q-notation, FIR Filters, IIR Filters, examples, interpolation and decimation filters, examples

UNIT V **[07 hours]**

An FFT Algorithm for DFT Computation, Overflow and Scaling, Bit-Reversed Index Generation & Implementation on the TMS32OC54xx, Case Study-TMS320C6713(TI), Case study-ADSP SHARC Processor (Analog Devices), interfacing memory and parallel I/O peripherals to programmable DSP devices.

LAB EXPREMENTS

The laboratory experiments are implemented using C**ode Composer Studio and DSP Processor**

Linear convolution of two given sequences, Circular convolution of two given sequences, Computation of N- Point DFT of a given sequence, Realization of an FIR filter (any type) to meet given specifications (The input can be a signal from function generator / speech signal, Audio applications such as to plot time and frequency & display of Microphone using DSP, Read a wave file and match with their respective spectrograms, Noise: Add noise above 3KHz and then remove; Interference suppression using 400 Hz tone, Impulse response of first order and second order system, Assembly language programming

TEXT BOOK:

Digital Signal Processing – Avatar Singh and S. Srinivasan, Thomson Learning, 2004.

REFERENCE BOOKS:

1. Texas Instruments Reference manual
2. **Digital Signal Processing**, Shaila D Apte, Wiley India, 2009.
2. **Digital Signal Processors** – B Venkataramani and M Bhaskar TMH, 2002
3. **Architectures for Digital Signal Processing** – Peter Pirsch John Weily, 2007.

INFORMATION THEORY & CODING
10TC6DCITC

Objective:

The objective of the course is

- To expose students to the fundamental elements and practices of information theory, covering both theoretical and applied issues of recognized importance in contemporary communications systems and networks.
- To study how information is measured in terms of probability and entropy, and the relationships among conditional and joint entropies, how these are used to calculate the capacity of a communication channel with and without noise, how discrete channels and measures of information generalize to their continuous forms.
- To learn the parameters associated with a code block and their relationship to the error-detecting and error-correcting abilities of a code block.
- To Know how to relate generating and control matrices of a cyclic code with its generating and control polynomials

UNIT I **[10 hours]**

INFORMATION THEORY: Introduction, Measure of information, (Entropy) Average information content of symbols in long independent sequences, Joint Entropy and conditional entropy, Mutual information, Relationship between entropy and mutual information, Mark-off statistical model for information source, Entropy and information rate of mark-off source. Problems**.**

UNIT II **[10 hours]**

SOURCE CODING: Encoding of the source output, Kraft inequality, Noiseless coding Theorem, Shannon's encoding algorithm, Shannon's Fano encoding algorithm. Huffman coding, problems**.**

UNIT III **[11 hours]**

COMMUNICATION CHANNELS: Discrete communication channels, Representation of channels, Channel Capacity, Shannon's Theorem on channel capacity, Channel efficiency, Binary channel, Binary symmetric channel, Binary Erasure channel, Cascaded channel, Problem Continuous channels: Channel coding theorem, Differential entropy and mutual information for continuous ensembles, Channel capacity Theorem.

UNIT IV **[11 hours]**

ERROR CONTROL CODING: Introduction, Types of errors, Types of codes : Linear Block Codes: Matrix description, Error detection and correction, Standard arrays and table look up for decoding, Binary Cyclic Codes: Algebraic structures of cyclic codes, Encoding using an (n-k) bit register, Syndrome calculation, Problems

UNIT V **[10 hours]**

CONVOLUTION CODES: Encoder for Convolution Codes: Using Time domain approach, Using Transform domain approach, State Diagram and code trees. RS codes, Golay codes, shortened cyclic codes, Burst error correcting codes. Burst and Random Error correcting codes.

TEXT BOOK:

Digital and analog communication systems – K. Sam Shanmugam, John Wiley, 1996.

REFERENCE BOOKS:

1. Digital communication – Simon Haykin, John Wiley, 2003.
2. Elements of information theory – Thomas M. Cover, John Wiley, 2006

HUMAN RESOURCE MANAGEMENT AND DEVELOPMENT
11ES7GCHRM

Course Objectives :

- Significant role of HRM in achieving management objectives is reflected

Course Description :

This course covers

- Understanding the Nature and Scope of HRM, Human Resource Planning, Recruiting Human Resources, Selecting Human Resources, Training, Development and Career Management, Development of Entrepreneurship;

Learning Outcomes:

Upon successfully completing the course, the student should:

- ✓ Improve the management of people or utilization of human resources better as a means of achieving competitive advantage.

UNIT I **[04 hours]**

MANAGEMENT: Understanding the Nature and Scope of HRM, Context of HRM

UNIT II **[05 hours]**

PLANNING: Human Resource Planning, Analyzing Work and Designing Jobs

UNIT III **[05 hours]**

RECRUITMENT: Recruiting Human Resources, Selecting Human Resources.

UNIT IV **[06 hours]**

TRAINING: Training, Development and Career Management, Appraising and Managing Performance, Managing Basic Remuneration.

UNIT V **[06 hours]**

ENTREPRENEUR: Meaning of Entrepreneur; Functions of an Entrepreneur, Types of Entrepreneur, Development of Entrepreneurship; Intrapreneur - an emerging Class.

TEXT BOOK:

Human Resource Management: K. Ashwathappa, Text and Cases. Fifth Edition (2008) Tata McGraw-Hill Publishing Company Ltd., New Delhi.

REFERENCE BOOKS:

1. **Human Resource Management,** Gary Dessler, Tenth Edition (Indian subcontinent adaptation 2008), Pearson Education, Inc.
2. **Dynamics of Entrepreneurial Development & Management** - Vasant Desai Himalaya Publishing House**.**

MICROWAVE & RADAR - 11TC7DCMWR

Objective: To study the various microwave components and know about their characteristics and applications in communication.

UNIT I **[08 hours]**

MICROWAVE TRANSMISSION LINES: Introduction to microwaves, Primary constants of a transmission line, Secondary constants, Characteristic impedance, SWR, Types of waveguides, various modes of waveguides, Propagation constant, Attenuation and phase constants, Wavelength, Velocity of propagation and Group velocity, Co-axial line, Modern Transmission lines- Microstrip line, Loss in Micro strip line, Strip line, Co-planar line.

UNIT II **[08 hours]**

MICROWAVE NETWORK THEORY AND PASSIVE DEVICES : Scattering parameters, Properties of S matrix, Microwave components: waveguide terminations, Construction, Operation and parameters of Tee junctions, Directional coupler, Isolator, Phase shifter, Attenuators, co-axial connectors and adapters, Microstrip Antennas

UNIT III **[08 hours]**

MICROWAVE ACTIVE DEVICES: Reflex Klystron, RWH theory, Gunn diode-Construction, JE characteristics, four frequency modes, Gunn waveguide oscillator, READ diode, IMPATT diode, TRAPATT diode, BARITT diode, PIN diode, Schottky diode, varactor diode, Parametric amplifiers, Microwave bipolar transistors, Unipolar FET, Microwave transistor oscillator

UNIT IV **[08 hours]**

RADAR : Basic Radar, The simple form of the Radar equation, Radar block diagram, Radar frequencies, application of Radar, Introduction to Doppler and MTI Radar, delay line Cancellers, digital MTI processing, Moving target detector, pulse Doppler Radar.

UNIT V **[07 hours]**

MICROWAVE MEASUREMENTS AND APPLICATIONS: Measurement of microwave power, frequency, losses, VSWR and Impedance using waveguides and strip lines or microstrip lines, Microwave communication, Other applications

TEXT BOOKS:

1. **Microwave Engineering** – Annapurna Das, Sisir K Das TMH Publication, 2nd Edition, 2010.
2 **Introduction to Radar systems**-Merrill I Skolnik, 3rd Ed, TMH, 2001.

REFERENCE BOOKS:

1. **Microwave Devices and circuits**- Liao / Pearson Education, Third edition.
2. **Microwave and radar Engineering**- M.Kulkarni, Umesh Publications, first edition.

OPTICAL FIBER COMMUNICATION - 11TC7DCOFC

OBJECTIVE:

TO STUDY THE STRUCTURE, TYPES AND MODES OF OPTICAL FIBERS, THE VARIOUS LOSSES ASSOCIATED IN TRANSMISSION, OPTICAL DEVICES AND THEIR APPLICATIONS IN NETWORKS

UNIT I **[08 hours]**

INTRODUCTION TO OPTICAL FIBER COMMUNICATION: History, General system, Advantages and disadvantages of OFC, Structure of fiber, Types of fibers, Ray theory and mode theory, cutoff wave length, mode filed diameter

UNIT II **[08 hours]**

SIGNAL DEGRADATION IN FIBERS: Attenuation, Absorption, Scattering, bending losses, dispersion, Intra modal dispersion, Inter modal dispersion. **FIBER COUPLERS AND CONNECTORS:** Fiber alignment and joint loss, single mode fiber joints, fiber splices, fiber connectors and couplers.

UNIT III **[08hours]**

OPTICAL TRANSMITTERS AND RECEIVERS: LEDs, LASERS, Photo detectors, Photo diodes, Optical receiver operation, Noise, analog receiversAnalog links, CNR, RF over fiber, Radio over fiber links, microwave photonics. Digital links –point–to–point links, System considerations, link power budget, rise time budget

UNIT IV **[08 hours]**

WDM AND COMPONENTS: WDM concepts, Mach-zehender interferometer, multiplexer, isolator and circulator, active optical components, optical amplifiers, photonic crystal fibers, couplers and connectors

UNIT V **[07 hours]**

OPTICAL AMPLIFIERS AND NETWORKS: optical amplifiers, basic applications and types, semiconductor optical amplifiers, EDFA. SONET / SDH, Optical Interfaces, SONET/SDH rings, High – speed light – waveguides.

TEXT BOOK:

Optical fiber communication- Gerd Keiser, 4th Edition, MGH, 2008

REFERENCE BOOK:

Optical fiber communications – John.M.Senior, Pearson Education, 3rd Impression, 2007

WIRELESS COMMUNICATION - 11TC7DCWCM

OBJECTIVE: The subject covers the basic information towards wireless and its standards. The subject involves evolution of wireless and benefits with respect to enterprises and user end. Wireless communication knowledge is helpful because in today's world requires mobility and it is advantages over the wired communication etc.

UNIT 1

Introduction to wireless communication and networks, Evolution of wireless communication- 1G, 2G , 3G, 4G, Multiple access techniques—TDMA, CDMA & FDMA, Common cellular network component, Cellular component identification, Call Establishment. **7 hrs**

UNIT 2

Wireless network architecture, the cellular concept, Cell Fundamentals, Capacity Expansion technique, Mobility Management, Characteristics of air interface, Wireless telecommunication coding techniques, Diversity techniques **8 hrs**

UNIT 3

Wireless modulation techniques—ð/4 DPQSK, MSK, GMSK, Cellular systems, cochannel/ adjacent channel interference, Cell splitting ,GSM PLMN, GSM subsystems, GSM interfaces, Mapping of GSM to OSI layers **8 hrs**

UNIT 4

GSM Logical channels and frame structures introduction: GSM Logical channels, allowed logical channel combinations, GSM frame structure, GSM bursts, data encryption in GSM, mobility management, GSM key technologies –handovers, DTX **8 hrs**

UNIT 5

Call flows in GSM, call authentication, call origination, call termination, call release, introduction to data services – SMS, GPRS, overview of CDMA, CDMA Channels, Path loss-okumura, cost 231,introduction to 3G, Wimax, UMTS, Bluetooth **8 hrs**

Text Books:

1. Gary J Mullet ,'Introducation to Wireless Telecommunication Systems and Networks'
2. Vijay K Garg, 'Principles and applications of GSM'

Reference:

1. Theodore S Rappaport, 'Wireless communication: Principles and Practice', Pearson, 2nd Edition
2. William C Y Lee, 'Wireless and cellular Telecommunications', McGraw Hill Publications, 3rd Edition

This syllabus is framed with guidance from ZTE

INTELLECTUAL PROPERTY RIGHTS - 11ES8GCIPR

Objective

To provide an understanding of basic concepts of IP relating to technology

- To give an insight into IP Management, Licensing, Valuation, Audit and other aspects of IP.
- To teach basic skills necessary for a good IP hygiene within the company.

UNIT I **[05 hours]**

Basic principles of IP laws: Introduction, Concept of property, Need for a holistic approach, Constitutional aspects of IP, Evolution of the patent system in UK, US and India, Basis for protection, Invention, Criteria for patentability, Non – patentable inventions.

UNIT II **[05 hours]**

Patents: Introduction, Origin and meaning of the term patent, Objective of a patent law, the legislative provisions regulating patents, principles underlying the patent law in India, patentable invention. Procedure for obtaining patent: Submission of application, Filing provisional and complete specification, Examination of the application, advertisement of the acceptance, opposition, Grant and sealing of patent, Term of the patent, compulsory license.Provisional and complete specification: Definition of Specification, Kinds of specification, provisional specification, complete specification, Claims, Conditions for amendment.

UNIT III **[05 hours]**

Rights conferred on a patentee: Patent rights, Exception and limitations, Duties of a Patentee.Transfer of patent: Forms of transfer of Patent rights, Assignment, kinds of assignment, License, kinds of license, Rights conferred on a licensee, Transmission of patent by operation of law.Infringement of patents: Construction of claims and infringement, patents held to be infringed, patents held to be not infringed.Action for Infringement: Where a suit is to be instituted, procedure followed in the suit, Onus of establishment infringement, Defence by the defendant, The Relief's, Injunction, Damages or account of profits, patent agents, patent drafting, database searching, and Case studies.

UNIT IV **[06 hours]**

Copy Right: Meaning and characteristics of copy right, Indian copy right law, requirement of copy right, Illustrations copy right in literary work, Musical work, Artistic work, work of architecture, Cinematograph film, sound recording.Author and Ownership of copy right: Ownership of copy right, Contract of service, Contract for service, rights conferred by copy right, terms of copy right, license of copy right.Infringement of copy right: Acts which constitute infringement, general principle, direct and indirect evidence of copying, Acts not constituting infringements, Infringements in literary, dramatic and musical works, Remedies against infringement of copy right, Case studies.

UNIT V **[04 hours]**

Trade Marks: Introduction, Statutory authorities, procedure of registration of trade marks, rights conferred by registration of trade marks, licensing in trade mark, infringement of trade mark and action against infringement.

TEXT BOOKS:

1. Dr. T Ramakrishna, "**Basic principles and acquisition of Intellectual Property Rights**", CIPRA, NSLIU -2005.
2. Dr.B.L.Wadehhra, " **Intellectual Property Law Handbook**", Universal Law Publishing Co. Ltd., 2002.

REFERENCE BOOKS:

1. Dr. T Ramakrishna , "**Ownership and Enforcement of Intellectual Property Rights**" , CIPRA, NSLIU -2005.
2. "**Intellectual Property Law (Bare Act with short comments)**",Universal Law Publishing Co. Ltd.. 2007.
3. "**The Trade marks Act 1999 (Bare Act with short comments)**", Universal Law Publishing Co. Ltd., 2005.
4. "**The Patents Act, 1970 (Bare Act with short comments), as amended by Patents (Amendment) Rules 2006 w.e.f. 5-5-2006**". Commercial law publishers (India) Pvt. Ltd., 2006.
5. Thomas T Gordon and Arthur S Cookfair, "**Patent Fundamentals for Scientist and Engineers**", CRC Press 1995.
6. Prabuddha Ganguli, "**Intellectual Property Rights**", TMH Publishing Co. Ltd, 2001

PROJECT MANAGEMENT - 11ES8GCPRM

Objectives :

- Project Management has developed in order to plan, co-ordinate and control the complex and diverse activities of modern industrial and commercial projects.
- All projects share one common characteristic - the projection of ideas and activities into new endeavors.

UNIT I **[06 hours]**

Introduction - Definitions - classifications - project risk - scope

UNIT II **[05 hours]**

Project planning - scope - problem statement - project goals - objectives

UNIT III **[05 hours]**

Project implementation - project resource requirements - types of resources - men - materials - finance

UNIT IV **[05 hours]**

Project monitoring - evaluation - control - project network technique - planning for monitoring and evaluation - project scheduling.

UNIT V **[05 hours]**

Project team management - recruitment - organizing - human resources - team operating rules - project organization - various forms of project organizations.

TEXT BOOK:

1. Project Management - for 21st Centrury-Beenet P Lientz, Kathyn Prea- Academic Press, 1995
2. Project Management -Denislok

REFERENCE BOOKS:

1. Project management - David I Cleland - Mcgraw Hill International Edition, 1999
2. Project Management - Gopalakrishnan - Mcmillan India Ltd.
3. Project Management-Harry-Maylor-Peason Publication

OBJECT ORIENTED PROGRAMMING USING C++
10ES5GE1OP

Objective:

The course aims is to introduce the students to Object Oriented Programming Concepts with special emphasis on Object Oriented Programming in C++. Starting with the basics of Procedure and Object Oriented Programming the subject would provide a greater overview of Object Oriented Programming features in C++.

UNIT I **[10 hours]**

Principles of Object oriented programming: OOP Concepts, Benefits and applications Beginning with C++: Definition, application, structure of C++ program, compiling and linking Tokens, expressions and control structures: Tokens, keywords, identifiers and constants, data types, symbolic constants, variables, operators, manipulators, typecasting, control statements and loops, operation overloading, new features of ANSI C++ standard, new data types, new operators, name space scope, operator key words, new keywords & headers.

UNIT II **[10 hours]**

Functions in C++: Function prototype, argument passing, recursion, inline functions, friend and virtual functions Classes and objects: Class definition and declaration, member functions, static data members and member functions, arrays of objects, returning objects.

UNIT III **[10 hours]**

Constructors and destructors: Constructors, parameterized constructors, multiple constructors in a class, copy constructor, dynamic constructors, and destructors. Operator overloading and type conversions: Overloading unary and binary operators, overloading using friends, rules for overloading.

UNIT IV **[11 hours]**

Inheritance: Single and multiple inheritance, public, private and protected inheritance. Pointers, virtual functions and polymorphism. Pointers, pointers to objects, this pointer, pointers to derived classes, virtual functions. Managing console I/O operations: C++ streams, C++ stream classes, I/O operations, managing O/P with manipulators.

UNIT V **[11 hours]**

Templates: Class templates, function templates, overloading template functions, member function templates and non type template arguments. Exception handling:

Basics, throwing and catching mechanisms, rethrowing an exception, specifying exceptions.

TEXT BOOKS:

1. **Object oriented Programming with C++,** -E Balagurusamy (TMH Publications, 4th edn)
2. **Object oriented Programming in turbo C++,**Robert Lafore (GALGOTIA Publications)

REFERENCE BOOK:

1. **Let Us C++—**Yashavanth P. Kanetkar (BPB Publications)**Programming With C++——-**Schaum'sseries (TMH Publications)
2. **Programming With C++——-**Schaum'sseries (TMH Publications)

DIGITAL SYSTEM DESIGN USING VHDL
10ES5GE1DD

Objective:

The objective of the course is to design a digital system using hardware description language (VHDL) and implementing these systems with Programmable logic devices.

UNIT I **[12 hours]**

Introduction: VHDL description of combinational networks, Modeling flip-flops using VHDL, VHDL models for a multiplexer, Compilation and simulation of VHDL code, Modeling a sequential machine, Variables, Signals and constants, Arrays, VHDL operators, VHDL functions, VHDL procedures, Packages and libraries, VHDL model for a counter. Additional Topics in VHDL: Attributes, Transport and Inertial delays, Operator overloading, Multi-valued logic and signal resolution, IEEE-1164 standard logic, Generics, Generate statements, Synthesis of VHDL code, Synthesis examples, Files and Text IO.

UNIT II **[10 hours]**

Designing With Programmable Logic Devices: Read-only memories, Programmable logic arrays (PLAs), Programmable array logic (PLAs), Other sequential programmable logic devices (PLDs), Design of a keypad scanner. Designing With Programmable Gate Arrays And Complex Programmable Logic Devices: Xlinx 3000 series FPGAs, Designing with FPGAs, Xlinx 4000 series FPGAs, using a one-hot state assignment, Altera complex programmable logic devices (CPLDs), Altera FELX 10K series CPLDs.

UNIT III **[10 hours]**

Design of Networks For Arithmetic Operations: Design of a serial adder with accumulator, State graphs for control networks, Design of a binary multiplier, Multiplication of signed binary numbers, Design of a binary divider.

UNIT IV **[10 hours]**

Digital Design with SM Charts: State machine charts, Derivation of SM charts, Realization of SM charts. Implementation of the dice game, Alternative realization for SM charts using microprogramming, Linked state machines.

UNIT V **[10 hours]**

VHDL Models For Memories And Buses: Static RAM, A simplified 486 bus model, Interfacing memory to a microprocessor bus. Floating-Point Arithmetic: Representation of floating-point numbers, Floating-point multiplication, Other floating-point operations.

TEXT BOOK:

Charles H. Roth. Jr:, **Digital Systems Design using VHDL**, Thomson Learning, Inc, 9th reprint, 2006.

REFERENCE BOOKS:

1. Stephen Brown & ZvonkoVranesic, **Fundamentals of Digital Logic Design** with VHDL, Tata McGrw-Hill, New Delhi, 2nd Ed., 2007
2. Mark Zwolinski, **Digital System Design with VHDL**, 2 Ed, Pearson Education., 2004
3. Volnei A Pedroni, **Digital electronics and Design with VHDL**. Elsevier

DATA STRUCTURES WITH C++ - 10ML5GE1DS

The objective: To introduce the fundamentals of Data Structures, Abstract concepts and how these concepts are useful in problem solving. Analyze step by step and develop algorithms to solve real world problems.

UNIT I **[08 hours]**

C++ programming Basics: Need of object oriented programming, procedural languages, characteristics of OOP, preprocessor directives, data types, manipulators. Structures: Structures, enumerated data types, Boolean type, Functions: passing arguments, returning values, reference arguments, overloaded functions, inline functions, variable and storage classes.

UNIT II **[07 hours]**

Objects and classes: objects as data types, constructors, destructors, overloaded constructors. Arrays: Arrays as class member data types, passing arrays, arrays as objects, strings, arrays of strings.

UNIT III **[07 hours]**

Operator overloading: over loading of unary operators, binary operators, data conversion.**Inheritance:** Inheritance, derived class and base class, overriding member functions, scope resolution, levels of inheritance, multiple inheritances.

UNIT IV **[07 hours]**

Pointers, pointers to objects, linked list, virtual functions, static functions, Working with files: Introduction, Classes for the stream operators, opening and closing files, detecting end-of-file, more about open( ); file modes, file pointers and their manipulations, sequential input and output operations, Updating a file: Random access, error handling during file operation.

UNIT V **[10 hours]**

Data structures: data representation, matrices, stacks, Queues

Lab experiments Lab components must comprise of experiments that reinforce the theoretical understanding of the corresponding subject. Experiments would address concepts of Structures, Classes, Objects, Operator overloading, Inheritance, File I/O. Stacks and Queues.

TEXT BOOKS:

1. **Object oriented programming in TURBO C++**, Robert Lafore, Galgotia Publications.2002
2. **Data Structures using C++,** D.S.Malik, Thomson, 2003

REFERENCE BOOKS:

1. **Object Oriented Programming with C++**, E Balaguruswamy, Third edition, TMH2006
2. **C++ the complete reference**, Herbert Schildt, Fourth edition, TMH, 2003
3. **Data Structures, Algorithms and Applications in C++:** SartajSahni, Tata McGrawHill Publications.

BIOMECHANICS - 10ML5GE1BM

Objective: To understand and to derive the laws and principles underlying the human movement the fundamental relations between structure and function. Also to understand the measuring techniques (instruments) and the modeling theory (theory).

UNIT I **[08 hours]**

Bio-fluid mechanics: Newton's laws, stress, strain, elasticity, Hook's-law, viscosity, Newtonian Fluid, Non-Newtonian fluid, viscoelastic fluids. Vascular tree.Relationship between diameters, velocity and pressure of blood flow, Resistance against flow.

UNIT II **[12 hours]**

Flow properties of blood: physical, Chemical and Rheological properties of blood Apparent and relative viscosity. Blood viscosity variation: Effect of shear rate, hematocrit, temperature and protein contents of blood. Casson's Equation. Problems associated with extra corporeal blood flow.

UNIT III **[10 hours]**

Bioviscoelastic fluid: Viscoelasticity, Viscoelastic Models: Maxwell, Voigt and Kelvin Models Response to harmonic variation. Use of viscoelastic models. Bio-Viscoelasticfluids : Protoplasm. mucus, saliva, semen, synovial fluids. Rheology of blood in microvessels: Fahreus·Lindqulst effect and inverse effect, hematocrit in very narrow tube.

UNIT IV **[10 hours]**

Cardiac mechanics: Cardiovascular system. Mechanical properties of Blood vessels: arteries, arterioles, capillaries, veins, Blood flow: laminar and turbulent. Physics of cardiovascular diseases.Prosthetic heart valves and replacements.
Respiratory mechanics: Alveoli mechanics, Interaction of blood and lung P-V curve of lung. Breathing mechanism.Airway resistance. Physics of lung diseases.

UNIT V **[12 hours]**

Soft tissue mechanics: Pseudoelasticity, non-linear stress-strain relationship, visco elasticity. Structure, function and mechanical properties of skin, ligaments and tendons. Orthopedic mechanics: Mechanical properties of cartilage. Diffusion properties of articular, cartilage, Mechanical properties of bone.Kinetics and Kinematics of joints, Lubrication of joints.Fundamental concepts of Gait analysis.

TEXT BOOKS:

1. **Biomechanics, Mechanical properties of Living Tissues**-Y.C Fung,SpringerVerlag, Edition2, 1993.
2. **Introduction to biomechanics of joints & joint replacement mechanical Engg**-D.Dowson, V Wright 1987 publication.
3. **The biomedical Hand book**-Joseph.D.Bronzino CRC Press, 2nd Edition2, 2000.

BMS COLLEGE OF ENGINEERING, BANGALORE
(Autonomous College under VTU)

COMMUNICATION SYSTEMS (EE ONLY)
10EE5GE1CS

OBJECTIVES:

This course provides an understanding of communication theory as applied to the transmission of information bearing signals with equal emphasis and attention given to both analog and digital communication techniques.

UNIT I **[12 hours]**

Amplitude modulation: Time-Domain Description, Frequency domain description, Generation of AM waves, Detection of AM waves, AM/DSB, Time-Domain Description, Frequency domain description Generation of DSBSC waves, Coherent Detection of DSBSC Modulated waves. Costas loop, Quadrature Carrier multiplexing, AM-SSB/SC generation, Frequency-Domain Description, Frequency discrimination method for generation an SSB Modulated wave, time domain description, phase discrimination method for generating an SSB modulated wave, Demodulation of SSB waves, Comparison of amplitude modulation techniques, frequency translation, FDM.

UNIT II **[07 hours]**

Angle modulation:Basic Concepts, Frequency Modulation, Spectrum Analysis Of sinusoidal FM wave, NBFM, WBFM, Constant Average power, Transmission bandwidth of FM waves, Generation of FM waves, Direct FM, demodulation of FM waves, frequency discriminator, ZCD, phase locked loop (1st order) of AM and FM.

UNIT III **[07 hours]**

Noise in Analog modulation systems: Signal-to-noise ratios, AM receiver model, Signal-to -noise ratios for coherent reception, DSBSC receiver, SSB receiver, noise in AM receivers using envelope detection, threshold effect, FM receiver model, noise in FM reception, FM threshold effect, pre-emphasis and de-emphasis in FM systems.

UNIT IV **[12 hours]**

Pulse modulation : Sampling theorem for low-pass and band-pass signal, statement and proof, PAM, Channel bandwidth for a PAM signal, natural sampling, flat-top sampling, signal recovery through holding, quantization of signals, quantization error, PCM, electrical representations of binary digits, PCM systems, DPCM, delta Modulation, Adaptive delta modulation.

UNIT V **[14 hours]**

Digital Modulation: Introduction, Binary Shift Keying, DPSK, QPSK, Type D flip-flop, QPSK transmitter, non-offset QPSK, QPSK receiver, signal - space representation, BFSK, spectrum, receiver for BFSK, geometrical representation of orthogonal BFSK, line codes, TDM.

TEXT BOOKS:

1. "**Analog and Digital communication**", Simon Haykin, John Wiley.
2. "**Principles of communication systems**", Taub and Schilling, Tata McGraw Hill.

REFERENCE BOOKS:

1. "**Electronic Communication Systems**", 2nd Edition, Blake, Thomson publishers.
2. "**Electronic Communication Systems**", George Kennedy.

FUNDAMENTALS OF VLSI (EE ONLY)
10EE6GE2FV

Objective

Use of VLSI technology has increased in recent past. With the advent of power semiconductor devices, most of the large circuits have been replaced by small and compact VLSI circuits.

UNIT I **[06 hours]**

A Review of Microelectronics and an Introduction To Mos Technology: Introduction to integrated circuit technology, Production of E-beam masks. Introduction, VLSI technologies, MOS transistors, fabrication, thermal aspects, production of E-beam masks.

UNIT II **[10 hours]**

Basic Electrical Properties of Mos an Bicmos Circuit: Drain to source current Ids versus Vds relationships-BICMOS latch up susceptibility. MOS transistor characteristics, figure of merit, pass transistor NMOS and COMS inverters, circuit model, latch up.

UNIT III **[08 hours]**

Mos And Bicmos Circuit Design Processes: Mass layers, stick diagrams, design, symbolic diagrams.

UNIT IV **[16 hours]**

A) Basic Circuit Concepts: Sheet resistance, capacitance layer inverter delays, wiring capacitance, choice of layers.

B) Scaling OfMos Circuits: Scaling model and scaling factors- Limit due to current density.

UNIT V **[12 hours]**

Subsystem Design And Layout , Subsystem Design Processes : Some architecture issues- other systems considerations. Examples of structural design, clocked sequential circuits . Some general considerations, an Illustration of design process, observations.

TEXT BOOKS:

"**Basic VLSI Design**" -3rd Edition, Pucknell Douglas Al , PHI

REFERENCE BOOKS:

1. "**Fundamentals of Modern VLSI Devices**"-Yuan TaunTak H Ning Cambridge Press, South Asia Edition 2003
2. "**ModernVLSI Design Wayne wolf**", Pearson Education Inc. 3rd edition"-Wayne Wolf 2003.

UTILIZATION OF ELECTRICAL POWER
10EE6GE2UP

Objective:

- To understand the fundamentals of illumination and its classification and the electric heating and welding.
- To study Electric traction systems in detail and their practical applications

UNIT I **[12 hours]**

Heating and welding: Advantages and methods of electric of heating, resistance ovens, induction heating, dielectric heating, the arc furnace, heating of building, electric welding, resistance and arc welding, control device and welding equipment.

UNIT II **[08 hours]**

Electrolytic process: Fundamental principles, extraction, refining of metals, electroplating. Factors affecting electro deposition process, power supply for electrolytic process.

UNIT III **[08 hours]**

Illumination: Laws of illumination, lighting calculation, factory lighting, flood lighting, street lighting, different types of lamps, incandescent, fluorescent, vapor and CFL and their working.

UNIT IV **[12 hours]**

Introduction to Electric traction: Systems of traction, speed time curve, tractive effort, co-efficient of adhesions, specific energy, factors affecting specific energy consumption, selection of traction motors.

UNIT V **[12 hours]**

Control of Traction Motors: Methods of speed control, energy saving by series parallel control. AC series motor, characteristics, regenerative braking, linear induction motor and their use.Diesel electric equipment, train lighting system.

TEXT BOOKS:

1. J.B.Gupta, **Utilization of Electric Power and Electric Traction**, S.K Kataria and Sons
2. Chakraborthy, SoniGupta&Bhatnagar, **A Course in Electrical Power**, DhanpatRai and Sons

REFERENCE BOOK:

Openshaw Taylor, **Utilization of electric energy**, Orient Longman

OPERATING SYSTEMS CONCEPTS
10TC6GE2OS

OBJECTIVE:

The objective of the subject is to introduce the students to the basic concepts of operating system, structure of an operating system and design overview & different types OS etc. The course emphasizes the need for learning various concepts related to the nature of applications such as real time application need real time operating system.

UNIT I **[10 hours]**

Introduction and overview of operating systems: Operating system, Goals of an O.S, Operation of an O.S, Resource allocation and related functions, User interface related functions, Classes of operating systems, O.S and the computer system, Batch processing system, Multi programming systems, Time sharing systems, Real time operating systems, distributed operating systems.

UNIT II **[10 hours]**

Structure of operating systems: Operation of an O.S, Structure of the supervisor, Configuring and installing of the supervisor, Operating system with monolithic structure, layered design, Virtual machine operating systems, Kernel based operating systems, and Microkernel based operating systems.

UNIT III **[12 hours]**

Memory management: Memory allocation to programs, Memory allocation preliminaries, Contiguous and noncontiguous allocation to programs, Memory allocation for program-controlled data, kernel memory.

Virtual memory: Virtual memory basics, Virtual memory using paging, Demand paging, Page replacement, Page replacement policies, Memory allocation to programs, Page sharing, UNIX virtual memory.

UNIT IV **[10 hours]**

File systems: File system and IOCS, Files and directories, Overview of I/O organization, Fundamental file organizations, Interface between file system and IOCS, Allocation of disk space, Implementing file access, UNIX file system.

UNIT V **[10 hours]**

Scheduling: Fundamentals of scheduling, Long-term scheduling, Medium and short term scheduling, Real time scheduling, Process scheduling in UNIX. Message

Passing: Implementing message passing, Mailboxes, Inter process communication in UNIX.

TEXT BOOK:

"**Operating Systems - A Concept based Approach**", D. M. Dhamdhare, TMH, 2nd Ed, 2006.

REFERENCE BOOKS:

1. **Operating Systems Concepts**, Silberschatz and Galvin, John Wiley, 5th Edition, 2001.
2. **Operating System – Internals and Design Systems**, Willaim Stalling, Pearson Education, 4th Ed, 2006.

BMS COLLEGE OF ENGINEERING, BANGALORE
(Autonomous College under VTU)

INTRODUCTION TO IMAGE PROCESSING
10TC6GE2IP (Except ML)

OBJECTIVE:

The objective of the subject is to introduce the students to the basic concepts and analytical methods of image processing and also use of modern image processing tools viz. MATLAB, LABVIEW etc. The application of image processing is vast covering the areas of medical field, military, satellites, entertainment etc. The course emphasizes the need for learning various algorithms related to image processing and applying them in practical environment.

UNIT I **[07 hours]**

Fundamentals of image processing: Introduction, Fundamental steps in DIP, Components of DIP system, A simple image formation model, Image sampling and quantization, Basic relationship between pixels.

UNIT II **[08 hours]**

Image Enhancement in Spatial Domain: Background, Point processing – Image negatives, Log transformations, Power law transformations, Contrast stretching, Gray level slicing, Bit plane slicing, Histogram processing – Histogram equalization, Histogram matching (specification), Local enhancement.

UNIT III **[08 hours]**

Image Enhancement in Frequency Domain: Background, Basic properties of the frequency domain, Basic filtering in the frequency domain, Basic filters and their properties, Smoothing frequency domain filters – Ideal lowpass filters, Butterworth lowpass filters, Gaussian lowpass filters, Sharpening frequency domain filters – Ideal highpass filters, Butterworth highpass filters, Gaussian highpass filters, Homomorphic filtering.

UNIT IV **[08 hours]**

Image Restoration: Image degradation/restoration model, Noise models, Restoration using spatial filtering – Mean filters, Geometric mean filters, Harmonic mean filters, Median filter, Max & min filters, Midpoint filter, Wiener filter, constrained least squared filter.

UNIT V **[08 hours]**

Color image transforms: Fundamentals of color image processing, Color models, Conversion of color models from one form to other form.

Basic image transforms: Two-dimensional orthogonal unitary transforms, Properties of Unitary Transforms, Introduction to Wavelet Transforms.

Lab Experiments to be conducted on image enhancement techniques, histogram equalization, filtering operations on images, arithmetic and logical operations on images, and contrast stretching.

Laboratory experiments on time domain and frequency domain, speech processing, LPC and some basic experiments on audio processing.

TEXT BOOK:

Digital Image Processing by Rafael C. Gonzalez & Richard E. Woods, Third Edition. Pearson Education.

REFERENCE BOOKS:

1. **Digital Image Processing** by Rafael C. Gonzalez & Richard E. Woods, First Edition. Pearson Education Inc.
2. **Digital Image Processing** by S.Jayaraman, S.Esakkirajan, T.Veerakumar, Tata McGraw hill, 2009

BIOSENSORS - 10ML6GE2SN

Objective: Understanding the components used for various biosensors and biosensor family. Principles and types of transducers. Helps to Know about the applications on clinical chemistry, healthcare and veterinary and agriculture, the usage of biosensors on environmental samples and application on Biochips and geonomics. Understanding the principles of semiconductor electrodes used for preparation of biosensors and its different types and different photometric assay techniques.

UNIT I **[10 hours]**

Introduction: Introduction to Biosensors. Advantages and limitations, various components of biosensors, the growing of biosensor.The biosensor family, the biomolecule ingredients, proteins, enzymes complexes, enzymes kinetics, the proteins of the immune systems.

UNIT II **[10 hours]**

Transducers in biosensors: Various types of transducers, principles and applications - Calorimetric, optical, potentiometric / amperometric, conductrometric/resistormetric, piezoelectric, semiconductor, impedimetric, mechanical and molecular electronics based transducers. Chemiluminescences - based biosensors.

UNIT III **[10 hours]**

Application and uses of biosensors: Biosensors in clinical chemistry, medicine and health care, biosensors for veterinary, agriculture and food. Biosensors for personal diabetes management, application of biosensors to environmental samples. Biochips and their application to genomics.

UNIT IV **[12 hours]**

Semiconductor electrodes: Measurement of H^+ , Ion selective interfaces, Ion selective electrodes, semiconductor electrodes, MIS structures, semiconductor solution interface, FET, chemical sensitive FETA (CHEMFETA), suspended gate field effect transistor, selectivity via pattern recognition, Ion selective FET (ISFET), reference FET, CHEMFET, assessment of CHEMFETS.

UNIT V **[10 hours]**

Photometric assay techniques: Energy transition, ultraviolet and visible absorption spectra, fluorescence and phosphorescence, infra Red transitions, light scattering, Raman scattering, applications of ultraviolet visible spectra, indicator linked bioassay, irrational spectroscopy, the optical transducer, wave guides in sensors, device construction, PH optical probes, light scattering analysis.

TEXT BOOKS:

1. **Biosensors** by Elizabeth A. Hall - Open University press, Milton Keynes.
2. **Commercial Biosensors** by Graham Ramsay, John Wiley and son, INC. (1998).

REFERENCE BOOKS:

1. **Biosensors** by Eggins
2. **Biosensors** edited by AEG CASS – OIRL press, Oxford University.
3. **Transducers and Instrumentation** by Murthy D V S. Prentice Hall, 1995

BIOSTATISTICS - 10ML6GE2BS

Objective: To Analyze Statistical Data and to infer efficient decision by applying various statistical method in the Medical Field. In this course, one will be able to calculate statistics and do decisions based on the results of statistics. Also one would be able to find the best statistics method to apply and come up with efficient decision.

UNIT I **[10 hours]**

Introduction to Biostatistics: Introduction, Some basic concepts, measurement and Measurement Scales, Simple random sample, Computers and biostatistical analysis. **Descriptive Statistics:** Introduction, ordered array, grouped data-frequency distribution, descriptive statistics- measure of central tendency, measure of dispersion, measure of central tendency computed from grouped data, variance and standard deviation-grouped data.

UNIT II **[10 hours]**

Basic probability Concepts: Introduction, two views of probability – Objective and Subjective, Elementary properties of Probability, calculating the probability of an event.**Probability distribution**: Introduction, probability distribution of discrete variables, binomial distribution, Poisson distribution, continuous probability distribution, normal distribution and applications.**Sampling distribution**: Introduction, sampling distribution, distribution of the sample mean, distribution of the difference between two sample means, distribution of the sample proportion, distribution of the difference between two sample proportions.

UNIT III **[08 hours]**

Estimation: Introduction, Confidence interval for population mean, t-distribution, Confidence interval for difference between two population means, Population proportion and difference between two population proportions, determination of sample size for estimating means, estimating proportions, confidence interval for the variance of normally distributed population and ratio of the variances of two normally distributed populations.

UNIT IV **[10 hours]**

Hypothesis Testing: Introduction, hypothesis testing – Single population mean, difference between two population means, paired comparisons, hypothesis testing – single population proportions, single population variance, ratio of two population

variance.**Analysis of variance (ANOVA)**: Introduction, completely randomized design, randomized completer block design, factorial experiment.

UNIT V **[14 hours]**

Linear Regression and Correlation: Introduction, regression model sample regression equation, evaluating the regression equation, using the regression equation, correlation model, correlation coefficient. Multiple Regression and Chi-square Distribution: Multiple linear regression model, obtaining multiple regression equation, evaluating multiple regression equation, Using the multiple regression equation, Multiple correlation model, mathematical properties of Chi-square distribution, tests of goodness of fit, tests of independence, tests of homogeneity.

TEXT BOOK:

BIOSTATISTICS-A Foundation for analysis in the Health Sciences by Warne W Daniel, John Wiley & Sons Publication, 6th Edition.

REFERENCE BOOKS:

1. **Principles of Biostatistics** – by Marcello Pagano and KimberleeGauvreu, Thomson Learning Publication, 2006
2. **Introduction to Biostatistics** – by Ronald N Forthofer and EunSul Lee, Academic Press.
3. **Basic Biostatisitcs and its Applications** – by Animesh K Dutta 2006.

ADVANCED MICROCONTROLLER & APPLICATIONS - 10EC6GE2MC

Objective:

- To provide basic concepts of a RISC Machine(ARM) Processor
- Understand architecture, instruction set and programming both in ARM and Thumb mode
- Understand the various aspects embedded C programming and embedded system protocols

UNIT I **[08 hours]**

Migration from 8051 to 32bit cores, RISC design and ARM Design Approach, Advantages of ARM, ARM processor Fundamentals, Registers, Current Program Status Registers,3 stage and 5 Stage Pipeline, Exceptions ,Interrupts and Vector Table, Processor Families and Co processor Interface.

UNIT II **[08 hours]**

ARM Instruction Sets, Data Processing Instructions, Branch Instructions, Load Store Software Interrupt, Program Status Register Instructions, ARM Organization & Implementation, Thumb Instruction Sets, Thumb Register Usage, ARM-Thumb Inter-working, Cross compilers and Optimization, Overview of C compilers and Optimization, Basic C data types, C looping Structures, Function calls, Pointer Aliasing, Structure Alignment, Portability Issues, Examples & exercise.

UNIT III **[08 hours]**

Writing and Optimizing ARM Assembly Code, Writing Assembly Code, Instruction Scheduling, Register Allocation, Looping Constructs, Bit Manipulation, Examples & exercise.

UNIT IV **[08 hours]**

Firmware and Bootloader, Embedded Operating Systems, Memory Management Unit Working With I2C ,SPI and USB protocols, Examples and Exercises

UNIT V **[07 hours]**

Future of the Architecture, Future Trends in Embedded Industry -Existing cores - MIPS ,Intel ATOM. Embedded ARM applications- VLSI Ruby II Advanced Communication Processors, The One CTMVWS22100 GSM Chip, the AMULET Asynchronous ARM Processors- Self- timed design

LAB EXPERIMENTS

Simple assembly language program: Running LEDs, Interfacing a 7 segment display and working, Using GPIOs on Expansion ports, Write serial communication program in C, Interfacing a TFT display, Interfacing and running PWM drive, Video Guide for porting Linux Kernel and working with Display drivers, Configuring and working with USB device Port, Configuring and working with Audio Codec

TEXT BOOKS:

1. **ARM System-On-Chip Architecture** By Steve Furber, Addison Wesley, Pearson Education, 2nd edition
2. **ARM System** Developer's Guide By Andrew N Sloss
3. **Experiments on ARM 9** –Practical Guide ,Book By Innovate Software Solutions Pvt Ltd

REFERENCE BOOKS:

1. **Jagger (Ed) ARM architectural reference manual**, Prentice Hall
2. **ARM assembly language an introduction** by J. R. Gibson
3. **ARM – Architecture, Programming and Development Tools** by Raj Kamal, from Pearson Education, 2005.

DSP ARCHITECTURE AND SYSTEMS - 10EC6GE2DA
(Except TC & IT)

Objectives

- To introduce concepts of Digital signal processing
- Provide Architectural and programming concepts of Texas TMS32054xx processor.
- Implementation of DSP algorithms and Interfacing of DSP to the external peripherals

UNIT I **[10 hours]**

Architectures for Programmable Digital Signal-Processors: Introduction, Basic Architectural Features, DSP Computational Building Blocks, Bus Architecture and Memory, Address Generation Unit, Programmability and Program Execution, Speed Issues, Features for External Interfacing.

UNIT II **[12 hours]**

Programmable Digital Signal Processors: Introduction, Data Addressing Modes of TMS320C54xx Digital Signal Processors, Data Addressing Modes of TMS320C54xx Processors, Program Control, Detail Study of TMS320C54X & 54xx Instructions and Programming, On-Chip peripherals, Interrupts of TMS320C54XX Processors, Pipeline Operation of TMS320C54xx Processor.

UNIT III **[10 hours]**

Implementation of Basic DSP Algorithms: Introduction, The Q-notation, FIR Filters, IIR Filters, Interpolation and Decimation Filters (one example in each case).**Implementation of FFT Algorithms**: Introduction, An FFT Algorithm for DFT Computation, Overflow and Scaling, Bit-Reversed Index Generation & Implementation on the TMS320C54xx.

UNIT IV **[10 hours]**

Interfacing Memory and Parallel I/O Peripherals to DSP Devices: Introduction, Memory Space Organization, External Bus Interfacing Signals. Memory Interface, Parallel I/O Interface, Programmed I/O, Interrupts and I / O Direct Memory Access (DMA).

UNIT V **[10 hours]**

Interfacing And Applications of DSP Processor: Introduction, Synchronous Serial Interface, A CODEC Interface Circuit. DSP Based Bio-telemetry Receiver, A Speech Processing System, An Image Processing System.

TEXT BOOK:

"**Digital Signal Processing**", Avatar Singh and S. Srinivasan, Thomson Learning, 2004.

REFERENCE BOOKS:

1. **Digital Signal Processing**: **A practical approach,** Ifeachor E. C., Jervis B. W Pearson-Education, PHI/ 2002
2. "**Digital Signal Processors**", B Venkataramani and M Bhaskar TMH, 2002
3. "**Architectures for Digital Signal Processing**", Peter Pirsch JohnWeily, 2007

BIOMEDICAL DSP - 10IT6GE2MD (Except ML)

Objective:

Examining the full scope of digital signal processing in the biomedical field, this course provides the basics of digital signal processing as well as programming in MATLAB for designing and implementing digital filers for biomedical application. It provides a set of laboratory experiments that can be done using either an actual analog-to-digital converter , or taking the available data base to process the biomedical signals. The course emphasizes on feature extraction and classification of normal and abnormal features using different modeling techniques.

UNIT I **[10 hours]**

INTRODUCTION TO BIOMEDICAL SIGNALS: The nature of biomedical signals, the action potential, objectives of biomedical signal analysis, Difficulties in biomedical signal analysis, computer aided diagnosis. Basic Electrocardiography, ECG data acquisition, ECG lead system, ECG parameters and their estimation, The use of multi-scale analysis for parameter estimation of ECG waveforms, Arrhythmia analysis monitoring, long term continuous ECG recording, Neurological Signal Analysis The brain and its potentials, The electrophysiological origin of brain waves, The EEG signal and its characteristics, EEG analysis.

UNIT II **[09 hours]**

Cardiological Signal Processing: Adaptive Interference/Noise Cancellation, A review of Wiener filtering problem, Principle of an Adaptive filter, The steepest-descent algorithm, the Widrow-Hoff least mean square adaptive algorithm, Adaptive noise canceller, Cancellation of 60Hz interference in ECG, Canceling Donor-heart interference in Heart-transplant electrocardiography, Cancellation of ECG signal from the electrical activity of the chest muscles, canceling of maternal ECG in fetal ECG, Cancellation of High frequency noise in Electro-surgery.

UNIT III **[06 hours]**

ECG Data Reduction Techniques : Direct data compression techniques, Direct ECG data compression techniques, Transformation compression techniques, Transformation compression techniques, other data compression techniques, Data compression techniques comparison.

UNIT IV **[06 hours]**

LINEAR PREDICTION THEORY : The Autoregressive (AR) method, Recursive estimation of AR parameters, Spectral error measure, Adaptive segmentation, Transient detection and elimination- the case of epileptic patients, overall performance. Sleep EEG. Data acquisition and classification of sleep stages, The Markov model and Markov chains, Dynamics of sleep-wake transitions, Hypnogram model parameters, Event history analysis for modeling sleep.

UNIT V **[08 hours]**

Prony's Method: Exponential modeling, Exponential parameter estimation, The original Prony problem, Least squares Prony method, The covariance method of linear prediction, Prony's method in the presence of noise, clinical application of Prony's method.

Simulation EXPERIMENTS:FIR filter DEsign, iir filter design , implementing Pan Tompkins algorithm, adaptive filters for cancelling different noise in ecg, AR prediction, Time frequency analysis for biomedical signals.

TEXT BOOKS:

1. "**Biomedical Signal Processing Principles and Techniques**", by D C Reddy, The McGraw-Hill publications.
2. "**Biomedical Signal Analysis a case study approaches**", by Rangaraj M. RangayyanThe John Wiley publications

REFERENCE BOOK:

"**Biomedical Digital Signal Processing**", Willis J. Tompkins, The Prentice Hall of India publications.

EMBEDDED SYSTEM DESIGN - 10EE6GE3ED (Only EE & ML)

Objectives:

- Create an environment for the systematic and effective application of scientific principles to the efficient design and operation of computer-based structures, processes and systems.
- Create a setting where students can identify deficiencies or weaknesses in an existing solution and try novel ideas to improve it.
- Indulge the concept where the task of design is fundamental and central.
- Prepare educational materials that have a great deal of content, while at same time teaching students to think and discover for themselves.
- Further enhancement of this subject for students will be in the field of Robotics, navigation, missile, satellite launching, wireless communication, instrumentation controls and defense applications from which students are benefitted to the greater extent and they will be convinced that this subject plays a vital role for the future scope.

UNIT I **[12 hours]**

Concept of embedded system design: Internal Block Diagram, Components, classification, skills required. Embedded Micro controller cores: Features, Architecture and block diagram of Motorola Controller (6808 or 6811).Embedded Memories ROM variants, RAM, Applications of **embedded system**: Examples of Embedded systems, SOC for cellular phones, Smart cards, etc.

UNIT II **[09 hours]**

Technical aspects of Embedded System: Interfacing between analog and digital blocks, Signal conditioning, digital signal processing, DAC & ADC interfacing, various signal conditioning circuits using DSP or Motorola Controller.

UNIT III **[10 hours]**

Interfacing Concepts: Sample & hold, multiplexer interface, Internal ADC interfacing with DSP or Motorola Controller, Data Acquisition System and Signal processing circuits, criteria in the selection of embedded system design, Design challenge, design technology, Software aspects of Embedded Systems.

UNIT IV **[11 hours]**

Software Design: Real time programming Languages, operating systems. Programming concepts and embedded programming in C, Scheduling algorithms such as Round Robin, Round Robin with interrupts, priority, pre-emptive, function queue-scheduling architecture, Real time OS architecture, and selection.

UNIT V **[10 hours]**

Peripheral Interfacing: Introduction to RTOS, Subsystem interfacing with external systems such as, Serial I/O devices, Parallel port interfaces, Input switches, Key boards and Memory interfacing. 10 Hours

TEXT BOOKS:

1. "**Embedded Microcomputer systems**: Real time interfacing"- Valvano, J.W, Brooks/Cole, 2000
2. "**Embedded System, Architecture, Programming and Design**"- Raj Kamal TMH 2003.

REFERENCE BOOKS:

1. "**A Unified Hardware/Software Introduction**"-Frank Vahid/Tony Givargis, Wiley student edition 2002 .
2. Jane W.S., Liu, "**Real time systems**", Pearson Education Asia Pub, 2004.
3. Motorola and Intel Manuals

ELECTRONIC INSTRUMENTATION - 10EE6GE3EI (EE only)

Objective

- The measuring instruments play an important role for any circuit applications. The various types of electrical/mechanical measurements can be done using voltmeters, recorders, transducers, phase meters etc. The subject gives a detail study of various types of measurements needed and the type of instruments needed for the same. This would be useful to students to enhance their knowledge in this field.

UNIT I **[11 hours]**

Electric instruments for measuring basic parameters: Introduction, amplified DC meter, AC voltmeter using rectifiers, electronic multi meter, considerations in choosing an analog voltmeter, Q meter.

UNIT II **[10 hours]**

Strip Chart Recorders, Galvanometer type, Null type, X-Y recorders
Standard Signal Generator, AF sine and square wave generator, function generator, square and pulse generator .(block diagram description)

UNIT III **[11 hours]**

Transducers: classification of transducers, selecting a transducer, potentiometric transducer, LVDT, strain gauges types, Piezo electric transducers, problems.

UNIT IV **[10 hours]**

Field Strength Meter, Stroboscope Phase meter, Direct reading Impedance meter, LC bridge, R-X meter

UNIT V **[10 hours]**

Instrumentation Systems, interfacing transducers to electronic control and measuring systems, multiplexing.

TEXT BOOKS:

1. **Modern Electronic Instrumentation and Measurement Techniques**, Albert.D.Helfrick, William.D.Cooper, 3/e Pearson, PHI.
2. **Electronic Instrumentation**, H.S. Kalsi, TMH.

REFERENCE BOOK:

A course in Electrical and Electronic Measurements and Instrumentation, A.K. Sawhney, 18th Edition, DhanpatRai and Co., New Delhi.

RENEWABLE ENERGY RESOURCES - 10EE6GE3RE

UNIT I **[13 hours]**

Introduction to energy sources, need for non-conventional energy sources

SOLAR ENERGY: Introduction, extra terrestrial and terrestrial solar radiation, Solar Constant, Basic Sun-Earth Angles – definitions and their representation, Solar Radiation Geometry (numerical problems), Estimation of Solar Radiation of Horizontal and Tilted Surfaces (numerical problems); Measurement of Solar Radiation Data – Pyranometer and Pyrheliometer.

SOLAR- ELECTRIC CONVERSION SYSTEM: solar energy collection ,thermal energy

transfer, thermal energy storage, energy conversion Solar Thermal Systems: Solar Water Heaters (Flat Plate Collectors), Solar Cookers – Box type, concentrating dish type, Solar driers, Solar Still, Solar Furnaces, Solar Green Houses.

UNIT II **[07 hours]**

Solar Electric Systems: Solar Thermal Electric Power Generation – Solar Pond and Concentrating Solar Collector (parabolic trough, parabolic dish, Central Tower Collector). Advantages and Disadvantages; Solar Photovoltaic – Solar Cell fundamentals, characteristics, classification, construction of module, panel and array. Photo-voltaic energy storage, Solar PV Systems – stand-alone and grid connected; Applications – Street lighting, Domestic lighting and Solar Water pumping systems. Central receiver systems, the Heliostats, satellite solar power systems.

UNIT III **[09 hours]**

Wind energy: Introduction, principles of wind power, wind turbine operation, site characteristics, variation of power output with wind speed, new developments: small machines, large machines.

UNIT IV **[12 hours]**

Energy from oceans: Introduction, ocean temperature differences, the open or Claude cycle, modification of the open OTEC cycle, the closed or Anderson cycle, OTEC cycle, ocean waves, wave motion, energy and power from waves, wave-energy conversion by floats, high pressure accumulation wave machines, the tides, the simple single-pool tidal system, the modified single-pool tidal system, the two-pool tidal system biofouling, Advantages &Limitation of OTEC.

GEOTHERMAL ENERGY: Introduction, origin and types of geothermal energy, operational and environmental problems, vapor dominated systems, liquid dominated systems, (flashed steam, binary cycle, total flow concept)

UNIT V **[11 hours]**

Energy storage: Energy storage systems, pumped hydro, compressed air storage, energystorage by (i) flywheels (ii) electrical battery (iii) super conducting magnet, (iv) latent heat (v)chemical reaction (vi) thermal sensing.

Emerging Technologies: Fuel Cell, Small Hydro Resources, Magneto Hydro Dynamic Generation, Hydrogen Energy, (Principle of Energy generation using block diagrams, advantages and limitations).

TEXT BOOK:

"**Non-Conventional Sources of Energy**"- 4th Edition, G.D.Rai, Khanna Publishers, New Delhi, 2007

REFERENCE BOOKS:

1. "**Generation of electrical Energy**"-B.R.Gupta-S.Chand& Company Ltd
2. "**Non-Conventional Energy Resources**"- Khan, B. H., TMH, New Delhi, 2006.

REAL TIME EMBEDDED SYSTEMS - 10TC6GE3RT (Except EC)

OBJECTIVE:

The objective of the subject is to introduce the students to the world of Real time systems. Real time system is a term used to indicate a process or a system which will produce response immediately such as, navigation, missile tracking etc. The course starts with an introduction to the real time system and later emphasizes on application and benefits of real time system.

UNIT I **[12 hours]**

Introduction to real time systems: Historical background, RTS Definition, Classification of Real-time Systems, Time constraints, Classification of Programs.**Computer hardware requirements for RTS:** Introduction, General-purpose computer, Single chip microcontroller, specialized processors, Process-related Interfaces, Data transfer techniques.

Concepts of computer control: Introduction, Sequence Control, Loop control, Supervisory control, Centralized computer control, Hierarchical and Distributed system, Human-computer interface, Benefits of computer control systems.

UNIT II **[10 hours]**

Operating systems: Introduction, Real-time multi-tasking OS, Scheduling strategies, Priority Structures, Task management, Scheduler and real-time clock interrupt handles, Memory Management, Code sharing, Resource control, Task co-operation and communication, Mutual exclusion, Data transfer, Liveness, Minimum OS kernel, Examples.

UNIT III **[10 hours]**

Design of RTS: General Introduction: Introduction, Specification documentation, Preliminary design, Single-program approach, Foreground/background, Multi-tasking approach, Mutual exclusion, Monitors.

UNIT IV **[10 hours]**

Design analysis: Introduction, Petri nets, Analysis of Petri Nets, Scheduling problem Real Time Database, Real Time Vs General Purpose Databases, Transaction priorities and Aborts, Concurrency Control, Disk Scheduling Algorithms, Maintaining Serialization Consistency.

UNIT V **[10 hours]**

RTS development methodologies: Introduction, Yourdon Methodology, Ward and Mellor Method, Hatley and Pirbhai Method, MASXOT, PAISLEY System.

TEXT BOOK:

Real - Time Computer Control- An Introduction – Stuart Bennet,, 2nd Edn. Pearson Education. 2005.

REFERENCE BOOKS:

1. **Real-time systems design and analysis** – Phillip. A. Laplante, second edition, PHI, 2005.
2. **Embedded systems** – Raj Kamal, Tata McGraw Hill, India, 2005.

INTRODUCTION TO SPEECH AND AUDIO PROCESSING 10TC6GE3SA (Except EC)

Objective: To introduce the fundamentals of speech signal processing and related applications. This course will present the basic principles of speech analysis and speech synthesis, and it will cover several applications including speech enhancement, speech coding and speech recognition. The course aims to deepen each student's familiarity with the practical application of signal processing in general, through the study of specific instances, and through the experience of the term project.

UNIT I **[07 hours]**

Production and classification of speech sounds: Introduction, mechanism of speech production. Acoustic phonetics: vowels, diphthongs, semivowels, nasals, fricatives, stops and affricates. DSP review.

UNIT II **[08 hours]**

Time-domain methods for speech processing: Time dependent processing of speech, short-time energy and average magnitude, short-time average zero crossing rate, Speech vs. silence detection, pitch period estimation using parallel processing approach, short-time autocorrelation function.

UNIT III **[08 hours]**

Frequency domain methods for speech processing: Introduction, definitions and properties: Fourier transforms interpretation and linear filter interpretation, sampling rates in time and frequency, Filter bank summation and overlap add methods for

short-time synthesis of speech, sinusoidal and harmonic plus noise method of analysis/synthesis.

UNIT IV **[08 hours]**

Linear predictive coding of speech: Basic principles of linear predictive analysis, Solution of LPC equations, Prediction error signal, Frequency domain interpretation, Relation between the various speech parameters, Synthesis of speech from linear predictive parameters, Applications.

UNIT V **[08 hours]**

Audio Processing: Auditory perception and psychoacoustics - Masking, frequency and loudness perception, spatial perception, Digital Audio, Audio Coding - High quality, low-bit-rate audio coding standards, MPEG, AC-3, Multichannel audio - Stereo, 3D binaural and Multichannel surround sound.

TEXT BOOKS:

1. **Digital processing of speech signals** – L. R. Rabiner and R. W. Schafer, Pearson Education Asia, 2004.
2. **Fundamentals of Multimedia** - Z. Li and M.S. Drew, Pearson Education Ltd., 2004.

REFERENCE BOOKS:

1. **Discrete time speech signal processing**– T. F. Quatieri, Pearson Education Asia, 2004.
2. **Speech and audio signal processing: processing and perception of speech and music**– B. Gold and N. Morgan, John Wiley, 2004.

DESIGN OF ANALOG & MIXED MODE VLSI CIRCUITS
10TC6GE3MM (Except EC)

Objective:

This course deals with the analysis and design of analog CMOS integrated circuits, emphasizing fundamentals as well as new paradigms. The objective is to develop both a solid foundation and methods of analyzing circuits by inspection so that the student learns what approximations can be made in which circuits and how much error to expect in each approximation.

UNIT I[10 hours]

Introduction to CMOS analog circuits**Basic MOS Device Physics:** General considerations, MOS I/V Characteristics, second order effects, MOS device models.

UNIT II **[10 hours]**

Single stage Amplifier: CS stage with resistance load, divide connected load, current source load, triode load, CS stage with source degeneration, source follower, common-gate stage, cascade stage, choice of device models. **Differential Amplifiers:** Basic difference pair, common mode response, Differential pair with MOS loads, Gilbert cell.

UNIT III **[10 hours]**

Operational Amplifiers: One Stage OP-Amp. Two Stage OP-Amp, Gain boosting, Common Mode Feedback, Slew rate, PSRR. Compensation of 2stage OP-Amp, Other compensation techniques

UNIT IV **[10 hours]**

Data converter fundamentals: Analog versus Digital Discrete Time Signals, Converting Analog Signals to Data Signals, Sample and Hold Characteristics, DAC Specifications, ADC Specifications, Mixed-Signal Layout Issues.

UNIT V **[12 hours]**

Data Converters Architectures: DAC Architectures, Digital Input Code, Resistors String, R-2R Ladder Networks, ADC Architectures, Flash, 2-Step Flash ADC, Pipeline ADC, Integrating ADC, Successive Approximation ADC.

TEXT BOOKS:

1. **Design of Analog CMOS Integrated Circuits**, B Razavi, First Edition, McGraw Hill,2001
2. **Design, Layout, Stimulation ,**R. Jacob Baker, Harry W Li, David E Boyce, CMOS Circuit, PHI Education, 2005

REFERENCE BOOKS:

CMOS Analog circuit Design Phillip. E. Allen, Douglas R. Holberg, Oxford University Press, 2002

BIOMEDICAL CIRCUITS WITH VLSI
10ML6GE3BC

Objective: This subject gives an overview of VLSI, i.e. basic concepts of physical structure of CMOS integrated circuits and various layers of MOSFET. The working principle and implementation of basic gates, switches, Boolean operations and transmission gates is studied. The DC characteristics and transient response of logic gates will be explored.

UNIT I **[08 hours]**

An Overview of VLSI: Complexity and design. Basic concepts, Physical structure of CMOS integrated circuits: Integrated circuit layers, MOSFETS.

UNIT II **[10 hours]**

Ideal switches and Boolean operation, MOSFETS and switches, Basic logic gates in CMOS, Complex logic gates in CMOS, Transmission gate circuits, CMOS layers, Designing FET array.

UNIT III **[10 hours]**

Electronic analysis of CMOS Logic gates, DC characteristics of the CMOS Inverter, Inverter Switching characteristics, Power dissipation, DC characteristics of NAND and NOR gates, NAND and NOR transient response, Analysis of complex logic gates, Gate design for transient performance.

UNIT IV **[12 hours]**

CMOS Circuits for Biomedical Implantable Devices: Introduction, Inductive Link to Deliver Power to Implants, High Data rate Transmission through Inductive links, Energy and Bandwidth Issues in Multi –Channel Biopotential Recordings. Self-Powered Sensors and circuits for biomechanical Implants: Introduction, Fundamentals of Piezoelectric Transduction and power Delivery. CMOS Circuits for Wireless Medical Applications: Introduction, Spectrum Regulations for Medical use, Integrated Receiver Architecture, Integrated Transmitter Architecture, Radio Architecture selection, System Budget calculations, Low noise Amplifier, Mixers, PolyphaseFilter, PowerAmplifier, PLL.

UNIT V **[12 hours]**

Wireless Integrated Neurochemical and Neuropotential sensing: Introduction, Neurochemical sensing, Neuropotential sensing, RF Telemetry and Power Harvesting in implanted Devices, Multimodal Electrical and Chemical Sensing. Visual cortical

Neuroprosthesis: Introduction, system architecture, prosthesis Exterior Body Unit and wireless link, Body implantable unit, system Prototype. Microneedles: A solid –state interface with the Human body Introduction, Fabrication Methods for Hollow out-of plane microneedles, Applications for microneedles.

TEXT BOOKS:

1. JOHN P. UYEMURA, John Wiley , "**Introduction to VLSI circuits and systems**", Wiley 2001 edition. For Unit:1, 2,3.
2. Krzysztof Iniewski " **VLSI circuits for Biomedical Applications**" Artech House 2008 edition. For Unit 4 and 5.

REFERENCE BOOK:

Douglas A. Pucknell and Kamran Eshranghian, "**Basic VLSI Design**", PHI third edition, 2005.

REHABILITATION ENGINEERING
10ML6GE3RE

Objective: To describe the role of occupational/physical/speech therapy, rehabilitation psychology and the multidisciplinary rehabilitation team in treating disabled patients in acute and chronic care settings. To comprehend rehabilitation framework of disease, functional impairment, activity limitation and barriers to social participation in approaching neurologic problems.

UNIT I **[12 hours]**

Introduction to Rehabilitation & Rehabilitation Team: What is Rehabilitation, Epidemiology of Rehabilitation, Health, Levels of Prevention, Preventive Rehabilitation, Diagnosis of Disability, Functional Diagnosis, Importance of Psychiatry in Functional diagnosis, Impairment disability handicap, Primary & secondary Disabilities, Effects of prolonged inactivity & Bed rest on body system.

Rehabilitation Team: Classification of members, The Role of Physiatrist, Occupational therapist, Physical therapist, Recreation therapist, Prosthetist-Orthotist, Speech pathologist, Rehabilitation nurse, Social worker, Corrective therapist, Psychologist, Music therapist, Dance therapist & Biomedical engineer.

UNIT II **[10 hours]**

Therapeutic Exercise Technique : Co-ordination exercises, Frenkels exercises, Gait analyses-Pathological Gaits, Gait Training, Relaxation exercises-Methods for training

Relaxation, Strengthening exercises-Strength training, Types of Contraction, Mobilisation exercises, Endurance exercises.

UNIT III **[10 hours]**

Principles in Management of Communication : Impairment-introduction to communication, Aphasia, Types of aphasia, Treatment of aphasic patient, Augmentative communication-general form of communication, types of visual aids, Hearing aids, Types of conventional hearing aid, Writing aids.

UNIT IV **[10 hours]**

Orthotic Devices in Rehabilitation Engineering : General orthotics, Classification of orthotics-functional & regional, General principles of Orthosis, Biomechanics of orthoses, merits & demerits of orthotics, Material design consideration in orthotics, Calipers-FO, AFO, KAFO, HKAFO. Spinal Orthosis, Cervical, Head cervical thoracic orthosis, Thoraco lumbar sacral orthosis, Lumbosacroorthosis, Splints-its functions & types.

UNIT V **[10 hours]**

Prosthetic Devices : Introduction, Partial Foot Prostheses- Foot-ankle assembly, Trans femoral Prostheses – Knee unit, Axis system, Friction Mechanisms, Extension aid, Stabilizers, Socket. Disarticulation Prostheses-Knee Disarticulation Prostheses, Hip Disarticulation Prostheses.

TEXT BOOK:

Rehabilitation Medicine By Dr. S. Sunder (Jaypee medical publications, New Delhi) Physical Rehabilitation by Susan B O'Sullivan, Thomas J Schmitz. 5th edition

ADAPTIVE SIGNAL PROCESSING
10EC6GE3SP

Objectives

- To introduce the concept of adaptive signal processing.
- Understand adaptive signal processing algorithms for some applications, like adaptive noise cancellation, interference canceling, etc.

UNIT I **[10 hours]**

Adaptive Systems: Definition and characteristics, Areas of application, General properties, Open-and closed-loop adaptation, Applications of closed-loop adaptation,

Example of an adaptive system. The Adaptive Linear Combiner: General description, Input signal and weight vectors, Desired response and error, the performance function, gradient and minimum mean-square error, Example of a performance surface, Alternative expression of the gradient, Decorrelation of error and input components.

UNIT II **[10 hours]**

Properties Of The Quadratic Performance Surface: Normal of the input correlation matrix, Eigen values and Eigen vectors of the input correlation matrix, an example with two weights, geometrical significance of eigenvectors and Eigen values, a second example.

UNIT III **[10 hours]**

Searching The Performance Surface: Methods of searching the performance surface, Basic ideal of gradient search methods, a simple gradient search algorithm and its solution, Stability and rate of convergence, the learning curve,Gradient search by Newton's method in multidimensional space, Gradient search by the method of steepest descent, Comparison of learning curves.

UNIT IV **[12 hours]**

Gradient Estimation And Its Effects On Adaptation: Gradient component estimation by derivate measurement, the performance penalty, Derivative measurement and performance penalties with multiple weights, variance of the gradient estimate, effects on the weight-over solution, excess mean-square error and time constants, mis adjustment, comparative performance of Newton's and steepest-descent methods, Total mis adjustment and other practical considerations. The LMS Algorithm: Derivation of the LMS algorithm, convergence of the weight vector, an example of convergence, learning curve, noise in the weight-vector solution, misadjustment, performance.

UNIT V **[10 hours]**

APPLICATIONS: Adaptive modeling of multipath communication channel, Adaptive modeling in FIR digital filter synthesis. The concept of adaptive noise canceling, stationary noise-canceling solutions, the adaptive interference canceller as a notch filter, multiple-reference noise canceling.

TEXT BOOKS:

1. **Adaptive Signal Processing**, Bernard Widrow and Samuel D. Stearns, Pearson Education Asia, 2001.

REFERENCE BOOKS:

1. **Adaptive filter Theory**, Simon Haykin, 4e, Pearson Education Asia, 2002
2. **Theory and Design of Adaptive Filters**, Jophn R. Treichler C. Richard Johnson, Jr. and Michael G. Larimore, Pearson education / PHI 2002.

IMAGE PROCESSING CONCEPTS
10EC6GE3IP (Except ML)

Objectives

- To provide basic theory and algorithms widely used in digital image processing
- Understand present technologies, issues.
- Understand basic Image Transform Techniques

UNIT I **[10 hours]**

Digital Image Fundamentals: Introduction , Image Sampling, Quantization , resolution, representation ,Human visual system , Classification of Digital Images, Image types, Elements of an Image processing system, Image file formats, Applications of Digital Image Processing.

UNIT II **[12 hours]**

Image Enhancement: Image Enhancement in Spatial domain, Some Basic Gray Level Trans -formations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations Basics of Spatial Filtering Image enhancement in the Frequency Domain filters, Smoothing Frequency Domain filters, Sharpening Frequency Domain filters, homomorphic filtering.

UNIT III **[08 hours]**

IMAGE RESTORATION AND RECONSTRUCTION: Model of image degradation/ restoration process, noise models, Restoration in the Presence of Noise, Only-Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear Position-Invariant Degradations, inverse filtering, minimum mean square error (Weiner) Filtering.

UNIT IV **[10 hours]**

COLOUR - IMAGE PROCESSING: Introduction ,Light and color, color formation, Human perception of color, Color models , Pseudo- Color image Processing, The chromaticity diagram, Color Image Quantization, histogram of color Image, Color Transforms, Smoothing and Sharpening , Noise in color Images, Color image Compression, Segmentation.

UNIT V **[12 hours]**

Image Transforms : Introduction, need for transforms, orthogonal & unitary transforms, properties of unitary transforms, Importance of Phase, Fourier transform, Two-dimensional Discrete Fourier transform , Walsh Transform, Hadamard Transform,

Haar Transform Slant Transform, DCT, K-L Transform, Comparison of different Image Transforms.

TEXT BOOK:

1. "**Digital Image Processing**", Rafael C. Gonzalez and Richard E. Woods, Pearson Education, 2009, 3rd edition.
2. "**Fundamentals of Digital Image Processing**", Anil K. Jain, Pearson Edun, 2001.

REFERENCE BOOKS:

"**Digital Image Processing**", S. Jayaraman, S Esakkirajan and T Veerakumar McGraw Hill , 2009

ROBOTICS - 10IT6GE3RB

UNIT I **[07 hours]**

Introduction Objectives, Classification of robots, Major components of robot, definitions: Kinematics, Controls, and actuators. Robot history, types and applications current and future with examples. Fixed and flexible automation

UNIT II **[10 hours]**

Robot Arm Kinematics : Introduction, The direct kinematics problem, Rotation Matrices, Composite rotation Matrix, Rotation matrix about arbitrary axis, Rotation matrix with Euler angle representation, Geometric interpretation of rotation matrix, Homogenous coordinates and transformation matrix, Geometric interpretation of Homogenous transformation matrices, Composite homogenous transformation matrices, Links, Joints, and their parameters, The Denavit - Hartenberg representation, Kinematic equation for manipulator, Other specifications of the locations of the end effectors, Inverse kinematics problem.

UNIT III **[08 hours]**

Control of Actuators : Objective, Motivation, Closed loop control in position servo, Effect of friction and gravity, Adaptive control, Optimal control, Computed torque technique, Transfer function of single joint, Position control for single joint, Brief discussion on performance and stability criteria.

UNIT IV **[10 hours]**

Sensors : Sensor characteristics, Position sensors- potentiometers, Encoders, LVDT, Resolvers, Displacement sensor, Velocity sensor- encoders, tachometers, Acceleration sensors, Force and Pressure sensors – piezoelectric, force sensing resistor, Torque sensors, Touch and tactile sensor, Proximity sensors-magnetic, optical, ultrasonic, inductive, capacitive, eddy-current proximity sensors.Hall Effect sensors, Binary sensors, Analog sensors, Force and Torque sensing, Elements of a Wrist sensor.

UNIT V **[10 hours]**

Vision and Processing : Image acquisition, illumination Techniques, imaging geometry, some basic transformations, perspective transformations. Camera model, camera calibration, stereo imaging, Higher-Level Vision: Segmentation, Edge Linking and Boundary detection, Thresholding. Region-oriented segmentation, Use of motion, Description, Boundary descriptors, Regional descriptors.

Mini project: **[7 Hours]**

Discussion on DC motors with gears, Stepper motor, Servo motor ,Mini projects using Basic sensors, 555 timers, Motors (DC motors with gears, Stepper motor, Servo motor)

A batch of TWO students are required to undertake a mini project to showcase the knowledge acquired during the course of this study.

Example topics :

1. Line follower robot
2. Obstacle avoiding robot
3. Face reorganization algorithm
4. MATLAB simulation or Use of robo sim
5. PCB design workshop (Using PCB design software)

Note: Carrying out small models / prototypes of projects are mandated which will carry a 20 percent weight in CIE

Project report has to be submitted with following chapters followed by a presentation

1. Abstract
2. Introduction
3. Block diagram
4. Materials used with detailed specification
5. Design and Design issues in detail
6. Model testing

TEXT BOOKS:

1. **"Robotics – control, sensing, Vision and Intelligence",** K.S.Fu, R.C.Gonzalez, C.S.G. Lee, McGraw Hill, 1987.
2. **"Robotic Engineering" -** Richard D Klafter, PHI

REFERENCE BOOKS:

1. **"Introduction to Robotics Mechanics and control",** John J. Craig, 2nd Edition, Pearson education, 2003

DIGITAL IMAGE PROCESSING
10IT6GE3DP (Except ML)

OBJECTIVES:

This course provides an understanding of basic concept and methodologies of digital image processing and develops a foundation that can be used as a basis for further study and research in this field.

UNIT I **[08 hours]**

Fundamentals and transforms: Introduction, Fundamental steps in digital image processing (DIP), components of DIP system, A simple image formation model, Image sampling and quantization, Basic relationship between pixels Fourier transforms, Hadamard transform, Discrete cosines transform.

UNIT II **[09 hours]**

Image enhancement: Point processing – Image negatives, Log transformations, Power law transformations, Contrast stretching, Gray level slicing, Bit plane slicing, Histogram equalization, Histogram matching (specification), Image subtraction, Image averaging, Basics of spatial filtering, Smoothing spatial and frequency domain filters Sharpening spatial and frequency domain filters –Homomorphic filtering.

UNIT III **[08 hours]**

Image restoration: Image degradation and restoration models, noise models, restoration using spatial filtering – mean filter, geometric mean filter, harmonic mean filter, median filter, max & min filters, midpoint filter. noise filtering by frequency domain filtering – band reject filter, band pass filter, notch filter, inverse filtering, minimum mean square error (Wiener) filtering.

UNIT IV **[07 hours]**

Image compression: Fundamentals, variable length coding, LZW coding, bit plane coding, constant area coding, run length coding, lossless predictive coding, lossy predictive coding, transform coding, image compression standards :basic, JPEG.

UNIT V **[07 hours]**

Image segmentation: Introduction, thresholding: threshold detection methods, optimal thresholding, multi-spectral thresholding, edge based segmentation: edge image thresholding, border tracing, Hough transform, region-based segmentation: region merging, region splitting, splitting & merging. Matching: matching criteria.

LAB EXPERIMENTS

Simulation and display of an image, negative of an image (Binary & Gray Scale), Implementation of relationships between pixels, Implementation of transformations of an imageContrast stretching of a low contrast image, histogram, and histogram equalization, Display of bit planes of an image, Display of FFT (1-D & 2-D) of an image, Computation of mean, standard deviation and correlation co-efficient of the given images, Implementation of image smoothening filters (Mean and Median filtering of an image), Implementation of image sharpening filters and edge detection using gradient filters, Image compression by DCT, DPCM, HUFFMAN codingImplementation of image restoring techniques, Implementation of image intensity slicing technique for image enhancement, Canny edge detection algorithm.

TEXT BOOKS:

1. "**Digital Image Processing** "Rafael C. Gonzalez & Richard E. Woods, Second Edition. Pearson Education Inc.
2. "**Image Processing, analysis and machine Vision**", Milan Sonka, Vaclav Hlavac& Roger Boyle.

REFERENCE BOOK:

"**Fundamentals of Digital Image Processing**", Anil K. Jain, 2nd Edition, Prentice Hall of India.

BMS COLLEGE OF ENGINEERING, BANGALORE
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HIGH VOLTAGE ENGINEERING
11EE7GE4HV

UNIT I **[08 hours]**

BREAKDOWN PHENOMENA: Classification of HV insulating media, Properties of important HV insulating media under each category, Gaseous dielectrics: Ionizations: primary and secondary ionization processes, Criteria for gaseous insulation breakdown based on Townsend's theory, Limitations of Townsend's theory, Streamer's theory of breakdown in non-uniform fields, Corona discharges, Breakdown in electro negative gasses, Paschen's law and its significance, Time lags of Breakdown.

UNIT II **[08 hours]**

GENERATION OF HV AC AND DC VOLTAGE: HV AC-HV transformer, Need for cascade connection and working of transformers units connected in cascade, Series resonant circuit- principle of operation and advantages, Tesla coil.HV DC voltage doubler circuit, cock croft- Walton type high voltage DC set, Calculation of high voltage regulation, ripple and optimum number of stages for minimum voltage drop.

UNIT III **[07 hours]**

GENERATION OF IMPULSE VOLTAGE AND CURRENT: Introduction to standard lightning and switching impulse voltages, Analysis of single stage impulse generator-expression for output impulse voltage, Multistage impulse generator, working of Marx impulse, Rating of impulse generator, Components of multistage impulse generator, Triggering of impulse generator by three electrode gap arrangement, Triggering gap and oscillograph time sweep circuits, Generation of switching impulse voltage, Generation of high impulse current.

UNIT IV **[08 hours]**

MEASUREMENT OF HIGH VOLTAGES: Electrostatic voltmeter-principle, construction and limitation. Chubb and Fortescue method for HV AC measurement, Generating voltmeter- principle, Construction, Standard sphere gap measurements of HV AC, HV DC, and impulse voltages; Factors affecting the measurements.

UNIT V **[08 hours]**

NON-DESTRUCTIVE INSULATION TESTING TECHNIQUES: Dielectric loss and loss angle measurements using Schering Bridge. Need for discharge detection and PD measurements aspects. Factor affecting the discharge detection, Discharge detection methods- straight and balanced methods,High voltage tests on Electrical Apparatus**:**

Definitions of terminologies, tests on isolators, circuit breakers, cables insulators and transformers.

Lab Experiments:

1. Estimation of breakdown of transformer oil.(Evaluation of K & n from the equation $v=kd^n$)
2. Measurement of HVAC using Spheregap (temperature pressure and humidity correction)
3. Measurement of HVAC using (a) point plane (b) plane-plane breakdown (Temperature, pressure and humidity correction)
4. Measurement of HVDC using sphere-sphere(Temperature, pressure and humidity correction)
5. Measurement of HVDC using (a) point plane (b) plane-plane breakdown (Temperature, pressure and humidity correction)
6. Electrolytic tank: Calculation for E(Electric field intensity) and capacitance C for the following configurations. (a) plane-plane (b) concentric cable model, drawing and analysis of equi-potential lines.
7. Tests on the following insulating materials in plate and sheet/thin film form. (a)Delrin (b)HDPE (c)Acrylic (d)PVC (e)Teflon (f)Polycarbonate (g)Bakelite (h)Polypropylene (i)Cast nylon (j)Polythelene & thinfilms/sheets & plates etc.

TEXT BOOKS:

1. High Voltage Engineering Fundamentals- E.Kuffel and W.S. Zaengi-2nd edition, Elsevier press, 2005
2. High Voltage Engineering- M.S.Naidu and Kamaraju- 3rd Edition, THM, 2007.
3. High Voltage Engineering- C.L.Wadhwa, New Age International Private limited, 1995.

REFERENCE BOOKS:

1. Extra High Voltage AC Transmission Engineering- Rakosh Das Begamudre, Wiley Eastern limited, 1987.
2. Transmission and Distribution Reference Book-Westing House.
3. High Voltage Technology-L.L.Alston- BSB Publication, 2007

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POWER SYSTEM OPERATION AND CONTROL
11EE7GE4PS

UNIT I **[12 hours]**

Power system Control And operating states, digital computer configuration, automatic generation control, area control error, Automatic load frequency control, Automatic load frequency control of single area systems, Speed governing systems Hydraulic valve actuator, Turbine generator response, Static performance of speed governor, Closing of ALFC loop, Concept of Control Area, Static response of primary ALFC loop.

UNIT II **[10 hours]**

ALFC of multi-area systems (POOL operation), the two-area system, modeling of the tie-line, Block diagram representation of Two-Area Systems, Static response of two area system and Tie line Bias Control, Automatic Voltage regulator: Basic generator control loops, Cross-coupling between control loops, Exciter types, Exciter modeling, Generator modeling, Static performance of AVR loop

UNIT III **[10 hours]**

Control of voltage and reactive power: Introduction, Generation and Absorption of reactive power, Relation between voltage, power and reactive power at a node, single machine infinite bus systems, methods of voltage control, sub synchronous resonance, voltage stability, voltage collapse, Overview of Economic Operation of Power systems without losses.

UNIT IV **[10 hours]**

Unit Commitment: Statement of the unit commitment problem, need and importance of unit commitment, Constraints in unit commitment, Unit commitment solution methods- Priority lists method, Forward Dynamic Programming method, Spinning reserve.Power system security: Introduction, factors affecting power system security, an overview of security analysis, linear sensitivity factors, AC power flow methods, contingency evaluation, techniques for contingency evaluation

UNIT V **[05 hours]**

System monitoring and control: Introduction, Energy Management systems, the basis of power system state estimation (PSSE), mathematical description of PSSE process, minimization technique for PSSE, Least square estimation, Error and detection in PSSE, System security and emergency control.

TEXT BOOKS:

1. **Modern Power System Analysis-** I J Nagarath and D P Kothari, TMH, 3rd Edition, 2003
2. **Electrical Energy Systems Theory**, O.J Elgerd, TMH,2008.
3. **Power generation, operation and control**- Allen J Wood & Woollenberg. John Wiley and Sons, Second Edition, 2009.
4. **Electric Power Systems-** B.M.Weedy and B.J. Cory, Wiley student edition, 19995.
5. **Computer Aided Power System Operation and Analysis-** R.N. Dhar, Tata McGraw-Hill, 1987.

REFERENCE BOOKS:

1. **Computer Aided Power System Analysis-** G.L.Kusic, PHI,2010.
2. **Power System Analysis, Operation and Control,** Abhijit Chakrabarti and Sunita Halder, PHI, Second Edition, 2009

INDUSTRIAL DRIVES &APPLICATIONS
11EE7GE4ID

Objective

With the increase in the demand for power electronics devices, the use of power electronics, in drive circuits have increased. DC & AC motors can be controlled using highly compact power electronics circuits. This subject is versatile and can be useful to all students of the electrical cluster stream.

UNIT I **[08 hours]**

AN INTRODUCTION TO ELECTRICAL DRIVES & ITS DYNAMICS: Electrical drives. Advantages of electrical drives, Parts of electrical drives, choice of electrical drives, status of dc and ac drives, Dynamics of electrical drives, Fundamental torque equation, speed torque conventions and multiquadrant operation. Equivalent values of drive parameters, components of low torques, nature and classification of load torques, calculation of time and energy loss in transient operations, steady state stability, load equalization.

UNIT II **[10 hours]**

SELECTION OF MOTOR POWER RATING: Thermal model of motor for heating and cooling, Classes of motor duty, determination of motor rating. **INDUSTRIAL DRIVES**: Rolling mill drives, cement mill drives, paper mill dries and textile mill drives.

UNIT III **[12 hours]**

D C MOTOR DRIVES: (a) Starting braking, transient analysis, single phase fully controlled rectifier, control of dc separately excited motor, Single-phase half controlled rectifier control of dc separately excited motor.**(b)** Three phase fully controlled rectifier control of dc separately excited motor, three phase half controlled controlled rectifier control of dc separately excited motor, multiquadrant operation of dc separately excited motor fed form fully controlled rectifier. Rectifier control of dc series motor, chopper controlled dc drives, chopper chopper control of separately excited dc motor. Chopper control of series motor.

UNIT IV **[12 hours]**

INDUCTION MOTOR DRIVES:

(a) Operation with unbalanced source voltage and single phasing, operation with unbalanced rotor impedances, analysis of induction motor fed from non-sinusoidal voltage supply, starting braking, transient analysis.

(b) Stator voltage control variable voltage frequency control from voltage sources, voltage source inverter control, closed loop control, current source inverter control, current regulated voltage source inverter control, rotor resistance control, slip power recovery, speed control of single phase induction motors.

UNIT V **[10 hours]**

SYNCHRONOUS MOTOR DRIVES: Operation form faced frequency supply, synchronous motor variable speed drives, and variable frequency control of multiple synchronous motors. Self-controlled synchronous motor drive employing load commutated thruster inverter.

TEXT BOOK:

Fundamentals of Electrical Drives, G.K Dubey, Narosa publishing house, 2nd Edition,2002.

REFERENCE BOOKS:

1. **Electrical Drives**, N.K De and P.K. Sen- PHI, 2009.
2. **A First Course On Electric Drives**, S.K Pillai-Wiley Eastern Ltd 1990.

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LOW POWER MICROCONTROLLER
11TC7GE4MC

Objectives

- To discuss the key features and benefits of MSP 430 microcontroller.
- To discuss the low power operation capabilities of the device
- To discuss the various integrated peripherals
- To discuss the development tools and its use in Real Time Embedded Applications

UNIT I **[08 hours]**

Introduction - Motivation for MSP430microcontrollers – Low Power embedded systems Main characteristics of a MSP430 microcontroller, Address space, Interrupt vector table, Flash/ROM, Information memory (Flash devices only), Boot memory (Flash devices only), RAM, Peripheral Modules, Special Function Registers (SFRs), Central Processing Unit (MSP430 CPU), Arithmetic Logic Unit (ALU), MSP430 CPU registers, Central Processing Unit (MSP430X CPU), Main features of the MSP430X CPU architecture, MSP430X CPU registers.

UNIT II **[08 hours]**

Addressing modes & **Instruction set**- Double operand instructions, Single operand instructions, Program flow control – Jumps, Emulated instructions and programming.

UNIT III **[08 hours]**

On-Chip Peripherals: Hardware Multiplier, analog-to-digital Converters, An ADC Example, LCD Driver System reset, System clocks, Interrupt management, Types of interrupts, Watchdog timer (WDT and WDT+), Supervisory Voltage System (SVS).

UNIT IV **[08 hours]**

General Purpose I/O- Registers, Flashing LED, Blinking the LED, Blinking the LED half the speed, toggle the LED state by pressing the push button, Enable / disable LED blinking by push button, Timers Introduction: Basic Timer 1, Capture/Compare blocks, Timer_A Interrupts, Timer_B special features

UNIT V **[07 hours]**

Low-power Design & Case Studies of applications of MSP430**:** MSP430 power consumption characteristics, MSP430 low-power modes, Periodic Interrupts and Low-

Power Design, Interrupts and Low-Power Design, LCD Controller Introduction, LCD_A Controller Operation, Data Acquisition Introduction

Lab Experiments

Basic debug introduction using CCE MSP430-EXP430FG4618 Flashing LEDez430-F2013 Flashing LEDMemory clock with Basic Timer 1 LCD message DisplaySample Temperature using SAR ADC10 Voltage ramp generatorData Memory transfer triggered by software Multiplication without hardware multiplier Flash memory programming with the CPU executing the code from flash memory.

REFERENCE BOOKS:

1. John H Davies, MSP430 Microcontroller Basics, Newnes Publications, 2008
2. Teaching MSP430, CD provided by Texas Instruments
3. Chris Nagy, Embedded systems Design using TI MSP430 Series, Newnes Publications, 2003

INTRODUCTION TO MULTIMEDIA CONCEPTS
11TC7GE4MM
(PREREQUISITE: AUDIO/IMAGE PROCESSING USING)

OBJECTIVE:

The objective of the subject is to introduce the students to the world of multimedia. Multimedia is a term used to indicate multiple medium of communication i.e. Text, Audio, Image and Video. The course starts with an introduction to all the media and later emphasizes on their respective processing which includes various compression standards.

UNIT I **[07 hours]**

FUNDAMENTALS OF MULTIMEDIA COMMUNICATIONS: Introduction, multimedia information representation, multimedia networks: telephone networks, data networks, broadcast television networks, ISDNs, broadband multiservice networks, multimedia applications: interpersonal communications, interactive applications over internet, entertainment applications.

UNIT II **[08 hours]**

MULTIMEDIA INFORMATION REPRESENTATION & MULTIMEDIA NETWORKS: Media types, communication modes, network types, multipoint conferencing: centralized, decentralized and hybrid modes, network QoS, basic digital principles for multimedia.

Introduction to networks in multimedia domain, Local Area Networks, concept of Ethernet, Token ring, brief overview of Bridges.

UNIT III **[08 hours]**

TEXT REPRESENTATION AND COMPRESSION: Text representation, Unformatted text, Formatted text, Hypertext, Introduction to compression techniques in multimedia, Text compression principles, Entropy encoding, Source encoding, Transform encoding, Text compression principles: Static Huffman coding ,Arithmetic coding, Basics of LZW coding, Brief overview of other text compression standards.

UNIT IV **[08 hours]**

IMAGE REPRESENTATION AND COMPRESSION: IMAGE: Image representation: Graphics, Digitized documents, Digitized Pictures, Raster scan principles, Three color image capture methods, Image compression principles, Image compression techniques: Graphics Interchange Format, JPEG: Image Preparation, Block Preparation, DCT, Quantization, Entropy encoding, Frame builder, Basics of JPEG decoder, Introduction to TIFF and JPEG 2000.

UNIT V **[08 hours]**

AUDIO AND VIDEO COMPRESSION: Introduction to audio compression, PCM Speech, CD quality audio, Synthesized audio, MIDI, Brief overview of various audio compression standards.

Introduction to Video compression: Broadcast TV, Color signals, Luminance and Chrominance, Signal bandwidth, digital video: 4:2:2 format, 4:2:0 format, HDTV format, Video compression techniques: H.261, Introduction to MPEG and Brief overview of other MPEG standards.

LAB EXPERIMENTS AND MINI PROJECT : The students are expected to develop a mini project using the idea of multimedia communication.

TEXT BOOK:

Multimedia Communications: Applications, Networks, Protocols, and Standards – Fred Halsall, Pearson Education, Second Indian reprint 2002.

REFERENCE BOOK:

Data Compression: The Complete Reference – David Salomon, Springer, Fourth Edition, 2007.

SOFTWARE DEFINED RADIO
11TC7GE4SR

OBJECTIVE:

This subject knowledge is helpful because in today's radio communication system where components that have been typically implemented in hardware such as mixers, filters, amplifiers, modulators/demodulators, detectors, etc. are instead implemented by means of software on a personal computer or embedded computing devices.

UNIT I **[10 hours]**

Introduction Software Based Radio, A Multi-Dimensional Model Sets the Stage, What is Software Based Radio , Software Defined Radio and Software Radio , Adaptive Intelligent Software Radio and Other Definitions , Functionality, Capability and SBR Evolution , Architectural Perspectives for a Software Based Radio , The Radio Implementer plane , The Network Operator plane, Software Radio Concepts , Adoption Timeframes for Software Based Radio, Realization of Software Based Radio Requires New Technology , Power/Performance/Price Limitations of Handsets Dictates Inflexible Networks, Regulatory Concepts Facilitate SBR Introduction

UNIT II **[12 hours]**

Radio Frequency Translation for Software Defined Radio Requirements and Specifications, Transmitter Specifications , Receiver Specifications, Operating Frequency Bands ,Receiver Design Considerations , Basic Considerations , Receiver Architectures, Dynamic Range Issues and Calculation , Adjacent Channel Power Ratio (ACPR) and Noise Power Ratio (NPR), Receiver Signal Budget, Image Rejection, Filter Functions within the Receiver , Transmitter Design Considerations, Filtering Analogies between Receiver and Transmitter ,Transmitter Architectures, Transmitter Efficiency and Linearity ,Candidate Architectures for SDR, Zero IF Receivers, Quadrature Local Oscillator, Variable Preselect Filters, Low IF Receivers

UNIT III **[10 hours]**

Radio Frequency Front End Implementations for Multimode SDRs Evolution of Radio Systems , Evolution of RF Front Ends – Superheterodyne Architecture , The AN2/6 Product Family – Dual Band, Six Mode , The AN2/6 Architecture , Lessons Learned From the AN2/6 , Alternative RF Front End Architectures , Direct Conversion RF Front Ends , Pure Digital RF Front Ends , Analog Digital Combination Solutions , Directions for a Completely Successful SDR RF Front End

UNIT IV **[10 hours]**

Data Conversion in Software Defined Radios The Importance of Data Converters in Software Defined Radios, ADCs for SDR Base Stations , ADCs for SDR Handsets, DACs for SDR Applications, Converter Architectures ,Flash Converters, Multistage Converters, Sigma-Delta Converters, Digital-to-Analog Converters, Converter Performance Impact on SDR, Noise Sources – Impact on SDR Sensitivity, SNR of Data Converter , Spurious Impact on Performance , Digital-to-Analog Converter Specification

UNIT V **[10 hours]**

The Digital Front End: Bridge Between RF and Baseband Processing The Front End of a Digital Transceiver, Signal Characteristics , Implementation Issues , The Digital Front End , Functionalities of the Digital Front End , The Digital Front End in Mobile Terminals and Base Stations , Digital Up- and Down-Conversion , Initial Thoughts , Theoretical Aspects , Implementation Aspects , The CORDIC Algorithm , Digital Down-Conversion with the CORDIC Algorithm , Digital Down-Conversion by Subsampling , Channel Filtering , Low-Pass Filtering after Digital Down-Conversion , Band-Pass Filtering before Digital Down-Conversion, Filterbank Channelizers , Sample Rate Conversion , Resampling after Reconstruction , Rational Factor SRC , Integer Factor SRC ,Concepts for SRC ,Systems for SRC ,Example ,Design Parameters ,Digital Down-Conversion ,Sample Rate Conversion , Channel Filtering

Mini Project: At the end of the course students are expected to submit a miniproject on SDR implementation using Matlab /C/ LabVIEW /FPGA/DSP Processor/ARM Processor

TEXT BOOK:

Software Defined Radio: Dr Walter Tuttlebee, Wiley

REFERENCE BOOKS:

1. Bruce Fett, 'Congitive Radio Technology', Newnes
2. 'Huseyin Arslan, 'Congitive radio, software defined radio and adaptive wireless systems', Springer

SATELLITE COMMUNICATION - 11TC7GE4SC

Objective:

To study the different components of the satellite communication system such as attitude and orbit control, TT&C, communication, antennas. To know the development of Indian space programmes.

UNIT I **[11 hours]**

OVER VIEW OF SATELLITE SYSTEMS: Introduction, frequency allocation, INTEL Sat, India in space. ORBITS: Kepler laws, orbital elements, orbit perturbations, inclined orbits, calendars, orbital plane and sun synchronous orbits, Geostationary orbit: antenna look angles, limits of visibility, earth eclipse of satellite, sun transit outage, launching orbits.

UNIT II **[11 hours]**

PROPAGATION IMPAIRMENTS AND SPACE LINK: Introduction, atmospheric loss, ionospheric effects, rain attenuation, other impairments.SPACE LINK**:** Introduction, EIRP, transmission losses, link power budget, system noise, CNR, uplink, down link, effects of rain, combined CNR

UNIT III **[10 hours]**

SPACE SEGMENT: Introduction, Power supply units, Attitude control, Station keeping, Thermal control, Telemetry tracking and command, Transponders, Antenna subsystem

UNIT IV **[10 hours]**

SATELLITE ACCESS: Pre-assigned FDMA, SCPC (spade system), TDMA, pre-assigned TDMA, demand assigned TDMA, down link analysis, comparison of uplink power requirements for TDMA & FDMA, On board signal processing, satellite switched TDMA.

UNIT V **[10 hours]**

SATELLITE SERVICES: DBS, orbital spacing, orbital spacing, power ratio, frequency and polarization, transponder capacity, bit rates for digital TV, satellite mobile services, VSAT, RadarSat, GPS, orbcomm

TEXT BOOK:

Satellite Communications, Dennis Roddy, 4th Edition, McGraw-Hill International edition, 2006.

REFERENCE BOOKS:

1. **Satellite Communications**, Timothy Pratt, Charles Bostian and Jeremy Allnutt, 2nd Edition, John Wiley & Sons, 2003.
2. **Satellite Communication Systems Engineering**, W. L. Pitchand, H. L. Suyderhoud, R. A. Nelson, 2nd Ed., Pearson Education., 2007.
3. **Satellite Communication Systems Engineering-**Louis J. Ippolito Jr, Wiley Publishers.

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(Autonomous College under VTU)

MEDICAL IMAGING SYSTEMS - 11IT7GE4MI (Except ML)

Objective:

The course focuses in the area of Therauptic instruments . The evolution of ultrasonic medical imaging, computerized tomography & NMR Scanners are introduced in the syllabus to provide an inner depth to theses diagnostic equipments / instruments.

*development of prototype

*Applying this knowledge in the design of smart sensors with portable equipment.

UNIT I **[10 hours]**

X-RAYS: Interaction between X-Rays and matter, Intensity of an X-Ray, Attenuation, X-Ray Generation and Generators, Beam Restrictors and Grids, Intensifying screens, fluorescent screens and Image intensifiers.

UNIT II **[09 hours]**

COMPUTED TOMOGRAPHY: Conventional tomography, Computed tomography principle, Projection function Generations of CT machines, Electron beam CT, Reconstruction algorithms, Helical CT.

UNIT III **[09 hours]**

ULTRASOUND IMAGING: Acoustic propagation, Attenuation, Absorption and Scattering, Ultrasonic transducers, Arrays, A mode, B mode, M mode scanners, Tissue characterization, Color Doppler flow imaging.

UNIT IV **[11 hours]**

MAGNETIC RESONANCE IMAGING: Angular momentum, Magnetic dipole moment, Magnetization, Larmor frequency, Rotating frame of reference, Free induction decay, Relaxation times, Pulse sequences. Introduction to functional MRI.

UNIT V **[13 hours]**

THERMAL IMAGING: Medical thermography, Infrared detectors, Thermographic equipment, Pyroelectric vidicon camera. **07 Hrs**

RADIONUCLIDE IMAGING: Interaction of nuclear particles and matter, Nuclear sources, Radionuclide generators, Nuclear radiation detectors, Rectilinear scanner, scintillation camera, SPECT, PET. **06 Hrs**

TEXT BOOKS:

1. **Principles of Medical Imaging**- Kirk shung, Academic Press.
2. **Handbook of Biomedical Instrumentation**- Khandpur, Tata McGraw-Hill Publishing Company Ltd., 2nd Edition, 2003.

REFERENCE BOOKS:

1. **Medical Imaging Signals and Systems**- Jerry L Prince and Jonathan M Links, Prentice Hall of India/Pearson Education.
2. **Fundamentals of medical Imaging**- Zhong Hicho and Manbir singh, John Wiley.

HOSPITAL MANAGEMENT SYSTEMS - 11ML7GE4HM

Objective: Human Resource Management is a management function concerned with hiring motivating & maintaining people in an organization. It focuses on people in an organization. It helps in manager recruitment, selection, and training. It aims at developing these members for an organization.

UNIT I **[08 hours]**

Introduction to data base management systems: Managing data, A Historical perspective, File systems versus a DBMS: Advantages, Describing and Storing data, Queries, Transaction management, Structure. People who work with databases, Artificial Intelligence in Medicine, The Structure of Medical Informatics.

UNIT II **[12 hours]**

Hospital Information System: Introduction, HMIS: Need, Benefits, Capabilities, Development, Functional areas. Modules forming HMIS, HMIS and Internet, Pre-requisites for HMIS, PACS, why HMIS fails, health information system, disaster management plans, advantages of HMIS, Security of computer records, The HELP System, Sources of Data for Decision –Making, Modes of Decision Output to physician

UNIT III **[12 hours]**

Computerized Patient Data Base Management: Introduction, History-taking by computer, Dialogue with the computer, Methods of history taking by computers, Patient data base management by computers Computerized medical record –Evolution. Computers in Clinical Laboratory: Introduction, Data base approach to Laboratory Computerization, Automated Clinical Laboratories, Automated Methods in Hematology,

Chromosome Analysis by computer, Computerized Electrocardiography (ECG), Assessment of performance of ECG computer programs, Computerized Electroencephalography, Computerized Electromyography.

UNIT IV **[10 hours]**

Computer-Assisted Medical Decision- Making: Introduction, General Model of CMD, Algorithmic Methods, Statistical pattern classification, Decision Analysis, Fuzzy set theory, Production Rule Systems, Cognitive Models, Internist, QMR, KES, A rule based decision aid for TIA.

UNIT V **[10 hours]**

Computers in the care of Critically Ill Patients: Automated computer Assisted Fluid and Metabolic balance, Pulmonary Function Evaluation, Cardiovascular Physiologic Evaluation. Computer-Assisted Therapy: Introduction, Digitalis Therapy, Evaluation of Patient response, Assessing Digitalis Toxicity, Computers for care of renal disorders, Computer based cancer Chemotherapy protocol advisor- ONCOCIN, Automated Drug delivery, Electromyogenic Controlled Limbs. Computer Aids for the Handicapped**:** Introduction, Mobility, Blind and Visually Handicapped, Computer aids for the deaf, computer speech generation and recognition.

TEXT BOOKS:

1. Data base Management systems (Third Edition)— Raghu Ramakrishna and Johannes Gehrke, McGraw-Hill, 2003
2. Computers in Medicine— R.D. LELE- Tata McGraw-Hill.
3. Medical Informatics: A Primer by Mohan Bansal, TMH publications

PHYSIOLOGICAL CONTROL SYSTEMS
11ML7GE4PC

Objective: This course will help the students to gain a better understanding of how the principles of control theory, systems analysis, and model identification are used in physiological regulation. It also emphasizes the concepts of classical control theory and its application to physiological systems, and contemporary topics and methodologies shaping bioengineering research today.

UNIT I **[12 hours]**

INTRODUCTION & MATHEMATICAL MODELING: History & Preliminaries, Fundamental concept, PCS an example. Generalized system properties, Models with combination of system elements, Linear models, parameter models, Linear systems, transfer functions, Computer analysis & simulation – Matlab & Simulink

UNIT II **[09 hours]**

STATIC ANALYSIS OF PHYSIOLOGICAL SYSTEMS: Introduction, open loop Vs closed loop, determination of steady state operating point, steady state analysis using Simulink, regulation of cardiac output, regulation of glucose, chemical regulation of ventilation.

UNIT III **[09 hours]**

TIME DOMAIN ANALYSIS OF LINEAR CONTROL SYSTEMS: Linearized respiratory mechanics, open & closed loop responses, Impulse & step response descriptors, transient response analysis using Matlab, SIMULINK applications.

UNIT IV **[10 hours]**

FREQUENCY DOMAIN ANALYSIS OF LINEAR CONTROL SYSTEMS: Steady state response, frequency response & analysis, frequency response model of a circulatory control, frequency response of glucose insulin regulation.

UNIT V **[12 hours]**

STABILITY ANALYSIS – LINEAR APPROACHES: Stability & transient responses, Root locus plots, Routhhurwitz stability criterion, Nyquist stability for stability, Relative stability, Stability analysis of pupillary light reflexes, Model of chynestokes breathing

TEXT BOOK:

'Physiological Control Systems – Analysis, Simulation & Estimation', by Michael C Khoo, Wiley IEEE press

REFERENCE BOOK:

1. 'Applications of control theory to physiological systems', Milhorn
2. 'Biological control system analysis', J H Milsum
3. 'Biological Engineering Principles', David C Cooney

WIRELESS COMMUNICATION - 11EC7GE4WC (Except TC)

Objectives

- This course introduces the student to the concepts of cellular communication.
- To enable the students to understand the various modulation techniques, propagation methods, coding and multiple access techniques used in wireless communication.
- Study the second generation digital cellular networks in detail.

UNIT I **[08 hours]**

Introduction: Application and requirements of wireless services, History, types of services, requirements for services, Economical and social aspects. Spectrum limitations, limited energy, user mobility.

UNIT II **[12 hours]**

The Cellular concept: System design fundamentals: Frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, Trunking and Grade of service, Improving coverage and capacity in cellular system.

UNIT III **[12 hours]**

Mobile radio propagation: Large scale path loss – Introduction to Radio wave propagation, free space propagation model, relating power to electric field, Reflection, Ground Reflection model, Diffraction, Scattering.Small scale fading- small-scale multipath propagation, Impulse response model of a multipath channel, small scale multipath measurements, Parameters of mobile multipath channels, Types of small scale fading.

UNIT IV **[10 hours]**

Equalization and Diversity: Fundamentals of Equalization, Training a Generic Adaptive Equalizer, Equalizers in communication receiver, Survey of Equalization Techniques, Linear and non-linear equalization, Algorithms for Adaptive Equalization, Fractionally Spaced equalizers, Diversity techniques, RAKE receivers.

UNIT V **[10 hours]**

Global System for Mobile communication: System overview, The air interface, Logical and physical channels, synchronization, coding , circuit switched data transmission, Establishing a communication and handoff, Services and billing.

TEXT BOOKS:

1. **Wireless Communication**- Andreas F Molish, Wiley Student, Second Edition (Units 1&5)
2. **Wireless Communication- Principles and Practice**, Theodre S Rappaport, Second Edition (Units 2, 3&4)

EMBEDDED SYSTEM DESIGN - 11EC7GE4ES

Objectives

- Introduce to features that build an embedded system.
- To understand the interaction of the various components within embedded system and the techniques of interfacing between processors & peripheral device related to embedded processing.
- To understand the basic concepts of systems programming like operating system, assembler compliers etc and the management task needed for developing embedded system.

UNIT I **[10 hours]**

Introduction to Embedded System: Introduction to functional building blocks of embedded systems – Register, memory devices, ports, timer, and interrupt controllers using circuit block diagram representationfor each category.

UNIT II **[08 hours]**

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

UNIT III **[10 hours]**

Devices & Buses for Devices Network: I/O devices, timer & counting devices; serial communication using I2C, CAN, USB buses; parallel communication using ISA, PCI, PCI/X buses, arm bus; interfacing with devices/ports, device drivers in a system – Serial port & parallel port.

UNIT IV **[12 hours]**

I/O Programming Schedule Mechanism: Intel I/O instruction – Transfer rate, latency; interrupt driven I/O - Non-maskable interrupts; software interrupts, writing interrupt service routine in C & assembly languages; preventing interrupt overrun; disability interrupts.Multi threaded programming – Context switching, premature & non-premature multitasking,semaphores.Scheduling – Thread states, pending threads, context switching, round robin scheduling, priority based scheduling, assigning priorities, deadlock, watch dog timers.

UNIT V **[12 hours]**

Real Time Operating System (RTOS): Introduction to basic concepts of RTOS, Basics of real time & embedded system operating systems, RTOS – Interrupt handling, task scheduling; embedded system design issues in system development process – Action plan, use of target system, emulator, use of software tools

TEXT BOOKS:

1. Rajkamal, **'Embedded System – Architecture, Programming, Des**ign', Tata McGraw Hill, 2003.
2. Daniel W. Lewis '**Fundamentals of Embedded Software'**, Prentice Hall of India, 2004.

REFERENCE BOOK:

1 David E. Simon, '**An Embedded Software Primer'**, Pearson Education, 2004.
2 Frank Vahid '**Embedded System Design – A Unified hardware & Software Introduction**' John Wiley, 2002.
3 Sriram V. Iyer, Pankaj Gupte, '**Embedded Real Time Systems Programming'**, Tata McGrawHill,2004.
4 Steve Heath, **'Embedded System Design'**, II edition, Elsevier, 2003

DISTRIBUTED COMPUTING - 11IT7GE4DC

OBJECTIVES:

This course is designed to provide clear understanding of fundamental concept and design principles that underlie a distributed computing system.

UNIT I **[10 hours]**

INTRODUCTION: Scope, goals, motivation, historical development, architectural models, design issues. **NETWORKS & PROTOCOLS:** Computer network principles, local network technologies, protocols for distributed systems, asynchronous transfer mode network.

UNIT II **[10 hours]**

REMOTE PROCEDURE CALLING: Introduction, characteristics of remote procedure calling, interface definitions, binding, the RPC software, and implementation of RPC with lightweight process.

UNIT III **[11 hours]**

SYNCHRONIZATION IN DISTRIBUTED SYSTEMS: Clock synchronization, mutual exclusion, election Algorithm, dead lock in distributed systems. **PROCESS AND PROCESSOR IN DISTRIBUTED SYSTEMS:** Threads, processor allocation, scheduling.

UNIT IV **[11 hours]**

DISTRIBUTED DATABASES: Division of responsibilities, file service, access control, directory service, and implementation.

STRUCTURED DISTRIBUTED DATABASES: Overview of client server, architecture, data fragmentation, replication and allocation techniques over processing.

UNIT V **[10 hours]**

CASE STUDY: Introduction, locus, sun network file system, Cambridge file server, Ameba, mach, Apollo domain.

TEXT BOOKS:

1. **"Modern Operating Systems ",** A S Tanenbaum PHI 1996
2. **"Distributed systems, concepts and design ",** George F Coulounis & Jeon dollimose

REFERENCE BOOK:

1. **"Distributed computing systems, synchronization, control and communication ",** Parkar & Venis J P; Academic press 1983
2. **"Distributed data base principles and systems",** Ceri S & Pelagatt, Mc-Graw Hill 1984
3. **"Distributed operating systems",** Pradeep K Sinha —PHI 1998.

Low Power VLSI design - 11EC7GE5LP

Objectives

Low Power technology is the most needed technology of modern electronics. This course enables the student to understand the design challenges of low power techniques and its impact on low power technology.

UNIT I **[08 hours]**

Introduction to Low power CMOS design: Need for Low Power VLSI chips, charging and discharging capacitance, Short circuit current in CMOS circuit, CMOS leakage current, Static current, Basic Principles of low power design, Low power figure of merit.

UNIT II **[12 hours]**

Power Analysis: Simulation Power Analysis: Spice circuit simulation, Discrete transistor modeling, Gate level logic simulation, architecture level analysis, Monte-Carlo simulation, Probabilistic Power analysis: Random Logic signals, Probability and frequency, Probabilistic power analysis techniques, Signal entropy.

UNIT III **[10 hours]**

Low power circuit techniques: Power consumption in circuits, Flip-flops and latches, logic, high capacitance nodes.

UNIT IV **[10 hours]**

Energy recovery in CMOS: A look at practical details, retractile logic, reversible pipelines, High performance approaches.

UNIT V **[12 hours]**

Clock distribution and logic synthesis for low power: Low power Clock distribution: Power dissipation in clock distribution, single driver Vs distributed buffers, Process variations in buffer and device sizing, Low power logic synthesis: Power estimation techniques, power minimization techniques.

TEXT BOOKS:

1. **Practical Low Power Digital VLSI design, Gary Yeap**, Kluwer academic publishers, 1998.
2. **Low Power design Methodologies ,** Jan M Rabaey, Massoud Pedram, Kluwer academic publishers, 2002.

REFERENCE BOOK:

1. **Low Power CMOS VLSI circuit design**, Kaushik Roy, Sharat C Prasad, Wiley Interscience publication, 2000.
2. **Low Power Design in deep submicron Electronics**, W. Nebel, J. Mermet, Kluwer academic publishers, 1997.

NETWORK SECURITY - 11EC7GE5NS

Objective

- This course focuses on communication security in computer systems and networks and aims at providing students with a comprehensive introduction to the field of network security and services that are most essential for secure communication over the net.

UNIT I **[12 hours]**

Services, Mechanisms and Attacks, The OSI security Architecture, A model for network security. Symmetric Ciphers: Symmetric Cipher model, Substitution techniques, Transposition technique, Simplified DES, Data encryption Standard, The strength of DES, Differential and linear cryptanalysis, Block cipher design principles and modes of operation.

UNIT II **[10 hours]**

Introduction to finite fields- Groups ,rings and fields, modular arithmetic, Euclid's Algorithm, Finite fields of the form GF(p), Polynomial arithmetic, Finite Fields of the form GF(2^n). Prime numbers, Fermat's and Euler's Theorems, Testing for primarily, the Chinese Remainder Theorem, and Discrete logarithms.

UNIT III **[10 hours]**

Principles of Public key cryptosystems, The RSA algorithm, Key Management, Diffe-Hellman Key exchange, Elliptic Curve Arithmetic, Authentication functions, Digital signatures, Digital signature standard.

UNIT IV **[10 hours]**

Electronic Mail Security- Pretty Good Privacy, S/MIME Web security- Secure Electronic Transaction.

UNIT V **[10 hours]**

Intruders, Intruder detection, Password management, Viruses and related threats. Firewalls Design Principles, Trusted systems.

TEXT BOOK:

1. **Cryptography and Network Security**-Principles and Practice:William Stallings, Third Edition.

REFERENCE BOOKS:

1. **Fundamentals of Network Security**-Eric Maiwald, 2009 Edition, Information Security Series
2. **Network Security-Private Communication in a public World**:Charlie Kaufman, Radia Perlman, Mike Speciner, Second Edition

BMS COLLEGE OF ENGINEERING, BANGALORE
(Autonomous College under VTU)

MULTIMEDIA COMMUNICATION - 11EC7GE5MM

Objective

- To provide students with the theoretical and applicative knowledge (concepts, principles, algorithms and standards) concerning the representation and transmission of multimedia signals over communications networks.
- Multimedia data transmission over ATM, LAN and mobile networks.
- Multimedia data synchronization for transmission.

UNIT I **[08 hours]**

Multimedia communications: Introduction, multimedia information representation, multimedia networks, multimedia applications, media types, communication modes, network types, multipoint conferencing, network QoS, application QoS.

UNIT II **[08 hours]**

Multimedia information representation: Introduction, digital principles, text, images, audio, video.

UNIT III **[12 hours]**

Text and image compression: Introduction, compression principles, text compression, image compression, JPEG 2000

UNIT IV **[14 hours]**

Audio and video compression: Introduction, audio compression, DPCM, ADPCM, APC, LPC, video compression, video compression principles, H.261, H.263, MPEG, MPEG-1, MPEG-2, and MPEG-4.

UNIT V **[10 hours]**

Synchronization: notion of synchronization, presentation requirements, reference model for synchronization, Introduction to SMIL, Multimedia operating systems, Resource management, process management techniques

TEXT BOOKS:

1.Fred Halsall, ¯**Multimedia Communications** , Pearson education, 2001 (unit 1-4)

2. K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic, ¯**Multimedia Communication Systems** , Pearson education, 2004 (unit 5)

REFERENCE BOOK:

Pallapa Venkataram, ¯**Multimedia Information Systems**", Pearson education (In Press), 2005

EMC –EMI - 11TC7GE5EM

Objective:

To study the effect of radiation in the increasingly wireless world and to arrive at ways of handling electromagnetic compatibility and interference.

UNIT I **[11 hours]**

BASIC CONCEPTS: Definition of EMC, EMI with examples, SMPS, UPS, Classification of EMC/EMI- CE,RE,CS,RS, Units of parameters, Sources of EMI, EMI coupling modes-CM,DM,ESD phenomena and effects, Transient phenomena and suppression

UNIT II **[11 hours]**

EMI MEASUREMENTS : Basic principles of RE,CE, RS, CS measurements, EMI measuring instruments-Antennas, LISN, feed through capacitor, current probe, EMC analyzer, and detection technique, open area site, shielded anechoic chamber, TEM cell

UNIT III **[10 hours]**

EMC STANDARD AND REGULATIONS: National and international standardizing organizations,-FCC, CE, and RE standards, frequency assignment-spectrum conversation

UNIT IV **[10 hours]**

EMI CONTROL METHODS AND FIXES: Shielding, grounding, bonding, filtering, EMI gasket, isolation transformer, optical isolator

UNIT V **[10 hours]**

EMC DESIGN AND INTERCONNETION TECHNIQUES: Cable routing and connection, component selection and mounting, PCB design-Trace routing, impedance control, decoupling, zoning and grounding

TEXT BOOK:

1. Prasad Kodali.V - Engineering Electromagnetic Compatibility - S.Chand&Co - New Delhi - 2000
2. Clayton R.Paul - Introduction to Electromagnetic compatibility - Wiley & Sons - 1992

REFERENCE BOOKS:

1. Keiser - Principles of Electromagnetic Compatibility - Artech House - 3rd Edition - 1994
2. Donwhite Consultant Incorporate - Handbook of EMI / EMC - Vol I - 1985

COMPUTER COMMUNICATION AND NETWORKING
11ES7GE5CN (Except EC)

Objective:·

- To understand the state-of-the-art in network protocols, architectures, and applications.
- To understand network functional components and their interaction.

UNIT I **[10 hours]**

INTRODUCTION: Uses of computer networks, Data communication, Circuit Switching, Packet Switching, Network Models, Example Networks, Network standardization. Theoretical basics of data communication, Layered tasks, OSI Model, Layers in OSI model, Functions, TCP/IP Suite, Addressing.

UNIT II **[12 hours]**

DATA LINK CONTROL: Framing, Flow and error control, Protocols, Noiseless channels: Simplest protocol, Stop and wait protocol, Noisy channels: Stop and wait protocol ARQ, piggy backing, Go-Back-N ARQ, sliding window protocol, Selective repeat ARQ, HDLC, Point to point protocol. **Multiple accesses control**: Random Access: ALOHA, CSMA, CSMA/CD, CSMA/CA, **Controlled access**: Reservation, Polling, and Token passing

UNIT III **[10 hours]**

MEDIUM ACCESS SUB LAYER: Static and dynamic channel allocation, multiple access protocols, LAN/MAN technology, Bus/Tree, Star and Ring topologies, The ring topology, Medium access control protocols, MAC performance, LAN/MAN standards, IEEE 802.2, 802.3, 802.4, IEEE802.5, 802.6, 802.11, and 802.16, Blue tooth

UNIT IV **[10 hours]**

NETWORK LAYER: Unicast Routing Protocols, Multicast Routing protocols, Logical addressing, Ipv4, Ipv6 format & addressing, Transition from Ipv4 to Ipv6, Delivery, Forwarding,

UNIT V **[10 hours]**

TRANSPORT LAYER: Transport layer Process to process Delivery, UDP, TCP, SCTP, Congestion, Congestion Control, Examples, QOS, and Techniques to improve QOS. **APPLICATION LAYER**: Client Server Model, Domain Name Space (DNS), Electronic mail, HTTP, world wide web (www)

TEXT BOOK:

1. Data communication and networking**–** Behrouz A. Forouzan**,** 4th Ed, TMH 2006.2. William Stallings, Data and Computer Communications, Fifth edition, PHI, 1998.3. Computer networks **–** Andrew. S. Tannenbaum

REFERENCE BOOKS:

1. Data communication and networking**– Behrouz** A. Forouzan**,** 3rd Ed, TMH 2006

ASIC Design - 11TC7GE5AD (Except EC)

Objective:

The course deals with the study of the hardware structure, synthesis methods, design methodology and design flow from the application to ASIC chip.

UNIT I **[10 hours]**

Introduction to ASICs Types of ASICs**:—** Full Custom with ASIC, Standard Cell based ASIC, Gate array based ASIC, Channeled gate array, Channel less gate array, structured gate array, Programmable logic device, Field programmable gate array. Design flow, ASIC cell libraries

UNIT II **[10 hours]**

CMOS LOGIC Data path Logic Cells**: -** Data Path Elements, Adders, Multiplier. I/O cell, Cell Compilers **ASIC LIBRARY DESIGN** Logical effort: - practicing delay, logical area and logical efficiency logical paths, multi stage cells, optimum delay, optimum no. of stages, library cell design.

UNIT III **[11 hours]**

PROGRAMMABLE ASICS The Antifuse, static RAM, EPROM and EEPROM Technology.Programmable ASIC logic cells

UNIT IV **[11 hours]**

Programmable ASIC I/O cells, Programmable ASIC interconnect.

UNIT V **[10 hours]**

Low-level Design Entry: Schematic Entry: -Hierarchical design. The cell library, Names, Schematic Icons & Symbols, Nets, schematic entry for ASICs, connections, vectored instances and buses, Edit in place, attributes, Netlist screener, Back annotation.

TEXT BOOK:

M.J.S .Smith, - "**Application - Specific Integrated Circuits**" – Pearson Education, 2003

REFERENCE BOOKS:

1. Jose E.France, Yannis Tsividis, "**Design of Analog-Digital VLSI Circuits for Telecommunication and Signal Processing**", Prentice Hall, 1994.
2. Malcolm R.Haskard; Lan. C. May, "**Analog VLSI Design - NMOS and CMOS**" Prentice Hall, 1998.
3. Mohammed Ismail and Terri Fiez, "**Analog VLSI Signal and Information Processing"**, McGraw Hill, 1994.

ELECTRICAL MACHINE DESIGN & DRAWING
11EE7GE5MD

Objective:-

- To study the design of Electrical Machines as per ISI specifications emphasizing on the materials used along with the design of motors.
- To prepare the design drawings using AUTOCAD software.

UNIT I **[07 hours]**

Principles of Electrical Machine Design:Introduction, considerations for the design of electrical machines, design factors, limitations, different types of materials & insulators used in electrical machines.

UNIT II **[08 hours]**

Design of transformers (Single phase and three phase): Output equation for single phase and three phase transformer, choice of specific loadings, expression for volts/turn, determination of main dimensions of the core, estimation of number of turns and cross sectional area of Primary and secondary coil, estimation of no load current.

UNIT III **[08 hours]**

Design of DC Machines: Output equation, choice of specific loadings and choice of number of poles, design of Main dimensions of the DC machines, Design of armature slot dimensions, commutators and brushes**. In**troduction, types of motors, output equation, choice of specific loadings.

UNIT IV **[08 hours]**

Design of Three Phase Induction Motor: Output equation, choice of specific loadings, main dimensions of three phase induction motor, stator winding design, choice of length of the air gap, General methodology of rotor design, design of slip ring induction motor, Estimation of no load current of Induction motor.

UNIT V **[08 hours]**

Design of Synchronous Machines: Output equation, choice of specific loadings, short circuit ratio, Design of main dimensions, armature slots and windings, slot details for the stator of salient and non salient pole synchronous machine, dimensions of the pole body.

COMPUTER AIDED ELECTRICAL DRAWING

1. Study of CAD graphics package
2. Exercises on Computer aided Electrical drawing
   a) Computer Aided Drawing of Single line diagram of a typical substation
   b) Computer aided drawing of simplex single layer lap and weave DC and AC armature windings
   c) Computer aided drawing of half sectional views of single phase core and shell type transformer
   d) Simple sectional views of alternators and induction motors of different types

TEXT BOOKS:

1. A.K.Sawhney, A course in electrical machine design, Dhanpat Rai & Sons
2. V.N.Mittle, Design of electrical Machines, 4/e edition, Standard Publishers.

REFERENCE BOOKS:

1. M.G.Say, Performance & Design of AC Machines.
2. R.K.Aggarwal, Principles of Electrical Machine Design.

SWITCH MODE POWER SUPPLIES - 11EE7GE5SP

UNIT I **[10 hours]**

INTRODUCTION TO DC-DC SWITCHED MODE CONVERTERS: Basic Topologies, Buck, boost, buck-boost, and Cuk converters.

UNIT II **[08 hours]**

FULL BRIDGE DC-DC CONVERTER: Detailed theory, working principles, modes of operation, with detailed circuits and wave forms, applications, merits and demerits (Operation of the above converters is CCM mode only)

UNIT III **[10 hours]**

DC-AC SWITCHED MODE INVERTERS: Single-phase inverter, three phase inverters. SPWM inverter, detailed theory, working principles, modes of operation with circuit analysis, applications, merits and demerits, problems based on input output voltage relationship.

UNIT IV **[14 hours]**

RESONANT CONVERTERS: Zero voltage and zero current switching, resonant switch converters, and comparison with hard switching, switching locus diagrams, and working principle. **HIGH FREQUENCY INDUCTOR AND TRANSFORMERS**: Design principles, definitions, comparison with conventional design and problems.(Examples of Inductor and Transformer design for forward and flyback converter)

UNIT V **[10 hours]**

POWER SUPPLIES: Introduction, DC power supplies: fly back converter, forward converter, push-pull converter, half bridge converter, full bridge converter, AC power supplies: switched mode ac power supplies, resonant ac power supplies, bidirectional ac power supplies.

TEXT BOOKS:

1. **Power Electronics-** converters, application & design**-** Mohan N, Undeland T.M., Robins, W.P-John Wiley 1989
2. **Power Electronics-Circuits, Devices,** Applications**-** Rashid M.H.-3rd Edition, Prentice Hall India, 2008.
3. **Power Electronics and A.C. Drives-** Bose B.K.-Prentice Hail 1986.
4. **Digital Power Electronics And Applications-** Muhammad Rashid. first edition, 2005, Elsevier

Embedded system & RTOS
11IT7GE5ES

UNIT I **[10 hours]**

INTRODUCTION: An Embedded System; Characteristics of Embedded Systems; Software embedded into a system; Real Time Definitions, Events and Determinism, Synchronous & Asynchronous Events, Determinism, Sequence Control, Loop control, Supervisory control, Centralized computer control, Hierarchical and Distributed system, Human-computer interface, Benefits of computer control systems.

UNIT II **[10 hours]**

OPERATING SYSTEMS: Introduction, Real-time multi-tasking OS, Scheduling strategies, Priority Structures, Task management, Scheduler and real-time clock interrupt handles, Memory Management, Code sharing, Resource control, Task co-operation and communication, Mutual exclusion, Data transfer, Liveness, Minimum OS kernel, Examples.

UNIT III **[12 hours]**

REAL TIME SPECIFICATIONS AND DESIGN TECHNIQUE: Mathematical specifications, flow charts, structure charts, Finite state automata, data flow diagrams, Petri Nets, Warnier Orr Notation, State charts.**PROCESSOR AND MEMORY ORGANIZATION:** Structural Units in a Processor; Memory Devices, Memory selection for an embedded system; Direct Memory Access, DMA controllers; Interfacing Processor, Memory and I/O Devices.

UNIT IV **[10 hours]**

INTERRUPT SERVICING (HANDLING) MECHANISM: Context and the periods for context switching; Deadline and interrupt latency. Language Features: Parameter passing, Recursion, Dynamic allocation, Typing, exception handling, abstract data typing.**REAL TIME KERNELS:** Real Time and Embedded Operating Systems; Interrupt Routines in RTOS environment; co routines, Interrupt driven systems, Foreground/ background systems, Full-featured Real Time Operating Systems.

UNIT V **[10 hours]**

INTER-PROCESS COMMUNICATION AND SYNCHRONIZATION OF PROCESSES: Multiple processes in an application; Problem of sharing data by multiple tasks and routines; Inter Process Communication, Mailboxes, Critical Regions, Semaphores, Deadlock.**PROGRAMMING LANGUAGES AND TOOLS: DESIRED LANGUAGE CHARACTERISTICS:** Data typing; Control Structures; Packages; Exception Handling; Overloading; Multitasking; Task Scheduling; Timing specification; Programming environments; Runtime support.

Lab Experiments will be conducted using low power Microcontroller MSP 430

TEXT BOOKS:

1. **Embedded Systems Architecture; Programming and Design**-Rajkamal; Tata McGraw Hill Publications.
2. **Real–Time Systems Design and Analysis––**3rd Edition, Phillip A. Laplante. Apr 2004. Wiley-IEEE Press.
3. **Real - Time Computer Control- An Introduction** – Stuart Bennet,, 2nd Edn. Pearson Education. 2005.

REFERENCE BOOKS:

1. **Real Time Systems**- C.M. Krishna, Kang G.Shin McGraw-Hill, 1997.
2. **An Embedded software primer**-David E Simon; Addison Wesley; 2000.
3. **An Introduction to Real Time Systems**-Raymond J.A. Buhr; Donald L. Bailey; Prentice Hall International; 1999.
4. **Embedded Real Time system**-Concepts, Design and Programming, Dr. K. V. K. K. Prasad Dream Tech Pres, New Delhi 2003.

ADVANCED BIOMEDICAL DIGITAL SIGNAL PROCESSING
11ML7GE5SP

Objectives: Understand the concepts of Discrete and continuous Random Variables, Probability Density Function and its types. To be able to understand the various measurement parameters based on signal processing concepts. Such as power spectral analysis on ECG,EMG,EEG signals.

UNIT I **[10 hours]**

INTRODUCTION: Discrete and continuous Random variables, Probability distribution and density functions. Gaussian and Raleigh density functions, Correlation between random variables.Stationary random process, Ergodicity, Power spectral density and autocorrelation function of random processes. Noise power spectral density analysis, Noise bandwidth, noise figure of systems.

UNIT II **[10 hours]**

TIME SERIES ANALYSIS: Introduction to time series analysis, AR, MA and ARMA models, Parameter estimation of ARMA models (Maximum likelihood method), Process order estimation, Adaptive segmentation, autocorrelation measure (ACM) method, spectral error measure(SEM) method.

UNIT III **[08 hours]**

SPECTRAL ANALYSIS: Introduction to spectral analysis, the PSD, Cross – Spectral Density and coherence functions, Linear filtering, the Wiener filter, Cepstral analysis. Homomorphic filtering

UNIT IV **[12 hours]**

SPECTRAL ESTIMATION: Introduction, estimation based on Fourier transform, the expected value of the Periodogram, weighted overlapped segment averaging (WOSA), smoothing of the Periodogram, estimation based on Maximum entropy method (MEM) and the AR method, the Moving average (MA) method, Autoregressive moving average (ARMA) methods, Prony's method, Maximum likely hood method (MLM), comparison of several methods.

UNIT V **[12 hours]**

WAVELETS: Introduction to Wavelets: Multi resolution, Formulation of Wavelet systems, The Scaling Functions, and scaling Coefficients, Wavelet and Wavelet Coefficients, Calculation of the Discrete Wavelet Transform, Wavelet-Based Signal Processing and Applications.

TEXT BOOKS:

1. Biomedical Signal Processing: Time & Frequency Analysis (Vol-1) by Arnon Cohen., CRC Press, 1986.
2. Introduction to Wavelets and Wavelet Transforms, Burrus, Gopinath and Gao, Prentice Hall, 1998.

REFERENCE BOOKS:

1. Biomedical Signal Analysis by Rangaraj M. Rangayyan –. IEEE Press, 2001.
2. Biomedical Signal Processing by MatinAkay, Academic, Press 1994
3. Wavelet Transforms by Raghuveer M. Rao and Ajit S. Bopardikar, Pearson, 1998.

ADVANCED MEDICAL IMAGE PROCESSING
11ML7GE5IP

Objective: The Subject aims to introduce advanced concepts and methodologies for digital image processing and implementing the various techniques of image processing to make the results (output images) more suitable than the original Bio-medical images.

UNIT I **[12 hours]**

MORPHOLOGICAL IMAGE PROCESSING: Preliminaries, Erosion, Dilation, Duality, Opening and Closing, The Hit-or-Miss Transformation, Some Basic Morphological Algorithms, Boundary Extraction, Hole Filling, Extraction of Connected Components, Convex Hull, Thinning, Thickening, Skeletons, Pruning, Morphological Reconstruction, Summary of Morphological Operations of Binary Images, Gray-Scale Morphology, Erosion and Dilation, Opening and Closing, Some Basic Gray-Scale Morphological Algorithms, Gray-Scale Morphological Reconstruction.

UNIT II **[08 hours]**

IMAGE SEGMENTATION: Fundamentals, Point, Line, and Edge Detection, Background, Detection of Isolated Points, Line Detection, Edge Models, Basic Edge Detection, More Advanced Techniques for Edge Detection, Edge Linking and Boundary Detection, Thresholding, Foundation, Basic Global Thresholding, Optimum Global Thresholding Using Otsu's Method, Using Image Smoothing to improve Global Thresholding, Using Edges to improve Global Thresholding, Multiple Thresholds, Variable Thresholding,

Multivariable Thresholding, Region-Based Segmentation, Region Growing, Region Splitting and Merging, Segmentation Using Morphological watersheds, Background, Dam Construction, watershed segmentation Algorithm, The Use of Markers, The Use of Motion in Segmentation, Spatial Techniques, Frequency Domain Techniques.

UNIT III **[10 hours]**

REPRESENTATION AND DESCRIPTION: Representation, Boundary (Border) Following, Chain Codes, Polygonal Approximations Using Minimum-Perimeter Polygons, Other Polygonal Approximation Approaches, Signatures, Boundary Segments, Skeletons, Boundary Descriptors, Shape Numbers, Fourier Descriptors, Statistical Moments, Regional Descriptors, Some Simple Descriptors, Topological Descriptors, Texture, Moment Invariants, Use of Principal Components for Description Relational Descriptors.

UNIT IV **[10 hours]**

OBJECT RECOGNITION: Patterns and Pattern Classes, Recognition Based on Decision-Theoretic Methods, Matching, Optimum Statistical Classifiers, Neural Networks, Structural Methods, Matching Shape Numbers, String Matching.

UNIT V **[12 hours]**

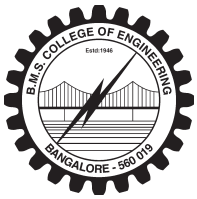
WAVELETS AND MULTIRESOLUTION PROCESSING: Image Pyramids, Sub band Coding, The Haar Transform, Multi resolution Expansions, Series Expansions, Scaling Functions, Wavelet Functions, Wavelet Transforms in One Dimension, The Wavelet Series Expansions, The Discrete Wavelet Transform, The Continuous Wavelet Transform. The Fast Wavelet Transform. Wavelet Transforms in Two Dimensions. Wavelet Packets

TEXT BOOK:

Digital Image Processing by RafaelC. Gonzalez & Richard E. Woods, Third Edition. Pearson Education Inc.

REFERENCE BOOKS:

1. **Digital Image Processing using MATLAB** by RafaelC. Gonzalez & Richard E. Woods, Second Edition.Pearson Education Inc.
2. **Image Processing, Analysis andMachine-Vision** by Milan Sonka,Vaclav Hlavac& Roger Boyle, Second Edition
3. **Digital Image Processing** by S Jayakumaran, S Esakkirajan, T Veerakumar, Tata McGraw Hill Education Private Ltd.



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(ಸ್ವಾಯತ್ತ ವಿದ್ಯಾ ಸಂಸ್ಥೆ)

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TELECOMMUNICATION ENGINEERING

BMS COLLEGE OF ENGINEERING, BANGALORE

(Autonomous College under VTU)

Bull Temple Road, Bangalore - 560 019

Table of Contents

Contents	Page No.
Scheme Semesters III –VIII	2 – 7
Cluster Electives Scheme	8 – 12
Course Summary	13
Syllabus - III Semester	14 – 21
Syllabus - IV Semester	22 – 29
Syllabus - V Semester	30 – 37
Syllabus - VI Semester	37 – 43
Syllabus - VII Semester	43 – 47
Syllabus - VIII Semester	48 – 50
Syllabus - Group I Cluster Elective	51 – 57
Syllabus - Group II Cluster Elective	57 – 69
Syllabus - Group III Cluster Elective	70 – 86
Syllabus - Group IV Cluster Elective	87 – 105
Syllabus - Group V Cluster Elective	106 – 118