Semester -I

Code	Subject	Cr	Hrs. /Week			Exam Hrs.	Maximum Marks				
			L	T	P		MS1	MS2	END TERM	IA	Total
Theory											
101	Engineering Mathematics-I	3	3	1	0	3	10	10	60	20	100
102	Engineering Physics	3	3	1	0	3	10	10	60	20	100
103	Communication Skills	3	3	1	0	3	10	10	60	20	100
104	Programming For Problem Solving	3	4	1	0	3	10	10	60	20	100
105	Basic Electrical Engineering	3	3	1	0	3	10	10	60	20	100

Practicals & Sessionals

Code	Subject	Cr	Hrs. /Week			Exam Hrs.	IA (60%)		EA (40%)	Total
			L	T	P		MP1 30%	MP2 30%		
106	Engineering Physics Lab	2	0	0	2	2	30	30	40	100
106	Language Lab	2	0	0	2	2	30	30	40	100
108	Computer Programming Lab	2	0	0	2	2	30	30	40	100
109	Basic Electrical Lab	2	0	0	2	2	30	30	40	100
110	Computer Aided Engg.Graphics	2	0	0	3	3	30	30	40	100
	Grand Total	**26**	**18**	**6**	**11**					**1000**

Semester-II

Code	Subject	Cr	Hrs. /Week			Exam Hrs.	Maximum Marks				
			L	T	P		MS1	MS2	END TERM	IA	Total
Theory											
201	Engineering Mathematics-II	3	3	1	0	3	10	10	60	20	100
202	Engineering Chemistry	3	3	1	0	3	10	10	60	20	100
203	Human Values	3	4	1	0	3	10	10	60	20	100
204	Basic M4BTECE-01anical Engineering	3	3	1	0	3	10	10	60	20	100
205	Basic Civil Engineering	2	2	1	0	3	10	10	60	20	100
Practicals & Sessionals											
Code	Subject	Cr	Hrs. /Week			Exam Hrs.	IA (60%)		EA (40%)	Total	
			L	T	P		MP1 30%	MP2 30%			
206	Engineering Chemistry Lab	2	0	0	2	2	30	30	40	100	
206	Human Values Activities	2	0	0	2	2	30	30	40	100	
208	Manufacturing Practice Workshop	2	0	0	2	2	30	30	40	100	
209	Basic Civil Engineering Lab	2	0	0	3	3	30	30	40	100	
210	Computer Aided Machine Drawing	2	0	0	2	2	30	30	40	100	
	Grand Total	**26**	**18**	**06**	**11**					**1000**	

Semester -III

Code	Subject	Credit	Hrs. /Week			Exam Hrs.	Maximum Marks				
			L	T	P		MT1	MT2	End Term	TA	Total
Theory subjects											
3BTECE01	Engineering Mathematics-III	3	3	0	0	3	10	10	60	20	100
3BTECE02	Analog Electronics	3	3	1	0	3	10	10	60	20	100
3BTECE03	Digital Electronics and Logic Design	3	3	1	0	3	10	10	60	20	100
3BTECE04	Network Analysis and Synthesis	3	3	1	0	3	10	10	60	20	100
3BTECE05	Communication Theory	3	3	1	0	3	10	10	60	20	100
3BTECE06	Data Structure and Algorithm	3	3	0	0	3	10	10	60	20	100
Practical laboratory courses											
Code	**Subject**	**Credit**	**Hrs. /Week**			**Exam Hrs.**	**Maximum Marks**				
			L	**T**	**P**		**MP1**	**MP2**	**End Term**	**Viva**	**Total**
3BTECE06	Analog Electronics Lab	2	0	0	2	3	30	30	30	10	100
3BTECE08	Digital Electronics Lab	2	0	0	2	3	30	30	30	10	100
3BTECE09	Circuit Design & Simulation lab	2	0	0	2	3	30	30	30	10	100
3BTECE10	Data Structure and Algorithm Lab	2	0	0	2	3	30	30	30	10	100
	Grand Total	**26**	**18**	**4**	**8**						**1000**

Semester -IV

Code	Subject	Credit	Hrs. /Week			Exam Hrs.	Maximum Marks				
			L	T	P		MT1	MT2	End Term	TA	Total
Theory subjects											
4BTECE01	Linear Integrated Circuits	3	3	0	0	3	10	10	60	20	100
4BTECE02	Electronic Switching Circuits	3	3	1	0	3	10	10	60	20	100
4BTECE03	Analog Communication Systems	3	3	0	0	3	10	10	60	20	100
4BTECE04	VLSI & MEMS t4BTECE-01nology	3	3	1	0	3	10	10	60	20	100
4BTECE05	Electronic Measurement & Instrumentation	3	3	1	0	3	10	10	60	20	100
4BTECE06	Reliability and Quality Management	3	3	1	0	3	10	10	60	20	100
Practical laboratory courses											
Code	**Subject**	**Credit**	**Hrs. /Week**			**Exam Hrs.**	**Maximum Marks**				
			L	**T**	**P**		**MP1**	**MP2**	**End Term**	**Viva**	**Total**
4BTECE07	Linear Integrated Circuits Lab	2	0	0	2	3	30	30	30	10	100
4BTECE08	Analog Communication Lab	2	0	0	2	3	30	30	30	10	100
4BTECE09	Electronic Measurement and Instrumentation Lab	2	0	0	2	3	30	30	30	10	100
	Grand Total	**26**	**18**	**4**	**8**						**900**

Semester -V

Code	Subject	Credit	Hrs. /Week			Exam Hrs.	Maximum Marks				
			L	T	P		MT1	MT2	End Term	TA	Total
Theory subjects											
5BTECE01	Microprocessor Theory and Applications	3	3	1	0	3	10	10	60	20	100
5BTECE02	Digital Communication and Systems	3	3	1	0	3	10	10	60	20	100
5BTECE03	Antenna & Wave propagation	3	3	1	0	3	10	10	60	20	100
5BTECE04	Electronics Device Modeling	3	3	0	0	3	10	10	60	20	100
5BTECE05	Control System	3	3	1	0	3	10	10	60	20	100
5BTECE06	Open Elective-I	3	3	1	0	3	10	10	60	20	100
Practical laboratory courses											
Code	**Subject**	**Credit**	**Hrs. /Week**			**Exam Hrs.**	**Maximum Marks**				
			L	**T**	**P**		**MP1**	**MP2**	**End Term**	**Viva**	**Total**
5BTECE07	Digital Communication Lab	2	0	0	2	3	30	30	30	10	100
5BTECE08	Electronics Device Modeling Lab	2	0	0	2	3	30	30	30	10	100
5BTECE09	Microprocessor Lab	2	0	0	2	3	30	30	30	10	100
	Grand Total	**26**	**18**	**4**	**8**						**900**

Semester -VI

Code	Subject	Credit	Hrs. /Week			Exam Hrs.	Maximum Marks				
			L	T	P		MT1	MT2	End Term	TA	Total
Theory subjects											
6BTECE01	Microcontroller & Embedded Systems	3	3	1	0	3	10	10	60	20	100
6BTECE02	Wireless Communication	3	3	1	0	3	10	10	60	20	100
6BTECE03	Digital Signal Processing	3	3	1	0	3	10	10	60	20	100
6BTECE04	Analog & Digital VLSI Design	3	3	0	0	3	10	10	60	20	100
6BTECE05	Open Elective-II	3	3	1	0	3	10	10	60	20	100
6BTECE06	HDL Based Design	3	3	0	0	3	10	10	60	20	100
Practical laboratory courses											
Code	**Subject**	**Credit**	**Hrs. /Week**			**Exam Hrs.**	**Maximum Marks**				
			L	**T**	**P**		**MP1**	**MP2**	**End Term**	**Viva**	**Total**
6BTECE07	VLSI & MEMS Lab	2	0	0	2	3	30	30	30	10	100
6BTECE08	Microcontroller & Embedded Lab	2	0	0	2	3	30	30	30	10	100
6BTECE09	Digital Signal Processing Lab	2	0	0	2	3	30	30	30	10	100
6BTECE10	Seminar	2	0	0	2	3	30	30	30	10	100
	Grand Total	**26**	**18**	**4**	**8**						**1000**

Semester –VII

Code	Subject	Hrs. /Week			Exam Hrs.	Maximum Marks				
		L	T	P		MT1	MT2	End Term	TA	Total
7BTECE01	Engineering Economics & Management	3	1	0	3	10	10	60	20	100
7BTECE02	Optical Communication Systems	3	1	0	3	10	10	60	20	100
7BTECE03	Industrial Electronics	3	1	0	3	10	10	60	20	100
7BTECE04	Elective-I	3	0	0	3	10	10	60	20	100
7BTECE05	Elective-II	3	0	0	3	10	10	60	20	100
Code	**Subject**	**Hrs. /Week**			**Exam Hrs.**	**Maximum Marks**				
		L	**T**	**P**		**MP1**	**MP2**	**End Term**	**Viva**	**Total**
7BTECE06	Project-I	0	0	2	3	30	30	30	10	100
7BTECE07	Optical Communication Systems Lab	0	0	2	3	30	30	30	10	100
7BTECE08	Industrial Electronics Lab	0	0	2	3	30	30	60	10	100
7BTECE09	Industrial Training Viva	0	0	2	3	30	30	60	10	100
	Grand Total	**18**	**4**	**8**						**900**

Semester -VIII

Code	Subject	Credit	Hrs. /Week			Exam Hrs.	Maximum Marks				
			L	T	P		MT1	MT2	End Term	TA	Total
Theory subjects											
8BTECE01	Microwave Devices & Systems	3	3	1	0	3	20	20	60	10	100
8BTECE02	Spread Spectrum & CDMA	3	3	1	0	3	20	20	60	10	100
8BTECE03	Data Communication & ComputerNetworks	3	3	1	0	3	20	20	60	10	100
8BTECE04	Elective-III	3	3	0	0	3	20	20	60	10	100
8BTECE05	Elective-IV	3	3	0	0	3	20	20	60	10	100
Practical laboratory courses											

Code	Subject	Credit	Hrs. /Week			Exam Hrs.	Maximum Marks				
			L	T	P		MP1	MP2	End Term	Viva	Total
8BTECE06	Microwave Devices & Systems Lab	2	0	0	2	3	30	30	30	10	100
8BTECE07	Communication & Network Simulation Lab	2	0	0	2	3	30	30	30	10	100
8BTECE08	Project-II	2	0	0	2	3	0	0	200	100	300
	Grand Total	**26**	**18**	**4**	**8**						**1000**

Elective-I:

ECE-414 (a) Satellite Communication ECE-414 (b) T.V. and Display T4BTECE-01nologyECE-414 (c) Biomedical Electronics
ECE-414 (d) Signal and Systems ECE-414 (e) Mobile Communication
ECE-414 (f) Telecommunication Management

Elective-II:

ECE-415 (a) MEMS & Sensor DesignECE-415 (b) FPGA & SoC Design ECE-415 (c)RF IC Design
ECE-415 (d) Advanced IC DesignECE-415 (e) HDL Based Design

Elective -III:

ECE-424 (a) Optical Networks
ECE-424 (b) Wireless Sensor Networks
ECE-424 (c) Signal processing for Image and VideoECE-424 (d) Error Control & Coding
ECE-424 (e) Radar & Navigational Aids

Elective -IV:

ECE-425 (a) Low Power VLSI Design T4BTECE-01niquesECE-425 (b) VLSI Interconnects & Packaging ECE-425 (c) NanoElectronics
ECE-425 (d) CAD of Integrated Circuits

Open Electives:

1. Data structure
2. Optimisation T4BTECE-01niques
3. Operation Research
4. Professional Ethics and Human Values
5. Numerical Analysis
6. MEMS and Sensor Design
7. Telecommunication Syatems

101 Engineering Mathematics-I

S N	CONTENTS
1	**Calculus:** Improper integrals (Beta and Gamma functions) and their properties; Applications of definite integrals to evaluate surfa
2	**SequencesandSeries:** Convergence of sequence and series, tests for convergence; Power series, Taylor'sseries, series for exponential, trigonometric and logarithm functions.
3	**FourierSeries:** Periodic functions, Fourier series, Euler's formula, Change of intervals,Half range sine and cosine series, Parseval's th
4	**MultivariableCalculus(Differentiation):** Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxim Lagrange multipliers; Gradient, curl and divergence.
5	**MultivariableCalculus(Integration):** Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variabl and volumes, Centre of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), Simple applications parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.

102:EngineeringPhysics

SN	CONTENTS	Hours
1	**WaveOptics:** Newton's Rings, Michelson's Interferometer, Fraunhofer Diffraction from a Single Slit. Diffraction grating: Construction, theory and spectrum, Resolving power and Rayleigh criterion for limit of resolution, Resolving power of diffraction grating, X-Ray diffraction and Bragg's Law.	9
2	**QuantumMechanics:** Introduction to quantum Mechanics, Wave-particle duality, Matter waves, Wave function and basic postulates, Time dependent and time independent Schrodinger's Wave Equation, Physical interpretation of wave function and its properties, Applications of the Schrodinger's Equation: Particle in one dimensional and three dimensional boxes.	6
3	**CoherenceandOpticalFibers:** Spatial and temporal coherence: Coherence length; Coherence time and 'Q' factor for light, Visibility as a measure of Coherence and spectral purity, Optical fiber as optical wave guide, Numerical aperture; Maximum angle of acceptance and applications of optical fiber.	4
4	**Laser:** Einstein's Theory of laser action; Einstein's coefficients; Properties of Laser beam, Amplification of light by population inversion, Components of laser, Construction and working of He-Ne and semiconductor lasers, Applications of Lasers in Science, engineering and medicine.	6
5	**MaterialScience&SemiconductorPhysics:** Bonding in solids: covalent and metallic bonding, Energy bands in solids: Classification of solids as Insulators, Semiconductors and Conductors, Intrinsic and extrinsic semiconductors, Fermi dirac distribution function and Fermi energy, Conductivity in semiconductors, Hall Effect: Theory, Hall Coefficient and applications.	6
6	**IntroductiontoElectromagnetism:** Divergence and curl of electrostatic field, Laplace's and Poisson's equations for electrostatic potential, Bio-Savart law, Divergence and curl of static magnetic field, Faraday's law, Displacement current and magnetic field arising from time dependent electric field, Maxwell's equations, Flow of energy and Poynting vector.	8
TOTAL		**40**

03: Communication Skills

SN	CONTENTS	Hours
1	**Communication:** Meaning, Importance and Cycle of Communication. Media and Types of Communication. Verbal and Non-Verbal Communication. Barriers to communication. Formal and Informal Channels of Communication (Corporate Communication). Divisions of Human Communication and Methods to improve Interpersonal Communication. Qualities of good communication.	6
2	**Grammar:** Passive Voice. Reported Speech. Conditional Sentences. Modal Verbs. Linking Words (Conjunctions)	6
3	**Composition:** Job Application and Curriculum-Vitae Writing. Business Letter Writing. Paragraph Writing. Report Writing.	6
4	**ShortStories:** "Luncheon" by Somerset Maugham."How Much Land Does a Man Need?" by Count Leo Tolstoy. "The Night Train at Deoli" by Ruskin Bond.	6
5	**Poems:** "No Men are Foreign" by James Kirkup. "If" by Rudyard Kipling. "Where the Mind is without Fear" by Rabindranath Tagore.	65
TOTAL		**35**

104: Programming for Problem Solving

SN	CONTENTS	Hours
1	**FundamentalsofComputer:** Stored program architecture of computers, Storage device- Primary memory, and Secondary storage, Random, Direct, Sequential access methods, Concepts of High- level, Assembly and Low-level languages, Representing algorithms through flowchart and pseudo code.	**12**
2	**Numbersystem:** Data representations, Concepts of radix and representation of numbers in radix r with special cases of r=2, 8, 10 and 16 with conversion from radix r1 to r2, r's and (r-1)'s complement, Binary addition, Binary subtraction, Representation of alphabets.	**12**
3	**CProgramming:** Problem specification, flow chart, data types, assignment statements, input output statements, developing simple C programs, If statement, for loops, while loops, do-while loops, switch statement, break statement, continue statement, development of C programs using above statements, Arrays, functions, parameter passing, recursion, Programming in C using these statements, Structures, files, pointers and multi file handling.	**12**
TOTAL		**36**

105: Basic Electrical Engineering

SN	CONTENTS	Hours
1	**DCCircuits:** Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff current and voltage laws, Series-Parallel circuits, Node voltage method, Mesh current method, Superposition, Thevenin's, Norton's and Maximum power transfer theorems.	8
2	**ACCircuits:** Representation of sinusoidal waveforms, peak and r.m.s values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase AC circuits consisting of R, L, C, RL, RC and RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.	8
3	**Transformers:** Ideal and practical transformer, EMF equation, equivalent circuit, losses in transformers, regulation and efficiency.	6
4	**ElectricalMachines:** Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Starting and speed control of induction motor, single- phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited DC motor. Construction and working of synchronous generators.	6
5	**PowerConverters:** Semiconductor PN junction diode and transistor (BJT). Characteristics of SCR, power transistor and IGBT. Basic circuits of single phase rectifier with R load, Single phase Inverter, DC-DC converter.	6
6	**ElectricalInstallations:** Layout of LT switchgear: Switch fuse unit (SFU), MCB, ELCB, MCCB, Type of earthing. Power measurement, elementary calculations for energy consumption.	6
TOTAL		**40**

106:EngineeringPhysicsLab

1 To determine the wave length of monochromatic light with the help of Michelson's interferometer.

2. To determine the wave length of sodium light by Newton's Ring.
3. To determine the wave length of prominent lines of mercury by plane diffraction grating with the help of spectrometer.
4. Determination of band gap using a P-N junction diode.
5. To determine the height of given object with the help of sextant.
6. To determine the dispersive power of material of a prism with the help of spectrometer.

6. To study the charge and discharge of a condenser and hence determine the same constant (both current and voltage graphs are to be plotted.

8. To determine the coherence length and coherence time of laser using He – Ne laser.
9. To measure the numerical aperture of an optical fibre.
10. To study the Hall Effect and determine the Hall Voltage and Hall coefficients.

106:LanguageLab

1. Phonetic Symbols and Transcriptions.
2. Extempore.
3. Group Discussion.
4. Dialogue Writing.
5. Listening comprehension.

108:ComputerProgrammingLab

1. To learn about the C Library,Preprocessor directive, Input-output statement.
2. Programs to learn data type, variables, If-else statement

3 Programs to understand nested if-else statement and switch statement

4. Programs to learn iterative statements like while and do-while loops
5. Programs to understand for loops for iterative statements
6. Programs to learn about array and string operations

6. Programs to understand sorting and searching using array

8. Programs to learn functions and recursive functions
9. Programs to understand Structure and Union operation

10 Programs to learn Pointer operations

11.Programs to understand File handling operations

12 Programs to input data through Command line argument

109:BasicElectricalEngineeringLab

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Transformers: Observation of the no-load current waveform on an oscilloscope. Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
3. Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents).Phase-shifts between the primary and secondary side.
4. Demonstration of cut-out sections of machines: dc machine (commutator- brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.
5. Torque Speed Characteristic of separately excited dc motor.
6. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform

(c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.

110: ComputerAidedEngineeringGraphics Lab

Introduction: Principles of drawing, lines, type of lines, usage of Drawing instruments, lettering, Conic sections including parabola, hyperbola, Rectangular Hyperbola (General method only); Scales-Plain, Diagonal and Vernier Scales.

ProjectionsofPoint&Lines: Position of Point, Notation System, Systematic Approach for projections of points, front view & Top view of point, Position of straight lines, line parallel to Both the RPs, Line perpendicular to either of the RPs, Line inclined to one RP and parallel to the other, Line inclined to Both the RPs, Traces of a line (One drawing sheet, one assignment in sketch book).

ProjectionofPlanes: Positions of planes, Terms used in projections of planes, plane parallel to RP, plane inclined to one RP and perpendicular to the other RP, plane perpendicular to Both the RPs, plane Inclined to Both the RPs, True shape of the plane, Distance of a point from plane, Angle between two planes. **ProjectionsofRegularSolids:** frustum and truncated solids, those inclined to both the Planes-Auxiliary Views.

SectionofSolids: Theory of sectioning, section of prisms and cubes, section of pyramids and Tetrahedron section of Cylinders, section of cones, section of spheres (One drawing sheet, one assignment in sketch book)

OverviewofComputerGraphics: Covering theory of CAD software [such as: The menu System,Toolbars (standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars),

Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.: Isometric Views of lines, Planes, Simple and compound Solids.

201: Engineering Mathematics-II

SN	CONTENTS	Hours
1	**Matrices:** Rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.	**10**
2	**Firstorderordinarydifferentialequations:** Linear and Bernoulli's equations, Exact equations, Equations not of first degree: equations solvable for *p*, equations solvable for *y*, equations solvable for *x* and Clairaut's type.	**6**
3	**Ordinarydifferentialequationsofhigherorders:** Linear Differential Equations of Higher order with constant coefficients, Simultaneous Linear Differential Equations, Second order linear differential equations with variable coefficients: Homogenous and Exact forms, one part of CF is known, Change of dependent and independent variables, method of variation of parameters, Cauchy- Euler equation; Power series solutions including Legendre differential equation and Bessel differential equations.	**12**
4	**PartialDifferentialEquations–Firstorder:** Order and Degree, Formation; Linear Partial differential equations of First order, Lagrange's Form, Non Linear Partial Differential equations of first order, Charpit's method, Standard forms.	**6**
5	**PartialDifferentialEquations–Higherorder:** Classification of Second order partial differential equations, Separation of variables method to simple problems in Cartesian coordinates including two dimensional Laplace, one dimensional Heat and one dimensional Wave equations.	**6**
TOTAL		**40**

202 : Engineering Chemistry

SN	CONTENTS	Hours
1	**Water:** Common impurities, hardness, determination of hardness by complexometric (EDTA method), Degree of hardness, Units of hardness Municipal water supply: Requisite of drinking water, Purification of water; sedimentation, filtration, disinfection, breakpoint chlorination. Boiler troubles: Scale and Sludge formation, Internal treatment methods, Primingand Foaming, Boiler corrosion and Caustic embrittlement Water softening; Lime-Soda process, Zeolite (Permutit) process, Demineralization process.Numerical problems based on Hardness, EDTA, Lime-Soda and Zeolite process.	**10**
2	**OrganicFuels:** Solid fuels: Coal, Classification of Coal, Proximate and Ultimate analyses of coal and its significance, Gross and Net Calorific value, Determination of Calorific value of coal by Bomb Calorimeter. Metallurgical coke, Carbonization processes; Otto-Hoffmann by- product oven method. Liquid fuels : Advantages of liquid fuels, Mining, Refining and Composition of petroleum, Cracking, Synthetic petrol, Reforming, Knocking, Octane number, Anti-knocking agents, Cetane number Gaseous fuels; Advantages, manufacturing, composition and Calorific value of coal gas and oil gas, Determination of calorific value of gaseous fuels by Junker's calorimeter Numerical problems based on determination of calorific value (bomb calorimeter/Junkers calorimeter/Dulongs formula, proximate analysis & ultimate and combustion of fuel.	**10**
3	**Corrosionanditscontrol:** Definition and significance of corrosion, Mechanism of chemical (dry) and electrochemical (wet) corrosion, galvanic corrosion, concentration corrosion and pitting corrosion. Protection from corrosion; protective coatings-galvanization and tinning, cathodic protection, sacrificial anode and modifications in design.	**3**
4	**EngineeringMaterials:** Portland Cement; Definition, Manufacturing by Rotary kiln. Chemistry of setting and hardening of cement. Role of Gypsum. Glass: Definition, Manufacturing by tank furnace, significance of annealing, Types and properties of soft glass, hard glass, borosilicate glass, glass wool, safety glass Lubricants: Classification, Mechanism, Properties; Viscosity and viscosity index, flash and fire point, cloud and pour point.	**10**
5	**Organicreactionmechanismandintroductionofdrugs:** Organic reaction mechanism: Substitution; SN1, SN2, Elecrophilic aromatic substitution in benzene, free radical halogenations of alkanes, Elimination; elimination in alkyl halides, dehydration of alcohols, Addition: electrophilic and free radical addition in alkenes, nucleophilic addition in aldehyde and ketones, Rearrangement; Carbocation and free radical rearrangements Drugs : Introduction, Synthesis, properties and uses of Aspirin, Paracetamol	**6**
TOTAL		**40**

203: Human Values

SN	CONTENTS	Hours
1	**CourseIntroduction-Need,BasicGuidelines,ContentandProcessforValueEducation** Understanding the need, basic guidelines, Self Exploration - its content and process; 'Natural Acceptance' and Experiential Validation, Continuous Happiness and Prosperity- Human Aspirations, Right understanding, Relationship and Physical Facilities,Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfill the above human aspirations: understanding and living in harmony at various levels	5
2	**UnderstandingHarmonyintheHumanBeing-HarmonyinMyself** Understanding human being as a co-existence of the sentient 'I' and the material 'Body' Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha Understanding the Body as an instrument of 'I',Understanding the characteristics and activities of 'I' and harmony in 'I' Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya.	5
3	**UnderstandingHarmonyintheFamilyandSociety-HarmonyinHuman-HumanRelationship** Understanding harmony in the Family, Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) , meaning of Vishwas; Difference between intention and competence, meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, harmony in the society , Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals ,Visualizing a universal harmonious order in society- Undivided Society (AkhandSamaj), Universal Order (SarvabhaumVyawastha)- from family to world family.	5
4	**UnderstandingHarmonyintheNatureandExistence-WholeexistenceasCoexistence** Understanding the harmony in the Nature. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature. Understanding Existence as Co-existence	5
5	**ImplicationsoftheaboveHolisticUnderstandingofHarmonyonProfessionalEthics.Naturalacceptanceofhumanvalues** Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models. Strategy for transition from the present state to Universal Human Order: At the level of individual: as socially and ecologically responsible engineers, technologists and managers. Case studies related to values in professional life and individual life.	5
TOTAL		**25**

204: Basic Mechanical Engineering

SN	CONTENTS	Hours
1	**Fundamentals:** Introduction to mechanical engineering, concepts of thermal engineering, mechanical machine design, industrial engineering and manufacturing technology. Steam Boilers classification and types of steam boilers and steam turbines. Introduction and Classification of power plants.	6
2	**PumpsandICEngines:** Applications and working of Reciprocating and Centrifugal pumps. Introduction, Classification of IC Engines, Main Components of IC Engines, Working of IC Engines and its components.	6
3	**RefrigerationandAirConditioning:** Introduction, classification and types of refrigeration systems and air-conditioning. Applications of refrigeration and Air-conditioning.	6
4	**TransmissionofPower:** Introduction and types of Belt and Rope Drives, Gears.	6
5	**PrimaryManufacturingProcesses:** Metal Casting Process: Introduction to Casting Process, Patterns, Molding, Furnaces. Metal Forming Processes: Introduction to Forging, Rolling,Extrusion, Drawing. Metal Joining Processes: Introduction to various types of Welding, Gas Cutting, Brazing, and Soldering.	6
6	**EngineeringMaterialsandHeatTreatmentofSteel:** Introduction to various engineering materials and their properties.	5
TOTAL		**40**

205: Basic Civil Engineering

SN	CONTENTS	Hours
1	**Introductiontoobjective,scopeandoutcomethesubject**	
2	**Introduction:** Scope and Specialization of Civil Engineering, Role of civil Engineer in Society, Impact of infrastructural development on economy of country.	8
3	**Surveying:** Object, Principles & Types of Surveying; Site Plans, Plans& Maps; Scales & Unit of different Measurements. Linear Measurements: Instruments used. Linear Measurement by Tape, Ranging out Survey Lines and overcoming Obstructions; Measurements on sloping ground; Tape corrections, conventional symbols. Angular Measurements: Instruments used; Introduction to Compass Surveying,Bearings and Longitude & Latitude of a Line, Introduction to total station. Levelling: Instrument used, Object of levelling, Methods of levelling in brief, Contour maps.	8
4	**Buildings:** Selection of site for Buildings, Layout of Building Plan, Types of buildings, Plinth area, carpet area, floor space index, Introduction to building byelaws, concept of sun light and ventilation. Components of Buildings & their functions, Basic concept of R.C.C., Introduction to types of foundation.	8
5	**Transportation:** Introduction to Transportation Engineering; Traffic and Road Safety: Types and Characteristics of Various Modes of Transportation; Various Road Traffic Signs, Causes of Accidents and Road Safety Measures.	8
6	**EnvironmentalEngineering:** Environmental Pollution, Environmental Acts and Regulations,Functional Concepts of Ecology, Basics of Species, Biodiversity,Ecosystem, Hydrological Cycle;Chemical Cycles: Carbon, Nitrogen& Phosphorus; Energy Flow in Eco- systemsWater Pollution: Water Quality standards, Introduction to Treatment& Disposal of Waste Water. Reuse and Saving of Water, Rain Water Harvesting.Solid Waste Management: Classification of Solid Waste, Collection, Transportation and Disposal of Solid. Recycling of Solid Waste: Energy Recovery,Sanitary Land fill, On-Site Sanitation. Air& Noise Pollution: Primary and Secondary air pollutants, Harmful effects of Air Pollution, Control of Air Pollution. . Noise Pollution, Harmful Effects of noise pollution, control of noise pollution, Global warming& Climate Change, Ozone depletion, Green House effect	8
	TOTAL	40

206: Engineering Chemistry Lab

1. Determination the hardness of water by EDTA method
2. Determination of residual chlorine in water
3. Determination of dissolved oxygen in water
4. Determination of the strength of Ferrous Ammonium sulphate solution with the help of K2Cr2O6 solution by using diphenyl amine indicator
5. Determination of the strength of CuSO4 solution iodometrically by using hypo solution
6. Determination of the strength of NaOH and Na2CO3 in a given alkali mixture

6. Proximate analysis of Coal

8. Determination of the flash & fire point and cloud & pour point of lubricating oil
9. Determination of the kinematic viscosity of lubricating oil by Redwood viscometer no. 1 at different temperature
10. Synthesis of Aspirin/ Paracetamol

206: Human Values Activities Lab

PS 1:

Introduce yourself in detail. What are the goals in your life? How do you set your goals in your life? How do you differentiate between right and wrong? What have been your salient achievements and shortcomings in your life? Observe and analyze them.

PS 2:

Now-a-days, there is a lot of talk about many technogenic maladies such as energy and material resource depletion, environmental pollution, global warming, ozone depletion, deforestation, soil degradation, etc. - all these seem to be manmade problems, threatening the survival of life Earth - What is the root cause of these maladies & what is the way out in opinion?

On the other hand, there is rapidly growing danger because of nuclear proliferation, arms race, terrorism, breakdown of relationships, generation gap, depression & suicidal attempts etc. - what do you think, is the root cause of these threats to human happiness and peace - what could be the way out in your opinion?

PS 3:

1. Observe that each of us has the faculty of 'Natural Acceptance', based on which one can verify what is right or not right for him. (As such we are not properly trained to listen to our 'Natural Acceptance' and may a time it is also clouded by our strong per-conditioning and sensory attractions).

Explore the following:

(i) What is Naturally Acceptable' to you in relationship the feeling of respect or disrespect for yourself and for others?

(ii) What is 'naturally Acceptable' to you - to nurture or to exploit others? Is your living in accordance with your natural acceptance or different from it?

2. Out of the three basic requirements for fulfillment of your aspirations - right understanding, relationship and physical facilities - observe how the problems in your family are related to each. Also observe how much time & effort you devote for each in your daily routine.

PS 4:

list down all your important desires. Observe whether the desire is related to Self (I) or the Body. If it appears to be related to both, visualize which part of it is related to Self (I) and which part is related to Body.

PS 5:

1. a. Observe that any physical facility you use, follows the given sequence with time:
Necessary and tasteful - unnecessary but still tasteful - unnecessary and tasteless - intolerable
b. In contrast, observe that any feeling in you is either naturally acceptable or not acceptable at all. If not acceptable, you want it continuously and if not acceptable, you do not want it any moment!
2. List down all your important activities. Observe whether the activity is of 'I' or of

PS6:

1. Chalk out some programs towards ensuring your harmony with the body - in terms of nurturing, protection and right utilization of the body.

2. Find out the plants and shrubs growing in and around your campus, which can be useful in curing common diseases.

PS6:

Form small groups in the class and make them carry out a dialogue focusing on the following eight questions related to 'TRUST';

1a. Do I want to make myself happy? 2a. Do I want to make the other happy?

3a. Does the other want to make himself/herself happy? 4a. Does the other want to make me happy?

What is the answer?

Intention (Natural Acceptance)

1b. Am I able to always make myself happy? 2b. Am I able to always make the other happy?

3b. Is the other able to always make himself/herself happy? What is the answer?

Let each student answer the questions for himself and everyone else. Discuss the difference between intention and competence. Observe whether you evaluate yourself and others on the basis of intention/competence.

PS8:

1. Observe, on how many occasions, you are able to respect your related ones (by doing the right evaluation) and on how many occasions you are disrespecting by way of under-evaluation, over-evaluation or otherwise evaluation.

2. Also, observe whether your feeling of respect is based on treating the other as you would treat yourself or on differentiations based on body, physical facilities or belieds.

PS9:

1. Write a narration in the form of a story, poem, skit or essay to clarify a salient Human Value to the children.

2. Recollect and narrate an incident in your life where you were able to exhibit willful adherence to balues in a difficult situation.

PS10:

List down some common units (things) of Nature which you come across in your daily life and classify them in the four orders of Nature. Analysis and explain the aspect of mutual fulfillment of each unit with other orders.

PS11:

Make a chart to show the whole existence as co-existence. With the help of this chart try to identify the role and the scope of some of the courses of your study. Also indicate the areas which are being either over-emphasized or ignored in the present context.

PS12:

Identify any two important problems being faced by the society today and analyze the root cause of these problems. Can these be solved on the basic of natural acceptance of human values. If so, how should one proceed in this direction from

PS 13:

1. Suggest ways in which you can use your knowledge of Science/Technology/Management etc. for moving towards a universal human order.
2. Propose a broad outline for humanistic Constitution at the level of Nation.

PS 14:

The course is going to be over now. It is time to evaluate what difference in your thinking it has made. Summarize the core massage of this course grasped by you. How has this affected you in terms of;

a. Thought
b. Behavior
c. Work and
d. Relization

What practical steps are you able to visualize for the transition of the society from its present state. Project:

Every student required to take-up a social project e.g. educating children in needy/weaker section, services in hospitals, NGO's and other such work i.e. social work at villages adopted by respective institute/ college.

208: Manufacturing Practices Workshop

Carpentry Shop

1. T – Lap joint
2. Bridle joint Foundry Shop
3. Mould of any pattern
4. Casting of any simple pattern Welding Shop
5. Lap joint by gas welding
6. Butt joint by arc welding

6. Lap joint by arc welding
8. Demonstration of brazing, soldering & gas cutting Machine Shop Practice
9. Job on lathe with one step turning and chamfering operations Fitting and Sheet Metal Shop
10. Finishing of two sides of a square piece by filing
11. Making mechanical joint and soldering of joint on sheet metal
12. To cut a square notch using hacksaw and to drill a hole and tapping

209: Basic Civil Engineering Lab

1. Linear Measurement by Tape:

a) Ranging and Fixing of Survey Station along straight line and across obstacles.

b) Laying perpendicular offset along the survey line

2. Compass Survey: Measurement of bearing of linesusing Surveyor's and Prismatic compass

3. Levelling: Using Tilting/ Dumpy/ Automatic Level

a) To determine the reduced levels in closed circuit.

b) To carry out profile levelling and plot longitudinal and cross sections for road by Height of Instrument and Rise & Fall Method.

4. To study and take measurements using various electronic surveying instruments like EDM, Total Station etc.

5. To determine pH, hardness and turbidity of the given sample of water.

6. To study various water supply Fittings.

6. To determine the pH and total solids of the given sample of sewage.

8. To study various Sanitary Fittings.

210:Computer Aided Machine Drawing Lab

Introduction: Principles of drawing, conventional representation of machine components and materials, lines, types of lines, dimensioning types, rules of dimensioning.

Conversion of pictorial views into orthographic views: (1 drawing sheet) Introduction to orthographic projection, concept of first angle and third angle projection, drawing of simple machine elements in first angle projection, missing view problems covering Principles of Orthographic Projections.

Sectional views of mechanical components: (1 drawing sheet) Introduction, cutting plane line, type of sectional views-full section, half section, partial or broken section, revolved section, removed section, offset section, sectioning conventions-spokes, web rib, shaft, pipes, different types of holes, conventions of section lines for different metals and materials.

Fasteners and other mechanical components: (Free hand sketch) Temporary and permanent fasteners, thread nomenclature and forms, thread series, designation, representation of threads, bolted joints, locking arrangement of nuts, screws, washers, foundation bolts etc., keys, types of keys, cotter and knuckle joints. Riveted joints, rivets and riveting, type of rivets, types of riveted joints etc. Bearing: Ball, roller, needle, foot step bearing. Coupling: Protected type,
flange, and pin type flexible coupling. Other components: Welded joints, belts and pulleys, pipes and pipe joints, valves etc.

Overview of Computer Graphics: (2 drawing sheets) Covering theory of CAD software such as: The menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), Command Line (Where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.: Isometric Views of Lines, Planes, Simple and compound Solids.

BTECE-311	MICROPROCESSOR THEORY & APPLICATIONS	L	T	P	C
		3	1	0	3

1. Introduction to Microprocessors & Microcomputers

History and Evolution, types of microprocessors, Microcomputer Programming Languages, Microcomputer Architecture, Intel 8085 Microprocessor, Register Architecture, Bus Organization, Registers, ALU, Control section, Instruction set of 8085, Instruction format, Addressing modes, Types of Instructions.

2. Assembly Language Programming and Timing Diagram

Assembly language programming in 8085, Macros, Labels and Directives, Microprocessor timings, Micro instructions, Instruction cycle, Machine cycles, T-states, State transition diagrams, Timing diagram for different machine cycles.

3. Serial I/O, Interrupts and Comparison of Contemporary Microprocessors

Serial I/O using SID, SOD. Interrupts in 8085, RST instructions, Issues in implementing interrupts, Multiple interrupts and priorities, Daisy chaining, interrupt handling in 8085,Enabling, Disabling & masking of interrupts.

4. Data Transfer t4BTECE-01niques

Data transfer t4BTECE-01niques, Parallel & Programmed data transfer using 8155. Programmable parallel ports & handshake input/output, Asynchronous and Synchronous data transfer using 8251. PIC (8259), PPI (8255), DMA controller (8257).

5. Microprocessor Interfacing T4BTECE-01niques

Interfacing Traffic Light Interface, Stepper Motor, 4 Digit 7 Segment LED , Elevator, Musical Tone Generator & 8 Channel 12Bit ADC with Multiplexor & A/D converters, D/A converters.

6. Architecture of Typical 16-Bit Microprocessors (Intel 8086)

Introduction to a 16 bit microprocessor, Memory address space and data organization, Segment registers and Memory segmentation, Generating a memory address, I/O address space, Addressing modes, Comparison of 8086 & 8088, Basic configurations of 8086/8088, Min. Mode, Max. Mode & System timing, Introduction to Instruction Set of 8086.

Text Books:

1. R.S. Gaonkar, Microprocessor Architecture, Programming & Applications with the 8085/8080A, Wiley Eastern Ltd.
2. A.H. Mukhopadhyay, Microprocessor, Microcomputer and Their Applications, 3rd Edition Alpha Science International, Ltd.

References:

1. M. Rafiquzzman: Microprocessors: Theory & Applications (Intel & Motorola), PHI.
2. Berry .B. Bray INTEL 8086/88, 80186, 286, 386, 486, Pentium Pro & Pentium IV.

3BTECE-01	DIGITAL COMMUNICATION AND SYSTEMS	L	T	P	C
		3	1	0	3

1. Analog to Digital Conversion

Noisy communications channels, The sampling Theorem, low pass signals and band pass signals, pulse Amplitude modulation, channel bandwidth for a PAM signal, Natural sampling,Flat top sampling, signal recovery & holding, Quantization of signal, Quantization error, pulse code modulation (PCM), Delta Modulation, adaptive delta modulation.

2. Digital Modulation T4BTECE-01niques:

Binary phase shift keying, differential phase shift keying, differential encoded PSK, QPSK, Quadrate Amplitude shift keying (QASK) Binary frequency shift keying.

3. Data Transmission:

Base band signal receiver, probability of error, the optimum filter, and white noise-the matched filter, probability of error of the matched filter, coherent reception: correlation, application of coherent reception in PSK and FSK. Correlation receiver for QPSK.

4. Noise in Pulse Code & Delta Modulation Systems:

PCM transmission, calculation of quantization noise, the O/P signal power, the effect of thermal noise, O/P signal to noise ratio in PCM, Delta Modulation, Quantization noise in delta modulation, the O/P signal to quantization noise ratio in delta modulation, O/P signal to noise ratio in delta modulation.

5. Information Coding and Decoding:

Coding for error detection and correction, Block coding – coding, anticoding, Hadamard code, Hamming code, Cyclic Codes, Convolution coding and decoding, Viterbi algorithm, Shannon Fano and Hoffman Codes.

Text Books:

1. Taub & Schilling: Principles of communication systems- McGraw-Hill Education (India).
2. Simon Haykin: Communication systems - John-Wiley & sons, Inc.

Reference Books:

1. Couch: Digital and Analog Communication Systems, 6th edn. Pearson Education.
2. Bernard Sklar: Digital Communication, 2nd Edn. Pearson Education.
3. Marvin K. Simon, Sami M. Hinedi, William C. Lindsey: Digital Communication T4BTECE-01niques,PHI.

3BTECE-02	ANTENNA AND WAVE PROPOGATION	L	T	P	C
		3	1	0	3

1. ELECTROMAGNETIC RADIATION

Radiation phenomenon from an oscillation dipole in free space, induction and radiation fields, Retarded potentials, Radiated power and radiation resistance from a short dipole , half wave dipole and quarter wave monopole.

2. ANTENNA BASICS

Directional properties of antennas, Radiation patterns, antenna gain and aperture, antenna terminal impedance, self and mutual impedance, front to back ratio, antenna beam width and bandwidth, antenna efficiency, antenna beam area, polarization, antenna temperature and Reciprocity properties of antennas.

3. ANTENNA ARRAYS

Classification of arrays, linear arrays of two point sources, linear arrays of n-point sources, pattern multiplication, array factor, linear arrays of equal amplitude and spacing (Broadside and end fire arrays) of n-point sources, directivity and beam width, non-uniform arrays excitation using Binomial series.

4. SPECIAL ANTENNAS

VLF and LF antennas(Hertz and Marconi antennas), effects of antenna height and effect of ground on performance of antenna , Rhombic antennas, Loop antennas , receiving antenna and radio direction finders. Folded dipole antennas, Yagi-uda antenna, horn antennas, microwave dish, helical antennas, frequency independent antennas, microstrip antennas, fractal antennas.

5. GROUND WAVE PROPAGATION

Characteristics for ground wave propagation, reflection at the surface of a finitely conducting plane and on earth, Attenuation Calculation of field strength at a distance.

6. IONOSPHERE PROPAGATION

The ionosphere, formation of the various layers, their effective characteristics, reflection and refraction of waves by ionosphere, virtual height, maximum frequency, skip distance, regular and irregular variation of ionosphere, Fading and Diversity reception, ordinary and extraordinary waves.

7. SPACE WAVE PROPAGATION

Space wave, range and effect of earth, Troposphere waves-reflection, refraction, duct propagation, Troposphere scatter propagation link

Text Book

1. J.D. Kraus, "Antennas, "McGraw Hill.
2. C.A. Balanis “Antennas Theory and Design”, Willey.
3. K D Prasad “Antenna & Wave Propagation”.

Reference Book

1. E.C. Jorden & B.C.Balmann," Electromagnetic waves & radiating System", P.H.I.
2. R.E.Collins, 'Antennas and Radio Propagation ", McGraw-Hill, 1987.

3BTECE-03	ELECTRONICS DEVICE MODELLING	L	T	P	C
		3	1	0	3

1. Introduction to device modelling

Introduction, physical significance of device modelling, various devices used in device modelling. material used in device modelling.

2. Junction Diodes

Depletion region of a p-n junction, Depletion-region capacitance, DC, small signal, large signal, high frequency model of diodes. Measurement and extraction of diode model- parameters.

3. BJT

DC, small signal, high frequency of bipolar junction transistors. Extraction of BJT model parameters, Transistor frequency response.

4. MOSFETs

MOSFET fundamentals, Types of MOSFETs, Concept of threshold voltage, Large signal behavior MOSFETs, Comparison of operating regions of Bipolar and MOS Transistors, Shichman Hodges and Level-1 MOS Models, Introduction to Charge–Sheet Models.

5. Short & Narrow Channel Effects in MOSFETs

Velocity saturation from horizontal field, Mobility degradation from the vertical field, Weak Inversion in MOS Transistors, Transistor frequency in weak inversion, Narrow & Short Channel Effects in MOSFETs.

6. Modern VLSI Devices

Principal of hetrojunction devices, High speed devices compound devices, opto devices.

Text Books:

1. S.M.Kang & Y.Leblibici, CMOS Digital Integrated Circuits-Analysis & Design, TMH, 3rd Ed.
2. S.M. Sze, Physics of Semiconductor Devices, Wiley Pub.

References

1. H.M. Rashid, Introduction to PSPICE, PHI.
2. B.G. Streetman & S. Baneerjee, Solid State Electronic Devices, PHI.
3. B. Razavi, Design of Analog CMOS Integrated Circuits,TMH.

3BTECE-04	CONTROL SYSTEM	L	T	P	C
		3	1	0	3

1. Basic Concepts

Historical review, Definitions, Classification, Relative merits and demerits of open and closed loop systems.

2. Mathematical Models of Control System

Linear and non-linear systems, Transfer function, Mathematical modeling of electrical, m4BTECE-01anical and thermal systems, Analogies, Block diagrams and signal flow graphs.

3. Control Components

DC servomotor, AC servomotor, Potentiometers, Synchronous, Stepper-motor.

4. Time and Frequency Domain Analysis

Transient and frequency response of first and second order systems, Correlation ship between time and frequency domain specifications, Steady-state errors and error constants, Concepts and applications of P, PD, PI and PID types of control.

5. Stability Analysis

Definition, Routh-Hurwitz criterion, Root locus t4BTECE-01niques, Nyquist criterion, Bode plots, Relative stability, Gain margin and phase margins.

6. State Variable Analysis

Introduction, Concept of State, State variables & State models, State Space representation of linear continuous time systems. State models for linear continuous –time systems, State variables and linear discrete time systems, Solution of state equations, Concept of Controllability & Observability.

BOOKS/REFERENCES:

1. Discrete time Control Systems by K. Ogata, Prentice Hall International,2nd Edition,1995.
2. Control System Engineering by Nagrath and Gopal,New Age International, 4th Edition,2006
3. Warwick, Kevin, An Introduction to Control Systems, World Scientific Publishing Co. Ptv. Ltd, 2nd ed, 1996.
4. Levine, W. S., Control System Fundamentals, CRC Press,3rd ed, 2000.
5. Distefano, Joseph J. , Stubberud, Allen R., Williams, Ivan J., Feedback and Control
6. Systems, Schaum‟s Outlines, 2nd ed, 1990.

Open elective-I/II	MEMS AND SENSOR DESIGN	L	T	P	C
		3	1	0	3

1. **Introduction to MEMS**
   Introduction to MEMS and Microsystems, Materials and Substrates for MEMS, Sensors/Transducers, Sensors characterization and classifications, microactuators, Application of MEMS.

2. **Material Properties**
   MEMS materials, structural and sacrificial materials, properties of silicon, m4BTECE-01anical, electrical and thermal properties of materials, Basic modeling of elements in electricaland m4BTECE-01anical systems.

3. **MEMS Fabrication**
   MEMS Fabrication T4BTECE-01nologies, single crystal growth, micromaching, photolithography, microsterolithography, thin film deposition, impurity doping, diffusion, etching, bulk and surface micromaching, etch stop t4BTECE-01nique and microstructure, LIGA.

4. **M4BTECE-01anical Sensors & Actuators**
   Stress and Strain, Hooke's Law. Stress and Strain of Beam Structures, Cantilever, Pressure sensors, Piezoresistance Effect, Piezoelectricity, Piezoresistive Sensor, capacitive sensors, Inductive sensors, MEMS inertial sensors, micromachined microaccelerometer for MEMS, Parallel-plate Actuator, piezoactuators.

5. **Magnetic Sensors**
   Magnetic material for MEMS, magnetic sensing and detection, mannetoresistive sensors, hall effect, magnetodiode, megnetotransitors, MEMS magnetic sensors, RF MEMS.

6. **Thermal Sensors:**
   Temperature coefficient of resistance, Thermo-electricity, Thermocouples, Thermal and temperature sensors, heat pump, micromachined thermocouple probe, thermal flow sensors, shape memory allloy.

Text Books:

1. Analysis and Design Principles of MEMS Devices by Minhang Bao, ELSEVIER.
2. M. J. Usher, “Sensors and Transducers”, McMillian Hampshire.
3. N. P. Mahalik, “MEMS” Tata McGraq Hill.

References

1. R.S. Muller, Howe, Senturia and Smith, “Microsensors”, IEEE Press.

2. S. M. Sze, Semiconductor Sensors, Willy –Interscience Publications.

Open elective-I/II	TELECOMMUNICATION SYSTEMS	L	T	P	C
		3	1	0	3

1. Introduction

Basic elements of communication network. Switching systems. Signaling and signaling functions.

2. Telecommunication systems

Digital telephone network.T1 Carrier systems. TDM hierarchy. Data under voice. Digital switching. 4BTECE-01o cancellers.

3. Transmission modes

Introduction Synchronous and asynchronous transmission. Line coding .Error performance. TDM. TDM loops and rings.

4. Switching systems

Space and time divided switches. Multistage switches. Design examples. Path finding. Switching matrix control. Digital time division switch. Time Space switching. Time Space Time switching. Digital Switching in analog environment.

5. Timing recovery

Introduction Timing recovery. Jitter. Network synchronization. Digital subscriber access- ISDN network. ADSL. Traffic analysis

Text Books:

1. J.C. Bellamy, Digital Telephony, (3/e), Wiley, 2000.
2. E.Keiser&E.Strange, Digital Telephony and Network Integration, (2/e), Van Nostrand, 1995.

Reference Books:

1. ThiagarajanViswanathan, Telecommunication Switching Systems and Networks, PHI, 2006.
2. J.E. Flood, Telecommunications Switching, Traffic and Networks, Prentice Hall, 1995.

3BTECE-	MICROCONTROLLER & EMBEDDED SYSTEMS	L	T	P	C
		3	1	0	3

1. Microcontroller

Introduction to Microcontrollers, Evolution, Microprocessors vs. Microcontrollers, MCS-51 Family Overview, Important Features, Architecture. 8051 Pin Functions, Architecture, Addressing Modes, Instruction Set, Instruction Types.

2. Programming

Assembly Programming, Timer Registers, Timer Modes, Overflow Flags, Clocking Sources, Timer Counter Interrupts, Baud Rate Generation. Serial Port Register, Modes of Operation, Initialization, Accessing, Multiprocessor Communications, Serial Port Baud Rate

3. Interrupts

Interrupt Organization, Processing Interrupts, Serial Port Interrupts, External Interrupts, and Interrupt Service Routines. Microcontroller Specification, Microcontroller Design, Testing, Timing Subroutines, Look-up Tables, Serial Data Transmission.

4. Introduction to Embedded Systems

Background and History of Embedded Systems, Definition and Classification, Programming languages for embedded systems: desirable characteristics of programming languages for embedded systems, Low-level versus high-level languages, Main language implementation issues: control typing. Major programming languages for embedded systems. EmbeddedSystems on a Chip (SoC), IP Cores and the use of VLSI designed circuits.

5. Embedded software development

Software development flow, polling, interrupt driven, multi-tasking systems, data types in C programming, Inputs, outputs and peripheral accesses, microcontroller interfaces. Architecture of an RTOS, Important features of RTOS, Embedded Systems Programming, Locks and Semaphores, Operating System Timers and Interrupts, Exceptions, Tasks. Task states and scheduling, Task structures, Synchronization, Communication and concurrency, Semaphores, Real-time clock and system clock.

6. 32-Bit Cortex-M Architecture

T4BTECE-01nical overview, Important features, Instruction set, Memory system, exceptions andinterrupts, exception handling, low power and system control features. Development with Keil and mbed.

Text Books:

1. Mazidi Muhammad Ali, The 8051 Microcontroller and Embedded Systems, second edition, Pearson publications
2. Joseph Yiu, The Definitive Guide to ARM Cortex-M3 processors, third edition, Newnes publication

References:

1. Jonathan W. Valvano, Volume 1, Introduction to ARM Cortex-M Microcontrollers (fifth edition, CreateSpace)

2. Jonathan W. Valvano, Volume 2, Real-Time Interfacing to ARM Cortex-M Microcontrollers (fourth edition, CreateSpace).
3. Jonathan W. Valvano, Volume 3, Real-Time Operating Systems for ARM Cortex-M Microcontrollers (second edition, CreateSpace).

3BTECE-	WIRELESS COMMUNICATION	L	T	P	C
		3	1	0	3

1. Introduction

Evolution of wireless communication systems, Examples of wireless communication systems.

2. The cellular concept – system design fundamentals

Concept of frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, Trunking and grade of service, Improving coverage and capacity in cellular systems.

3. Propagation models

Free space propagation model, Two-ray ground reflection model, Distance power loss, Macro-cell propagation model, Micro-cell propagation model, Shadowing model, Multipath effects in mobile communication, Models for multipath reception.

4. Equalization, diversity and channel coding

Fundamentals of equalization, Adaptive equalizers, Linear and nonlinear equalization, Algorithms for adaptive equalization, Diversity t4BTECE-01niques, Fundamentals of channel coding, Overview of error detection and correction codes.

5. Multiple access t4BTECE-01niques

Introduction to multiple access, Frequency division multiple access, Time division multiple access, Spread spectrum multiple access, Space division multiple access, Packet radio, Orthogonal frequency division multiple access; Introduction to wireless systems and standards.

Text Book:

1. Wireless Communications: Principles and Practice by Theodore S. Rappaport; Pearson / PHI Publication

References:

1. Wireless Communications and Networks: 3G and Beyond by Iti Saha Misra; Tata McGraw Hill Publication
2. Mobile Cellular Telecommunications: Analog and Digital Systems by William C. Y. Lee; Tata McGraw Hill Publication
3. Wireless and Digital Communications by Dr. Kamilo Feher; PHI Publication

3BTECE-	DIGITAL SIGNAL PROCESSING	L	T	P	C
		3	1	0	3

1. Discrete-time signals and systems

Basic elements of a digital signal processing system, Advantages of digital signal processing, Classification of signals, The concept of frequency in continuous-time and discrete-time domain, Discrete-time signals and systems, Analysis of discrete-time linear shift-invariant systems, Linearity, Causality and stability criterion, Discrete-time systems described by difference equations.

2. Discrete-time Fourier transform

The Fourier transform of discrete-time signals (DTFT), Properties of the DTFT, The frequency response of an LTI discrete-time system, The Fourier series of discrete-time signals(DTFS).

3. Discrete Fourier Transform

Frequency domain sampling and the DFT, Properties of the DFT, Linear filtering methods based on the DFT, Efficient computation of the DFT: Decimation-in-time and decimation-in frequency Fast Fourier transform algorithms.

4. Z-transform

Introduction to the Z-transform & the inverse Z-transform, Properties of the Z-transform, relationship between the Fourier transform and the Z-transform, Rational Z-transforms & the System function, Analysis of linear time-invariant systems in the Z-domain.

5. Digital filter structures

Digital filter categories, Realization structures for FIR & IIR digital filters, Implementation of digital filters : Direct form-I, Direct form-II, Cascade form and Parallel form structures for FIR and IIR filters.

6. Digital filter design

General considerations of digital filter design, Linear phase digital filters, Simple digital FIR filters : Low pass, High pass filters, Digital IIR filters : Low pass, High pass , Band pass, Band stop filters.

Text Books:

1. Digital Signal Processing: Principles, Algorithms and Applications by John G. Proakis & Dimitris G. Manolakis; Pearson Education.
2. Digital Signal Processing by Sanjit K. Mitra; Tata McGraw Hill Publication.

References:

1. Digital Signal Processing by Alan V. Oppenheim & Ronald W. Schafer; PHI Publication.
2. Theory & Application of Digital Signal Processing by Rabiner & Gold; PHI Publication.

3BTECE-	ANALOG AND DIGITAL VLSI DESIGN	L	T	P	C
		3	1	0	3

1. MOSFETS

Fundamentals of Enhancement Mode MOSFETs, Depletion Mode MOSFETs, Weak & strong Inversion Conditions, Threshold Voltage Concept in MOSFETs, Current-Voltage (IV) Characteristics of a MOSFET, Limitations in IV Model and MOSFET Parasitics. Trends & Projections in VLSI Design & T4BTECE-01nology, Flow of VLSI Circuit Design. Scaling in MOS devices.

2. VLSI Design Styles

NMOS, CMOS Process flow, Noise Margin, Inverter Threshold Voltage, NMOS Inverter design and characteristics, CMOS Inverter Design and Properties, Delay and Power Dissipation. Parallel & Series Equivalent circuits, Static CMOS Circuit Design and Pr4BTECE-01arge-Evaluate logic, Dynamic CMOS logic circuits.

3. VLSI Physical Design

Stick Diagrams, Physical Design Rules, Layout Designing, Euler‟s Rule for Physical Design. Reliability issues in CMOS VLSI, Latching.

4. Memory Design

ROM Design, SRAM Design.

5. CMOS Amplifier

Single stage CS amplifier, CG amplifier, CD amplifer

6. CMOS Differential amplifier

Single Stage MOS Amplifier, Differential Amplifier and their analysis.

TEXT BOOKS:

1. B.G. Streetman & S. Banerjee, “Solid State Electronic Devices”, PHI.
2. S.M. Kang & Y. Leblebici, “CMOS Digital Integrated Circuits-Analysis & Design”.
3. B. Razavi, “Design of Analog CMOS Integrated Circuits”, TMH.

REFERENCES:

1. K. Eshraghian & Pucknell, “Introduction to VLSI”, PHI.

3BTECE-	HDL BASED DESIGN	L	T	P	C
		1	0	3	2

1. Introduction

Introduction and levels of abstraction, modeling and hierarchical design concepts, Languages, Compilation & Simulation, concurrency, Logic value system,

2. Language concepts

Lexical conventions, data types, modules and ports, behavioral modeling, dataflow modeling, structural modelling

3. RTL Design

Control & Data partitioning, Synthesis concepts, non synthesizable constructs, operators, expressions, conditional statements, post synthesis simulation, basic test bench

4. Advanced

Procedures and timing control, procedural blocks, loops, Tasks and functions, Testbench modeling t4BTECE-01niques, Path delay modeling, Timing analysis, User defined premitives, compiler directives, system tasks.

5. Hardware modules

Boolean equations, Encoders, Decoders, multiplexers, cascaded multiplexers, adders, comparators, multipliers, shifters, Mealy & Moore finite state machine, Implementation on FPGA.

TEXT BOOKS:

1. Peter J. Ashenden, The Designer's Guide to VHDL, 2nd Edition, Morgan Kaufmann Publishers, 2001.
2. J. Bhasker, A Verilog HDL Primer, Star Galaxy Press, 1996.
3. Samir Palnitkar, Verilog HDL : A Guide to Digital Design and Synthesis, Prentice Hall, 1996.

REFERENCES:

1. Vivek Sagdeo, The Complete Verilog Book, Kluwer Academic Publishers.
2. Douglas J. Smith, HDL Chip Design : A Practical guide for Designing, Synthesizing and Simulating ASICs and FPGAs using VHDL or Verilog, Doone Pubns, 1996.
3. Ben Cohen, VHDL Coding Styles and Methodologies, Kluwer Academic Publishers, 1999
4. J. Bhasker, A VHDL Primer, Third Edition, Prentice Hall, 1998.

4BTECE-01	ENGINEERING ECONOMICS & MANAGEMENT	L	T	P	C
		3	1	0	3

1. Basic Economics Concept

Stock and flow, static and dynamic economics. Micro economics and macro economics, National Income concept.

2. Market Demand

Demand, meaning and types, law of demands, exception to the law of demand, Elasticity of demand, Method of measuring elasticity of demand, marginal utility analysis.

3. Production Analysis

Production function, law of returns, least cost combinations, cost and cost curves. Choice of plant size in the long run, law of supply, elasticity of supply.

4. Cost Concepts and Estimation

Cost element, economics Vs accounting concept of cost and revenues, standard cost, Actual cost, overhead cost, cost control, Break-Even Analysis.

5. Economic Appraisal T4BTECE-01niques

Long range and Short range budgeting, Industrial securities, criteria for project appraisal, social benefit-cost analysis, Deputation concept and t4BTECE-01niques.

6. Monetary System

Money and its function, function of the commercial bank and central bank, monetary policy.

7. Inflation and Business Cycles

Causes, Effects and method of control Inflation. Concept of business cycles.

8. Introduction to International Economics

Classification theory and modern theory of international trade, meaning of foreign exchange, equilibrium rate of exchange, purchasing power parity theory, impact of globalization of Indian Economy.

TEXT BOOKS/REFERENCES:

1. A Text book of Economic Theory: by stonier and hauge,pearson Publication.
2. Modern Economic Theory: by Sampat Mukherjee, New Age International Publisher
3. Engineering Economics:by Degramo ,prentice Hall.
4. International Economics: by Bo Sodersten ,Macmillan.
5. Principle of Macroeconomics : by Rangarajan and Dholokia, Tata McGraw Hill.
6. Monetary Economics: by Suraj B.Gupta, S chand.
7. Project planning analysis, Selection, Implementation and review: by Prasanna Chandra, Tata

McGraw Hill Education.
8. Cost Accounting: by Jawahar Lal ,McGraw Hill.

BTECE-412	OPTICAL COMMUNICATION SYSTEMS	L	T	P	C
		3	1	0	3

1. **OVERVIEW**
   The Electromagnetic Spectrum, Properties of Light, Dual Nature of Light Concept of a photon, Wave Model, Characteristics of light waves. Concepts of information, general communication systems, evolution of Basic Fiber Optic Communication System, Benefits and disadvantages of Fiber Optics. Transmission Windows. Transmission Through Optical Fiber, The Laws of Reflection and Refraction, Light rays and light waves, Reflection of light from optical surfaces, Refraction of light from optical interfaces, The Numerical Aperture (NA), The Optical Fiber, Types of Fiber.

2. **LOSSES IN OPTICAL FIBER**
   Attenuation, Material absorption losses, linear and non linear scattering losses, fiber bend loss, dispersion viz. inter modal dispersion and intra modal dispersion, overall fiber dispersion and polarization, Dispersion shifted and dispersion flattened fibers, attenuation and dispersion limits in fibers, Kerr nonlinearity, self phase modulation, combined effect of dispersion and self phase modulation.

3. **FIBER MATERIAL, COUPLERS AND CONNECTORS**
   Preparation of optical fiber: liquid-phase t4BTECE-01niques, vapor phase deposition t4BTECE-01niques, Connector Principles, Fiber End Preparation, splices, connectors.

4. **OPTICAL SOURCES AND DETECTORS**
   Sources: Basic principle of surface emitter LED and edge emitter LED- material used, structure, internal quantum efficiency and characteristics, LASER Diode - material used, structure, internal quantum efficiency and characteristics, working Principle and characteristics of Distributed feedback (DFB) laser. Detectors: PIN photodiode - material used, working principle & characteristics, Avalanche Photodiode: - material used, working principle and characteristics

5. **ADVANCED TOPICS**
   Optical TDM, SCM, WDM and Hybrid multiplexing methods, Fiber Optic Networks, Transreceivers for Fiber-Optic Networks, Semiconductor Optical Amplifiers, Erbium Doped Fiber Amplifiers (EDFAs).

6. **OPTICAL NETWORKS**
   Elements and Architecture of Fiber-Optic Network, SONET/SDH, ATM, IP, Optical Line Terminals (OLT), Optical Add-Drop Multiplexers, Optical Cross Connects.

TEXT BOOKS:

1. Optical Fiber Communication Principles & Practice by John M.Senior, PHI Publication
2. Optical Communication Systems by John Gowar, PHI Publications.

REFERENCES:

1. Optical Fiber Communication by Gerd Keiser, Mc Graw Hill International Publications.
2. Fundamentals of Fibre Optics in Telecommunication and sensor systmes by Bishnu P.Pal, New Age International (P) Ltd.
3. Optical Networks Practical Perspective, by Rajiv Ramaswami, Kumar N. Sivarajan, Elsevier.

BTECE-413	INDUSTRIAL ELECTRONICS	L	T	P	C
		3	1	0	3

1. POWER SEMICONDUCTOR DEVICES

Thyristor: Thyristor characteristics, Thyristor turn-on methods, Thyristor protection, Series and parallel operation of thyristors, Thyristor commutation; Characteristics of Diac and Triac;Power diode; Power transistor; Power MOSFET; IGBT.

2. PHASE CONTROLLED CONVERTERS

Principle of phase control, Single-phase half-wave circuit with different types of load, Single-phase full-wave mid-point converter, Single-phase full-wave bridge converters, Single-phase semiconverter, Three-phase thyristor converters, Single-phase and three-phasedual converters.

3. DC CHOPPERS

Principle of chopper operation and control strategies, Step-up and step-down choppers, Types of chopper circuits, Voltage-commutated chopper, Current-commutated chopper, Load-commutated chopper.

4. INVERTERS

Single-phase voltage source inverters, Modified McMurray half-bridge and full-bridge inverter, McMurray-Bedford half-bridge and full-bridge inverter, Pulse-width modulated inverters, Current source inverters, Series inverters, Parallel inverter.

5. APPLICATIONS OF INDUSTRIAL ELECTRONICS

Switched mode power supply (SMPS), Uninterruptible power supplies, Solid state relays.

TEXT BOOKS:

1. Power Electronics: Circuits, Devices and Applications by Muhammad H. Rashid; Pearson / PHI Publication.
2. Power Electronics by Dr. P. S. Bimbhra; Khanna Publishers.

REFERENCES:

1. Power Electronics by P. C. Sen; Tata McGraw Hill Publication.
2. Power Electronics by C. W. Lander; McGraw Hill Publication.

ECE-414(A)	SATELLITE COMMUNICATION	L	T	P	C
		3	1	0	3

1. ORBITAL M4BTECE-01ANISM

Satellite orbit and orbital equations, Kepler‟s laws of planetary motion, locating satellite inthe orbit, locating satellite with respect to earth, Look angle calculation, coverage angle and slant range, orbital perturbations, satellite launching, orbital effects in communication subsystem performance.

2. SATELLITES

Satellite subsystems, Attitude and orbit control system, Telemetry tracking command and monitoring, power system, communication subsystem, satellite antennas.

3. SATELLITE LINK DESIGN

Basic link analysis, Interference analysis, terrestrial interference, Intermodulation interference, inter-symbol interference and rain induced attenuation, uplink power control, system availability, system design for link without frequency reuse and system design for linkwith frequency reuse.

4. EARTH STATION

Earth station antenna types, Antenna gain, antenna gain to noise temperature ratio, G/T measurement, frequency division multiple access, FDM-FM-FDMA, Single channel per carrier.

5. SATELLITE BASED NAVIGATION SYSTEM:

The principle of measuring signal transit time, Basic principles of satellite navigation, Signal travel time Determining position, The effect and correction of time error, functional segments of GPS, Improved GPS: DGPS, SBAS, A-GPS and HSGPS.

TEXT BOOKS:

1. Tri, T.Ha, “Digital Satellite Communications, ” (Second Edition) Tata McGraw Hill.
2. Timothy Pratt, Jeremy E., “Satellite Communications,” Willey.
3. G S Rao, “Global Navigation Satellite Systems,” Tata McGraw Hill.

REFERENCE BOOKS:

1. Nagaraja, “Electronic Navigation”, Tata McGraw Hill.
2. Jay Farrell, “The Global Positioning System & Inertial Navigation,” Tata McGraw Hill.

ECE-414(B)	TV AND DISPLAY T4BTECE-01NOLOGY	L	T	P	C
		3	1	0	3

1. Cathode ray tube display (CRT).
2. Liquid crystal display (LCD) - High-Performance Addressing display (HPA), Thin-film transistor display (TFT).
3. Light-emitting diode display (LED), Electroluminescent display (ELD), Organic light-emitting diode display (OLED).
4. 3D Display, Mobile Displays.
5. Fundamentals of HDTV, IPTV.

TEXT/REFERENCE BOOKS:

1. Joseph A. Castellano, Handbook of Display T4BTECE-01nology, Gulf Professional Publishing, 1992.
2. Chen J., Cranton W., Fihn M, Handbook of Visual Display T4BTECE-01nology, Springer, 2012.

ECE-414(C)	BIOMEDICAL ELECTRONICS	L	T	P	C
		3	1	0	3

1. Biomedical Signals

Origins of Bioelectric Signals, Human body, Heart and Circulatory System, Electrodes, Transducers, ECG, EMG.

2. Recording & Monitoring Instruments :

RecordingElectrodes,Recording Electrodes, Recording ,Electrodes, Recording Electrodes, Physiological Transducers, Biomedical Recorders, Biomedical Recorders, Heart rate measurement, Temperature measurement, Foetal Monitoring System, Foetal Monitoring System, Foetal Monitoring System, Foetal Monitoring System, Biomedical Telemetry.

3. Imaging System:

Working with X-Rays, CT scanner, NMR, NMR, Ultrasonic System, Ultrasonic System, Ultrasonic System.

4. Therapeutic & Physiotherapy Equipment's:

Cardiac Pacemakers, Cardiac defibrillator, SW Diathermy & MW Diathermy.

5. Patient Safety

Electric Shock Hazards, Test Instruments, Biomedical Equipment‟s, BiomedicalEquipment‟s.

Text Books

1. Handbook of Biomedical Instrumentation by R.S. Khandpur.
2. Biomedical Instrumentation and Measurements: Leslie Cromwell, PHI.

Reference Books:

1. Introduction to bioinformatics: T.K. Attuwood, Pearson Education.
2. Introduction to biomedical equipment T4BTECE-01nology: Joseph J. Carr & John M Brown, PearsonEducation.

ECE-414(D)	SIGNAL AND SYSTEMS	L	T	P	C
		3	1	0	3

1. Linear Wave Shaping:

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

2. Non- Linear Wave shaping:

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

3. Switching characteristics & Devices:

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

4. **Time Base Generators :** General features of a time base signal, methods of generating time base waveform, Miller and Bootstrap time base generators – basic principles, Transistor miller time base generator,Transistor Bootstrap time base generator, Current time base generators.

5. **Synchronization & frequency Shaping :** Principles of Synchronization, Frequency division in sweep circuit, Astable relaxation circuits, Monostable relaxation circuits, Synchronization of a sweep circuit with symmetrical signals, Sine wave frequency division with a sweep circuit. Sampling gate Basic operating principles of sampling gates, Unidirectional and Bi- directional sampling gates, Reduction of pedestal in gate circuits, Applications of sampling gates.

6. Classification of signals and systems

Continuous time signals (CT signals), discrete time signals (DT signals) - Step, Ramp, Pulse, Impulse, Exponential, Classification of CT and DT signals - periodic and periodic, random singals, CT systems and DT systems, Basic properties of systems - Linear Time invariant Systems and properties.

TEXT BOOKS:

1. Pulse, Digital and Switching Waveforms - J. Millman and H. Taub, McGraw-Hill.
2. Solid State Pulse circuits - David A. Bell, PHI.
3. A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall, 1983.

REFERENCES:

1. Pulse and Digital Circuits – A. Anand Kumar.
2. Wave Generation and Shaping - L. Strauss.

ECE-414(E)	MOBILE COMMUNICATION	L	T	P	C
		3	1	0	3

1. Introduction

Wireless communication systems, Applications of wireless communication systems, Types of wireless communication systems, trends in mobile communication systems.

2. **Cellular Mobile Systems:** Basic cellular systems, Performance criteria, Uniqueness of mobile radio environment, Operation of cellular systems, analog & digital cellular systems.

3. Elements of Cellular Radio System Design

Concept of frequency reuse channels, Co-channel interference reduction factor, Desired C/I from a normal case in an omnidirectional antenna system, Handoff m4BTECE-01anism, Cell splitting.

4. Interference in Cellular Mobile System

Co-channel interference, Design of an omnidirectional antenna system in the worst case, Design of a directional antenna system, Lowering the antenna height, Power control, Reduction in CI by tilting antenna, umbrella pattern effect Adjacent-channel interference, Near-end – far-end interference, Effect on near-end mobile units.

5. Frequency management, channel assignment and handoffs

Frequency management, Frequency-spectrum utilization, Set-up channels, Fixed channel assignment schemes, Non-fixed channel assignment schemes, Concept of handoff, Initiationof a hard handoff, Delaying a handoff, Forced handoffs, Queuing of handoffs, Power- difference handoffs, Mobile assisted handoff, Soft handoffs, Cell-site handoff, Intersystem handoff, dropout calls.

6. GSM system overview

GSM system architecture, GSM radio subsystem, GSM channel types, Frame structure for GSM, Signal processing in GSM, GPRS and EDGE.

7. Wireless Networks

Overview of Wi-Fi, WiMAX and Bluetooth t4BTECE-01nology (Basic features and physical specifications).

Text Books:

1. Mobile Cellular Telecommunications: Analog and Digital Systems by William C. Y. Lee; Tata McGraw Hill Publication.
2. H. Labiod, H. Afifi, C. De Santis: WI-FI, BLUETOOTH , ZIGBEE and WIMAX-Springer-2007
3. Wireless Communications: Principles and Practice by Theodore S. Rappaport; Pearson / PHI Publication

References:

1. Wireless Communications and Networks: 3G and Beyond by Iti Saha Misra; Tata McGraw Hill Publication
2. Wireless and Digital Communications by Dr. Kamilo Feher; PHI Publication

ECE-414(F)	TELECOMMUNICATION MANAGEMENT	L	T	P	C
		3	1	0	3

1. Principles and Evolution of Switching Systems:

Basics of switching system, manual switching system, rotary dial telephone, signaling tones, Strowger switching components, step-by-step switching, design for 100 line, 1000 line, 10,000 line exchange, touch tone dial telephone, cross bar switching and exchange organization. Four wire concept, operation of hybrid, 4BTECE-01o suppressors. Centralized anddistributed SPC, software architecture, application software, enhanced services offered by SPC.

2. Space Division Switching:

Two, three and multistage space division networks, blocking probability calculations using Lee‟s method. Time Division Switching: Basic time division space switching, time division time switching, time multiplexed space switching, time multiplexed time switching. Combination Switching: S-T, T-S, S-T-S, T-S-T and other multistage combination switching.

3. Traffic Engineering:

Network traffic load and parameters, GOS and blocking probability, modeling switching systems, incoming traffic and service time characterization, blocking models and loss systems, delay systems.

4. Telephone Networks:

Subscriber loop systems, high data rate digital subscriber loop, asymmetric digital subscriber loop, VDSL, transmission plan, transmission systems, numbering plan, charging plan, basics of signaling, In channel signaling, common channel signaling.

5. Data Networks:

Data transmission in PSTN, switching t4BTECE-01niques for data transmission, OSI reference model, Satellite based data networks, fiber optic networks, protocol stacks, internetworking. ISDN services, transmission channels and user network interface in ISDN, ISDN protocol architecture, ISDN standards, ISDN numbering and addressing. Introduction to the basic principles of frame relay, TCP/IP and ATM.

Text Books:

1. Thiagarajan Viswanathan, “Telecommunication Switching Systems and Networks”, PHI Learning, New Delhi, 2008.
2. John C. Bellamy, “Digital Telephony”, John Wiley and Sons, Third edition, 2000.

Reference Book:

1. J.E.Flood, “Telecommunication switching traffic and networks”, Pearson Education Ltd, New Delhi, 2001.

ECE-415(A)	MEMS & SENSOR DESIGN	L	T	P	C
		3	1	0	3

1. Introduction to MEMS

Introduction to MEMS and Microsystems, Materials and Substrates for MEMS, Sensors/Transducers, Sensors characterization and classifications, microactuators, Application of MEMS.

2. Material Properties

MEMS materials, structural and sacrificial materials, properties of silicon, m4BTECE-01anical, electrical and thermal properties of materials, Basic modeling of elements in electrical and m4BTECE-01anical systems.

3. MEMS Fabrication

MEMS Fabrication T4BTECE-01nologies, single crystal growth, micromaching, photolithography, microsterolithography, thin film deposition, impurity doping, diffusion, etching, bulk and surface micromaching, etch stop t4BTECE-01nique and microstructure, LIGA.

4. M4BTECE-01anical Sensors & Actuators

Stress and Strain, Hooke's Law. Stress and Strain of Beam Structures, Cantilever, Pressure sensors, Piezoresistance Effect, Piezoelectricity, Piezoresistive Sensor, capacitive sensors, Inductive sensors, MEMS inertial sensors, micromachined microaccelerometer for MEMS, Parallel-plate Actuator, piezoactuators.

5. Magnetic Sensors

Magnetic material for MEMS, magnetic sensing and detection, mannetoresistive sensors, hall effect, magnetodiode, megnetotransitors, MEMS magnetic sensors, RF MEMS.

6. Thermal Sensors:

Temperature coefficient of resistance, Thermo-electricity, Thermocouples, Thermal and temperature sensors, heat pump, micromachined thermocouple probe, thermal flow sensors, shape memory allloy.

Text Books:

1. Analysis and Design Principles of MEMS Devices by Minhang Bao, ELSEVIER.
2. M. J. Usher, “Sensors and Transducers”, McMillian Hampshire.
3. N. P. Mahalik, “MEMS” Tata McGraq Hill.

References

1. R.S. Muller, Howe, Senturia and Smith, “Microsensors”, IEEE Press.
2. S. M. Sze, Semiconductor Sensors, Willy –Interscience Publications.

ECE-415(B)	FPGA & SoC DESIGN	L	T	P	C
		3	1	0	3

1. Revision of basic Digital systems:

Combinational Circuits, Sequential Circuits, Timing, Power Dissipation. Current state of the field. SoC, IP Design, SoPC. Design methodology, System Modeling, Hardware-Software Co-design, Device T4BTECE-01nology and Application Domains.

2. Digital system Design:

Top down Approach to Design, Case study. Data Path, Control Path, Controller behavior and Design, Case study Mealy & Moore Machines, Timing of sequential circuits, Pipelining, Resource sharing, FSM issues (Starring state, Power on Reset, State diagram optimization, State Assignment,Asynchronous Inputs, Output Races, fault Tolerance.

3. HDL for synthesis:

Introduction, Behavioral, Data flow, Structural Models. Simulation Cycles. Process.Concurrent Statements. Sequential Statements. Loops. Delay Models. Sequential Circuits, FSM Coding. Library. Functions, Procedures. Test benches.

4. FPGA deisgn:

Introduction.Logic Block Architecture.Routing Architecture. Programmable Interconnections. Design Flow. Xilinx Virtex-V (Architecture). Boundary Scan. Programming FPGA's. Constraint Editor, Static Timing Analysis. One hot encoding. Applications. Tools. Embedded System on Programmable Chip.Hardware-software co-simulation, Bus function models, BFMSimulation. Debugging FPGA Design.

5. SoC design:

System-level and SoC design methodologies and tools, HW/SW Co-design, analysis, partitioning, real-time scheduling, hardware acceleration, Virtual platform models, co-simulation and FPGAs for prototyping of HW/SW systems, Introduction to SystemC, SoCand IP integration, verification and test.

Textbooks:

1. Zainalabedin Navabi, Verilog, analysis and modeling of digital systems, McGraw-Hill.
2. D. Black, J. Donovan, SystemC: From the Ground Up, Springer, 2004.

References:

1. Jon F Wakerly, Digital Design: Principles and Practices, Prentice Hall.
2. G. De Micheli, Synthesis and Optimization of Digital Circuits, McGraw-Hill, 1994.

ECE-415(C)	RF IC DESIGN	L	T	P	C
		3	1	0	3

1. Characteristics of passive IC components at RF frequencies:

Interconnects, resistors, capacitors, inductors and transformers – Transmission lines. Noise – classical two-port noise theory, noise models for active and passive components

2. High frequency amplifier design:

Zeros as bandwidth enhancers, shunt-series amplifier, f_T doublers, neutralization and unilateralization

3. Low noise amplifier design:

LNA topologies, power constrained noise optimization, linearity and large signal performance

4. Mixers:

Nonlinear systems as linear mixers, multiplier-based mixers, subsampling mixers, diode-ring mixers

5. RF power amplifiers:

Class A, AB, B, C, D, E and F amplifiers, modulation of power amplifiers, design and linearity considerations

6. Oscillators & synthesizers:

Basic topologies, VCO, describing functions, resonators, negative resistance oscillators, synthesis with static moduli, synthesis with dithering moduli, combination synthesizers – phase noise considerations.

Text Books:

1. Thomas H. Lee, The Design of CMOS Radio-Frequency Integrated Circuits, 2nd ed., Cambridge, UK: Cambridge University Press, 2004.
2. Behzad Razavi, RF Microelectronics,2nd Ed., Prentice Hall, 1998.

Reference Books:

1. A.A. Abidi, P.R. Gray, and R.G. Meyer, eds., Integrated Circuits for Wireless Communications, New York: IEEE Press, 1999.
2. R. Ludwig and P. Bretchko, RF Circuit Design, Theory and Applications, Pearson, 2000.

ECE-415(D)	ADVANCED IC DESIGN	L	T	P	C
		3	1	0	3

1. **Operational Amplifier Design** using CMOS as well as Bipolar t4BTECE-01nologies. Linear and non linear applications of operational amplifiers. Active filters, response characteristics of Butter worth, Chebyshev and causal filters. Design and analysis of higher order filters of all types.

2. **Design of Super Buffer Circuits** for driving large capacitive loads. Design and analysis CMOS Schmitt trigger circuit.

3. **Comparators** and their characteristics zero crossing detector, voltage limiters, absolute value detectors, sample and hold circuit.

4. **Biomedical applications** of instrumentation amplifier. Design and analysis of multi-vibrator circuits using transistors, Op-Amps and 555 Timer.

5. **Design and analysis of oscillator circuits** using transistors and Op-Amps. Phase shift, Wein Bridge and quadrature oscillators. Square wave, triangular wave, saw tooth wave generators and voltage controlled oscillator.

6. **Differential and Feedback Amplifiers** and their analysis.

Text Books:

1. P.E. Allen, D. R. Holberg, „CMOS Analog Circuit Design".
2. S.M. Kang & Y. Leblebici, „CMOS Digital Integrated Circuits-Analysis & Design", TMH.
3. R.A. Gayakwad, „OP-AMP and Linear Integrated Circuits", 2nd edition, PHI.

References:

1. J. Millman & H. Taub, „Pulse, Digital and Switching Waveforms", TMH.
2. B.G. Streetman and S. Banerjee, „Solid State Electronic Devices", PHI.
3. B. Razavi, „Design of Analog CMOS Integrated Circuits", Tata Mcgraw Hill, 2005.

ECE-415(E)	HDL based design	L	T	P	C
		3	1	0	3

1. Introduction

Introduction and levels of abstraction, modeling and hierarchical design concepts, Languages, Compilation & Simulation, concurrency, Logic value system

2. Language concepts

Lexical conventions, data types, modules and ports, behavioral modeling, dataflow modeling, structural modelling.

3. RTL Design

Control & Data partitioning, Synthesis concepts, non synthesizable constructs, operators, expressions, conditional statements, post synthesis simulation.

4. Hardware modules

Boolean equations, Encoders, Decoders, multiplexers, cascaded multiplexers, adders, comparators, multipliers, sorters, shifters, static and dynamic memories, Mealy & Moore finite state machine, Implementation on FPGA

Text Books:

1. Peter J. Ashenden, The Designer's Guide to VHDL, 2nd Edition , Morgan Kaufmann Publishers, 2001
2. J. Bhasker, A Verilog HDL Primer, Star Galaxy Press, 1996
3. Samir Palnitkar, Verilog HDL : A Guide to Digital Design and Synthesis, Prentice Hall, 1996

References:

1. Vivek Sagdeo, The Complete Verilog Book, Kluwer Academic Publishers.
2. Douglas J. Smith, HDL Chip Design : A Practical guide for Designing, Synthesizing and Simulating ASICs and FPGAs using VHDL or Verilog, Doone Pubns, 1996.
3. Ben Cohen, VHDL Coding Styles and Methodologies, Kluwer Academic Publishers, 1999.
4. J. Bhasker, A VHDL Primer, Third Edition, Prentice Hall, 1998.

BTECE-421	MICROWAVE DEVICES & SYSTEMS	L	T	P	C
		3	1	0	3

1. Introduction on Microwaves

Frequency allocations and frequency plans, Microwave waveguide, Rectangular waveguide and its analysis, circular waveguide, modes of propagation, dominant modes, cut off wavelength, mode excitation.

2. Microwave generators and amplifiers

Limitations of conventional tubes at microwave frequency, reflex klystron, two and multi cavity klystron amplifiers and oscillators and their analysis, Basics on Magnetrons and traveling wave tube and their applications.

3. Microwave devices

Scattering matrix of microwave waveguide junction, properties of S-matrix, E-plane tee, H- plane tee, magic tee, attenuators, directional couplers, ferrite devices, Faraday rotation, gyrator, isolator, circulators and cavity resonators

4. Microwave solid-state devices

Gunn diode and its modes of operation, Avalanche IMPATT diode, TRAPATT diode, operations and V-I characteristics of Tunnel diode, Schottky diode, Backward diode and Varactor diodes, PIN diode and its applications.

5. Microwave Measurements

Measurement of standing wave ratio, measurement of wavelength and frequency, measurement of power, radiation pattern measurement of antenna.

6. Micro-Strip Lines

Introduction on Micro strip lines, characteristic impedance of micro strip lines, losses in micro strip lines, quality factor of micro strip, parallel strip lines, coplanar strip lines and shielded strip lines.

7. Microwave Link

Microwave radio station, microwave transmitter and receiver, multiplexing equipment, microwave link.

Text Books:

1. Foundations for Microwave Engineering, International student edition, R E.Collins
2. Microwave Engg by M Kulkarni,
3. Microwave Devices and Circuits „3rd edition" Samuel Y Liao.

Reference Books:

1. Microwave Engg, David M. Pozar, Wily Publication
2. Microwave Engineering by A Das and S K Das
3. Microwave Engineering Rajeswari Chatterjee
4. Microwaves by M.L.Sisodiya and Vijay Laxmi Gupta

BTECE-	SPREAD SPECTRUM AND CDMA	L	T	P	C
		3	1	0	3

1. Principles of direct spread spectrum

Direct spectrum system: Definition and concepts, Spreading Sequences and Waveforms,Random Binary Sequence, Shift-Register Sequences, Periodic Auto Correlations, Polynomials over the Binary Field, Systems with PSK Modulation, Power Spectral density of DSS-CDMA, Pulsed Interference, De-spreading with Matched Filter.

2. Frequency Hopped Systems

Concepts and characteristics, Modulations, MFSK, Hybrid Systems, Frequency Synthesizers, Direct Frequency Synthesizer, Digital Frequency Synthesizer, Indirect Frequency Synthesizers.

3. Spreading Code Acquisition and Tracking

Initial Code acquisition, Acquisition strategy: Serial Search, Parallel Search, multi-dwell detection, false alarm and miss probability for matched filter receiver, False alarm and miss probability for radiometer, mean overall acquisition time for serial search.

4. Performance of Spread Spectrum System

Link performance of direct sequence spread spectrum CDMA in (i) Additive White Noise Channel (ii) Multipath fading Channel. Concept of Rake Receiver, Performance of RAKE receiver in multipath fading.

5. CDMA Systems

CDMA-IS-95: Forward link Channels, Reverse link Channels, Power Controls and Handoff Procedure in IS-95, Overview of CDMA based 3G Systems.

Text Books:

1. Don Torrieri: Principles of Spread Spectrum Communication Systems- Springer Science & Business Media, Inc.
2. Andrew J. Viterbi: CDMA: Principles of Spread Spectrum Communication – Addison-Wesley Publishing Company.

References:

1. Mosa Ali Abu-Rgheff, “Introduction to CDMA Wireless Communications”, Elsevier Academic Press.
2. R. MichaelBuehrer, “Code Division Multiple Access-CDMA”, Morgan & Claypool Publishers Series.
3. Jhong S. Lee and Leonard E. Miller, “CDMA Systems Engineering Handbook”, Art4BTECE-01House Publishers.
4. R. Michael Buehrer, “Code Division Multiple Access (CDMA),” Morgan and Claypool Publishers.

8BTECE-	DATA COMMUNICATION & COMPUTER NETWORKS	L	T	P	C
		3	1	0	3

1. Introduction to Data Communication

Goals and Applications of Networks, Wireless Network, Interfaces and services. Reference Models: The OSI reference model, TCP/IP reference model.

2. Physical Layer

Data and Signals, Digital and Analog transmission, Transmission Media, Wireless transmission, Switching

3. Data Link Layer

Data link layer design issues, Services provided to Network layers, Framing, Error control, Flow control, Error detection and correction, Elementary data link protocols, An unrestricted Simplex protocol, A Simplex Stop-and-Wait protocol, Simplex Protocol for a noisy channel, Sliding Window protocols, A protocol using go-back-N, A protocol using selective repeat, Example data link protocol-HDLC, PPP.

4. Medium Access Sublayer

Channel Allocations, Random Access, ALOHA, Carrier Sense Multiple Access Protocols, Collision free Protocols, Limited contention protocols, Controlled Access, Channelization, Wired LANs: Ethernet, Wireless LANs.

5. Network Layer

Network Layer Design issue, Logical Addressing, Address Mapping, Error Reporting and Multicasting, Delivery Forwarding and Routing.

6. Transport Layer

Process to Process Delivery: UDP,TCP and SCTP.

7. Application Layer

Design issues of the layer, Domain Name systems, File Transfer, http, web documents,Virtual Terminals.

Text Books:

1. J Frauzon “Computer Communication and Networks”.
2. W. Stallings, “Data and computer communication”, PHI.

References:

1. S. Keshav, “An Engineering Approach on Computer Networking”, Addison Welsey.
2. Wayne Tomasi “Introduction to Data Communications and Networking” Pearson.
3. A.S. Tanenbaum, “Computer Networks”, PHI.

8BTE CE-	OPTICAL NETWORKS	L	T	P	C
		3	1	0	3

1. Introduction to Optical Network

Services, Circuit Switching, Packet Switching, Optical Networks, Optical Layer, Transparency and All Optical Networks, Optical Packet Switching, Transmission Basics, Network Evolution.

2. Optical Amplifiers

Stimulated Emission, Spontaneous Emission, Erbium Doped Fiber amplifiers, Raman amplifiers, Semiconductor Optical Amplifiers, Cross talk in SOAs.

3. Multiplexers and Filters to Wavelength Converters

Gratings, Diffraction Pattern, Bragg Gratings, Fiber Gratings, Fabry-Perot filters, Multilayer Dielectric Thin-Film Filters, Mach-Zehnder Interferometers, Arrayed Waveguide Grating, Acousto-Optic Tunable Filter, High channel Count Multiplexer Architectures, Optoelectronics Approach, Optical Gating, Interferometric T4BTECE-01niques, Wave Mixing.

4. Transmission System Engineering

System Model, Power Penalty, Transmitter, Receiver, Optical Amplifiers, Cross talk, Dispersion, Fiber Nonlinearities, Wavelength Stabilization Design of Soliton Systems, Designof Dispersion –Managed Soliton Systems.

5. Client Layers of the Optical Layer

SONET/SDH, ATM, IP, Storage Area Networks, Gigabit and 10-Gigabit Ethernet.

6. WDM Network Elements & Design

Optical Line Terminals, Optical Line Amplifiers, Optical Add/Drop Multiplexers, Optical Cross connects. Cost Trade-Offs: A Detailed Ring Network Example, LTD and RWA Problems, Dimensioning Wavelength-Routing Networks, Statistical Dimensioning Models, Maximum Load Dimensioning Models

7. Access Networks

Network Architecture Overview, Enhanced HFC, and fiber to the Curb (FTTC).

Textbooks/References

1. Optical Networks: A practical Perspective. Ramaswami & K.N. Sivarajan Morgan
2. Kaufmann 2nd Edition. G.P. Agarwal, "Fiber optic communication systems ", 2nd Edition, John Wiley & Sons, New York, 1997.
3. Franz and Jain, "Optical communication system ", Narosa Publications, New Delhi, 1995.
4. G.Keiser, "Optical fiber communication ", Systems, McGraw-Hill, New York, 2000.
5. Franz & Jain, "Optical communication ", Systems and components, Narosa Publications, New Delhi, 2000.

8BTECE-	WIRELESS SENSOR NETWORKS	L	T	P	C
		3	1	0	3

1. Introduction

Wireless sensor networks: the vision, Networked wireless sensor devices Applications of wireless sensor networks, Key design challenges

2. Network deployment

Structured versus randomized deployment, Network topology, Connectivity in geometricrandom graphs, Connectivity using power control, Coverage metrics, Mobile deployment

3. Localization and Time synchronization

Key issues, Localization approaches, Coarse-grained node localization using minimal information, Fine-grained node localization using detailed information, Network- wide localization, Theoretical analysis of localization t4BTECE-01niques, Key issues of time synchronization, Traditional approaches, Fine-grained clock synchronization, Coarse-grained data synchronization

4. Wireless characteristics and Medium-access

Wireless link quality, Radio energy considerations, The SINR capture model for interference, Traditional MAC protocols, Energy efficiency in MAC protocols, Asynchronous sleep t4BTECE-01niques, Sleep-scheduled t4BTECE-01niques, and Contention-free protocols.

5. Sleep-based topology control and Energy-efficient routing

Constructing topologies for connectivity, Constructing topologies for coverage, Set K-cover algorithms, Cross-layer issues, Metric-based approaches, Routing with diversity, Multi-path routing, Lifetime-maximizing energy-aware routing t4BTECE-01niques, Geographic routing, Routing to mobile sinks

6. Dta-centric networking

Data-centric routing, Data-gathering with compression, Querying, Data-centric storage and retrieval, the database perspective on sensor networks

7. Transport reliability and congestion control

Basic m4BTECE-01anisms and tunable parameters, Reliability guarantees, Congestion control, Real- time scheduling

Text/Reference Books:

1. Bhaskar Krishnamachari: Networking Wireless Sensors- Cambridge University Press
2. Kazem Sohraby, Daniel Minoli, Taieb Znati: Wireless Sensor Networks: T4BTECE-01nology,Protocols and Applications- John Wiley & Sons

8BTE CE-	SIGNAL PROCESSING FOR IMAGE AND VIDEO	L	T	P	C
		3	1	0	3

1. Digital image fundamentals

Image acquisition, representation, visual perception, quality measures, sampling and quantization, basic relationship between pixels, imaging geometry, color spaces, Video spaces, analog and digital video interfaces, video standards.

2. Two dimensional systems

Properties, analysis in spatial, frequency and transform domains.

3. Image transforms

DFT, DCT, Sine, Hadamard, Haar, Slant, KL transform, Wavelet transform. Image enhancement – point processing, spatial filtering,

4. Image restoration

Inverse filtering, de-blurring. Video processing – display enhancement, video mixing, video scaling, scan rate conversion.

5. Image compression

lossless and lossy compression t4BTECE-01niques, standards for image compression – JPEG, JPEG2000.

6. Video compression

Motion estimation, intra and interframe prediction, perceptual coding, standards - MPEG, H.264 Image segmentation – feature extraction, region oriented segmentation, descriptors, morphology, Image recognition .

Text/Reference Books:

1. R. C. Gonzalez and R E Woods, Digital Image Processing, Pearson Education, 2002
2. A K Jain, Fundamentals of Digital Image Processing, Pearson Education,1989
3. W Pratt, Digital Image Processing, Wiley, 2001
4. Al Bovik, Handbook of Image and Video, Academic Press, 2000
5. Keith Jack, Video Demystified, LLH, 2001

8BTE CE-	ERROR CONTROL & CODING	L	T	P	C
		3	1	0	3

1. Linear Block Codes

The Repetition codes, Vector space over binary field, Syndrome Error Detection, Minimum distance of block codes, Hamming codes, Error detection and correction, Shortened and extended linear block codes.

2. Cyclic Codes

Definition, Polynomials, Generator polynomials, Encoding and Decoding, Generator andParity check matrices for cyclic codes. Linear feedback shift registers for encoding and decoding cyclic codes, The Meggitt decoder.

3. BCH and RS codes

Galois fields, GF(2^3), GF(2^4), GF(2^5), Primitive field elements, Irreducible and primitive polynomials, Minimal Polynomials, Definition and construction of binary BCH Codes, Decoding of BCH Codes, Error location Polynomial, PGZ - Decoder, RS codes, The Berlekamp algorithm.

4. Convolution Codes

Convolution codes and encoders, Convolution encoder representation, The Veterbi decoder.

5. LDPC and Turbo Codes

Introduction to LDPC and Turbo Codes.

Text Books:

1. J. C. Moreira, P. G. Farrell, “Essentials of Error – Control Coding”, Wiley.
2. S. Gravano, “Introduction to Error Control Codes”, Oxford University Press.

Reference Books:

1. Shu Lin and Daniel J. Costello Jr., “Error Control Coding: Fundamentals and Applications”, Prentice Hall.
2. Tood K. Moon, “Error Correction Coding” Wiley.

8BTE CE-	RADAR & NAVIGATIONAL AIDS	L	T	P	C
		3	1	0	3

1. Introduction

Working Principle of Radar, Radar Frequencies, Radar Equation, Minimum detectable signal, integration of radar pulses, Pulse repetition frequency and range ambiguities, Applications of Radar.

2. Radar systems

Elementary Radar signal processing, RADAR cross section, RADAR detection, range & Doppler measurements, tracking,

3. CW Radar

The Doppler Effect, FM-CW radar- Multiple frequency radar , MTI Radar- Principle, Delay line cancellers- Staggered PRF, MTI-Pulse Doppler radar- Tacking Radar –Sequential lobing-Conical Scan- Monopulse – Acquisition- Comparison of Track. Detection of Radar signals in noise – Matched filter criterion-detection criterion – Extraction of information and waveform design , Propagation of radar waves –Radar clutter

4. Navigation Aids

Radio Direction Finding - The Loop Antenna - Loop Input Circuits - An Aural Null Direction Finder - The Goniometer - Errors in Direction Finding - Adcock Direction Finders - Direction Finding at Very High Frequencies - Automatic Direction Finders - The Commutated Aerial Direction Finder - Range and Accuracy of Direction Finders Radio Ranges - The LF/MF Four course Radio Range - VHF Omni Directional Range(VOR) - VOR Receiving Equipment - Range and Accuracy of VOR - Recent Developments. Global Positioning System (GPS)

Books Recommended:

1. Skolnik, “Introduction to Radar Systems”, Tata McGraw Hill.
2. Peyton Z. Peebles, Jr, “Radar Principles”, John Wiley and Sons (2004).
3. Nagaraja, “Electronic Navigation”, Tata McGraw Hill.
4. M.Skolnik, Introduction to Radar system, McGraw Hill 2002.
5. R.J Sullivan, Radar foundation for imaging & advanced concepts, PHI, 2004.

8BTECE-	LOW POWER VLSI DESIGN T4BTECE-01NIQUES	L	T	P	C
		3	1	0	3

1. Introduction:

Need for low power VLSI chips, Sources of power dissipation on Digital Integrated circuits, Physics of power dissipation in CMOS devices, Dynamic dissipation in CMOS, leakage power dissipation, Impact of t4BTECE-01nology Scaling, T4BTECE-01nology & Device innovation.

2. Low Power Design:

Circuit Level: Transistor & gate sizing, Circuit t4BTECE-01niques for leakage power reduction, supply voltage scaling t4BTECE-01niques, DTCMOS, MTCMOS, low voltage low power design,Flip Flops & Latches design,

Logic Level: Gate reorganization, signal gating, logic encoding, state machine encoding, pre-computation logic.

Low Power Architecture & Systems: Power & performance management, switching activity reduction, parallel architecture with voltage reduction, flow graph transformation, Low Power bus.

3. Power Estimation

Simulation Power analysis: SPICE circuit simulators, gate level logic simulation, capacitive power estimation, static state power, gate level capacitance estimation, data correlation analysis in DSP systems,

Probabilistic power analysis: Random logic signals, probability & frequency, probabilistic power analysis t4BTECE-01niques.

4. Low Power Clock Distribution

Power dissipation in clock distribution, single driver Vs distributed buffers, Zero skew Vs tolerable skew, Various clock distribution networks

Text Books:

1. Gary K. Yeap, “Practical Low Power Digital VLSI Design”, KAP, 2002
2. Rabaey and Pedram, “Low power design methodologies” Kluwer Academic,1997

Reference Books:

1. Kaushik Roy, Sharat Prasad, “Low-Power CMOS VLSI Circuit Design” Wiley, 2000.
2. Kait-Seng Yeo, Kaushik Roy, “Low-Voltage Low-Power VLSI subsystems” Tata McGraw-Hill, 2009.

8BTECE-	VLSI INTERCONNECTS & PACKAGING	L	T	P	C
		3	1	0	3

1. Interconnects

Small, Intermediate and long interconnects in VLSI, Interconnect Parasitics: Resistance, Inductance and Capacitance. Interconnect RC Delays: Elmore Delay Calculation. Interconnect Models: Lumped RC Model, Distributed RC Model, Transmission line model. SPICE Wire Models: Distributed RC lines in SPICE, Transmission line models in SPICE.

2. Scaling issues in VLSI Devices and Interconnects

Scaling and its effect on performance parameters.

3. Interconnect Delay

Methods for improving interconnect RC delay

4. CMOS Repeater Driven Interconnects

The Static Behavior- Switching Threshold, Noise Margins, The Dynamic Behavior- Computing the capacitances, Propagation Delay: First order Ana**a**lysis, Propagation Delay from a Design perspective. Power, energy and Energy-Delay- Dynamic Power Consumption, Static Consumption, Transient analysis of repeater loaded interconnects and analysis of Power Consumption using SPICE

5. Transmission line model of Interconnects

Lossy line, Termination Conditions, Crosstalk and Noise in interconnects.

6. Advanced Interconnect T4BTECE-01niques

Reduced-swing Circuits, Current-mode Transmission T4BTECE-01niques, Clocking of high-speed systems, CNT and Optical Interconnects.

7. Packaging T4BTECE-01niques

Introduction to packaging, Package design considerations, VLSI Assembly T4BTECE-01niques, Packaging fabrication t4BTECE-01nology, THM, Surface Mounting.

Text Books:

1. H.K. Bakoglu, “Circuits, Interconnections & Packaging for VLSI”, Addison Wesley Publication Company Inc.
2. A.K. Goel, High-Speed VLSI Interconnections, Wiley Interscience, 2nd Edition, 2007.

Reference Books:

1. M. A. Elgamel, M. A. Bayoumi, Interconnect Noise Optimization in NanometerT4BTECE-01nologies, Springer.
2. Jan M. Rabaey, Analysis and Design of Digital Integrated Circuits– A design Perspective, TMH, 2nd Edition 2003.
3. F.Moll, M.Roca, Interconnection Noise in VLSI Circuits, Kluwer Academic Publishers.

8BTECE-	NANOELECTRONICS	L	T	P	C
		3	1	0	3

1. Introduction of Nanoelectronics

The "Top-Down" Approach; The "Bottom-Up" Approach; Why Nanoelectronics; Nanot4BTECE-01nology Potential; MOS Scaling theory-Issues in scaling MOS transistors; Short channel effects; Requirements for non-classical MOS transistor; Metal gate transistor-Motivation, requirements, Integration Issues; High-k gate based MOSFET-Motivation, requirements, integration issues of high-k.

2. Quantum M4BTECE-01anics of Electrons

General postulates of quantum m4BTECE-01anics; Time-independent Schrodinger"s equation- boundary conditions on the Wave function; Analogies between quantum m4BTECE-01anics and classical electromagnetic; probabilistic current density; Multiple particle systems; Spin and angular Momentum.

3. Free and Confined Electrons

Free Electrons; Free electron gas theory of metals; Electrons confined to a bounded region of space and quantum numbers; Partially confined electrons- finite potential wells; Quantum wells; Quantum wires; Quantum dots.

4. Tunnel Junctions and Applications of Tunneling

Tunneling through a potential barrier; Potential energy profiles for material interfaces; Applications of tunneling; Coulomb blockade, Single-Electron Transistor (SET).

5. Germanium Nano MOSFETs

Strain, Quantization; Advantages of germanium over silicon; PMOS versus NMOS; Compound semiconductors - material properties; MESFETs; Compound semiconductors MOSFETs in the context of channel quantization and strain; Hetero structure MOSFETs exploiting novel materials, strain, quantization.

6. Non-Conventional MOSFET Structures

SOI-PDSOI and FDSOI; Ultrathin body SOI-double gate transistors, integration issues; Vertical transistors–FinFET and Surround gate FET; Carbon Nanotube Transistors (CNT); Semiconductor Nanowire FETs and SETs; Molecular SETs and Molecular Electronics.

Text Books:

1. Fundamentals of Modern VLSI Devices, Y. Taur and T Ning, Cambridge University Press.
2. Fundamental of Nanoelectronics, George W. Hanson Pearson Education.

References:

1. Silicon VLSI T4BTECE-01nology, Plummer, Deal, Griffin, Pearson Education India.
2. Encyclopedia of Materials Characterization, Edited by Brundle, C.Richard; Evans, Charles A. Jr.; Wilson, Shaun, Elsevier.

8BTECE-	CAD OF INTEGRATED CIRCUITS	L	T	P	C
		3	1	0	3

1. Introduction to Hierarchical and Structured Design

Role of CAD Tools in the VLSI design process, CAD Algorithms for switch level and circuitssimulation, T4BTECE-01niques and algorithms for symbolic layout, Algorithms for physical design – Placement and routing Algorithms, Compaction, Circuit extraction and Testing.

2. Specification of Combinational Systems Using VHDL

Introduction to VHDL, Basic language element of VHDL, Behavioral Modeling, Data flow modeling, Structural modeling, Subprograms and overloading, VHDL description of gates.

3. Description and Design of Sequential Circuits

Standard combinational modules, Design of a Serial adder with accumulator, State graph for control network, Design of a binary multiplier, Multiplication of a signed binary number, Design of a binary divider.

4. Register-Transfer Level Systems

Execution graph, Organization of system, Implementation of RTL Systems, Design of RTL systems, Analysis of RTL systems.

5. Data Subsystems

Storage modules, Functional modules, Data paths, Control subsystems, Micro programmed controller, Structure of a micro programmed controller, Micro instruction format, Micro instruction sequencing, Micro instruction Timing, Basic component of a micro system, Memory subsystem.

6. I/O Subsystem

Processors, Operation of the computer and cycle time. Binary decoder, Binary encoder,Multiplexers and demultiplexers, Floating Point arithmetic-representation of floating point number, Floating point multiplication, Adders, Multipliers.

7. PLA based synthesis

Multilevel logic synthesis, Logic optimization, Logic simulation, Compiled and event simulators, Relative advantages and disadvantages, Layout Algorithms, Circuit partitioning, Placement and routing algorithms, Automatic test program generation, Combinational testing, D-Algorithm and PODEM algorithm, Scan-based testing of sequential circuits, Testability measures for circuits.

Text Books

1. J. Bhaskar, “A VHDL Primer”, Addison Wesley, 1999.
2. M. Ercegovac, T. Lang and L.J. Moreno, “Introduction to Digital Systems”, Wiley, 2000.
3. C. H. Roth, “Digital System Design using VHDL”, PWS Publishing.
4. G. DeMicheli, “Synthesis and optimization of digital circuits”, McGraw Hill.

References

1. J.F. Wakerly, “Digital Design-Principles and Practices”, PHL
2. Douglas Perry, “VHDL”, MGH.