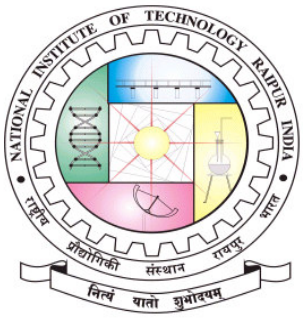
SCHEME AND DETAILED SYLLABUS

FOR

B.TECH FOUR YEAR DEGREE COURSE

IN

ELECTRONICS & TELECOMMUNICATION ENGINEERING



DEPARTMENT OF ELECTRONICS & TELECOMMUNICATION

National Institute of Technology Raipur

Chhattisgarh – 492010

SCHEME AND DETAILED SYLLABUS

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(To be applicable for batches admitted from July, 2010 onwards)

Table of Contents

PREFACE

Curriculum document is a comprehensive plan of any educational programme. It is also one of the means for bringing about qualitative improvement in any programme. The objective of this curriculum is to enable the students to face present and future challenges in the field of Electronics and Telecommunication Engineering. To improve upon overall development and efficiency of the teaching-learning process, the contents of various subjects' communication skills, present quality standards etc. have been improved upon to suit present and future requirements by enriching the curriculum by adding conceptual, practical, industry-relevant and futuristic components.

The field of Electronics and Telecommunication Engineering has continued to evolve and expand, further blurring its boundaries with other disciplines. In particular the overlap with computer science continues to grow. In addition to becoming broader, Electronics Engineering has been strongly influenced by the rapid growth in information processing. Information technology has served both as a dominant consumer electronic technology, and provided the tools that drive further innovations. As a consequence, the complexity of the systems that our students deal with has grown exponentially. Our curriculum must provide them with not only the insights to understand the underlying technologies and theories associated with each level of complexity, but also the knowledge and skills to choose the appropriate abstraction level for each component, making the complexity work for them rather than against them.

Today's students have more exposure and background in software than hardware. Students are also used to dealing in a world with abundant information, and many distractions and they feel more comfortable in situations where the application for the information being taught is clear. Our current curriculum lays out the fundamentals first before getting to applications and is a "poor impedance match" to our students. In summary, we need to change our undergraduate curriculum to

- Motivate students to "sample" different areas,
- Emphasize how fundamental principles cut across different core areas,
- Arouse the students' interest and curiosity in "hardware,"
- Blur the boundary between "software" and "hardware,"
- Broaden the students' appreciation of system issues, and
- Familiarize students with different levels of system abstraction.

Unfortunately we need to implement these changes in a constrained environment. It may not be possible to teach everything essential in four year under graduate course. It may be left on the student which particular sub-field he/she is interested in. This curriculum first covers up the fundamental subjects before allowing the students to try a wide range of subjects in the form of electives. We hope this curriculum to be useful for bringing out successful engineers and scientists of future.

SCHEME OF STUDY

SCHEME OF STUDY

Semester III

S. No	Board of Studies	Sub Code	Subject Name	Periods/ week			Examination Scheme					Total Marks	Credits L+(T+P)/ 2
				L	T	P	TA	FE	SE	T.C.A.	ESE		
1	Math	MA	Mathematics-III	3	1	-	20	15	15	50	70	120	4
2	ETC	EC301	Signals and systems	3	1	-	20	15	15	50	70	120	4
3	ETC	EC302	Digital logic design	3	1	-	20	15	15	50	70	120	4
4	ETC	EC303	Electronic measurements and instrumentation	3	1	-	20	15	15	50	70	120	4
5	ETC	EC304	Network analysis and synthesis	3	1	-	20	15	15	50	70	120	4
6	ETC	EC305	Devices and circuits-I	4	1	-	20	15	15	50	70	120	5
7	ETC	EC391	Data structures lab	-	-	3	30	-	-	30	20	50	2
8	ETC	EC392	Devices and circuits-I lab	-	-	3	30	-	-	30	20	50	2
9	ETC	EC393	Digital logic design lab	-	-	3	30	-	-	30	20	50	2
10	Humanities		Value Education	-	-	2	25	-	-	25	0	25	1
11			Discipline	-	-	-	25	-	-	25	0	25	1
			Total	19	6	11	260	90	90	440	480	920	33

TCA = Total of Continuous Assessment, TA = Teacher's Assessment, FE = First Exam, SE = Second Exam, ESE = End Semester Exam.

Semester IV

S. No	Board of Studies	Sub Code	Subject Name	Periods/ week			Examination Scheme					Total Marks	Credits L+(T+P)/ 2
				L	T	P	TA	FE	SE	T.C.A.	ESE		
1	Mathematics	MA	Probability and stochastic process	3	1	-	20	15	15	50	70	120	4
2	ETC	EC401	Analog communication	3	1	-	20	15	15	50	70	120	4
3	ETC	EC402	Computer organization and architecture	3	1	-	20	15	15	50	70	120	4
4	ETC	EC403	Electromagnetic waves and antennas	3	1	-	20	15	15	50	70	120	4
5	ETC	EC404	Devices and circuits-II	3	1	-	20	15	15	50	70	120	4
6	ETC	EC405	Microprocessors (8085/86)	4	1	-	20	15	15	50	70	120	5
7	ETC	EC491	Analog communication lab	-	-	3	30	-	-	30	20	50	2
8	ETC	EC492	Devices and circuits-II lab	-	-	3	30	-	-	30	20	50	2
9	ETC	EC493	Microprocessors (8085/86) lab	-	-	3	30	-	-	30	20	50	2
10	Humanities		Personality Development	-	-	2	25	-	-	25	0	25	1
11			Discipline	-	-	-	25	-	-	25	0	25	1
			Total	19	6	11	260	90	90	440	480	920	33

Semester V

S. No.	Board of Studies	Sub Code	Subject Name	Periods/week			Examination Scheme					Total Marks	Credits L+(T+P)/ 2
				L	T	P	TA	F E	S E	T.C. A.	ES E		
1	ETC	EC51X	Elective-1	3	1	-	20	15	15	50	70	120	4
2	ETC	EC501	Analog integrated circuits and applications	3	1	-	20	15	15	50	70	120	4
3	ETC	EC502	Automatic control systems	3	1	-	20	15	15	50	70	120	4
4	ETC	EC503	Digital signal processing	3	1	-	20	15	15	50	70	120	4
5	ETC	EC504	Microcontroller and embedded system	3	1	-	20	15	15	50	70	120	4
6	ETC	EC505	Digital communication	4	1	-	20	15	15	50	70	120	5
7	ETC	EC591	Digital communication lab	-	-	3	30	-	-	30	20	50	2
8	ETC	EC592	Analog integrated circuits lab	-	-	3	30	-	-	30	20	50	2
9	ETC	EC593	Digital signal processing lab	-	-	3	30	-	-	30	20	50	2
10	Hum anities		Managerial Skill	-	-	2	25	-	-	25	0	25	1
11			Technical Visit/ Practical Training	-	-	-	25	-	-	25	0	25	1
			Total	19	6	11	260	90	90	440	480	920	33

ELECTIVE 1			
S. No.	Board of Studies	Sub Code	Subject Name
1	ETC	EC511	Internet and web technology.
3	ETC	EC512	Electronic system design.
4	ETC	EC513	Power electronics.
5	ETC	EC514	Fundamentals of operating systems
6	ETC	EC515	Audio system engineering

Semester VI

S. No	Board of Studies	Sub Code	Subject Name	Periods/week			Examination Scheme					Total Marks	Credits L+(T+P)/ 2
				L	T	P	TA	F E	S E	T.C. A.	ES E		
1	ETC	EC61X	Elective-2	3	1	-	20	15	15	50	70	120	4
2	ETC	EC601	Data communication and networking	3	1	-	20	15	15	50	70	120	4
3	ETC	EC602	Digital system design	3	1	-	20	15	15	50	70	120	4
4	ETC	EC603	Wireless communication	3	1	-	20	15	15	50	70	120	4
5	ETC	EC604	VLSI and microelectronics	3	1	-	20	15	15	50	70	120	4
6	ETC	EC605	Microwave and radar engineering	4	1	-	20	15	15	50	70	120	5
7	ETC	EC691	VLSI and digital system design lab	-	-	3	30	-	-	30	20	50	2
8	ETC	EC692	Microcontroller and embedded system lab	-	-	3	30	-	-	30	20	50	2
9	ETC	EC693	Microwave and RF lab	-	-	3	30	-	-	30	20	50	2
10	Hum anities		I & E Skill	-	-	2	25	-	-	25	0	25	1
11			Discipline	-	-	-	25	-	-	25	0	25	1
			Total	19	6	11	260	90	90	440	480	920	33

ELECTIVE 2			
S. No	Board of Studies	Sub. Code	Subject Name
1	ETC	EC611	Optoelectronic devices and circuits
2	ETC	EC612	Advanced microprocessors
3	ETC	EC613	Neural network & fuzzy logic
4	ETC	EC614	Industrial instrumentation.
5	ETC	EC615	Adaptive signal processing

Semester VII

S. No	Board of Studies	Sub Code	Subject Name	Periods/week			Examination Scheme					Total Marks	Credits L+(T+P)/2
				L	T	P	TA	FE	SE	T.C.A.	ESE		
1	ETC	EC701	Information theory and coding	3	1	-	20	15	15	50	70	120	4
2	ETC	EC71X	Elective-3	3	1	-	20	15	15	50	70	120	4
3	ETC	EC72X	Elective-4	3	1	-	20	15	15	50	70	120	4
4	ETC	EC702	Telecom switching and cellular system	4	1	-	20	15	15	50	70	120	5
5	ETC	EC791	Communication system simulation Lab	-	-	3	30	-	-	30	20	50	2
6	ETC	EC792	System design and simulation Lab	-	-	3	30	-	-	30	20	50	2
7	ETC	EC793	Pract. Training	-	-	-	50	-	-	50	0	50	2
8	ETC	EC794	Minor Project	-	-	12	100	-	-	100	50	150	6
9	ETC	EC795	Seminar and Report Writing	-	-	2	50	-	-	50	0	50	1
			Total	13	4	20	340	60	60	460	370	830	30

ELECTIVE 3 & 4 (SEMESTER VII) Any two from the following

S. No.	Board of Studies	Sub Code	Subject Name
1	ETC	EC711	Digital signal processors and applications.
2	ETC	EC712	ARM system architecture and design.
3	ETC	EC713	Digital image processing.
4	ETC	EC714	Digital communication hardware design.
5	ETC	EC715	Nonlinear signal and image processing.
6	ETC	EC726	Data acquisition and computer interfacing.
7	ETC	EC727	Cryptography and network security.
8	ETC	EC728	Smart antenna systems.
9	ETC	EC729	Wireless sensor networks.

Semester VIII

S. No	Board of Studies	Sub Code	Subject Name	Periods/week			Examination Scheme					Total Marks	Credits L+(T+P)/2
				L	T	P	TA	FE	SE	T.C.A.	ESE		
1	ETC	EC801	Optical fiber communication	3	1	-	20	15	15	50	70	120	4
2	ETC	EC81X	Elective-5	3	1	-	20	15	15	50	70	120	4
3	ETC	EC82X	Elective-6	3	1	-	20	15	15	50	70	120	4
4	ETC	EC802	Communication systems	4	1	-	20	15	15	50	70	120	5
5	ETC	EC891	OFC lab	-	-	3	30	-	-	30	20	50	2
6	ETC	EC892	Communication systems lab	-	-	3	30	-	-	30	20	50	2
7	ETC	EC893	Major Project	-	-	16	100	-	-	100	100	200	8
8			Discipline	-	-	-	50	-	-	50	-.	50	1
			Total	13	4	22	290	60	60	410	420	830	30

ELECTIVE 5 & 6 (SEMESTER VIII) Any two from the following			
S. No.	Board of Studies	Sub Code	Subject Name
1	ETC	EC811	Broadband access technology.
2	ETC	EC812	Artificial intelligence.
3	ETC	EC813	Multimedia communication.
4	ETC	EC814	Spread spectrum systems
5	ETC	EC815	Speech processing and coding
6	ETC	EC816	Wavelet and applications
7	ETC	EC817	Advanced semiconductor devices
8	ETC	EC818	Pattern recognition
9	ETC	EC819	Multirate systems and filter bank.

DETAILED SYLLABUS

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

SEMESTER: III

S. No	Board of Studies	Sub Code	Subject Name	Periods/ week			Examination Scheme					Total Marks	Credits L+(T+P)/2
				L	T	P	TA	FE	SE	T.C.A.	ESE		
1	Math ematics	MA	Mathematics-III	3	1	-	20	15	15	50	70	120	4
2	ETC	EC301	Signals and systems	3	1	-	20	15	15	50	70	120	4
3	ETC	EC302	Digital logic design	3	1	-	20	15	15	50	70	120	4
4	ETC	EC303	Electronic measurements and instrumentation	3	1	-	20	15	15	50	70	120	4
5	ETC	EC304	Network analysis and synthesis	3	1	-	20	15	15	50	70	120	4
6	ETC	EC305	Devices and circuits-I	4	1	-	20	15	15	50	70	120	5
7	ETC	EC391	Data structures lab	-	-	3	30	-	-	30	20	50	2
8	ETC	EC392	Devices and circuits-I lab	-	-	3	30	-	-	30	20	50	2
9	ETC	EC393	Digital logic design lab	-	-	3	30	-	-	30	20	50	2
10	Hum anities		Value Education	-	-	2	25	-	-	25	0	25	1
11			Discipline	-	-	-	25	-	-	25	0	25	1
			Total	19	6	11	260	90	90	440	480	920	33

TCA = Total of Continuous Assessment, TA = Teacher's Assessment, FE = First Exam, SE = Second Exam, ESE = End Semester Exam.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 3 **Code: MA**
Subject: Mathematics - III
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
SERIES SOLUTION OF DIFFERENTIAL EQUATIONS AND SPECIAL FUNCTIONS: Series solution of differential equations, The method of Frobenius, Bessel's differential equation, Bessel's function of the First Kind - recurrence relations, generating function, orthogonality, Legendre's differential equation, Legendre's polynomial - Rodrigue's formula, generating function, recurrence relations, orthogonality.

UNIT II
PARTIAL DIFFERENTIAL EQUATIONS: Formation, Solution of Lagrange's linear differential equation, homogeneous linear differential equation with constant coefficients, non-homogeneous linear differential equations, Method of separation of variables.

UNIT III
LAPLACE TRANSFORM: Definition, Linearity, shifting & scaling properties, Transform of elementary functions, Transform of derivatives and integrals, Multiplication by t & division by t. Inverse Laplace transform, Convolution theorem, Transform of periodic functions, Unit step function & Dirac delta function, Initial value & final value theorems, Application to solution of ordinary differential equations.

UNIT IV
COMPLEX VARIABLES: Limit, Derivative, Analytic function, Cauchy-Riemann equations, Harmonic functions, Application to flow problems. Complex integration, Cauchy's integral theorem and integral formula, Taylor's & Laurent's series, Singular point, Poles & residues, Residue theorem & its application to contour integration.

UNIT V
NUMERICAL METHODS: Solution of nonlinear algebraic equations, single and multistep methods for differential equation.

Text Books:

1. Engineering Mathematics, E Kreysig, John Wiley and Sons.
2. Higher Engineering Mathematics, B S Grewal, Khanna Publications.

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 3 **Code:EC301**
Subject: Signal and System
Credits:4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
Signals and classification of signals ,basic continuous time and discrete time signals ,continuous LTI, discrete LTI systems ,impulse response stability etc. ,properties eigen values and eigen functions properties of discrete and continuous LTI systems ,systems described by difference and differential equations.

UNIT II
Laplace and Z-transforms ,Laplace transforms of common signals ,properties of Laplace transforms , inverse Laplace transforms , Z-transforms of common sequences ,properties of Z-transforms , inverse Z-transforms , relation between Z and Laplace Transform , analysing continuous time systems using Laplace and discrete time systems usig Z-transforms.

UNIT III
Fourier analysis of continuous time signals and systems, Fourier series representation of periodic systems, Fourier transforms , properties of CTFT ,frequency response of continuous time LTI, systems, Fourier transforms of power signals filter characteristics of LTI systems ,transmission of signals through LTI systems , filtering , bandwidth ,quadrature filter and Hilbert transforms .

UNIT IV
Fourier analysis of discrete time signals and systems ,discrete Fourier series ,DTFT, properties of DTFT, frequency response of discrete time LTI systems ,DFT.

UNIT V
State space analysis, concept of state, state space representation discrete time LTI systems , state space representation of continuous time LTI systems ,solutions of state equation for discrete time LTI systems , solutions of state equation for continuous time LTI systems ,FFT.

Text books:

1. Signals & Systems, 2nd Edition, by Alan Oppenheim, Alan Wilsky, S. Nawab. Prentice Hall, 1997.
2. Signals and Systems, by Simon Haykin and Barry Van Veen. Wiley, 1999.

Reference books:

1. Schaum's Outline of Signals and Systems – H Hsu, TMH.

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 3 **Code:EC302**
Subject: Digital Logic Design
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
Weighted & Non-weighted codes, Sequential codes, self complementing codes, Cyclic codes, 8-4-2-1 BCD code, Excess-3 code, Gray code, Error detecting code, 2-out-of-5 code, Error correcting code: Hamming code, Alphanumeric codes. Representation of negative numbers in binary system, Binary arithmetic. Boolean algebra: Reduction of Boolean expressions using laws, theorems and axioms of Boolean algebra,

UNIT II
Expansion of a Boolean expression to SOP and POS forms, Minimization of completely & incompletely specified Boolean functions using Karnaugh Map and Quine-McCluskey Methods, Synthesis using AND-OR, NAND, NOR and XOR forms. Design examples.
Introduction to CAD tools: Introduction to VHDL, Programmable Logic Devices, Custom Chips, Standard Cells and Gate Arrays Practical Aspects, Transmission Gates, Implementation details for FPGAs

UNIT III
Combinational Circuit Building Blocks: Multiplexers, Decoders, Encoders, Code Converters, Arithmetic Circuits, ROM, PLA, VHDL for Combinational Circuits. Design of any Boolean function, binary adders, subtractors, BCD adder and subtractor, magnitude comparators, etc., using above building blocks.

UNIT IV
Flip-Flops & Timing Circuit: S-R Latch; Gated S-R Latch; D Latch; J-K flip-Flop; T Flip-Flip: Edge Triggered S-R, D, J-K and T Flips-Flops; Master - Slave and Edge triggered Flip-Flops; Direct Preset and Clear Inputs. Shift Registers*:* PIPO, SIPO, PISO, SISO, Bi-Directional Shift Registers; Universal Shift register. Counter*:* Synchronous Counters: Design of synchronous counters, Ring counter, Johnson counter, Pulse train generators using counter, Design of Sequence Generators; Digital Clock using Counters. Meanly State Model, Design of Finite State Machines using CAD Tools, Serial Adder Example, Asynchronous Counter: Ripple Counters; Design of asynchronous counters, Effects of propagation delay in Ripple counters,

UNIT V
Implementation Technology**:** Transistor Switches, Basic features of DTL and ECL. TTL family gates: fan-in, fan-out and noise margin. MOS family: NMOS and CMOS Logic Gates, Negative Logic System, Comparison among various logic families.

Text Books:

1. An Engineering Approach to Digital Design, W. Fletcher, PHI Edition.
2. Fundamentals of Digital Logic with Verilog Design, S. Brown and Z. Vranesic, Tata McGraw Hill New Delhi, 2008.
3. Digital System Design using VHDL, C. H. Roth, Thompson Publications, Fourth Edition, 2002.

Reference:

1. Digital Logic and Computer Design, Morris Mano PHI
2. Digital Integrated Electronics, Taub B & Schilling, McGraw Hill

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 3 **Code:EC303**
Subject: Electronic Measurements and Instrumentation
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I

General Principles of Measurements-Standards- Absolute and Working Standards- Calibration of Meters- Qualities of Measurements- Characteristics- Errors in Measurement and its Analysis- Direct Deflecting Instruments - Moving Coil - Moving Iron, Dynamo Meter, Induction, Thermal, Electrostatic and Rectifier Type- Shunts and Multipliers- Various Types of Galvanometers.

UNIT II

Measurement of Current, Voltage and Resistance- Measurement of Insulation Resistance, Earth Resistance, Earth Tester- Measurement of Power and Energy - Dynamometer Type Wattmeter - Error and Compensation - Ampere Hour Meter - Single and Three Phase Energy Meters (Induction Type) - Calibration - Electronic Energy meter-Trivector Meter - Frequency Meters - Power Factor Meters - Energy / Harmonic Analyzer- Current Transformers and Potential Transformers.

UNIT III

Null Deflection Method - Measurement of Resistance, Current, Voltage and Power -Direct Current Potentiometer - Wheatstone Bridge - Kelvin Double Bridge - Carey Foster Slide Wire Bridge - Bridge Current Limitations - Localization of Cable Fault by Murray and Varley Loop Tests - A.C. Potentiometers - Various A.C. Bridges and Measurement of Inductance & Capacitance- Magnetic Measurements: Classification - Measurement of Flux and Permeability – Hibbert's Magnetic Standard - Flux Meter- Hall Effect- Gauss meter- Ballistic Galvanometer-Magnetic Measurements-B.H. Curve and Permeability Measurement - Hysteresis Measurement- Core Loss Measurement.

UNIT IV

Illumination- Laws of Illumination - Polar Curves - Photometry - Luminous Efficiency - Measurement of Illumination of Different Light Sources - Illumination of Surfaces - Levels of Illumination- Digital Measurements and Meters- Oscilloscopes - Basic Principle of Signal Display - Triggered Sweep CRO - Trigger Pulse Circuit - Delay Line in Triggered Sweep - Synchronous Selector for Continuous Sweep CRO - Dual Beam CRO -Dual Trace Oscilloscope - Applications.

UNIT V

Data Acquisition System: Introduction, instrumentation system, sample & hold circuit, configuration and objective of data acquisition system, single channel and multi channel data acquisition system, applications.

Text Books:

1. Electrical Measurements & Measuring Instruments, Golding E.W, Wheeler Pub.
2. Modern Electronics Instrumentation, Cooper W.D, Prentice Hall of India.

Reference Books:

1. Electronic Measurements & Instrumentation, Oliver & Cage, McGraw Hill.
2. Electronics & Electrical Measurements and Instrumentation, J B Gupta, Katson Publication.

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 3 **Code: EC304**
Subject: Networks Analysis and Synthesis
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
Introduction: The capacitance parameter, The inductance parameter , The resistance parameter, reference direction for current and voltage, active element convention , the dot convention for coupled circuits, Krichhoff's laws, the number of network equation, source transformation, example of the formulation of network equation loop variables analysis, node variables analysis, duality, network. Dependent sources.
Network graph theory: concept of network graph , terminology used in network graph, relation betweens Twigs and Links, properties of tree in a graph, formation of incidence Matrix[A_i], number of trees in a graph, cut-set matrix, tie set matrix, fundamental tie-set matrix, fundamental of cut-set.

UNIT II
Initial Conditions In Networks: Why Study Initial Conditions, Initial Conditions In Element, Geometrical Interpretation Of Derivatives, A Procedure for Evaluating Initial Conditions, initial State of a Network.
Transforms of other signal waveform: The shifted unit steep Function, The ramp- and Impulse functions, Wave forms, synthesis, the initial and final value of F(t) from f(s), the convolution integral, convolution as a summation.

UNIT III
Impedance function and Network theorems: The Concept of complex frequency, Transform Impedance an Transform Circuits, Series and Parallel combination of elements, Superposition and Reciprocating, Theremin's Theorem an Norton's Theorem.
Network function: poles and zeros, terminal pairs or ports, network function for one port and two port, the calculation of network function: ladder network , general network, poles and zeros of network function, restrictions on poles and zero location for driving point function, Restriction on poles and zero location for transfer function, time domain behavior from the pole and zero plot, stability of active network.

UNIT IV
Two port parameters: relation of two port variables, short circuit admittance parameters, the open circuit impedance parameters, Transmission parameters, the hybrid parameters, relation between parameter sets, parallel connection of two port network.
Input power, power transfer and insertion loss: energy and power, effective or root mean square values, average power and complex power, problem in optimizing power transfer, insertion loss, Tellegen's theorem.

UNIT V
Network synthesis: concept of network synthesis, reactive network , driving point immittance of LC network, LC network synthesis using foster and caurr form, RC and RL network synthesis by Foster and Caurr form.

Text Books:

1. Network analysis- M.E.Van Valkenbarg, PHI/ Pearson Education
2. Engineering circuit analysis-Hayt and Kimberley, TMH

Reference books:

1. Electric Circuit Analysis-Alexender and Sadique, TMH
2. Network Theory- D. Roy Chaudhary, Newage Asian

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 3 **Code: EC305**
Subject: Devices and Circuits-I
Credits: 5
Total Theory Periods: 40 **Total Tutorial Periods: 10**

UNIT I
DIODE CIRCUITS: Review of diode fundamentals, Capacitance: Transition and Diffusion Capacitance. Rectifying circuits and DC Power Supplies: Load line analysis of diode circuit, Half wave rectifier: Voltage regulation, Ripple factor, ratio of rectification, Transformer Utilization factor. Full wave rectifier, Bridge rectifier. Filter circuits for power supply: Inductor filter, Capacitor filter, LC filter, Multiple LC filter, CLC filter. Zener diode: Break down mechanism, Characteristics, Specifications, Voltage multipliers clipping circuits ,double diode clippers, clamping circuits.

UNIT II
BIPOLAR JUNCTION TRANSISTORS: Review of transistor fundamentals, Current components, Early Effect. Ebers-Moll Model, Maximum Voltage Ratings.
Transistor Biasing and Thermal stabilization: The operating point, Bias stability, Stability factor, Emitter bias, Collector – to – base bias, Voltage divider bias with emitter bias, Emitter bypass capacitor. Bias compensation.

UNIT III
FIELD EFFECT TRANSISTORS: Introduction, Construction, Operation, V-I Characteristics, Transfer Characteristics, Drain Characteristics.
Metal Oxide Semiconductor Field Effect Transistor (MOSFET): Introduction, Construction, Operation and characteristics, Depletion MOSFET, Enhancement MOSFET.

UNIT IV
UJTS AND THYRISTORS - Unijunction transistors-construction operation principle, current controllable devices, PNPN Diode – material, characteristics, silicon-controlled rectifier- V-I characteristics, gate triggering characteristics, DIAC and TRIAC, Thyristor parameters- repetitive peak reverse voltage, non- repetitive peak reverse voltage, repetitive peak OFF-state voltage, break-over voltage, critical rate of rise of ON-state current, critical rate of rise OFF-state voltage, holding current and holding voltage, latching current, amperes squared seconds (I^2t) rating.

UNIT V
LOW FREQUENCY TRANSISTOR AMPLIFIER: Graphical Analysis of CE amplifier; h-parameter Models for CB, CE, CC configurations and their Interrelationship; Analysis and Comparison of the three Configurations; Linear analysis of Transistor Circuits: Miller's Theorem: Cascading: Simplified Models and Calculation of CE and CC Amplifiers; Effect of emitter Resistance in CE amplifiers: Cascode amplifiers: Darlington Pair, analysis of Single stage FET amplifier-CS and CD Configuration, FET as VVR.

Text books:
1. Microelectronics circuits-Sedra/Smith,Oxford University Press.
2. Microelectronics – Millman and Grabel, TMH.

Reference Books:
1. Electronic Devices and Circuit Theory – Boylestad & Nashelsky, 8th Ed. PHI.
2. Art of Electronics , Cambridge University press.

Semester: 3 **Code: EC391**
Subject: Data Structures Laboratory
Credits: 2

Introduction**:** Data types, Abstract data types, data Structures, storage structure, Concept of 'O' notation, Time complexity & Space complexity issues. Arrays, Stacks & recursions, Queues, Linked list, Hashing, Trees Graphs & their Applications Linked representation of Graph, Adjacency Matrix, Adjacency list, Shortest path algorithm, Graph Traversal: BFS, DFS, BDD and its application ,Sorting Techniques **:** Bubble sort, Quick sort, selection sort, Heap sort, insertion sort, merge sort, radix sort & efficiency considerations. Searching Techniques**:** Sequential search, index sequential search, Binary search, Interpolation Search, Tree Searching, and Fibonacci Search. Files: properties of physical storage media, file organization techniques.

Text Books:

1. Introduction to Data Structures with applications, Tremblay & Sorenson, Tata-McGraw-Hill, 2nd Ed., 2006.
2. Data Structures and Algorithm Analysis in C, M. A. Weiss, Addison-Wesley, 3nd Ed., 2006.

Reference Books:

1. Data Structures, Algorithms and Applications in C++, S. Sahani, Silicon Press, 2004.
2. Structures and Algorithms, A. V.Aho, J. E. Hopcroft & J.D. Ullman, Data Addition-Wesley, 1998.
3. Data Structures and Algorithms: Concepts, Techniques and Applications, G. A. V. Pai, Tata McGraw Hill, 1st Ed, 2008.
4. Data Structures, D. Samanta, PHI, 2004.

Semester: 3 **Code: EC392**
Subject: Devices and Circuits-I Laboratory
Credits: 2

Lab assignments based on EC305, EC303 using trainer kits. Usage and construction of instruments like CRO, multimeter, ammeter, voltmeter.

Semester: 3 **Code: EC393**
Subject: Digital Logic Design Laboratory
Credits: 2

Lab assignments based on EC302 Digital logic design.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

SEMESTER: IV

S. No	Board of Studies	Sub Code	Subject Name	Periods/ week			Examination Scheme					Total Marks	Credits L+(T+P)/ 2
				L	T	P	TA	FE	SE	T.C.A.	ESE		
1	Mathematics	MA	Probability and stochastic process	3	1	-	20	15	15	50	70	120	4
2	ETC	EC401	Analog communication	3	1	-	20	15	15	50	70	120	4
3	ETC	EC402	Computer organization and architecture	3	1	-	20	15	15	50	70	120	4
4	ETC	EC403	Electromagnetic waves and antennas	3	1	-	20	15	15	50	70	120	4
5	ETC	EC404	Devices and circuits-II	3	1	-	20	15	15	50	70	120	4
6	ETC	EC405	Microprocessors (8085/86)	4	1	-	20	15	15	50	70	120	5
7	ETC	EC491	Analog communication lab	-	-	3	30	-	-	30	20	50	2
8	ETC	EC492	Devices and circuits-II lab	-	-	3	30	-	-	30	20	50	2
9	ETC	EC493	Microprocessors (8085/86) lab	-	-	3	30	-	-	30	20	50	2
10	Humanities		Personality Development	-	-	2	25	-	-	25	0	25	1
11			Discipline	-	-	-	25	-	-	25	0	25	1
			Total	19	6	11	260	90	90	440	480	920	33

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 4 **Code: MA**
Subject: Probability and Stochastic Process
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
Introduction to Probability and random variables: Definitions, scope and history; limitation of classical and relative-frequency-base definitions , Sets, fields, sample space and events; axiomatic definition of probability. Combinatorics: Probability on finite sample spaces. Joint and conditional probabilities, independence, total probability; Bayes' rule and applications. The random variable concept, Distribution function, Density function, The Gaussian random variable, Other distribution and density examples, Conditional distribution and density functions.

UNIT II
Operation on One Random Variable – Expectation & Multiple Random Variables
Expectation, Moments, Functions that give Moments, Transformations of a random variable, Computer generation of one random variable**.** Vector random variables, Joint distribution and its properties, Joint density and its properties, Conditional distribution and density, Statistical independence, Distribution and density of a sum of random variables, Central limit theorem.

UNIT III
Random Processes-The random process concept, Stationarity and independence, Correlation functions, Measurement of correlation functions, Gaussian random processes, Poisson random process, Complex random processes

UNIT IV
Spectral Characteristics of Random Processes-Power density spectrum and its properties, Relationship between power spectrum and autocorrelation function, Cross-Power density spectrum and its properties, Relationship between cross-power spectrum and cross-correlationfunction, Some noise definitions and other topics, power spectrum of complex processes.

UNIT V
Queueing Theory – Introduction, markov sequences Queueing Systems ,Birth-Death Process The M/M/1 Queueing System The M/M/s Queueing System The M/M/1/K Queueing System The M/M/s/K Queueing System

Text books:

1. Theory and Problems of Probability, Random Variables, and Random Processes schaum series. Hwei P. Hsu, TMH.
2. Probability random variables and random signals principles, Peebles, PHI.

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 4 **Code: EC401**
Subject: Analog Communication
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
Amplitude modulation , DSB,SSB, (with and without carrier), VSB, frequency translation, mixing, QAM. mathematical analysis, modulation and demodulation techniques.

UNIT II
Angle modulation ,instantaneous frequency, phase and frequency modulation, Fourier spectra, NBFM, WBFM, phasor representation ,tone modulation bandwidth estimation, demodulation methods.

UNIT III
Noise, physical noise sources, shot, thermal etc ,available power, frequency dependence, characterization of noise in systems, noise figure, noise tempareture, cascaded systems, equivalent noise bandwidth, quadrature component narrowband noise, envelope phase representation, psd, white noise.

UNIT IV
Noise in analog communication, additive noise, signal to noise ratio, AWGN, Noise in baseband communication systems, amplitude and angle modulation, Pre-emphasis and de-emphasis.

UNIT V
AM generation ring bridge modulator SSB generation filter, phase, weavers Method of FM generation variable reactance ,VCO super heterodyne receiver Frequency discriminator method, PLL for fm demodulation, PLL for am carrier acquisition, zero crossing detector for FM.

TEXT BOOKS:
1. Principle of Communication –Ziener Tranter, JWS
2. Communication System- A.B. Carlson, TMH

REFERENCE BOOKS:
1. Modern Analog and Digital Communication –B.P. Lathi, Oxford
2. Principle of Communication – Taub & schilling, TMH

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: IV **Code: EC402**
Subject: Computer Organization and Architecture
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
Introduction to Processor Architecture – Design Methodology- System Representation – Gate level – Register level – Processor level – CPU Organization – Data Representation – Basic Formats – Fixed Point Numbers – Floating Point Numbers – Instruction Sets – Instruction Formats – Instruction Types – Programming Considerations.

UNIT II
Datapath Design – Fixed Point Arithmetic – Addition and Substraction – Multiplication – Division – Arithmetic Logic Units – Combinational ALUs – Sequential ALUs – Floating Point Arithmetic – Pipeline Processing – Control Design : Basic Concepts – Introduction – Hardwired Control – Design Examples – Microprogrammed Control – Basic Concepts – Multiplier Control Unit – CPU Control Unit – Pipeline Control – Instruction Pipelines – Pipeline Performance – Superscalar Processing

UNIT III
Memory Organisation – Memory Hierarchy – Main memory – RAM and ROM chips – Memory Address Map – Memory Connection to CPU – Auxiliary Memory – Magnetic disks – Magnetic Tape – Associative Memory – Hardware Organization - Read Operation – Write Operation – Cache Memory : Associative Mapping – Direct Mapping – Set Associative Mapping –Virtual Memory – Address Space and Memory Space – Address Mapping Using Pages – Associative Memory Page Table – Page Replacement – Memory Management Hardware – Segmented Page Mapping

UNIT IV
System Organization – Communication Methods – Basic Concepts – Bus Control – I/O and System Control – I/O Organization – Isolated Versus Memory Mapped I/O - Programmed I/O – DMA and Interrupts – I/O Processors – Operating Systems – Parallel Processing – Processor Level Parallelism – Multiprocessors – Fault Tolerance.

Text Books:

1. Computer Architecture and Organization, John P Hayes, McGraw-Hill International Editions, Computer Science Series.
2. Computer System Architecture, Morris Mano, Prentice-Hall India, Eastern Economy Edition.

Reference Books:

1. Computer Organization, Carl Hamacher, Zvonko Vranesic & Safwat Zaky, Mc Graw Hill.
2. Computer Organization and Design, Pal Choudhuri P., Prentice-Hall India
3. Computer Organization and Design, Patterson D.A. & Hennessy J.L., Morgan Kaufmann Publishers
4. Computer Organization and Architecture, William Stallings, Pearson Education.

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 4 **Code:EC403**
Subject: Electromagnetic Waves and Antennas
Credits:4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
Introduction: Review of electromagnetic fields, Gradient, divergence and curl, their physical interpretation, divergence and stroke's theorems, linear, homogenous and isotropic media. Electrostatic Field**:** Coulomb's law, Gauss's law and it's applications ,Poisson's equations. Magnetic Field: Ampere's law magnetic vector potential magnetic flux and it's calculation for different current distribution ,boundary conditions. Electromagnetic Induction: Electromotive force ,Lenz's law ,Faraday's law, Energy stored in magnetic field.

UNIT II
Fields and waves: Displacement Current: Maxwell's Equations: Circuit Theory as Quasi-static Approximation: Poynting's theorem and Flow of power. Plane wave: Solution of Wave Equation for Loss less and lossy media; Phase Velocity, Dispersion: *Group* Velocity, Complex Propagation Constant, Intrinsic Impendence, Normal and Oblique Incidence of Plane Wave on a Perfect Conductor and polarization: Linear, Circular and elliptical.

UNIT III
Transmission lines: Complex Propagation constants, loss less transmission lines, distortion and distortion less condition, characteristics impedance, Reflection Coefficient, standing Wave Ratio, Transmission line parameters, Line Calculation for matched and General Terminations, Impedance Transformation buy quarter Wave line ,Stub Matching.

UNIT IV
Wave Propagation- Electromagnetic or radio waves, modes of propagation, structure of atmosphere, characteristics of different ionized regions, sky wave propagation, definition: virtual height, maximum usable frequency, lowest usable frequency, skip distance, ionospheric absorption, multi hop propagation, space wave propagation, duct propagation.

UNIT V
Antennas and Radiation: Isotropic Radiator and Radiation Pattern; Radiation Intensity: Antenna Gain: Reciprocity Theorem and its Application: Effective Length; Antenna Top Loading and Tuning: Effect of Earth: Antenna Efficiency: Bandwidth: Effective Aperture of short Dipole and Half –wave Dipole: polarization Antenna Arrays and their Design: Broadside and End fired Array: collinear Array: Array of point sources: Nonisotropic Dolph. Tchebycheff Array, Practical Antennas – Resonant and Non-resonant Antenna; Rhombic Antenna & Loop Antenna.

Text Books:

1. Engineering Electromagnetism, Hayt, 7th Ed., TMH
2. Electromagnetic Fields – Jordan & Ballman, PHI.

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 4 **Code:EC404**
Subject: Device and Circuits-II
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
HIGH FREQUENCY TRANSISTOR AMPLIFIERS: CE hybrid π- model: Validity and parameter Variation: Current Gain with Resistive load: frequency response of a single stage CE Amplifier: Gain-Bandwidth product: CC stage High frequencies: Multistage Amplifiers: sources of Noise in Transistor Circuits; Noise Figure.

UNIT II
MULTISTAGE AMPLIFIERS: Classification: Distortion in Ampli1iers: Frequency Response: Bode plots: Step Response: pass band of Cascaded Stages: Response of a Two-stage RC Coupled Amplifier at Low and high frequencies: Multistage amplifiers: Sources of Noise in Transistor Circuits: Noise Figure.

UNIT III
LARGE SIGNAL AMPLIFIER-Classification , large signal amplifier characterstics, class A amplifiers: class A amplifier with direct-coupled resistive load , transformer-coupled class A amplifier, class A push-pull amplifiers, class B amplifiers- transformer-coupled push-pull class B amplifier, complementary-symmetry push-pull class B amplifier, class AB amplifier, class C amplifier, class D amplifiers.

UNIT IV
FEEDBACK AMPLIFIERS: Classification: Feedback concept; Ideal Feedback amplifier: Properties of Negative Feedback Amplifier Topologies: Method of Analysis of Feedback amplifiers: Voltage series Feedback: Voltage series Feedback pair: Current series, Current shunt and Voltage shunt feedback; Effect of feedback on amplifier Bandwidth and stability.

UNIT V
OSCILLATOR: Sinusoidal oscillator: phase shift oscillators, Wien Bridge oscillator: Resonant circuit oscillators: LC Collpit & LC Hartley, Amplitude Frequency and phase stability analysis of all Oscillators,General form of Oscillator Configuration; Crystal oscillator.

Text Books:

1. Microelectronics Circuits- Sedra/Smith , Oxford University press.
2. Microelectronics – Millman and Grabel, TMH.

Reference books:

1. Integrated Electronics – Millman & Halkias, TMH
2. Art of Electronics, Cambridge University Press

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: IV **Code:EC405**
Subject: Microprocessor (8085/8086)
Credits: 5
Total Theory Periods: 48 **Total Tutorial Periods: 12**

UNIT I
Review of logic design using MSI/LSI chips such as De-multiplexers/Decoders, Multiplexers, Priority encoders, Registers, Counters, Buffers, Latches. Introduction to functions performed by microprocessor, R/W and ROM memory models, Memory map and addresses, I/O devices, I/O Addressing. The 8085 programming model, Instruction classification, Instruction and data formats, Addressing modes, Data transfer operations, Arithmetic operations, Logic operations, Branch operations, Writing Assembly Language programs, Hand assembly of a program 8085 Microprocessor architecture, Logic pin-out, machine cycles and bus timings

UNIT II
Memory interfacing, Absolute, Partial decoding, Multiple Address range, Interfacing memory with wait states, Interfacing I/O devices, Peripheral I/O, Memory mapped I/O, 8085 single-board microcomputer system. Interfacing of 8085 with 8155/8156 (RAM), 8355/8755 (ROM). Programming techniques with additional instructions, Looping, counting and indexing, Data transfer from/to memory to/from microprocessor, 16-bit arithmetic instructions, Logic operations like rotate, compare, Time delays, Counters, Stack, Subroutine, Call and return instructions. Interrupts, The 8085 interrupt process, multiple interrupt and priorities, vectored interrupts, Restart as software instruction.

UNIT III
Programmable Interfacing devices, Basic concept, 8279 programmable Keyboard/Display interface, 8255A programmable Parallel interface, Interfacing keyboard and display using 8255A, 8254 programmable Interval Timer, 8259A programmable Interrupt Controller, Direct Memory Access (DMA), 8237 DMA Controller. Serial I/O and Data communication, Basic concept in serial I/O, Data communication over telephone lines, Standards in serial I/Os, The 8085-serial I/O lines, 8251A programmable communication interface Microprocessor Applications, Interfacing scanned multiplexed displays and Liquid Crystal Displays, Interfacing a matrix keyboard.

UNIT IV
Architecture and pin configuration of 8086, Instruction Format; Addressing modes Basic 8086 system bus architecture, Minimum mode Configuration, Maximum mode configuration; memory interfacing with 8086 in minimum and maximum mode; System Bus Timings, Bus Standards. Interrupts of microprocessor 8086

UNIT V
Instruction set of 8086 and programming examples, Data Transfer Instruction; Arithmetic Instructions; Branching and Looping Instructions, NOP and Halt, Flag Manipulation Instructions; Logical, Shift and Rotate Instruction. Byte and String Manipulation: String Instructions; REP Prefix, Table Translation, Number Format conversions. Assembler Directives and Operators; Assembly Process; Translation of assembler Instructions. Programming of microprocessor 8086

Text Books:

1. Microprocessor Architecture, Programming and Application by R. S. Gaonkar, Wiley Eastern.
2. Advance Microprocessor and Peripherals (Architecture, Programming & Interfacing) by A. K. Roy & K. M. Bhurchandi – TMH

Reference Books:

1. The Intel Microprocessor – (Architecture, Programming & Interfacing) by Barry B. Bery.
2. Microprocessors and Programmed Logic (2nd Edition), Pearson Education by Kenneth L. Short
3. Microcomputer Systems: The 8086/8088 Family, Yu-Cheng Lieu & Glenn A. Gibson, Prentice Hall India.
4. Microprocessors & Interfacing: Programming & Hardware, Douglas V. Hall, Tata McGraw Hill.

Semester: 4 **Code: EC491**
Subject: Analog Communication Laboratory
Credits: 2

Lab assignments based on EC401 Communication system-I.

Semester: 4 **Code: EC492**
Subject: Devices and Circuits-II Laboratory
Credits: 2

Lab assignments based on EC404 using trainer kits and Multisim/Orcad. Practical PCB design and fabrication in workshop.

Semester: 4 **Code: EC493**
Subject: Microprocessor (8085/86) Laboratory
Credits: 2

Lab assignments based on EC405.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

SEMESTER: V

S. No.	Board of Studies	Sub Code	Subject Name	Periods/week			Examination Scheme					Total Marks	Credits L+(T+P)/ 2
				L	T	P	TA	F E	S E	T.C. A.	ES E		
1	ETC	EC51X	Elective-1	3	1	-	20	15	15	50	70	120	4
2	ETC	EC501	Analog integrated circuits and applications	3	1	-	20	15	15	50	70	120	4
3	ETC	EC502	Automatic control systems	3	1	-	20	15	15	50	70	120	4
4	ETC	EC503	Digital signal processing	3	1	-	20	15	15	50	70	120	4
5	ETC	EC504	Microcontroller and embedded system	3	1	-	20	15	15	50	70	120	4
6	ETC	EC505	Digital communication	4	1	-	20	15	15	50	70	120	5
7	ETC	EC591	Digital communication lab	-	-	3	30	-	-	30	20	50	2
8	ETC	EC592	Analog integrated circuits lab	-	-	3	30	-	-	30	20	50	2
9	ETC	EC593	Digital signal processing lab	-	-	3	30	-	-	30	20	50	2
10	Hum anities		Managerial Skill	-	-	2	25	-	-	25	0	25	1
11			Technical Visit/ Practical Training	-	-	-	25	-	-	25	0	25	1
			Total	19	6	11	260	90	90	440	480	920	33

ELECTIVE 1			
S. No.	Board of Studies	Sub Code	Subject Name
1	ETC	EC511	Internet and web technology.
3	ETC	EC512	Electronic system design.
4	ETC	EC513	Power electronics.
5	ETC	EC514	Fundamentals of operating systems
6	ETC	EC515	Audio system engineering

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 5 **Code: EC501**
Subject: Analog Integrated Circuits and Applications
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I

Operational Amplifiers: Basic operational amplifier; Block Schematic of OPAMP, Differential Amplifier: DC & AC analysis of transistorized & FET differential amplifier; Analysis of MC1435 & 741 op-amp; measurement of op-amp parameters; Open Loop & Closed Loop Configuration of OPAMP. Input & Output impedance of closed loop OPAMP; Input Offset-error compensation, Maximum Ratings. Inverting Amplifier, Non-Inverting Amplifier, Voltage Follower, frequency response, stability, frequency compensation: Lag & Lead compensation. SPICE Simulation.

UNIT II

Applications of OPAMP: *Linear Circuits*- Summing amplifier, Difference amplifier, V to I and I to V converter, Instrumentation amplifier , Bridge amplifier, Integrator, Differentiator.

Nonlinear Circuits- Comparators, Comparator IC such as LM339, Schmitt trigger, Precision rectifiers, Peak detector, Analog switches, Sample and Hold Amplifiers, Log & Anti-log Amplifiers.

UNIT III

Active Filter Design: Transfer function, first order active filter, standard second order responses, KRC filters, Generalized impedance converters, Switched capacitor filters.

UNIT IV

Signal Generators: Square Wave Generator, Triangular Wave Generator, Sawtooth Wave generator, function generator IC8038. *555 Timer*: Functional Diagram: Monostable and Astable operation.

D-A and A-D Converters : D/A Converter using Binary Weighted Resistor Network and R-2R Ladder Network ; Inverted Ladder Network, IC DAC0832,DAC7545, D/A Specification ; Analog Switches Sample & HoldCircuits ; Analog Multiplexers, Parallel Comparator type A/D Converter, Successive Approximation A/D Converter, Counting & Dual Slope A/D Converter, A/D Converter using Voltage to Frequency and Voltage to Time Conversion, Delta Modulation type A/D Converter, ADC0844, ADC12181.

UNIT V

PLL:Functional diagram and principle of operation of 565; Transfer characteristics; lock range & capture range; Applications of PLL. *Voltage Regulators:* Voltage regulator characteristics, Regulator Performance parameters, Types of Voltage regulator, Shunt & Series Regulator using OPAMP, Transistorised Series Feedback Regulator, Safe Operating Area, Protection Circuit, Short Circuit Protection, Current Limiting Circuit, Foldback Limiting, Three Terminal IC Regulator(LM 317, LM 337, 78XX, 79XX) [Description, Schematic Diagram and Pin Diagram] General Purpose IC Regulator (723): Important features and Internal Structure, SMPS.

Text Books:

1. Design with Operational Amplifiers and Analog Integrated circuits by Serrgio Franco, Tata McGRAW – Hill.
2. Integrated Electronics by Millman & Halkias, TMH Publishing Co.
3. Operational Amplifiers and Linear Integrated Circuits by Coughlin Driscoll, Pearson Education.
4. Operational Amplifiers by G.B.Clayton , International Edition.

Reference Books:

1. Linear Integrated Circuits D.Roy Choudhary, Shail Jain, New Age International.
2. OP-AMP and Integrated Circuits by Ramakant Gaikwad, Pearson Education.
3. Analog Filter Design by M.E.Van Valkenburg, PHI.
4. Design and Applications of Analog Integrated Circuits by Soclof, PHI

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 5 **Code: EC502**
Subject: Automatic Control Systems
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
Mathematical Model of Physical Systems: Differential Equation of Physical system. Transfer function, Block Diagram Algebra, signal flow graphs. Feedback characteristics of control systems. Feedback & Non feedback systems, reduction of parameter variation, control of system Dynamic. Control of the effect of dynamic signal by use of feedback, regeneration feedback.

UNIT-II
Time Response Analysis: Design specification and performance Indices. Standard Text signals, Time response of first and second order system, steady state error and error constants, Effect of adding a zero to a system. Design specification of second order system stability concept, Routh- Hurwitz stability criteria relation stability analysis.

UNIT-III
Root Loci's Technique: Root loci's concept construction for Root loci, Root contours, system with transportation by Polar Plots, Bode Plots. All pass and minimum phase system.

UNIT-IV
Stability in Frequency Domain: Nyquist stability criteria, Assessment of relation stability. Realization of basic compensators, Cascade compensation in time and frequency Domain. Feedback compensation.

UNIT-V
Sate Variable Analysis and Design: Concept of stab, state variables and state model. State model for linear continuous time systems, Diaganalization, solution of state equation, concept of controllability and observability. Pole placement by state feedback.

Text Books:
1. Control System Engineering, L. Nagrath and Gopal, New Age International Publications
2. Automatic Control System, B.C. Kuo, PHI

Reference Books:
1. Modern Control Engineering, Ogata, Pearson Education
2. Modern Control Engineering, Roychoudhury, PHI
3. Control Engineering – A Comprehensive Foundation, Ramakalyan, Vikas Publishing House Pvt. Ltd.
4. Introduction to Control Engineering, Ajit K. Mandal, New Age International Publications.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 5 **Code: EC503**
Subject: Digital Signal Processing
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
Need of digital signal processing, Analog IO interface for real time DSP system, Block diagram, Review of FFT algorithm, Review of Z transform, Properties of z transform, Rational z transforms, Inversion of z transform, One sided z transform, Analysis of LTI system in z domain, Stability. Correlation and convolution methods.

UNIT II
IMPLEMENTATION OF DISCRETE TIME SYSTEMS: Structures for realization of discrete time systems, Structures for FIR systems, Structures for IIR systems, State space system analysis and structures, Representation of numbers, Quantization of filter coefficients, Round off effects in digital filters, Introduction to digital signal processors, MAC unit, Circular buffer.

UNIT III
FIR FILTER DESIGN: Features of FIR filers, Linear phase response and its implications, FIR filter specifications, FIR filter design, Coefficient calculation methods, Window method, Optimal method, Frequency sampling method, Design of FIR differentiators, Design of Hilbert transformer, Comparison of various design methods. Introduction to adaptive FIR filters.

UNIT IV
IIR FILTER DESIGN: Features of IIR filters, Design stages, specifications, Pole-zero placement method, Impulse invariant method, Matched Z transform method, Bilinear Z transform method, Calculating coefficients by mapping s-plane poles and zeros, Choice of coefficient calculation methods, Finite word-length effects, Digital frequency oscillators, DTMF detection using Goertzel algorithm.

UNIT V
MULTIRATE DSP: Decimation and interpolation, Sampling rate conversion by rational factor, Implementation of sampling rate conversion, Multistage implementation of rate converters, Sampling rate conversion of bandpass signals, Conversion by arbitrary factor, Application of MDSP, Digital filter banks, Quadrature mirror filter bank.

Text books:

1. Digital signal processing, 4/e, J G Proakis, D G Manolakis, Pearson Education 2007.
2. Digital signal processing – A practical approach, 2/e, E C Ifeachor, B W Jervis, Pearson Education 2002.

Reference Books:

1. Digital signal processing – Fundamentals and applications, Li Tan, Elsevier Inc, USA 2008.
2. C algorithms for real time DSP, P M Embree, Prentice Hall Inc, USA 1995.
3. Digital signal processing laboratory, B P Kumar, CRC Press, USA 2005.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 5 **Code: EC504**
Subject: Microcontroller and Embedded Systems
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT 1
Microcontrollers : Microprocessors and Micro-controllers, Types of Micro-controllers – Embedded; External memory, Processor Architecture – Harvard v/s Princeton; CISC v/s RISC, Micro-controller Memory types – control storage; variable area; stack; hardware register space, Micro-controller features – clocking; I/O pins, Interrupts, Timers, Peripherals.

UNIT 2
8051 Processor Architecture And Instruction Set : The CPU, Addressing modes, external addressing, Interrupt handling, Instruction execution, Instruction set – data movement; arithmetic; bit operators; branch, Software development tools like assemblers; simulators; cross-compilers, O/P file formats. Hardware Features : 8051 – Device packaging, Chip technology, Power considerations, Reset, System clock/oscillators, Parallel I/O, Timers, Interrupts, Serial I/O, Control store and External memory devices.

UNIT 3
Pic Microcontrollers and Instruction Set: PIC Micro-controllers – overview; features, PIC-18 architecture, file selection register, Memory organization, Addressing modes, Instruction set, Interrupt handling.
PIC-18 – Reset, low power operations, oscillator connections, I/O ports – serial; parallel, Timers, Interrupts, ADC.

UNIT 4
Enhanced Features: Dallas HSM & Atmel Micro-controllers – Architecture enhancements, control store and external memory, scratchpad RAM enhancements, Timers, Serial I/O, Analog I/O, Voltage comparators. PIC-18 Flash Micro-controllers – STATUS; OPTION_REG; PCON registers, Program & Data Memory, Data EEPROM & Flash Program EEPROM, Interrupts, I/O ports, Timers, Capture/Compare/PWM module, Master Synchronous Serial Port module, USART, ADC.

UNIT 5
Interfacing & Microcontroller Applications :LEDs, Push Buttons, Relays, Latch connections, Keyboard, Seven Segment and LCD displays interfacing, I2C bus operation, Serial EEPROM. Software development tools.

Text books:

1. The 8051 Microcontroller and Embedded Systems using Assembly and C, Mazidi, Mazidi & McKinlay, PHI.
2. Programming and Customizing the 8051 Micro-controller, Myke Predko, Tata McGraw-Hill edition.
3. Fundamentals of Microcontrollers and Applications in Embedded Systems (with the PIC18 Microcontroller Family), R A Gaonkar, Penram Publishing India.

Reference books:

1. The 8051 Microcontroller & Embedded Systems Using Assembly and C by Kenneth J. Ayala, Dhananjay V. Gadre, Cengage Learning India Publication.
2. Embedded Systems, Shibu K, Tata McGraw Hill Publishing, New Delhi 2009.
3. Technical references on www.microchip.com

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 5 **Code: EC505**
Subject: Digital Communication
Credits: 5
Total Theory Periods: 40 **Total Tutorial Periods: 10**

UNIT I
Digital transmission of analog signal, sampling theorem, quantization, companding, PAM, PWM, PPM, PCM, DPCM, delta modulation, adaptive delta modulation, delta sigma modulation, bandwidth requirements of PCM, TDM, noise in PCM, PPM, PWM, DM.

UNIT II
Signalling formats ,base band data transmission in presence of white Gaussian noise , pulse shaping , inter symbol interference , Nyquist theorem for pulse shaping ,raised cosine filters ,digital signalling through band limited channels ,synchronisation techniques .

UNIT III
Digital modulation formats ASK ,BFSK , PSK , FSK , MFSK , DPSK ,QPSK transmitters, receivers, signals spectrum, bandwidth, constellation diagrams, M-array data communication systems.

UNIT IV
Binary synchronous data transmission, matched filters, errors probability for matched filter receivers, correlated implementation for the matched filters, Coherent and non coherent detection of ASK, PSK, BPSK, FSK.

UNIT V
Optimum receivers and signal space concepts, orthonormal representation of signals, binary signal detection and hypothesis testing, probability of error calculation, ASK, PSK, FSK, BPSK, MPSK, QAM. Error correction coding.

Text Books:

1. Communication Systems, 4/e, Simon Haykin, John Wiley and Sons.
2. Communication system, A B Carlson, McGraw Hill.
3. Communication systems, Proakis & Salehi, Pearson Education.

Reference Books:

1. Communication systems, Ziemmer, Tarner, John Wiley and Sons.
2. Analog and digital communication systems, B P Lathi, Oxford University Press.
3. Schaum's outline in analog and digital communication, Hsu, Tata McGraw Hill.
4. Communication systems, Taub, Schilling, Tata McGraw Hill.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 5 **Code: EC591**
Subject: Digital Communication Laboratory
Credits: 2

Lab assignments based on EC505 Communication system II using trainer kits and LabView.

Semester: 5 **Code: EC592**
Subject: Analog Integrated Circuits and Applications Laboratory
Credits: 2

Lab assignments based on EC501 Analog integrated circuits and applications using trainer kits and Multisim/Orcad.

Semester: 5 **Code: EC593**
Subject: Digital Signal Processing Laboratory
Credits: 2

Lab assignments based on EC503 Digital signal processing using TMS320C6713 DSK (and daughter cards) and code composer studio (or any Analog Devices processor and Visual DSP++ environment), Matlab or LabView.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 5 **Code: EC511**
Subject: Internet and Web Technology
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
INTRODUCTION TO INTERNET: Introduction, Evolution of Internet, Internet Applications, Internet Protocol -TCP/IP, UDP, HTTP, Secure Http(Shttp), Internet Addressing – Addressing Scheme – Ipv4 & IPv6, Network Byte Order, Domain, Name Server and IP Addresses, Mapping. Internet Service Providers, Types Of Connectivity Such As Dial-Up Leaded Vsat Etc. Web Technologies: Three Tier Web Based Architecture; Jsp, Asp, J2ee, .Net Systems

UNIT II
HTML CSS AND SCRIPTING: HTML - Introduction, Sgml, Dtd(Document Type Definition, Basic Html Elements, Tags and usages, HTML Standards , Issues in HTML Dhtml: Introduction Cascading Style Sheets: Syntax ,Class Selector, Id Selector Dom (Document Object Model) & Dso (Data Source Object) Approaches To Dynamic Pages: Cgi, Java Applets, Plug Ins, Active X, Java Script – Java Script Object Model, Variables-Constant – Expressions, Conditions-Relational Operators- Data Types – Flow Control – Functions & Objects-events and event handlers – Data type Conversion & Equality – Accessing HTML form elements.

UNIT III
XML: What is XML – Basic Standards, Schema Standards, Linking & Presentation Standards, Standards that build on XML, Generating XML data, Writing a simple XML File, Creating a Document type definition, Documents & Data ,Defining Attributes & Entities in the DTD ,Defining Parameter Entities & conditional Sections, Resolving a naming conflict, Using Namespaces, Designing an XML data structure, Normalizing Data, Normalizing DTDS.

UNIT IV
INTERNET SECURITY & FIREWALLS: Security Threats From Mobile Codes, Types Of Viruses, Client Server Security Threats,Data & Message Security, Various electronic payment systems, Introduction to EDI, Challenges–Response System, Encrypted Documents And Emails , Firewalls: Hardened Firewall Hosts, Ip- Packet Screening, Proxy Application Gateways, Aaa (Authentication , Authorization and Accounting).

UNIT V
WEBSITE PLANNING & HOSTING: Introduction, Web Page Lay-Outing, Where To Host Site, Maintenance Of Site, Registration Of Site On Search Engines And Indexes, Introduction To File Transfer Protocol, Public Domain Software, Types Of Ftp Servers (Including Anonymous), Ftp Clients Common Command. Telnet Protocol, Server Domain, Telnet Client, Terminal Emulation. Usenet And Internet Relay Chat.

Text Books:

1. Internet & Intranet Engineering,- Daniel Minoli, TMH.
2. Alexis Leon and Mathews Leon – Internet for Every One, Tech World.

Reference Books:

1. Eric Ladd, Jim O'Donnel –"Using HTML 4, XML and JAVA"-Prentice Hall of India - 1999.
2. Beginning Java Script– Paul Wilton – SPD Publications –2001.
3. Frontiers of Electronics of Commerce, Ravi kalakota & Andrew B. Whinston, Addison Wesley.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 5 **Code: EC512**
Subject: Electronic System Design
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I

Introduction to Electronic System Design, Packaging & Enclosures of Electronic System: Cooling in/of Electronic System, Electromagnetic Compatibility (EMC).

UNIT II

Cabling of Electronic Systems, Grounding of Electronic Systems, Balancing & Filtering in Electronic Systems, Shielding of Electronic Systems, Protection Against Electrostatic Discharges (ESD).

UNTI III

Analog & Mixed Signal Circuit Design Issues and Techniques: Understanding and interpreting data sheets and specifications of various passive and active components, non-ideal behavior of passive components, over voltage effects on analog integrated circuits - amplifier input stage over voltage, amplifier output voltage phase reversal, protecting integrated circuits from ESD, amplifier guard shields, amplifier decoupling. Selection of amplifiers for data converters. Properties of a high quality instrumentation amplifier. Design issues affecting dc accuracy & error budget analysis in instrumentation amplifier applications. Selection of isolation amplifiers. ADC and DAC static transfer function and DC errors, AC errors in Data converters and dynamic performance. Selecting An A/D Converter. Analog Signal handling for high speed and accuracy. Error budget considerations for an electronic system. Circuit layout and grounding in mixed signal system. Analog & Mixed Signal circuit and PCB design exercises.

UNIT IV

Logic Circuit Design Issues and Techniques: Transmission lines, reflections and termination. Digital circuit radiation. Digital circuit layout and grounding. PCB design guidelines for reduced EMI. Basic design considerations for backplanes. Digital circuit & PCB design exercises.

Text Books:

1. Electronic Instrument Design, 1st edition; by: Kim R. Fowler; Oxford University Press.
2. Noise Reduction Techniques in Electronic Systems, 2nd edition; by: Henry W.Ott;John Wiley&Sons.
3. Digital Design Principles& Practices, 3rd edition by: John F. Wakerly; Prentice Hall International, Inc.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 5 **Code: EC513**
Subject: Power Electronics
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
Power diodes - basic structure and V-I characteristics - various types - power transistors - BJT, MOSFET and IGBT - basic structure and V-I characteristics - thyristors - basic structure - static and dynamic characteristics - device specifications and ratings - methods of turning on - gate triggering circuit using UJT - methods of turning off - commutation circuits - TRIAC

UNIT II
Line frequency phase controlled rectifiers using SCR - single phase rectifier with R and RL loads - half controlled and fully controlled converters with continuous and constant currents - SCR inverters - circuits for single phase inverters - series, parallel and bridge inverters - pulse width modulated inverters - basic circuit operation

UNIT III
AC regulators - single phase ac regulator with R and RL loads - sequence control of ac regulators - cycloconverter - basic principle of operation - single phase to single phase cycloconverter - choppers - principle of operation - step-up and step-down choppers - speed control of DC motors and induction motors

UNIT IV
Switching regulators - buck regulators - boost regulators - buck-boost regulators - cuk regulators - switched mode power supply - principle of operation and analysis - comparison with linear power supply - uninterruptible power supply - basic circuit operation - different configurations - characteristics and applications

UNIT V
Applications of power electronics: Single-phase AC voltage controller and solid-state AC regulators, separately excited DC motor control using line commutated converters. Stepper motor control. Electronic ballast for fluorescent lighting. Active power filters.

Text Books:

1. Power Electronics, Sen P.C., Tata Mc Graw Hill,2003
2. Power Electronics, Rashid, Prentice Hall India,1993

Reference Books:

1. Power Electronics, Ned Mohan et.al, John Wiley and Sons, 1989
2. Thyristorised Power Controllers, G.K.Dubey et.al, Wiley & Sons, 2001
3. Power Semiconductor Circuits, Dewan & Straughen, Wiley & Sons, 1984
4. Power Electronics, Singh M.D, Khanchandani K.B., Tata McGraw Hill, 1998

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 5 **Code: EC514**
Subject: Fundamentals of Operating Systems
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
INTRODUCTION: Operating System objective and function. The Evolution of Operating Systems, Batch, interactive, time – sharing and real time systems. Protection. Operating System Structure: System COMPONENTS, operating system service, System structure. Distributed Computing, The Key Architecture Trend: Parallel Computation, Input-Output Trends.

UNIT II
CONCURRENT PROCESSES: Process concept: - Introduction Definitions of "Process", Process States, Process State Transitions, The process Control Block, Operations on Processes, Suspend and Resume, Interrupt Processing, The Nucleus of the Operating System. Asynchronous Concurrent Process: - Introduction, Parallel Processing, A Control Structure for Indicating Parallelism, Mutual Exclusion, The Producer / consumer problem, the critical section problem, semaphores, Classical problems in concurrency, Inter process Communication, Process generation, Process Scheduling. CPU Scheduling: Scheduling concepts, Performance criteria, and scheduling algorithms. Algorithm evaluation, Multiprocessor scheduling.

UNIT III
DEAD LOCKS: System model, Deadlock characterization. Prevention, avoidance and detection, Recovery from dead lock Combined approach.

UNIT IV
MEMORY MANAGEMENT: Base machine, resident Monitor, Multiprogramming with fixed partitions. Multiprogramming with variable partitions. Multiple Base Registers. Paging, segmentation paged segmentation, Virtual Memory concept, Demand Paging, Performance, Page Replacement algorithms, Allocation of frames, Thrashing, Cache memory organization impact on performance.

UNIT V
I/O MANAGEMENT & DISK SCHEDULING: I/O Devices and the organization of the I/O function. I/O Buffering, Disk I/O, Operating System Design issues. File System: File concept- File organization and Access mechanism, File Directories, File sharing. Implementation issues. Case Studies: - Unix System, MVS, OS/2, A Virtual Machine Operating System.

Text Books:

1. Operating System Concepts, Silbersehatz A. and Peterson, J. L., Wiley.
2. An Introduction to Operating Systems, Dietel, H. N., Addison Wesley.

References Books:

1. Operating System: Concept & Design, Milenkovic M., and McGraw Hill.
2. Operating System, Stalling, William, Maxwell McMillan International Editons, 1992.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 5 **Code: EC515**
Subject: Audio System Engineering
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
INTRODUCTION: Decibel, Neper in acoustics, Directivity, Phon, Harmonic distortion, Impedance and gain of electrical system, Impedance Properties of Moving Coil Loudspeakers, Handling the Acoustic Input and Output of the System, Interfacing the Electrical Output Power to the Acoustic Environment, Loudspeaker directivity and coverage.

UNIT II
ACOUSTIC ENVIRONMENT: Inverse Square Law , Atmospheric Absorption, Doppler Effect, Reflection and Refraction, Effect of a Space Heater on Flutter Echo, Absorption , Classifying Sound Fields, Acoustic Environment Indoors, Acoustics measurements, Large room acoustics, Small room acoustics.

UNIT III
DESIGN FOR ACOUSTIC ENVIRONMENT: Designing for Acoustic Gain, Maximum Physical Distance, Establishing an Acceptable Signal-to-Noise Ratio (SNR), Establishing an EAD, Needed Acoustic Gain (NAG), Number of Open Microphones, Feedback Stability Margin, Calculating Potential Acoustic Gain, Obtaining ΔDx Values, Measuring Acoustic Gain, Achieving Potential Acoustic Gain, Limiting Parameters in Sound Reinforcement System Design, Finding Required Electrical Power (REP). Designing for Speech Intelligibility, Articulation Losses of Consonants in Speech, Maxfield's Equation, Speech Power and Articulation, Speech Intelligibility Calculations, Non-Acoustic Articulation Problems, Relationship Between Qmin and D2(MAX), High Density Overhead Distribution, %ALCONS Variables.

UNIT IV
MICROPHONES AND LOUDSPEAKERS: Microphone as the System Input, Microphone Sensitivity, Thermal Noise, Microphone Selection, Nature of Response and Directional Characteristics, Boundary Microphones, Wireless Microphones, Microphone Connectors, Cables, and Phantom Power, Measurement Microphones, Microphone Calibrator. Loudspeaker Types, Radiated Power, Axial Sound Pressure Level, Efficiency, Loudspeaker Electrical Impedance, Loudspeaker Directivity Factor, Loudspeaker Sensitivity, Direct Radiator Example Calculations, Horns and Compression Drivers, Practical Considerations Involving Horns, Horn Compression Drivers, Crossover Networks, Loudspeaker Arrays, Bessel Array, Line Arrays, Vented Enclosure Bass Loudspeakers.

UNIT V
SYNCHRONIZATION AND EQUALIZATION: Signal Delay, Synchronization and Alignment of Arrays, Finding Acoustic Origins of Unlike Devices. Sound system equalization, System criteria, Transient Nature of Acoustic Feedback, Introduction of Real-Time Analyzers, Band-Rejection, Bandpass, and Band-Boost Filters, TEF Analysis in Equalization , How to Approach Equalization, What Real-Time Regenerative-Response Method of Equalizing a Sound System , Equalizing for Playback, Improper Use of Real Time Analysis in Monitoring Music and Speech, Diaphragmatic Absorbers, Proximity Modes, Checking Microphone Polarity, Loudspeaker Polarity.

Text Book:
1. Sound System Engineering, 3/e, D Davis, E Patronis, Elsevier Inc, USA 2006.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

SEMESTER: VI

S. No	Board of Studies	Sub Code	Subject Name	Periods/week			Examination Scheme					Total Marks	Credits L+(T+P)/ 2
				L	T	P	TA	F E	S E	T.C. A.	ES E		
1	ETC	EC61X	Elective-2	3	1	-	20	15	15	50	70	120	4
2	ETC	EC601	Data communication and networking	3	1	-	20	15	15	50	70	120	4
3	ETC	EC602	Digital system design	3	1	-	20	15	15	50	70	120	4
4	ETC	EC603	Wireless communication	3	1	-	20	15	15	50	70	120	4
5	ETC	EC604	VLSI and microelectronics	3	1	-	20	15	15	50	70	120	4
6	ETC	EC605	Microwave and radar engineering	4	1	-	20	15	15	50	70	120	5
7	ETC	EC691	VLSI and digital system design lab	-	-	3	30	-	-	30	20	50	2
8	ETC	EC692	Microcontroller and embedded system lab	-	-	3	30	-	-	30	20	50	2
9	ETC	EC693	Microwave and RF lab	-	-	3	30	-	-	30	20	50	2
10	Hum anities		I & E Skill	-	-	2	25	-	-	25	0	25	1
11			Discipline	-	-	-	25	-	-	25	0	25	1
			Total	19	6	11	260	90	90	440	480	920	33

ELECTIVE 2			
S. No	Board of Studies	Sub. Code	Subject Name
1	ETC	EC611	Optoelectronic devices and circuits
2	ETC	EC612	Advanced microprocessors
3	ETC	EC613	Neural network & fuzzy logic
4	ETC	EC614	Industrial instrumentation & automation
5	ETC	EC615	Adaptive signal processing

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 6 **Code: EC601**
Subject: Data Communication and Networking
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
DATA COMMUNICATIONS: Components – Direction of Data flow – networks – Components and Categories – types of Connections – Topologies –Protocols and Standards – ISO / OSI model – Transmission Media – Coaxial Cable – Fiber Optics – Line Coding – Modems – RS232 Interfacing sequences.

UNIT II
DATA LINK LAYER: Error – detection and correction – Parity – LRC – CRC – Hamming code – low Control and Error control - stop and wait – go back-N ARQ – selective repeat ARQ- sliding window – HDLC. - LAN - Ethernet IEEE 802.3 - IEEE 802.4 - IEEE 802.5 - IEEE 802.11 – FDDI - SONET – Bridges

UNIT III
NETWORK LAYER: Internetworks – Packet Switching and Datagram approach – IP addressing methods – Subnetting – Routing – Distance Vector Routing – Link State Routing – Routers.

UNIT IV
TRANSPORT LAYER: Duties of transport layer – Multiplexing – Demultiplexing – Sockets – User Datagram Protocol (UDP) – Transmission Control Protocol (TCP) – Congestion Control – Quality of services (QOS) – Integrated Services.

UNIT V
APPLICATION LAYER: Domain Name Space (DNS) – SMTP – FTP – HTTP - WWW – Security – Cryptography.

Text Book:
1. Behrouz A. Forouzan, “Data communication and Networking”, Tata McGraw-Hill, 2004.

Reference Books:
1. Andrew S. Tanenbaum, “Computer Networks”, PHI, Fourth Edition, 2003.
2. William Stallings, “Data and Computer Communication”, Sixth Edition, Pearson Education, 2000.
3. James F. Kurose and Keith W. Ross, “Computer Networking: A Top-Down Approach Featuring the Internet”, Pearson Education, 2003.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 6 **Code: EC602**
Subject: Digital System Design
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT 1
REVIEW OF LOGIC FUNDAMENTALS: Combinational logic, Boolean algebra and algebraic simplification, Karnaugh map, Hazards in combinational circuits, Mealy sequential circuit design, Moore sequential circuit design, Equivalent states and reduction of state tables, Sequential circuit timing, Tristate logic and busses.

UNIT II
INTRODUCTION TO VHDL: Computer aided design, Hardware description languages, VHDL description of combinational circuits, VHDL modules, Sequential statements and VHDL processes, Modelling flip-flops using VHDL, Processes using Wait statements, VHDL delays, Compilation, simulation and synthesis of VHDL code, Data types and operators, VHDL libraries, Modelling registers and counters, Behavioural and structural VHDL, Variables, signals and constants, Arrays, Loops in VHDL, Assert and report statements.

UNIT III
Programmable logic devices: Overview of PLDs, CPLD, FPGA, Architectures of popular FPGAs – Xilinx Spartan, Xilinx Virtex, Altera Cyclone etc. Design examples: BCD to seven segment display decoder, BCD adder, 32-bit adder, Traffic light controller, State graphs for control circuits, Scoreboard and controller, Synchronization and debouncing, Add and shift multiplier.

UNIT IV
SM CHARTS AND MICROPROGRAMMING: State machine charts, Derivation of SM charts, Realization, Implementation of dice game, Microprogramming, Linked state machines.

UNIT V
Testing and Diagnosis, Fault modelling: Logical fault models, Fault Detection and Redundancy, Fault Equivalence and Fault Location, Fault Dominance, Single stuck model, Multiple stuck model, Bridging faults. Design for Testability: Testability, Ad hoc Design, Scan Registers and scan techniques, Boundary scan standards. Built in Self Test: Test Pattern generation, Generic Off line BIST Architectures. Compression Techniques: General aspects, Signature Analysis.

Text Books:

1. Principles of Digital System Design using VHDL, C H Roth, L K John, Cengage Learning, New Delhi, 1998.
2. Switching & Finite Automata Theory, Zvi Kolavi, Tata McGraw Hill, New Delhi.
3. Fundamentals of Digital Logic with VHDL Design, S Brown, Z Vranesis, Tata McGraw Hill, New Delhi 2003.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 6 **Code: EC603**
Subject: Wireless Communication
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
PATH LOSS AND SHADOWING**:** Radio Wave Propagation, Transmit and Receive Signal Models, Free-Space Path Loss, Ray Tracing, Two-Ray Model, The Okumura Model, Hata Model, Shadow Fading. STATISTICAL MULTIPATH CHANNEL MODELS: Time-Varying Channel Impulse Response, Narrowband Fading Models, Autocorrelation, Cross Correlation, and Power Spectral Density, Envelope and Power Distributions, Level Crossing Rate and Average Fade Duration, Wideband Fading Models, Power Delay Profile, Coherence Bandwidth, Doppler Power Spectrum and Channel Coherence Time.

UNIT II
CAPACITY OFWIRELESS CHANNELS: Capacity in AWGN, Capacity of Flat-Fading Channels, Channel and System Model, Channel Distribution Information (CDI) Known, Channel Side Information at Receiver, Channel Side Information at Transmitter and Receiver, Capacity with Receiver Diversity, Capacity Comparisons, Capacity of Frequency-Selective Fading Channels, Time-Invariant Channels, Time-Varying Channels.

UNIT III
Equalizer Noise Enhancement, Equalizer Types, Folded Spectrum and ISI-Free Transmission, Linear Equalizers, Zero Forcing (ZF) Equalizers, Minimum Mean Square Error (MMSE) Equalizer, Maximum Likelihood Sequence Estimation, Decision-Feedback Equalization, Other commonly used Equalization Methods, Adaptive Equalizers: Training and Tracking.

UNIT IV
SPREAD SPECTRUM: Spread Spectrum Principles, Direct Sequence Spread Spectrum (DSSS), DSSS System Model, Spreading Codes for ISI Rejection: Random, Pseudorandom, and *m*-Sequences, Synchronization, RAKE receivers, Frequency-Hopping Spread Spectrum (FHSS), Multiuser DSSS Systems, Spreading Codes for Multiuser DSSS, Downlink Channels, Uplink Channels, Multiuser Detection, Multicarrier CDMA, Multiuser FHSS Systems.

UNIT V
MULTICARRIER MODULATION: Data Transmission using Multiple Carriers, Multicarrier Modulation with Overlapping Sub-channels, Mitigation of Subcarrier Fading, Coding with Interleaving over Time and Frequency, Frequency Equalization, Precoding, Adaptive Loading, Discrete Implementation of Multicarrier, DFT and its Properties, Cyclic Prefix, Orthogonal Frequency Division Multiplexing (OFDM), Matrix Representation of OFDM, Vector Coding, Challenges in Multicarrier Systems, Case Study: The IEEE 802.11a Wireless LAN Standard.

Text books:

1. Wireless communication, A Goldsmith, Cambridge University Press, 2005.
2. Wireless communication, T S Rappaport, PHI, New Delhi.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 6 **Code: EC604**
Subject: VLSI and Microelectronics
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
Introduction, Trends & Projections in VLSI Circuits, Flow diagram of VLSI Circuit, Design and VLSI Design issues. Stick Diagrams; Physical Design Rules; Layout Designing; Euler's Rule for VLSI Physical Design.

UNIT II
MOSFET fundamentals, Enhancement Mode MOSFETs, Depletion Mode MOSFETs, Weak & strong Inversion Conditions, Threshold Voltage Concept in MOSFETs, IV Characteristics of a MOSFET, Limitations in IV Model and MOSFET capacitiance.

UNIT III
Basic VLSI Design Styles-NMOS, CMOS Process flow; Noise Margin; Inverter Threshold Voltage; NMOS Inverter design and characteristics; CMOS Inverter Design and Properties; CMOS transmission gates, Delay, Power Dissipation and scaling in CMOS circuits.

UNIT IV
Parallel & Series Equivalent circuits; Static CMOS Circuit Design: case study; VLSI Interconnects. High Speed Dynamic CMOS logic families; Precharge-Evaluate logic; Dynamic CMOS logic circuits, cascading , charge sharing and clock distribution.

UNIT V
Memory / Regular Structure Design; ROM Design, SRAM and DRAM Design.

Text Books

1. CMOS Digital Integrated Circuits-Analysis & Design, S.M. Kang & Y. Leblibici, TMH, Ed. 2003.
2. Principles of CMOS VLSI Design: A System Perspective, N.H.E. Weste & K. Eshraghian, Pearson Education India, 2004.

Reference Books

1. Digital Integrated Circuits-A Design Perspective, J.M. Rabaey, PHI.
2. Introduction to VLSI, K. Eshraghian & Pucknell, PHI.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 6 **Code: EC605**
Subject: Microwave and Radar Engineering
Credits: 5
Total Theory Periods: 40 **Total Tutorial Periods: 10**

UNIT I
Microwave Components: Rectangular cavity resonators; Q of a cavity resonator; Re-entrant cavities; Slow-wave structure; Microwave hybrid circuits; S-parameters and their properties; Waveguide tees ; Hybrid ring; Waveguide corners bends and twists; Two hole directional coupler; S- Matrix; Circulators and Isolators; Hybrid couplers.

UNIT – II
Microwave Linear Beam and Crossed-Field Tubes: Failure of conventional tube at high frequency; Klystron-Velocity modulation; Bunching; output power and loading; Reflex klystron-Velocity modulation; power output and efficiency and electronic admittance; Helix travelling wave tubes; amplification process; Conventional current; Electric field wave modes; Basic principle of coupled cavity; Magnetron-Types and Principles of operation; Modes of oscillation; Strapping; pi-mode separation.

UNIT – III
Microwave Devices: Transistors, Tunnel Diodes and Microwave FETs: Structure; Operation; Characteristics and Power frequency limitations of microwave transistors; Tunnel diodes and Field-Effect Transistors. Transfer Electron Devices: Gunn diode; Gunn effect; Principle and Mode of operation; Microwave generation and amplification Tunnel Diode; PIN diode and Crystal diode. Modulator; Switches, Avalanche Transit- Time Devices: Physical Structure; Principle of operation; Characteristics; Power output and Efficiency of IMPATT, TRAPATT and BARITT diodes; Parametric amplifiers.

UNIT – IV
Microwave Measurement: Microwave bench; Precautions; Power measurement; Bolometric method; Attenuation; VSWR; Impedance, Frequency and Q of the Cavity.

UNIT – V
Principles and Applications of Radar: Basic Radar, Radar Block Diagram, Radar Frequencies, Applications of Radar, Radar Range Equation, MTI and Pulse Doppler Radar: Introduction to Doppler and MTI Radar, delay line cancellers, staggered PRF. Range gated Doppler filter, limitations to MTI performance. Tracking with Radar, Monopulse Tracking, Conical Scan and Sequential Lobing, Limitations to Tracking Accuracy, Low Angle Tracking, Tracking in range, Comparison of Trackers.

Text Books:

1. Microwave Devices and Circuits by Samuel Y. Liao, 3rd Ed., Pearson Education.
2. Foundations of Microwave Engineering by R .E. Collin, TMH Pub.
3. Introduction to Radar Systems by M.I Skolnik, TMH Pub. Co.

Reference Books:

1. Microwave Principles by Reich.
2. Microwaves, Gupta, New Age International Publishers.
3. Microwave and Radar Engg., M. Kulkarni, Umesh Publication.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 6 **Code: EC691**
Subject: VLSI and Digital System Design Laboratory
Credits: 2

Lab assignments based on EC602 Digital System Design and EC604 VLSI and Microelectronics.

Semester: 6 **Code: EC692**
Subject: Microcontroller and Embedded Systems Laboratory
Credits: 2

Lab assignments based on EC601 Microcontroller and Embedded Systems.

Semester: 6 **Code: EC693**
Subject: Microwave and RF Laboratory
Credits: 2

Lab assignments based on EC605 Microwave and Radar Engineering.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 6 **Code: EC611**
Subject: Optoelectronic Devices and Circuits
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
Optical processes in semiconductors – electron hole recombination, absorption, Franz-Keldysh effect, Stark effect, quantum confined Stark effect, deep level transitions, Auger recombination (10 hours)

UNIT II
Lasers – threshold condition for lasing, line broadening mechanisms, axial and transverse laser modes, heterojunction lasers, distributed feedback lasers, quantum well lasers, tunneling based lasers, modulation of lasers. (8 hours)

UNIT III
Optical detection – PIN, APD, modulated barrier photodiode, Schottky barrier photodiode, wavelength selective detection, microcavity photodiodes. (8 hours)

UNIT IV
Optoelectronic modulation - Franz-Keldysh and Stark effect modulators, quantum well electro-absorption modulators, electro-optic modulators, quadratic electro-optic effect quantum well modulators, optical switching and logic devices (8 hours)

UNIT V
Optoelectronic ICs – hybrid and monolithic integration, materials and processing, integrated transmitters and receivers, guided wave devices (8 hours)

Text Books:

1. Semiconductor Optoelectronic Devices, Pallab Bhattacharya, 2nd Ed; Pearson Education, 2002
2. Photonics: Optical Electronics in modern communication, Amnon Yariv & Pochi Yeh, 6th Ed; Oxford Univ. Press, 2006
3. Fundamentals of Photonics, B E Saleh and M C Teich, Wiley-Interscience; 1991

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 5 **Code: EC612**
Subject: Advanced Microprocessors
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
ADVANCED MICROPROCESSOR ARCHITECTURE: Internal Microprocessor Architecture-Real mode memory addressing – Protected Mode Memory addressing –Memory paging - Data addressing modes – Program memory addressing modes – Stack memory addressing modes- Data movement instructions – Program control instructions- Arithmetic and Logic Instructions.

UNIT II
INTRODUCTION TO INTEL 80286, 80386 & 80486: Introduction to 80286, Intel 80386 Microprocessor, Architecture, Pins & Signals, Memory System Registers, 80386 Memory Management, Paging Technique, Protected Mode Operation, brief introduction to 80387 Math Coprocessor. Intel 80486.

UNIT III
PENTIUM PROCESSORS: Introduction to Pentium Microprocessor – Special Pentium registers- Branch Prediction Logic, Floating Point Module, Cache Structure, and Superscalar Architecture. Pentium memory management – New Pentium Instructions –Pentium Processor –Special Pentium pro features – Pentium 4 processor.

UNIT IV
16-BIT MICRO CONTROLLERS: 8096/8097 Architecture-CPU registers –RALU-Internal Program and Data memory Timers-High speed Input and Output –Serial Interface-I/O ports –Interrupts –A/D converter- Watch dog timer –Power down feature –Instruction set- External memory Interfacing – External I/O interfacing.

UNIT V
RISC PROCESSORS AND ARM: The RISC revolution – Characteristics of RISC Architecture – The Berkeley RISC – Register Windows – Windows and parameter passing – Window overflow – RISC architecture and pipelining – Pipeline bubbles – Accessing external memory in RISC systems – Reducing the branch penalties – Branch prediction – The ARM processors – ARM registers – ARM instructions – The ARM built-in shift mechanism – ARM branch instructions – sequence control – Data movement and memory reference instructions.

Text Books:

1. The Intel Microprocessors 8086/8088, 8086, 80286, 80386, 80486, Pentium, Pentium Pro Processor, Pentium II, Pentium III, Pentium 4, Architecture, Programming and interfacing, Barry B.Brey, Prentice Hall of India Private Limited, New Delhi, 2003.
2. Design with Microcontroller, John Peatman, McGraw Hill Publishing Co Ltd, New Delhi.
3. The principles of computer Hardware, Alan Clements, Oxford University Press, 3rd Edition, 2003.

Reference Books:

1. The concepts and feature of micro controllers 68HC11, 8051 and 8096, Rajkamal, S Chand Publishers, New Delhi.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 6 **Code: EC613**
Subject: Neural Networks and Fuzzy Logic
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
Introduction to ANS Technology: Elementary Neurophysiology, Models of a Neuron, Neural Networks viewed as directed graphs, Feedback, from neurons to ANS, Artificial Intelligence and Neural Networks.

UNIT II
Learning and Training: Hebbian, Memory based, Competitive, Error-Correction Learning, Credit Assignment. Problem: Supervised and Unsupervised learning, Memory models, Recall and Adaptation. Network Architectures, Single-layered Feed-forward Networks, Multi-layered Feedforward Networks, Recurrent Networks, Topologies.

UNIT III
Algoritms for ANN: Activation and Synaptic Dynamics, Stability and Convergence. A Survey of Neural Network Models : Single-layered Perceptron – least mean square algorithm, Multi-layered Perceptrons – Back propagation Algorithm, XOR – Problem, The generalized Delta rule, BPN Applications, Adalines and Madalines – Algorithm and applications.

UNIT IV
Radial basis functions, introduction to neural network signal processing , pattern detection , character recognition, Signal processing using multilayer perceptron, structure of multilayer perceptron, training the MLP.

UNIT V
Adaptive Fuzzy Systems: Introduction to Fuzzy sets and operations, Examples of Fuzzy logic, Fuzzy Associative memories, Fuzziness in neural networks, Comparison of Fuzzy and neural Truck-Backer upper control systems.

Text Books:
1. Neural Network: A Comprehensive Foundation, Haykin, Pearson Education.
2. Neuro-Fuzzy and Soft-Computing – A computational approach to learning and machine intelligence; Jang, Sun and Mizutani; Prentice Hall of India.

Reference Books:
1. Neural Networks, Freeman, Pearson Education
2. Fundamentals of Artificial Neural Networks, Hassoun, PHI.
3. Artificial Neural Networks by B. Yagna Narayan, PHI.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 6 **Code: EC614**
Subject: Industrial Instrumentation & Automation
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
Instrument Characteristics: Transducer performance characteristics, Generalized performance of systems, Static terms and characteristics, Dynamic terms and characteristics, standard test inputs, zero, first and second order instruments and their responses, Higher order systems, calibration and standards, process of calibration, standards for calibration.

UNIT II
Pressure Measurement: Terminology, Units; Manometers – Piezometer, U-Tube Double Column Manometer, Single Column Manometer, U-Tube Differential Ma nometer; Advantages and Limitations; Bourdan Gauge; ring balance manometer, bell type pressure gauges, elastic pressure transducers, low pressure gauges, Dead Weight Piston Gauge, Servo Operated Manometer, Feedback Pneumatic Load Cell.

UNIT III
Temperature Measurement: Types of temperature measuring instruments; Liquid-in-glass thermometers; Bimetallic Thermometers; Thermocouples, Laws of thermocouples, Elements of thermoelectric pyrometers, Resistance thermometers; Thermistors; Radiation and Optical Pyrometers, Temperature Balance Systems, Heat Flow Balance Systems.

UNIT IV
Flow Measurement: Classification of flow measurement techniques, variable head meters and related theory for incompressible fluids, Nozzle, Orifice, Venturi, Pitot Tube, Anemometers, Turbine Meter, Current Meter, Electromagnetic Flow Meter, Ultrasonic Flow Meter, Variable Area Meters, Variable Head and Area Meters, Quantity Meters, Servo Operated Electromagnetic Flow Meter.

UNIT V
Introduction to Process Control: Control Systems; Proce ss control principles; Servomechanisms; Process Control Block Diagram; Process control system evaluation, Analog and Digital Processing, Time Response. Final Control: Final Control Operation; Signal Conversions; Actuators; Control Elements, Hydraulic and Pneumatic Control Systems.

Text Books:

1. Transducers and Instrumentation; Murty, D.V.S.; PHI, 10th print 2003
2. Process Control Instrumentation Technology; Johnson, C.; PHI, 4 th Edition

Reference Books:

1. Sensors and Transducers; Patranabis, D.; PHI, 2nd Edition
2. Industrial Control & Instrumentation, W. Bolton, University Press.
3. Electronic Measurements and Instrumentation: Oliver and Cage: TMH.
4. Electronic Instrumentation, H.S. Kalsi, 2 nd Ed., TMH.
5. Mechanical and Industrial Measurements; Jain, R.K.; Khanna Publ., 2000

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 6 **Code: EC615**
Subject: Adaptive Signal Processing
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
Introduction: Definition and characteristics, general properties,open and closed loop adaptation, Adaptive Linear Combiner: General description, input signal and Weight vectors, desired response and error performance function, gradient and minimum mean square, alternative definition of gradient, decorelection of error and input components.

UNIT II
Theory of Adaptation with Stationary Signals: Input correlation matrix, Eigen values and eigenvectors of the correlation matrix,and their geometrical significance. Basic ideas of gradient search methods, gradient search by Newton's method and method of steepest descent

UNIT III
Gradient component estimation by derivative measurement, effects of gradient noise on weight vector solution, excess MSE, time constant and misadjustment , performance comparison of Newton and S.D. methods.

UNIT IV
Adaptive Algorithms: Least mean square algorithm, convergence, learning curve noise in Weight vector misadjustmentand performances of LMS algorithms, sequential regression algorithm, adaptive recursive LMS algorithm, random search algorithm.

UNIT V
An ideal : The LMS / Newton Algorithm, properties of the LMS / Newton Algorithm, the sequential regression algorithm , adaptive recursive filters random search algorithm , lattice structures, the adaptive lattice predictor, adaptive filters with orthogonal signals

Text Book:
1. Adaptive signal processing, Bernard Widrow, Samuel D. Stearns.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

SEMESTER: VII

S. No	Board of Studies	Sub Code	Subject Name	Periods/week			Examination Scheme					Total Marks	Credits L+(T+P)/2
				L	T	P	TA	FE	SE	T.C.A.	ESE		
1	ETC	EC701	Information theory and coding	3	1	-	20	15	15	50	70	120	4
2	ETC	EC71X	Elective-3	3	1	-	20	15	15	50	70	120	4
3	ETC	EC72X	Elective-4	3	1	-	20	15	15	50	70	120	4
4	ETC	EC702	Telecom switching and cellular system	4	1	-	20	15	15	50	70	120	5
5	ETC	EC791	Communication system simulation Lab	-	-	3	30	-	-	30	20	50	2
6	ETC	EC792	System design and simulation Lab	-	-	3	30	-	-	30	20	50	2
7	ETC	EC793	Pract. Training	-	-	-	50	-	-	50	0	50	2
8	ETC	EC794	Minor Project	-	-	12	100	-	-	100	50	150	6
9	ETC	EC795	Seminar and Report Writing	-	-	2	50	-	-	50	0	50	1
			Total	13	4	20	340	60	60	460	370	830	30

ELECTIVE 3 & 4 (SEMESTER VII) Any two from the following

S. No.	Board of Studies	Sub Code	Subject Name
1	ETC	EC711	Digital signal processors and applications.
2	ETC	EC712	ARM system architecture and design.
3	ETC	EC713	Digital image processing.
4	ETC	EC714	Digital communication hardware design.
5	ETC	EC715	Nonlinear signal and image processing.
6	ETC	EC726	Data acquisition and computer interfacing.
7	ETC	EC727	Cryptography and network security.
8	ETC	EC728	Smart antenna systems.
9	ETC	EC729	Wireless sensor networks.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 7 **Code: EC701**
Subject: Information Theory and Coding
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
Introduction to information theory, Probability, entropy and inference, The source coding theorem, Symbol codes, Stream codes, Codes for integers.

UNIT II
Noisy channel coding: Dependent random variables, Communication over a noisy channel, Noisy-channel coding theorem, Error correcting codes and real channels.

UNIT III
Classical Channel Codes: Linear block codes, Cyclic codes, Convolutional codes, Maximum likelihood decoding of convolutional codes, Viterbi algorithm.

UNIT IV
Turbo codes: Performance of turbo codes, Turbo decoding, BCJR algorithm.

UNIT V
Low Density Parity Check Codes: Representations of LDPC codes, Sum-product and message passing algorithm, Iterative decoder for LDPC codes.

Text Books:

1. Information Theory, Inference, and Learning Algorithms, David MacKay, CUP, 2003.
2. Communication Systems, Simon Haykin, Wiley India, 2001.
3. Channel Codes- Classical and Modern, William Ryan, Shu Lin, CUP, 2009.

Reference Books:

1. T Elements of Information Theory, M Cover, J A Thomas, Wiley India, 2006.
2. Information Theory and Network Coding, R W Yeung, Springer 2008.
3. Coding and Information Theory, R W Hamming, Prentice Hall, USA 1986.

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 7 **Code: EC702**
Subject: Telecom Switching and Cellular System
Credits: 5
Total Theory Periods: 40 **Total Tutorial Periods: 10**

UNIT I
DIGITAL SWITCHING SYSTEMS: Introduction and history of telecom switching, Telephone equipment, Telephone exchange system, Switching functions, Space division switching, multiple stage switching, blocking probabilities, path finding, switch matrix control, Time division switching, Two dimensional switching, Digital cross connect systems.

UNIT II
GSM CELLULAR SYSTEM ARCHITECTURE: Cellular concept, Simplified design of classic cellular system, Basic GSM architecture, Basic radio transmission parameters of the GSM system, Logical channel description, GSM time hierarchy, GSM burst structures, Description of the call set-up procedure, Handover, Ensuring privacy and authentication of a user, Modifications and derivatives of GSM.

UNIT III
TRAFFIC ANALYSIS: Traffic characterization, arrival and holding time distributions, Loss systems, lost call cleared, returned, held, Network blocking probabilities, Delay systems. Traffic theory applied to cellular system, Ways of increasing system capacity, Channel assignment to the cells.

UNIT IV
SPEECH AND DATA IN GSM: Construction of a typical mobile station, Coding and decoding of speech signal, GMSK modulation, Sequential data detection. Data transmission in GSM, Data services in GSM, SMS, HSCSD, GPRS, EDGE.

UNIT V
TRANSMISSION SYSTEMS: Optical fiber transmission system elements, Line codes (mBnB code, Bit insertion code), DWDM, Pleciosynchronous digital hierarchy (PDH), Synchronous digital hierarchy (SDH), SDH multiplexing overview, Frame formats, operations, Payload framing and frequency justification, Virtual tributaries, E4 payload mapping, SDH optical standards, SDH microwave and satellite standards, SDH network.

Text Books:

1. Digital Telephony, J C Bellamy, John Wiley and Sons.
2. Mobile communication systems, K Wesolowski, John Wiley and Sons, England 2002.

Reference Books:

1. Mobile cellular telecommunications, W C Y Lee, Tata McGraw-Hill, New Delhi 2006.
2. Telecommunication Switching & System, Thayagarajan V., Tata McGraw-Hill, New Delhi

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 7 **Code: EC791**
Subject: Communication System Simulation Laboratory
Credits: 2

Simulation of various digital communication techniques and error correction codes using tools like Matlab/Octave, Labview, C/C++ models etc.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 7 **Code: EC792**
Subject: System Design and Simulation Laboratory
Credits: 2

Lab assignments given EC71X Elective-3.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 7 **Code: EC794**
Subject: Minor Project
Credits: 6

1. The students are expected to take up a Project under the guidance of a faculty from the Institute.
2. The topic of the project should be justified for the degree of B.Tech (Electronics & Telecommunication). The project chosen may have sufficient scope to be extended to Major project.
3. Students should submit synopsis of project within one month of offering of projects by faculty to the Student Projects Coordinator nominated by HoD. Synopsis should clearly state the quanta of work to be done in Minor project and the work for Major.
4. The students may be asked to work individually or in a group having not more than three students.
5. The quanta of work should justify a semester of work and live up to the standards of an NIT.
6. The students are expected to submit the report in standard format approved by the department in partial fulfillment of the requirement for the degree of B.Tech (Electronics & Telecommunication).
7. There will be a presentation cum viva-voce at the end of the semester and the students are to demonstrate the project at the time of viva-voce. The students will be evaluated for ESE in Minor project by a team of faculty nominated by the Head of Department.

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 7 **Code: EC711**
Subject: Digital Signal Processor & Its Application
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
ARCHITECTURES FOR PROGRAMMABLE DSP DEVICES: Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Speed Issues, Features for External interfacing.

UNIT II
EXECUTION CONTROL AND PIPELINING: Hardware looping, Interrupts, Stacks, Relative Branch support, Pipelining and Performance, Pipeline Depth, Interlocking, Branching effects, Interrupt effects, and Pipeline Programming models.

UNIT III
PROGRAMMABLE DIGITAL SIGNAL PROCESSORS : Commercial Digital signal-processing Devices, Data Addressing modes of TMS320C54XX DSPs, Data Addressing modes of TMS320C54XX Processors, Memory space of TMS320C54XX Processors, Program Control, TMS320C54XX instructions and Programming, On-Chip Peripherals, Interrupts of TMS320C54XX processors, Pipeline Operation of TMS320C54XX Processors.

UNIT IV
IMPLEMENTATIONS OF BASIC DSP ALGORITHMS : The Q-notation, FIR Filters, IIR Filters, Interpolation Filters, Decimation Filters, PID Controller, Adaptive Filters, 2-D Signal Processing, FFT Algorithm for DFT Computation, A Butterfly Computation, Overflow and scaling, Bit-Reversed index generation, An 8-Point FFT implementation on the
TMS320C54XX, Computation of the signal spectrum.

UNIT V
INTERFACING MEMORY AND I/O PERIPHERALS TO PROGRAMMABLE DSP DEVICES: Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access (DMA). A Multichannel buffered serial port (McBSP), McBSP Programming, a CODEC interface circuit, CODEC programming, A CODEC-DSP interface example.

Text Books:

1. Digital Signal Processors, Architecture, Programming and Applications – B. Venkataamani and M. Bhaskar, TMH, 2004.
2. Digital Signal Processing- A practical approach, Ifeachor & Jervis, Pearson Education.

Reference Books:

1. TMS320C50, TMS320C54XX, TMS320C6713 databooks.

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 7 **Code: EC712**
Subject: ARM System Architecture and Design
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
ARCHITECTURAL FEATURES OF ARM PROCESSOR: Processor modes, Register organization, Exceptions and its handling, Memory and memory-mapped I/Os, ARM and THUMB instruction sets, addressing modes, ARM floating point architecture and DSP extensions, ARM co-processors.

UNIT II
ARM 9 TDMI ARCHITECTURAL STUDY: H/W architecture, Timing diagrams for various accesses, Memory buses: AMBA, ASB, APB, Case study of Intel Xscale architecture or Samsung ARM implementations

UNIT III
ARM AND THUMB INSTRUCTION SETS: Conditional execution and flags, Branch instructions, The barrel shifter, Immediate constants, Single register data transfer, Block data transfer, Stack management, Coprocessor instructions, Register access in Thumb, ARM architecture V5TE new instructions, Assembler workbooks
ARM / THUMB INTERWORKING: Switching between states, Branch exchange example, Mixing ARM and Thumb subroutines, ARM to thumb veneer, Thumb-to-ARM veneer, Interworking calls, and Interworking using codewarrior.

UNIT IV
ARM DEVELOPPER SUITE (ADS) OVERVIEW: Using the core tools, C/C++ compilers key features, Supplied libraries, Codewarrior introduction, Debugging with multi-ICE.
ADS INTRODUCTORY WORKBOOK: Compiling and running an example, Creating a header file, Creating a new project, Viewing registers and memory.
EXCEPTION HANDLING: Exception return instructions, Exception priority, Vector table instructions, Chaining exception handlers, Register usage in exception handlers, FIQ vs IRQ, Example C interrupt handler, Software managed interrupt controller, Issues when re-enabling interrupts, C nested interrupt example, Invoking SWIs, Data abort with memory management, The return address

UNIT V
EMBEDDED SOFWARE DEVELOPMENT: ROM or RAM at 0x0, ROM/RAM remapping, Exception vector table, Reset handler, Initialization : stack pointers, code and data areas, C library initialization, Scatter loading, Linker placement rules, Long branch veneers, C library functionality, Placing the stack and heap, Debugging ROM images.

Text Books:
1. ARM System Developer's Guide: Designing and Optimizing, Sloss Andrew N, Symes Dominic, Wright Chris, Morgan Kaufman Publication.
2. ARM System-on-Chip Architecture, Steven Furber, Pearson Education

Reference Books:
1. Technical references on www.arm.com.

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 7 **Code: EC713**
Subject: Digital Image Processing
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
Introduction to image processing: Applications and fields of image processing, Fundamental steps in Digital image processing, Elements of visual perception, Image sensing and acquisition, Basic Concepts in Sampling and Quantization, representing digital images

UNIT II
Image Enhancement in the Spatial Domain: Some basic gray level transformations, Histogram Processing, Histogram modification, Image subtraction, spatial filtering, Sharpening Spatial filters, use of first and second derivatives for enhancement ; Image Enhancement in the Frequency Domain, Gaussian filters, Homomorphic filtering Pseudocolouring : intensity slicing, gray level to color transformation,

UNIT III
Image Segmentation:-Some Basic Relationships between pixels, point, line and edge detection, Gradient operators, Canny edge detection, pyramid edge detection. Edge linking and boundary detection, Hough transform, Chain codes, boundary segments, skeletons, Boundary descriptors, Fourier descriptors.

UNIT IV
Thresholding: The role of illumination, global thresholding, adaptive thresholding, use of boundary characteristics for histogram improvement and local thresholding, Region based segmentation, Region growing, region splitting and merging.

UNIT V
Image Compression: Data redundancies Elements of information, variable-length coding, predictive coding, Transform coding, Image compression standards; Wavelets and Multiresolution processing: - Image pyramids, sub band coding
Basics of Image restoration, Color image processing Applications of Image Processing: - Finger print analysis, Digital watermarking, Optical character recognition etc.

Text Books:

1. Digital Image Processing, Gonzalez & Woods, Pearson Education, 2003
2. Introduction to Digital Image Processing, Alasdair Mc Andrew, Cengage learning, 2009
3. Fundamental of Digital Image Processing, A K Jain, PHI.

Reference Books:

1. Image Processing, Analysis and Machine Vision, Milan Sonka, Thomson Learning, 2001
2. Digital Image Processing, Pratt W.K, John Wiley & Sons, 2001

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 7 **Code: EC714**
Subject: Digital Communication Hardware Design
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
Introduction to Virtex 2/4/6 board with RF transceivers (platform like WRAP, SMT349, Lyrtech SFF SDR etc), Architecture of Virtex 2/4/6 FPGA, RF module, Radio up and down converter modules, Timing module, Control register and other settings.

UNIT II
Programming with Virtex 4/6 FPGA, Programming with VHDL, Programming FPGA with Xilinx system generator and AccelDSP. Implementation of FIR and IIR filters on FPGA, Generation of sinusoid, Optimizing VHDL programs for FPGA architecture.

UNIT III
TRANSMITTER: Bandpass modulation, Binary ASK, BFSK, BPSK, QPSK generation with Virtex 6 board. Baseband pulse shaping to improve spectral efficiency, Sinc shaped pulse, Raised cosine pulse.

UNIT IV
RECEIVER DESIGN: Carrier phase recovery, Decision directed algorithm for phase recovery, Recursive Costas loop, Symbol timing recovery, Coherent detection of PSK, QPSK, Equalization, Implementation on FPGA board.

UNIT V
Non coherent receivers for ASK and FSK, Envelope detector. Implementation on WRAP board or a SDR.

Text Books:

1. Digital signal processing with field programmable gate arrays, 3/e, U Meyer-Baese, Springer India, 2007.
2. Communication systems- Analysis and design, H P E Stern, S A Mahmoud, Pearson Education India, 2004.
3. Transceiver and system design for digital communications, S R Bullock, Scitech Publishing 2000.

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 7 **Code: EC715**
Subject: Nonlinear Signal and Image Processing
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
BASICS OF DISCRETE VOLTERRA SERIES: Introduction and basic definitions, nonlinear sampled-data systems, multidimensional z transform, discrete volterra series in the z domain, conditions for convergence and stability, matrix representation for multiple-input and multiple-output systems, nonlinear systems with fading memory, further considerations on fading memory, approximation of the system response by volterra series, discrete volterra series for binary signals, associated expansions and other approximations.

UNIT II
NONLINEAR ECHO CANCELLATION: Adaptive cancellers, nonlinear echo cancellation in data transmission, interleaved and passband nonlinear transversal filters.

UNIT III
KALMAN FILERING: Bayesian recursive relation and Kalman filter, Estimation of Gaussian random vectors, Extended Kalman filter, Unscented Kalman filtering.

UNIT IV
PERTICLE FILTERING: Bayesian inference in HMM, Sequential Monte Carlo methods, Basics of Monte Carlo method, Importance sampling, Particle filtering, SMC for filtering, Auxiliary particle filtering, Limitations of particle filter.

UNIT V
NONLINEAR IMAGE PROCESSING: Median and order statistics filter, Stack filters, Weighted median smoothers and filters, Spatial rank order selective filters, Nonlinear mean filters.

Text books:

1. Nonlinear aspects of telecommunications, A Boryz, CRC Press, 2001.
2. Nonlinear image processing, ed. S K Mitra, G L Sicuranza, Academic Press, USA 2001.

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 7 **Code: EC726**
Subject: Data Acquisition and Computer Interfacing
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
Bus system: Bus systems in microcomputers ST 100 bus, Multi bus, EISA, PCI Bus, HP IB/GPIB Bus, Bus and their applications. I/O Interface: Standard I/O interfaces RS-232 C, RS-232 D Centronics interface, current loop interface, and RS-449 communication interface. Programming for hardware in Visual Basic/Visual C++.

UNIT II
GPIB BUS: Bus structure, Signals, Controlling a device in GPIB, IEEE 488.2, SCPI. Plug-in boards and ISA, Description of ISA bus, Common interface chips, Interfacing to ISA. LabView PCI based data acquisition board operation.

UNIT III
OVERVIEW OF USB: Design goals of USB, Cables and connectors, LS/FS signalling environment, LS/FS transfer types and scheduling, Packets and transactions, Error recovery.

UNIT IV
HIGH SPEES USB OPERATION: Overview of HS device operation, HS signalling environment, Transfers, transactions and scheduling, HS error detection and handling, HS suspend and resume.

UNIT V
USB DEVICE CONFIGURATION: Configuration process, Hub configuration, Device classes, Overview of host software.

Text Books:

1. Visual basic for electronic engineering applications, V Himpe, Freely downloadable e-book.
2. USB system architecture, Don Anderson, Addison-Wesley Developer's Press, USA 2001.

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: **Code: EC727**
Subject: Cryptography & Network Security
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
INTRODUCTION: OSI Security Architecture, Classical Encryption techniques, Cipher Principles, Data Encryption Standard – Block Cipher Design Principles and Modes of Operation - Evaluation criteria for AES – AES Cipher – Triple DES – Placement of Encryption Function – Traffic Confidentiality

UNIT II
PUBLIC KEY CRYPTOGRAPHY : Key Management - Diffie-Hellman key Exchange – Elliptic Curve Architecture and Cryptography - Introduction to Number Theory – Confidentiality using Symmetric Encryption – Public Key Cryptography and RSA.

UNIT III
AUTHENTICATION AND HASH FUNCTION: Authentication requirements – Authentication functions Message Authentication Codes – Hash Functions – Security of Hash Functions and MACs, MD5 message Digest algorithm, Secure Hash Algorithm, RIPEMD, HMAC Digital Signatures, Authentication Protocols – Digital Signature Standard.

UNIT IV
NETWORK SECURITY: Authentication Applications: Kerberos – X.509, Authentication Service, Electronic Mail Security – PGP – S/MIME - IP Security – Web Security.

UNIT V
SYSTEM LEVEL SECURITY: Intrusion detection – password management – Viruses and related Threats – Virus Counter measures – Firewall Design Principles – Trusted Systems.

Text Books:

1. Cryptography And Network Security – Principles and Practices, William Stallings, Prentice Hall of India, Third Edition, 2003.

Reference Books:

1. Network Security Private Communication in a public world, Charlie Kaufman, Radia Perlman & Mike Speciner, Prentice Hall of India Private Ltd., New Delhi.
2. Cryptography and Network Security, Atul Kahate, Tata McGraw-Hill, 2003.
3. Applied Cryptography, Bruce Schneier, John Wiley & Sons Inc, 2001.
4. Security in Computing, Third Edition, Charles B. Pfleeger, Shari Lawrence Pfleeger, Pearson Education, 2003.

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 7 **Code:EC728**
Subject: Smart Antenna Systems
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
Antenna arrays and diversity techniques, basic MIMO systems, channel model for multiple antenna systems.

UNIT II
Smart antenna introduction, smart antenna configuration, SDMA, architecture of smart antenna systems**.**

UNIT III
DOA(Direction of arrival) fundamentals ,DOA calculations, algorithms ESPIRIT,MUSIC.

UNIT IV
Beamforming fundamentals adaptive algorithms constant modulus, quasi Newton.

UNIT V
Space time processing, integration and simulation of smart antennas, smart antenna systems for mobile Adhoc networks.

Text Books:
1. Smart Antennas, Tapan k. Sarkar, IEEE Press Wiley Interscience

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 7 **Code: EC729**
Subject: Wireless Sensor Networks
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
Introduction to wireless sensor neteorks (WSN), Hardware of wireless sensor node, Network deployment, Localization, Coarse grained and fine grained localization, Network wide localization, Theoretical analysis of localization techniques.

UNIT II
Time synchronization, Traditional approaches, Fine grained clock synchronization, Coarse grained data synchronization. Medium access and sleep scheduling.

UNIT III
Sleep based topology control, Topologies for connectivity, topologies for coverage, Cross layer issues. Energy efficient and robust routing, Metric based approaches, Routing with diversity, Multipath routing, Energy aware routing.

UNIT IV
Distributed detection and estimation in sensor networks.

UNIT V
Data centric networking, Data centric routing, Data gathering with compression, Querying, Data centric storage and retrival.

Text Books:

1. Networking wireless sensor nodes, B Krishnamachari, Cambridge University Press, New York 2005.
2. Wireless sensor networks: An information processing approach, F Zhao, L J Guibas, Morgan Kaufman Publishers/ Elsevier, New Delhi 2004.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

SEMESTER: VIII

S. No	Board of Studies	Sub Code	Subject Name	Periods/week			Examination Scheme					Total Marks	Credits L+(T+P)/2
				L	T	P	TA	FE	SE	T.C.A.	ESE		
1	ETC	EC801	Optical fiber communication	3	1	-	20	15	15	50	70	120	4
2	ETC	EC81X	Elective-5	3	1	-	20	15	15	50	70	120	4
3	ETC	EC82X	Elective-6	3	1	-	20	15	15	50	70	120	4
4	ETC	EC802	Communication systems	4	1	-	20	15	15	50	70	120	5
5	ETC	EC891	OFC lab	-	-	3	30	-	-	30	20	50	2
6	ETC	EC892	Communication systems lab	-	-	3	30	-	-	30	20	50	2
7	ETC	EC893	Major Project	-	-	16	100	-	-	100	100	200	8
8			Discipline	-	-	-	50	-	-	50	-.	50	1
			Total	13	4	22	290	60	60	410	420	830	30

ELECTIVE 5 & 6 (SEMESTER VIII) Any two from the following

S. No.	Board of Studies	Sub Code	Subject Name
1	ETC	EC811	Broadband access technology.
2	ETC	EC812	Artificial intelligence.
3	ETC	EC813	Multimedia communication.
4	ETC	EC814	Spread spectrum systems
5	ETC	EC815	Speech processing and coding
6	ETC	EC816	Wavelet and applications
7	ETC	EC817	Advanced semiconductor devices
8	ETC	EC818	Pattern recognition
9	ETC	EC819	Multirate systems and filter bank.

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 8 **Code: EC801**
Subject: Optical Fiber Communication
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT – I
Basic Optical Laws and definition: Numerical Aperture; Optical Fiber Modes and propagation; Single Mode and Multi-Mode Fibers; Step Index and Graded Index Fibers Structures; Different types of attenuations in optical fiber communication; Fiber Optic Cable; Fabrication.

UNIT – II
Light sources: Light Emitting diodes and types of LEDS; LASER principles; Laser diode and types of LDs; Operating characteristics and Modulation circuits of LED and LASER diodes.

UNIT – III
Optical Couplers and connectors: Connector principles; fibre end preparation; splices; connectors; source coupling; Distribution system; Distribution networks; Directional couplers; Star couplers; Switches.

UNIT – IV
Light Detectors: Principle of photo-detection; semiconductor photodiode; PIN photodiode; Avalanche photodiode; Noise and Detection; Thermal noise and Shot noise; signal to noise ratio.

UNIT – V
Optical Measurement & Networks: Numerical Aperture; Attenuation and Dispersion measurement; Optical networks: Introduction to SONET/SDH; SONET/SDH Networks; formats and interface.

Text Books:
1. Optical Fiber Communication, Keiser, TMH
2. Fiber Optic Communications, Palais, 4th Ed., Pearson Education

Names of Reference Books:
1. Opto Electronics and Fiber Optic Communication, Sarkar & Sarkar, New Age International Publishers.
2. Text Book on Optical Fiber Communication and its Applications, Gupta, PHI
3. Fundamentals of Optical Fiber Communication, Satish Kumar, PHI
4. Semiconductors Optoelectronic Devices, Bhattacharya, Pearson Education
5. Optical Fiber Communication-Principles and Practice, John Senior, PHI

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 8 **Code: EC802**
Subject: Communication Systems
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
Multiple Input Multiple output (MIMO) systems- Narrow band multiple antenna system model- Parallel decomposition of MIMO Channels- Capacity of MIMO Channels, Space-time codes for MIMO wireless communication- Alamouti code- Diversity-on-receive and Diversity-on-transmit schemes- Generalized complex orthogonal space-time block codes- Differential Space time block codes, Trellis coded modulation (TCM)-TCM encoding & decoding

UNIT II
Study of a software defined radio system: Wireless Research Open Access Platform (WARP) or Lyrtech or any other popular SDR. Hardware architecture of WARP, Design flow, Study of a reference design, eg. OFDM wired-wireless bridge, OFDM CSMA link.

UNIT III
Quantum computing and communication: Quantum computing basics, Entangalment, Measurements, Grover algorithm, Introduction to quantum information theory, Introduction to quantum cryptography.

UNIT IV
An overview of satellite communication, Satellite orbits, Kepler's law, Orbital Elements, Eclipse effect, Sun transit outage, Placement of a satellite in a geostationary orbit, Station keeping and Stabilization.

UNIT V
Communication Satellite Subsystems: Space Platform (Bus) and Communication, Subsystem (Payload), Satellite Antennas, Frequency reuse Antennas. Earth Stations: Earth station antennas, Tracking, Equipment for earth stations, Equipment Reliability and Space qualification.

Text Books:

1. MIMO Wireless Communication, Oestges, Clerckx, Academic Press.
2. Space Time Coding, Vucetic, Yuan, John Wiley & Sons, 2003.
3. Warp.rice.edu
4. Quantum Computing and Communcations, A Imre, F Balazs, John Wiley & Sons, 2005.
5. Satellite Communication, T. Pratt & C. W. Bostian, John Wiley and Sons.

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 8 **Code: EC891**
Subject: Optical Fiber Communication Lab
Credits: 2

Lab assignments given in EC801 Optical Fiber Communication.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 8 **Code: EC892**
Subject: Communication System-III Laboratory
Credits: 2

Lab assignments given in EC802 Communication systems - III.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 8 **Code: EC893**
Subject: Major Project
Credits: 8

1. The students are expected to take up a Project under the guidance of a faculty from the Institute.
2. The topic of the project should be justified for the degree of B.Tech (Electronics & Telecommunication). The project may be a continuation of Minor project.
3. Students should submit synopsis of project within one month of offering of projects by faculty to the Student Projects Coordinator nominated by HoD. Synopsis should clearly state the amount of work already done in Minor project and the work to be done in Major project.
4. The students may be asked to work individually or in a group having not more than three students.
5. The quanta of work should justify a semester of work and live up to the standards of an NIT.
6. The students are expected to submit the report in standard format approved by the department in partial fulfillment of the requirement for the degree of B.Tech (Electronics & Telecommunication).
7. There will be a presentation cum viva-voce at the end of the semester and the students are to demonstrate the project at the time of viva-voce. The students will be evaluated for ESE in Major project by a team of faculty nominated by the Head of Department. This team of faculty shall evaluate all the students on a common standard within the department and evaluate them accordingly.

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 8 **Code: EC811**
Subject: Broadband Access Technology
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I REVIEW OF ACCESS TECHNOLOGIES
Phone-Line modem, cable-access, ISDN, Emerging Broad band Technologies, Cable DSL, Fiber and Wireless

UNIT II DIGITAL SUBSCRIBER LINES
Asymmetric Digital subscriber lines (ADSL) – Rate Adaptive subscriber line (RADSL)-ISDN Digital subscriber line (IDSL) - High bit rate DSL (HDSL)-Single line DSL (SDSL)- very high bit rate DSL (VDSL)- Standards for XDSL & Comparison.

UNIT III CABLE MODEM
Cable Modem, DOCSIS – Physical Cabling, Dual Modem Operation, Hub Restriction, Upstream Operation – Downstream operation – Access control – framing Security sub layer – Data link layer – LLC & Higher layers – ATM centric VS IP – centric cable modem.

UNIT IV FIBER ACCESS TECHNOLOGIES
Optical Fiber in access networks, Architecture and Technologies- Hybrid fiber – Coax (HFC) system, Switched Digital Video (SDV) – Passive optical networks (PON) – FTTX (FTTH, FTTB, FTTC, FTT cab) comparison.

UNIT V BROAD BAND WIRELESS
Fixed Wireless, Direct Broadcast Satellite (DBS), Multi channel multi point distribution services (MMDS), Local multi point distribution services (LMDS), and Wideband integrated Digital Interactive Services (WIDIS), Mobile Wireless 3G – IMT 2000.

Text Books:

1. Niel Ransom and Albert A. Azzam, “Broadband Access Technologies: ADSL, VDSL Cable Modem, Fiber and LMDS, McGraw Hill 1999.
2. Gilbert Held, “Next Generation Modems: A Professional Guide to DSL and cable modems”, John Wiley & sons, 2000.
3. Walter j Woralski, “ADSL and DSL Technologies”, McGraw Hill computer Communication series, 1998.
4. William Webb, “Introduction to Wireless Local Loop broadband and narrow band system”, Artech House, 2000.
5. Martin P. Clarke, “Wireless Access Network: Fixed Wireless Access and WLL network Design and operation”, John Wiley & Sons 2000.

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 8 **Code: EC812**
Subject: Artificial Intelligence
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
Introduction to Artificial Intelligence, Simulation of sophisticated & Intelligent Behavior in different area, problem solving in games, natural language, automated reasoning visual perception, heuristic algorithm versus solution guaranteed algorithms.

UNIT II
Understanding Natural Languages, Parsing techniques, context free and transformational grammars, transition nets, augmented transition nets, Fillmore's grammars, Shanks Conceptual Dependency, grammar free analyzers, sentence generation, and translation.

UNIT III
Knowledge Representation, First order predicate calculus, Horn Clauses, Introduction to PROLOG, Semantic Nets, Partitioned Nets, Minskey frames, Case Grammar Theory, Production Rules Knowledge Base, The Inference System, Forward & Backward Deduction.

UNIT IV
Expert System, Existing Systems (DENDRAL, MYCIN), domain exploration, Meta Knowledge, Expertise Transfer, Self Explaining System.

UNIT V
Pattern Recognition, Introduction to pattern Recognition, Structured Description, Symbolic Description, Machine perception, Line Finding, Interception, Semantic, & Model, Object Identification, Speech Recognition. Programming Language: Introduction to programming Language, LISP, PROLOG

Text Books:

1. Introduction to Artificial Intelligence, Charnick, Addision Wesley
2. LISP, Winston, Addison, Wesley
3. Expert Systems Programming, Marcellous, PHI

Reference Books:

1. Artificial Intelligence, Elamie, Academic Press
2. Foundation of Logic Programming, Lioyed, Springer Verlag

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 8 **Code: EC813**
Subject: Multimedia Communication
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
FUNDAMENTALS OF IMAGE AND VIDEO: Image data types, Popular image file formats, Basics of colour science in image and video, Colour models in images, Colour models in video, Types of video signals, Analog video, Digital video.

UNIT II
COMPRESSION ALGORITHM AND STANDARDS: Distortion measures, Quantization, discrete cosine transform based lossy compression, main steps in JPEG standard, JPEG modes, JPEG bit stream, main steps of JPEG 2000 image compression. Introduction to video compression, Video compression based on motion vectors, Search for motion vectors, H.261, H.263.

UNIT III
MPEG VIDEO AND AUDIO CODING: MPEG-1, motion compensation in MPEG-1, major differences form H.261, MPEG-2, Supporting interlaced video, scalabilities, major difference form MPEG-1, Introduction to MPEG-4, Qualitative idea of methods in MPEG-4. MIDI standard, Psychoacoustics, MPEG audio, Other commercial audio codec's.

UNIT IV
MULTIMEDIA NETWORK COMMUNICATION: Quality of service, QoS for IP protocols, prioritized delivery, Multimedia over IP, Multimedia over ATM networks, Transport of MPEG-4, Media on demand.

UNIT V
STREAMING VIDEO OVER INTERNET AND WIRELESS IP NETWORK: Architecture for video streaming systems, Application layer QoS for streaming video, Continuous media distribution services, Streaming servers, Media synchronization, Protocols for streaming video, Streaming video over wireless IP networks.

Text Books:

1. Fundamentals of Multimedia, Ze-Nian Li, Mark S Drew, PHI Learning, Delhi 2008.
2. Video Processing and Communication, Yao Wang, Jorn Ostermann, Qua-Qin Zhang, Prentice Hall, USA.

Reference Books:

1. Multimedia: Computing, Communication & Applications, Ralt Steinmetz and Klara Nahrstedt, Pearson Education India, 2004.

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 8 **Code: EC814**
Subject: Spread Spectrum Systems
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
Introduction to Cellular Mobile Radio Communication: FDMA, TDMA, DSSS, FHSS, Pulse position hopped CDMA. Modulation Formats for SS Communication, Correlation and Spectral Properties of Modulated Signals, Generation of DS SS Signals, Frequency-Hopped SS Signals, Pulse Position-Hopped SS Signals, Orthogonal and Quasi-Orthogonal Expansions of SS Signals.

UNIT II
Reception of Spread Spectrum Signals in AWGN: Neyman–Pearson Hypothesis Testing Concept, Coherent Reception of DS CDMA Signals (Uplink Transmission), Coherent Reception of DS CDMA Signals (Downlink Transmission), Reception of DS DPSK SS Signals, Reception of FH SS Signals, Reception of PPH SS Signals.

UNIT III
Pseudorandom Signal Generation: Pseudorandom Sequences and Signals, Finite-Field Arithmetic, Maximum-Length Linear Shift Registers, Randomness Properties of Maximal-Length Sequences, Generating Pseudorandom Signals (Pseudonoise) from Pseudorandom Sequences, Other Sets of Spreading Sequences.

UNIT IV
Synchronization of Pseudorandom Signals: Hypothesis Testing in the Acquisition Process, Performance of the Hypothesis Testing Device, The Acquisition Procedure, Modifications of the Acquisition Procedure, Time Tracking of SS Signals, Coherent Reception of Uplink Transmitted Signals in the DSCDMA System.

UNIT V
CDMA Cellular Networks: General Aspects of CDMA Cellular Networks, Other-Cell Relative Interference Factors, Handoff Strategies, Power Control, Erlang Capacity of CDMA System, Interference Cancellation in the Reverse Link of the DS CDMA System, User Coordination in the Forward Link of the DS CDMA System, Third-Generation Wireless Cellular Networks.

Text Books:
1. Theory of code division multiple access communication, Kamil Sh Zigangirov, Wiley Inter Science.

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 8 **Code: EC815**
Subject: Speech Processing and Coding
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
SPEECH: PRODUCTION, PERCEPTION AND ACOUSTIC-PHONETIC CHARACTERIZATION: Introduction, Speech production process, Time and frequency domain representation of speech, Speech sounds and features, The vowels, Diphthongs, Semivowels, Nasal Consonants, Unvoiced Fricatives, Voiced Fricatives, Voiced & Unvoiced Stops, Acoustic-Phonetic Approach to Speech Recognition, Statistical Pattern-Recognition Approach to Speech Recognition, AI Approaches to Speech Recognition, Neural Networks and their Application to Speech Recognition.

UNIT II
SPECTRAL ANALYSIS OF SPEECH: Short time Fourier analysis, filter bank design, speech coding, subband coding of speech, transform coding, channel vocoder, formant vocoder, cepstral vocoder, vector quantizer coder.

UNIT III
SPEECH SYNTHESIS: Pitch extraction algorithms, Gold Rabiner pitch trackers, autocorrelation pitch trackers, voice/unvoiced detection, homomorphic speech processing, homomorphic systems for convolution, complex cepstrums, pitch extraction using homomorphic speech processing

UNIT IV
AUTOMATIC SPEECH RECOGNITION SYSTEMS: Isolated word recognition, connected word recognition, large vocabulary word recognition systems, pattern classification, DTW, HMM, speaker recognition systems, speaker verification systems, speaker identification systems.

UNIT V
HIDDEN MARKOV MODELS: Discrete-Time Markov Processes, Extensions to HMMs, Coin-toss Models, The Urnand-Ball Model, Elements of an HMM, HMM generator of observations. Three Basic problems for HMMs and their solutions, Probability Evaluation, 'Optimal' State sequence, Parameter estimation, Re-estimation procedure. HMM types, continuous observation densities in HMMs, Autoregressive HMMs, Variants on HMM structures, Inclusion of Explicit State Duration Density in HMMs, Optimization Criterion – ML, MMI and MDI, Comparisons of HMMs.

Text Books:

1. "Fundamentals of Speech Recognition", Rabiner L. and Juang B., Pearson Education
2. ''Signal Processing of Speech'', Owens F.J., Macmillan New Electronics

Reference Books:

1. "Speech and Language Processing", Jurafsky, Pearson Education
2. "Discrete Time Speech Signal processing: Principles and Practice", Quatieri, Pearson Education
3. "Fundamentals of Speech Signal Processing", Saito S. & Nakata K., Academic Press
4. "Voice and Speech Processing", Thomas Parsons, McGraw Hill Series.

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 8 **Code: EC816**
Subject: Wavelets and Applications
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
Fundamentals of Signal Decomposition – Introduction to Fourier Series & Orthogonal Systems – Brief Overview of Fourier Transform and Short Time Fourier Transform – Time Frequency Analysis – Introduction to Wavelets – Basis Functions – Specifications – Admissibility Condition – Continuous Wavelet Transform – Definition – CWT as a correlation – Constant Q Factor Filtering Interpretation and Time Frequency Resolution – Inverse CWT.

UNIT II
Introduction to Discrete Wavelet Transform and Orthogonal Wavelet Decomposition – Approximation of Vectors in Nested Linear Vector Spaces – Multiresolution Analysis – Dilation Equation & Wavelet Equation – Orthogonal Wavelet Decomposition based on Haar Wavelet – DWT and Filter Banks – Mallat's Algorithm – Signal Decomposition (Filtering and Down Sampling) – Signal Reconstruction – (Upsampling and Filtering)

UNIT III
Construction of a General MRA – Formal Definition – Implication of the Dilation Equation and Orthogonality – Two Scale Relation for the Wavelet Function – Digital Filter Implementation – Restrictions on Filter Coefficients – Regularity and Varnishing Moments – Biorthogonal Wavelet Bases – Filtering Relationship for Biorthogonal Filters – Examples of Biorthogonal Scaling Functions and Wavelets – Lifting Scheme – Two Dimensional Wavelets.

UNIT IV
Wavelet Packet Analysis (1D & 2D) – Wavelet Packet Algorithms – Haar Wavelet Packets -Best Basis Selection – Applications: Image Compression – Embedded Zero Tree Wavelet Coding (EZW) – Set Partitioning in Hierarchical Tree (SPIHT) – Audio Compression – Signal Denoising: Hard Thresholding & Soft Thresholding – Medical and Bio-medical Signal and Image Processing Applications –

UNIT V
Advanced Topics: Introduction to Multiwavelets, Ridgelets and Curvelets. Applications of wavelets in communication, modulation, OFDM, solving differential equations.

Text books

1. J. C. Goswami and A. K. Chan, "Fundamentals of Wavelets: Theory, Algorithms and Applications" Wiley-Interscience Publication, John Wiley & Sons Inc., 1999. R. M.
2. Rao and A. Bopardikar, "Wavelet Transforms: Introduction to Theory and Applications" Addison-Wesley, 1998.

Reference books

1. Mark A. Pinsky, "Introduction to Fourier Analysis and Wavelets," Brooks/Cole Series in Advanced Mathematics, 2002
2. M. Holschneider, "Wavelets: An analysis tool" Oxford Science Publications, 1998.
3. M. Vetterli, J. Kovacevic, "Wavelets and Subband Coding" Prentice Hall Inc, 1995.
4. Stephen G. Mallat, "A Wavelet Tour of Signal Processing" 2nd Edition Academic Press, 2000.
5. Gilbert Strang and Truong Q. Nguyen, "Wavelets and Filter Banks" 2nd Edition Wesley-Cambridge Press, 1998

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 8 **Code: EC817**
Subject: Advanced Semiconductor Devices
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
Compound Semiconductors: The families (III-V's, II-VI's, IV-VI's, IV-IV's), alloys, E_g vs a; band structures (E vs k; Γ, L, X minima; direct vs. indirect gaps); crystal lattices, electrical properties, optical properties; trends in properties and the periodic table. The useful compounds.

UNIT II
Metal-Semiconductor Interfaces (Schottky Barriers): The compound semiconductor surface; Fermi level pinning. Theories of barrier formation and of current flow; diffusive vs. ballistic flow; contrasts with p-n diodes. Theory and practice of ohmic contacts.

UNIT III
Heterostructures: E-x Profiles: ΔE_c, ΔE_v, $E_c(x)$, $E_v(x)$; $n_o(x)$, $p_o(x)$; modulation doping. Conduction parallel to heterojunction; mobility in semiconductors and carrier scattering mechanisms.

UNIT IV
Heterojunctions: Conduction normal to junction: I-V models and characteristics. Theory of graded layers: creation of internal carrier-specific fields.

UNIT V
Quantum Effect Structures: Coupled quantum structures: super lattices. Resonant tunneling: RTD structure and concept. I-V theory. Related devices and applications: RTD-load logic, memory cells.
Epitaxy: Concerns / constraints — lattice-matched systems; strained layers (pseudomorphic) — limits of thickness; impact of strain on bands, properties -Techniques — MOCVD, CBE, MBE

Text Books:

1. GaAs High-Speed Devices: Physics, Technology and Circuit Applications, C.Y. Chang, F. Kai, Wiley Publication
2. Compound Semiconductor Device Physics, Sandip Tiwari, Academic Press (1991), ISBN 0-12-691740-X

Reference Books:

1. Introduction to Semiconductor Technology: GaAs and Related Compounds, Cheng T. Wang, John Wiley & Sons,
2. David K. Ferry, Gallium Arsenide Technology, Howard W. Sams & Co., 1985
3. Indium Phosphide and Related materials: Processing, Technology and Devices, Avishay Katz, Artech House, 1992.
4. High Speed Semiconductor Devices, S.M. Sze, Wiley 1990.

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 8 **Code: EC818**
Subject: Pattern Recognition
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
Introduction, Machine perception, Pattern recognition systems, sensing, segmentation and grouping, feature extraction, classification, design cycle, learning and adaptation.

UNIT II
Bayesian Decision Theory: Continuous features, minimum error rate classification, classifiers, discriminant functions, decision surfaces, Discrete features, missing and noisy features, Bayesian belief networks, Compound Bayesian decision.

UNIT III
Maximum Likelihood and Bayesian Parameter Estimation: ML estimation, Bayesian estimation, Gaussian case, General theory, sufficient statistics, problem of dimensionality, component analysis and discriminant, EM algorithm, Markov models, Hidden Markov model.

UNIT IV
Non-parametric Techniques: Density estimation, Parzen window, Kn nearest neighbor rule, Metrics and nearest neighbor classification, Fuzzy classification.

UNIT V
Linear Discriminant Function: Linear discriminant function and decision surfaces, generalized linear discriminant function, two category of linearly seperable case, non separable bahaviour.

Text Books:

1. Pattern Classification, Duda and Hart.

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 8 **Code: EC819**
Subject: Multirate Systems and Filter Bank
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
Multirate System Fundamentals: Sampling theorem, Sub-Nyquist sampling, generalization; Basic multirate operations: up sampling and down sampling - time domain and frequency domain analysis; Identities of multirate operations; Interpolator and decimator design; Rate conversion; Polyphase representation of signals and systems; uniform DFT filter bank, decimated uniform DFT filter bank – polyphase representation.

UNIT II
Multirate Filter Banks: Maximally decimated filter banks, Quadrature mirror filter (QMF) banks - Polyphase representation, Errors in the QMF - Aliasing and imaging; Methods of cancelling aliasing error, Amplitude and phase distortions; Prefect reconstruction (PR) QMF bank - PR condition; Design of an alias free QMF bank; Power symmetry in QMF bank.

UNIT III
M-channel Perfect Reconstruction Filter Banks Filter banks with equal pass bandwidth, filter banks with unequal pass bandwidth – Errors created by the filter banks system - Aliasing and imaging - Amplitude and phase distortion, polyphase representation - polyphase matrix. Perfect reconstruction system - Necessary and sufficient condition for perfect reconstruction, FIR PR systems, Factorization of polyphase matrices, Design of PR systems, Calculation of sub-band coding gain.

UNIT IV
Linear Phase Perfect Reconstruction (LPPR) Filter Banks: Necessary conditions for linear phase property; Lattice structures for LPPR FIR QMF banks - Synthesis, M-channel LPPR filter bank, Quantization effects - Types of quantization effects in filter banks - Implementation - Coefficient sensitivity effects, round off noise and limit cycles, dynamic range and scaling.

Text Books:

1. Multirate Systems and Filter Banks, P. P. Vaidyanathan, Prentice Hall, PTR, 1993.
2. Multirate Digital Signal Processing, N. J. Fliege, John Wiley, 1994.

Reference Books:

1. Digital Signal Processing: A Computer based Approach, Sanjit K. Mitra, McGraw Hill, 1998.
2. Multirate Digital Signal Processing, R. E. Crochiere, L. R. Rabiner, Prentice Hall Inc, 1983.
3. Digital Signal Processing: Principles, Algorithms and Applications, John G. Proakis, Dimitris G. Manolakis, Prentice Hall India, 1999.
4. Digital Signal Processing, Boaz Porat, Prentice Hall Inc, 1998.
5. Multiresolution Signal Decomposition: Transforms, Subbands and Wavelets, Ali N. Akansu, Richard A. Haddad, Academic Press 1992.