NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

SEMESTER: VIII

S. No	BoS	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	ET20811	Optical Fiber Communication	3	1	-	20	15	15	50	70	120	4
2	ETC	ET2083x	Elective-5	3	1	-	20	15	15	50	70	120	4
3	ETC	ET2083x	Elective-6	3	1	-	20	15	15	50	70	120	4
4	ETC	ET20812	Communication systems	4	1	-	20	15	15	50	70	120	5
5	ETC	ET20821	OFC lab	-	-	3	30	-	-	30	20	50	2
6	ETC	ET20822	Communication systems lab	-	-	3	30	-	-	30	20	50	2
7	ETC	ET20823	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 (SEMESTER VIII)			
S. No.	Board of Studies	Sub Code	Subject Name
1	ETC	ET20831	Broadband access technology.
2	ETC	ET20832	Artificial intelligence.
3	ETC	ET20833	Multimedia communication
4	ETC	ET20834	Spread Spectrum Systems
5	ETC	ET20835	Speech Processing and coding
ELECTIVE 6 (SEMESTER VIII)			
1	ETC	ET20836	Wavelet and applications
2	ETC	ET20837	Advanced semiconductor devices.
3	ETC	ET20838	Pattern Recognition
4	ETC	ET20839	Multirate Systems and filter banks
5	ETC	ET20840	Real Time Embedded Systems

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 8 **Code: ET20811**
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 Laser diodess; Operating characteristics and Modulation circuits of LED and LASER diodes.

UNIT III
Optical Couplers and connectors: Connector principles; fiber 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.

Names of 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: ET20812**
Subject: Communication Systems
Credits: 5
Total Theory Periods: 40 **Total Tutorial Periods: 10**

UNIT I
Multiple Input Multiple Output (MIMO) systems: Narrow band multiple antenna 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 encoding and decoding.

UNIT II
Study of a software defined radio system: Wireless Research Open Access Platform (WARP) or Lyrtech or any other popular SDR, hardware architectures, design flow, study of a reference design, e.g. OFDM wired-wireless bridge, OFDM CSMA link etc.

UNIT III
Quantum computing and communication: Quantum computing basics, Entanglement, measurements, Grover algorithm, Introduction to quantum information theory and 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 Communication, A Imre, F Balazas, John Wiley & Sons, 2005.
5. Satellite Communication, T Pratt, C W Bostian, John Wiley & Sons.

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 8 **Code: ET20821**
Subject: OFC Lab
Credits: 3
Total Practical Periods: 3

Lab assignments given in ET20811 Optical Fiber Communication.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 8 **Code: ET20822**
Subject: Communication Systems Laboratory
Credits: 3

Lab assignments given in ET20812 Communication systems.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 8 **Code: ET20823**
Subject: Major Project
Credits: 16

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 fulfilment 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.

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 8 **Code: ET20831**
Subject: Broadband Access Technology
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
Introduction to Broadband Networking: Services and Technology: Digital Subscriber Line (ADSL, HDSL, RADSL, And VDSL), Access network architecture (DSLAM, ATM), Modulation technologies (DMT) X.25, Frame relay ,X.25 v/s Frame relaying, Frame mode protocol architecture, Frame relay and Frame switching, Frame mode call control , Call control protocol, DLCI, Bearer capability, Link layer core parameters, LAPF.

UNIT II
ISDN – Integration of Transmission and Switching, Analog and Digital switching, Principles of ISDN, User interface, Architecture, ISDN standards, I-series recommendations. ISDN: interface and Functions – Transmission structure, User network interface, ISDN protocol architecture, ISDN connections, Addressing, Interworking, B-ISDN architecture and standards.
B-ISDN Services – Conversational, Messaging, Retrieval, Distribution, Business and Residential requirements. B-ISDN protocols – User plane, Control plane, Physical layer, Line coding, Transmission structure, SONET- Requirement, Signal Hierarchy, System Hierarchy.

UNIT III
ATM – Overview, Virtual channels, Virtual paths, VP and VC switching, ATM cells, Header format, Generic flow control, Header error control, Transmission of ATM cells, Adaptation layer, AAL services and protocols. ATM switching – ATM switching building blocks, ATM cell processing in a switch, Matrix type switch, Input, Output buffering, Central buffering, Performance aspects of buffering switching networks.

UNIT IV
Cable Modem Service: Head end and regional network architecture (Cable Modem Termination System – CMTS, Hybrid Fibre Coax networks – HFC), Cable Labs initiatives (DOCSIS. Packet Cable, Cable Home) Optical Fibre-based Networks: Passive Optical Network (PON) architecture (Optical line termination, optical network terminals), Standards (BPON, GPON, EPON) Fixed and Mobile WiMAX: Architecture, Standards (IEEE 802.15, 802.16), Services

UNIT V
IP QoS Control Mechanisms, Resource Reservation Protocol (RSVP), Differentiated Services (Diff Serv), Multi-Protocol Label Switching (MPLS), IP Multicast (IMS) Services Enabled by Broadband: VoIP: Network Architecture, Protocol Architecture for VoIP SIP: Network and Services Convergence, Network and Services Management, Unified Communications Services, SIMPLE Presence Architecture, H.323, SGCP, MGCP, IPDC

Text Books:

1. ISDN and Broadband ISDN with Frame Relay and ATM, William Stallings, Prentice-Hall,4th edition
2. Broadband Communications, Balaji kumar, Mac-Graw Hill
3. ATM Networks, O Kyas & G. Grawford, Prentice Hall PTR, 2002.
4. Multi Wavelength Optical Network, Stern T & K. Bala, Pearson Education, 1999.

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 8 **Code: ET20832**
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: ET20833**
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: ET20834**
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: ET20835**
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: ET20836**
Subject: Wavelet 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.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 8 **Code: ET20837**
Subject: Advanced Semiconductor Devices
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
MESFETs: Basic concept, models for terminal characteristics; accounting for velocity saturation. Dynamic models: large signal switching transients; small signal, high f models.

UNIT II
HBTs: Concept: emitter efficiency, base transport, base resistance, junction capacitance. HJ collector and collector-up refinements. Applications of graded layers: control of HJ spikes; ballistic injection; problems with upper-valley minima.

UNIT III
MODFETs — basic device, theory. Deep level problem (transconductance collapse); pseudomorphic solution. Telecommunications applications — key features: gain, bandwidth, linearly, noise.

UNIT IV
Laser Diodes: Feedback and stimulated emission. Cavity design; double heterostructure concept. Quantum well, wire, dot active regions. Strained layers; pseudomorphic active regions.

UNIT V
Detectors: Structure and theory of basic types: p-i-n (conventional and unicarrier), APD, Schottky diode, m-s-m; resonant cavity concepts.
Quantum Effect Devices: Electron waveguides, single electron transistors.

Text Books:

1. GaAs High-Speed Devices: Physics, Technology and Circuit Applications C.Y. Chang, F. Kai, Wiley
2. Compound Semiconductor Device Physics, Sandip Tiwari, Academic Press, 1991.

Reference Books:

1. Introduction to Semiconductor Technology: GaAs and Related Compounds, Cheng T. Wang, Ed., John Wiley & Sons,
2. Gallium Arsenide Technology, David K. Ferry, Ed., Howard W. Sams & Co., 1985
3. Indium Phosphide and Related materials: Processing, Technology and Devices, Avishay Katz, Ed., 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: ET20838**
Subject: Pattern Recognition
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
Basics of pattern recognition, Bayesian decision theory, Classifiers, Discriminant functions, Decision surfaces, Normal density and discriminant functions, Discrete features.

UNIT II
Parameter estimation methods, Maximum-Likelihood estimation, Gaussian mixture models, Expectation-maximization method, Bayesian estimation, Hidden Markov models for sequential pattern classification, Discrete hidden Markov models, Continous density hidden Markov models, Dimension reduction methods, Fisher discriminant analysis, Principal component analysis.

UNIT III
Non-parametric techniques for density estimation, Parzen-window method, K-Nearest Neighbour method, Linear discriminant function based classifiers, Perceptron, Support vector machines.

UNIT IV
Non-metric methods for pattern classification, Non-numeric data or nominal data, Decision trees.

UNIT V
Unsupervised learning and clustering, Criterion functions for clustering, Algorithms for clustering: K-means, Hierarchical and other methods, Cluster validation.

Text Books:
1. R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2001
2. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009
3. C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 8 **Code: ET20839**
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.

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 8 **Code: ET20840**
Subject: Real Time Embedded Systems
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
Hardware Software Codesign And Programme Modelling: Characteristics of an Embedded System, Quality Attributes of Embedded Systems, Fundamental Issues in Hardware Software Co-Design, Computational Models in Embedded Design, Introduction to Unified Modelling Language (UML), Hardware Software Tradeoffs.

UNIT II
REAL-TIME OPERATING SYSTEMS (RTOS) BASED EMBEDDED SYSTEM DESIGN
Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling, Threads, Processes and Scheduling :Putting them Altogether, Task Communication, Task Synchronization, Device Drivers, How to Choose an RTOS.

UNIT III
PROGRAM MODELING CONCEPTS: Program Models, DFG Models, state Machine Programming Models for Event controlled Program Flow, Modeling of Multiprocessor Systems, UML Modeling.

UNIT IV
REAL TIME OPERATING SYSTEMS: OS Services, Process Management, Timer junctions, Event Functions, Memory Management, Device, File and IO Subsystems Management, Interrupt Routines in RTOS Environment and Handling of Interrupt, Source Calls, Real time Operating Systems, Basic Design an RTOS, RTOS Task Scheduling Models, Interrupt Latency and Response of the Tasks as Performance Matrices, OS Security Issues.

UNIT V
DESIGN EXAMPLES AND CASE STUDIES OF PROGAM MODELING AND PROGRAMMING WITH RTOS: Case study of Communication between Orchestra Robots, Embedded Systems in Automobile, Case study of an Embedded System for an Adaptive Cruise Control(ACC) System in a Car, Case study of an Embedded System for a Smart Card, Case study of a Mobile Phone Software for Key Inputs.

Text Books:

1. Introduction to Embedded System, Shibu K V, McGraw Hill Higher Edition.
2. Embedded Systems Architecture, Programming and Design, Raj Kamal, Second Edition, McGraw Hill Companies.
3. Embedded System Design by Peter Marwedel, Springer.

Reference Books:

1. Embedded System Design – A Unified Hardware/Software Introduction, Frank Vahid, Tony D. Givargis, John Wiley, 2002.
2. Embedded/ Real Time Systems, KVKK Prasad, Dreamtech Press, 2005.
3. An Embedded Software Primer, David E. Simon, Pearson Ed. 2005.