A. Distribution of Credits

<table>
<thead>
<tr>
<th></th>
<th>Minimum Credits Through Course Work</th>
<th>Minimum Credits Through Research</th>
<th>Total Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programme Core (PC)</td>
<td>24</td>
<td>11</td>
<td>35</td>
</tr>
<tr>
<td>Programme Electives (PE)</td>
<td>16</td>
<td>12</td>
<td>28</td>
</tr>
<tr>
<td>Open Electives (OE)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Dissertation-3rd Sem</td>
<td>12</td>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td>Dissertation-4th Sem</td>
<td>0</td>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>

B. Semester-wise Distribution of Credits

(may vary as per the need of specific programme, but the requirement of minimum overall credits listed in A must be satisfied)

<table>
<thead>
<tr>
<th>Semester</th>
<th>Credits for Dissertation Work</th>
<th>Grade</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sem-1</td>
<td>17</td>
<td>17</td>
<td>16</td>
</tr>
</tbody>
</table>

C. Grade of Dissertation (EC-801)

<table>
<thead>
<tr>
<th>Semester</th>
<th>Credits for Dissertation Work</th>
<th>Grade</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sem-3</td>
<td>12</td>
<td>AAA</td>
<td>A ∈ S</td>
</tr>
<tr>
<td>Sem-4</td>
<td>20</td>
<td>AAAAA</td>
<td>A is awarded for each set of 4 units, [S: Satisfactory, X: Unsatisfactory]</td>
</tr>
</tbody>
</table>

D. Self Study Course

Self-study course will be related to the research/specialization area of a candidate. The concerned supervisor will act as course coordinator who will be responsible for proposing the course name and syllabus for approval of the DPGC. If the same course is offered to more than one student, there may only be one course coordinator. The candidate has to be continuously evaluated in same pattern as applicable to other courses (two mid-term exams, one semester exam, assignments, quizzes, etc.).
# Teaching Scheme (2011 onwards)

## FIRST SEMESTER

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Course No.</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Hours/Week</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>EC-611</td>
<td>Information Theory And Coding</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>EC-612</td>
<td>Mobile Communication</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>EC-613</td>
<td>Optical Networks</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
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<tr>
<td>4.</td>
<td>Programme Elective-1</td>
<td>3</td>
<td>0</td>
<td>0</td>
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<tr>
<td>5.</td>
<td>Programme Elective-2</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
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<tr>
<td>6.</td>
<td>EC-614</td>
<td>Optical Communication Lab</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

**Total** | 15 | 0 | 3 | 18 | 17 |

## SECOND SEMESTER

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Course No.</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Hours/Week</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>EC-615</td>
<td>Digital Signal Processing</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
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<tr>
<td>2.</td>
<td>EC-616</td>
<td>Modelling and Simulation of Communication System and Networks</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
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<tr>
<td>3.</td>
<td>EC-617</td>
<td>CDMA Technology and Systems</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
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<tr>
<td>4.</td>
<td>Programme Elective-3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Open Elective-1 (from other Dept)</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
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</tr>
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<td>6.</td>
<td>EC-618</td>
<td>Communication System &amp; Networks Simulation (Lab)</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

**Total** | 15 | 0 | 3 | 18 | 17 |

## THIRD SEMESTER

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Course No.</th>
<th>Course Title</th>
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<th>T</th>
<th>P</th>
<th>Hours/Week</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>EC–799</td>
<td>Self Study</td>
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<td></td>
<td>3</td>
<td>2</td>
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<tr>
<td>2.</td>
<td>EC-800</td>
<td>Seminar</td>
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<td>3</td>
<td>3</td>
<td>2</td>
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<tr>
<td>3.</td>
<td>EC-801</td>
<td>Dissertation (to be continued in IVth Sem)</td>
<td></td>
<td></td>
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<td>24</td>
<td>12</td>
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**Total** | 30 | 16 |

## FOURTH SEMESTER

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Course No.</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Hours/Week</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programme Elective-1</td>
<td></td>
<td></td>
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<tr>
<td>EC-725 Advanced Digital Communication</td>
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<tr>
<td>EC-726 Soft Computing</td>
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<td></td>
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<tr>
<td>EC-727 Computer Communication and Networks</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Programme Elective-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC-733 Microwave Devices and Circuits</td>
</tr>
<tr>
<td>EC-734 Wi-Fi, Bluetooth and Zigbee Technology</td>
</tr>
<tr>
<td>EC-735 Advanced Antenna Design</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Programme Elective-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC-741 Wireless Sensor Networks</td>
</tr>
<tr>
<td>EC-742 Wi-Fi Telephony and VoIP</td>
</tr>
<tr>
<td>EC-743 Digital Image Processing and Pattern Recognition</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Open Electives</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC-750 Wi-Fi, Bluetooth and Zigbee Technology</td>
</tr>
</tbody>
</table>
1. **Measures of information and Channel Capacity**

   Entropy, Relative Entropy And Mutual Information. Basic Inequalities: Jensen Inequality And Its Physical Application, Log-Sum Inequality And Its Physical Application, Fano Inequality And Its Physical Application, Data Processing Theorem And Its Physical Application, Consequences Of The Inequalities In The Field Of Information Theory.

2. **Entropy Rate And Channel Capacity**

   Stationary Markov Sources: Entropy Rate And Data Compression. Definition Of Capacity And Its Computation Of Discrete Memory Less Channels(BNC, BSC, BEC, Cascaded Channels, Noiseless Channels, Noisy Typewriter), The Channel Coding Theorem And The Physical Significance Of Capacity.

3. **Data Compression By Fixed-To-Variable-Length Codes**


4. **Design Of Linear Block Codes**

   Introduction Of Linear Block Codes, Syndrome And Error Detection, Minimum Distance Of A Block Code, Error Detecting And Error Correcting Capability Of A Block Code, Design Of Encoder And Syndrome Decoder For Linear Block Codes.

5. **Design Of Cyclic Codes**

   Description Cyclic Codes, Generator And Parity Check Matrices Of Cyclic Codes, Encoding Of Cyclic Codes, Syndrome Computation And Error Detection, Decoding Of Cyclic Codes, Cyclic Hamming Codes.

6. **Convolutional Codes**

   Encoding Of Convolutional Codes, Structural Properties Of Convolutional Codes, Distance Properties Of Convolutional Codes, Design Of Encoder And Decoder For Convolutional Codes.

**Textbooks/References**

1. **Introduction to cellular mobile systems**

   Basic cellular systems, Performance criteria, Uniqueness of mobile radio environment, Operation of cellular systems, Concept of frequency reuse channels, Cochannel interference reduction factor, Desired C/I from a normal case in an omnidirectional antenna system, Handoff mechanism, Cell splitting.

2. **Cell coverage for signal and traffic**

   General introduction, Obtaining the mobile point-to-point model, Propagation over water or flat open area, Foliage loss, Propagation in near-in distance, Long-distance propagation, Obtain path loss from a point-to-point prediction model, Cell-site antenna heights and signal coverage cells.

3. **Cochannel and adjacent-channel interference in mobile communications**

   Cochannel interference, Design of an omnidirectional antenna system in the worst case, Design of a directional antenna system, Lowering the antenna height, Power control, Diversity receiver, Adjacent-channel interference, Near-end – far-end interference, Effect on near-end mobile units.

4. **Frequency management, channel assignment and handoffs:**

   Frequency management, Frequency-spectrum utilization, Set-up channels, Definition of channel assignment, Fixed channel assignment schemes, Nonfixed channel assignment schemes, Concept of handoff, Initiation of a hard handoff, Delaying a handoff, Forced handoffs, Queuing of handoffs, Power-difference handoffs, Mobile assisted handoff, Soft handoffs, Cell-site handoff only, Intersystem handoff.

5. **Multiple access techniques and digital cellular systems:**

   Multiple access techniques for mobile communications; Global system for mobile (GSM): GSM system architecture, GSM radio subsystem, GSM channel types, Frame structure for GSM, Signal processing in GSM; GPRS; EDGE; Overview of third generation (3G) wireless networks.

**Textbooks/References**

2. Wireless Communications: Principles and Practice by Theodore S. Rappaport; Pearson / PHI Publication
3. Wireless Communications and Networks: 3G and Beyond by Iti Saha Misra; Tata McGraw Hill Publication
4. Wireless and Digital Communications by Dr. Kamilo Feher; PHI Publication
1. **Introduction to Optical Network**

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

2. **Optical Amplifiers**

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

3. **Multiplexers and Filters to Wavelength Converters**


4. **Transmission System Engineering**


5. **Client Layers of the Optical Layer**

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

6. **WDM Network Elements & Design**


7. **Access Networks**

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

**Textbooks/References**


1. Discrete time signals and systems

2. Time Domain Representation of Signals & Systems
   Discrete Time Signals, Operations on Sequences, the sampling process, Discrete-Time systems, Time-Domain characterization of LTI Discrete-Time systems, state-space representation of LTI Discrete-Time systems, random signals.

3. Transform-Domain Representation of Signals
   The Discrete-Time Fourier Transform, Discrete Fourier Transform, DFT properties, computation of the DFT of real sequences, Linear Convolution using the DFT. Z-transforms, Inverse z-transform, properties of z-transform

4. Transform-Domain Representation of LTI Systems
   The frequency response, the transfer function, types of transfer function, minimum-phase and maximum-Phase transfer functions

5. Digital Processing of Continuous-Time Signals

6. Digital Filter Structure
   Block Diagram representation, Signal Flow Graph Representation, Equivalent Structures; bone FIR Digital Filter Structures, IIR Filter Structures, State-space structure, all pass filters, tunable IIR Digital filters, cascaded Lattice realization of IIR and FIR filters, Parallel all pass realization of IIR transfer function

7. Digital Filter Design

8. Applications of DSP in communication systems

Textbooks/References

3. Allan Y. Oppenheim & Ronald W. Schater, ”Digital Signal Processing”, PHI
EC-616 MODELING AND SIMULATION OF COMMUNICATION SYSTEM AND NETWORKS

1. Univariate and Multivariate Models


2. Simulation Of Random Variables And Random Process

Properties of random Numbers, Generation of random numbers, techniques for generating Random numbers: Linear Congruential Method and Combined Linear Congruential Method, Validation of random number generators: KS Test, Chi-square test, Runs test, Autocorrelation Test.

3. Random Variate Generators

Inverse transform technique for generating discrete random and continuous random variables (examples for exponential, uniform, triangular, poisson, binomial distributed random variables), Acceptance-Rejection technique for generation of Discrete and Continuous random variables, Some special generators: Box Muller method, Sum-of-12 method for generating Normally distributed random variables, Validation of the generation methods using goodness of fit tests.

4. Estimation Of Performance Measures

Quality of an estimator, estimator of SNR, Probability density functions of analog communication system, BER of Digital communication systems, Unbiased estimation of expected value, Unbiased estimation of Variance, Monte Carlo method and Importance sampling method for estimating the integral (Crude Monte Carlo Method, Acceptance-rejection Monte Carlo, Stratified sampling, Importance sampling Methods and their performance Comparison)

5. Queuing Models

Characteristics of Queuing models, Queuing notation, Long Run Performance measures of Queuing Systems, Steady state behavior of M/M/I and M/M/I/N queuing models, little formula, Burke’s theorem M/G/I queuing Model, Embedded Markov Chain analysis of TDM systems, Polling, Random access systems.

Textbooks/References


1. **Principles of CDMA**
   The concept of spreading, cellular mobile network, Capacity of CDMA system, spreading codes and their properties, pseudo-random sequences, maximal length linear shift register sequence, randomness properties of MLSR sequence.

2. **Theory and application of Pseudorandom Sequence**
   Galois Field and primitive polynomials, mechanization of linear feedback shift register binary irreducible polynomial, state vector variations for PN sequence phase shifts, shift register generator with special loading vectors, use of mask to select a sequence phase shift, P-N sequence specified in IS-95, Auto correlation and cross correlation properties of binary sequence in CDMA.

3. **Spread Spectrum Techniques for CDMA**
   Direct Sequence CDMA, Power spectral density of DSS-CDMA, Link performance of direct sequence spread spectrum CDMA in (i) Additive White Noise Channel (ii) Multipath fading channel. Concept of Rake receiver, performance of RAKE receiver in multipath fading channel.

4. **Spreading Code Acquisition and Tracking**
   Initial code acquisition, Acquisition strategy: serial search, parallel search, multi-dwell detection, False alarm and miss probability for matched filter receiver, False alarm and miss probability for radiometer, mean overall acquisition time for serial search.

5. **CDMA Systems:**
   **IS-95:** Forward link channels, Reverse link channels, Power controls and handoff procedure in IS-95. Concept of 2 G and 3-G systems, CDMA-2000 and WCDMA: channel allocation, Power control and handoff procedures.

6. **Overview of OFDM**
   LTE systems, OFDMA and SC-OFDMA, implementation and signal processing aspect for OFDM, synchronization and channel estimation aspect, interleaving and channel diversity.

**Textbooks/References**

1. **Introduction**

   Functional architecture coded and encoded digital communication system architecture

2. **Digital Modulations Techniques**

   BPSK, BFSK and DPSK, QPSK, M-ary PSK, MSK, M-ary FSK, GMSK.

3. **OPTIMUM RECEIVERS FOR AWGN CHANNEL**

   Optimum receiver for signals corrupted by AWGN, performance of optimum receiver for memory less modulation, optimum receiver for CPM signals, optimum receiver for signals with random phase in AWGN channel.

4. **CARRIER AND SYMBOL SYNCHRONIZATION**

   Signal Parameter estimation, carrier phase estimation, symbol timing estimation, Joint estimation.

5. **Band Limited Channels:**

   Optimum pulse shape design, optimum demodulations of digital signals in the presence of ISI and AWGN, equalization techniques, diminishing and detection I-Q modulation, QAM, QPSK, QBM, CPM, FSK, MSK

6. **Recent advancements of Digital communication Systems**

**Textbooks/References**

EC-726 Soft Computing

1. Artificial Neural Networks
   Basic-concepts-single layer perception-Multi layer perception-Supervised and unsupervised learning back propagation networks, Application.

2. Fuzzy Systems

3. Neuro-Fuzzy Modelling

4. Genetic Algorithm
   Survival of the fittest-pictures computations-cross over mutation-reproduction-rank method-rank space method, Application.

5. Soft Computing and Conventional AI
   AI Search algorithm-Predicate calculus rules of interface - Semantic networks-frames-objects-Hybrid models; Applications.

Textbooks/References

2. Fuzzy Logic Engineering Applications- Timothy J.Ross; McGraw Hill;
3. Neural Networks- Simon Haykin, pearson Education
4. Fuzzy Sets and Fuzzy Logic- George J.Klir and Bo Yuan, Prentice Hall;
Computer Communication And Networks


Textbooks/References

1. **Introduction to Microwaves**
   Frequency allocations & allocation plans, letter designation for microwave band

2. **Active microwave devices**
   Multi cavity Klystron, Reflex Klystron, Magnetron, Traveling Wave Tube, Tunnel diode, Gunn Diode, PIN diode, Avalanche Diodes

3. **Passive microwave devices**
   Wave-guides, Scattering matrix, Passive microwave devices: attenuator, resonators, ferrite devices circulators, isolators, gyrator, directional coupler, microwave tees

4. **Active & Passive Microwave Circuits**
   Introduction to Active & Passive Microwave circuits, Noise in microwave circuits, Detectors & Mixers, PIN diode control circuits.

5. **MMIC technology**
   Introduction, types of MICs and their technology, Fabrication process of MMIC, Hybrid MICs, Configuration, Dielectric substances, thick and thin film technology, Encapsulation and mounting of Devices, Design and Fabrication of Lumped elements for MICs, Comparison with distributed circuits

6. **Recent advancements in Microwaves**

**Textbooks/References**

1. Liao S.Y.: Microwave Circuits & Devices. PHI.
2. David M. Pozar: Microwave engineering, John WILEY & Sons.
3. K.C Gupta, & A Singh: Microwave Integrated Circuits, Eastern WILEY.
1. **Wi-Fi: Architecture and Functions**
   WLAN Roadmap via IEEE 802.11 Family Evolutions, IEEE 802.11 Architecture, Different Physical Layers, Data Link Layer, Medium Access Control Layer, Mobility, Security, IEEE 802.11 Family and its Derivative Standards

2. **Bluetooth: Architecture and Functions**

3. **IEEE 802.15.4 and ZigBee**

**Textbooks/References**

EC-735  Advanced Antenna Design

1. **Basics Concepts of Radiation**
   Radiation from surface current and current line current distribution, Basic antenna parameters, Radiation mechanism-CURRENT distribution of Antennas, Impedance concept-Balanced to Unbalanced transformer.

2. **Radiation from Apertures**
   Field equivalence principle, Rectangular and circular apertures, Uniform distribution on an infinite ground plane, Aperture fields of Horn antenna-Babinet's principle, Geometrical theory of diffraction, Reflector antennas, Design considerations - Slot antennas.

3. **Synthesis of Array Antennas**
   Types of linear arrays, current distribution in linear arrays, Phased arrays, Optimization of Array Patterns, Continuous aperture sources, Antenna synthesis techniques.

4. **Micro Strip Antennas**
   Radiation mechanisms, Feeding structure, Rectangular patch, Circular patch, Ring antenna. Input impedance of patch antenna, Micro strip dipole, Micro strip arrays.

5. **EMI S/EMC/Antenna Measurements**
   Log periodic, Bi-conical, Log spiral ridge Guide, Multi turn loop, Traveling Wave antenna, Antenna measurement and instrumentation, Amplitude and Phase measurement, Gain, Directivity, Impedance and Polarization Measurement, Antenna range; Design and Evaluation.

6. **Smart Antennas systems**
   Generalized array signal processing; Beam forming concepts-DOB, TRB & SSBF, Switched beam antennas, spatial diversity, and fully adaptive antennas for enhanced coverage, range extension & improvement in frequency refuse, interference nulling for LOS & Multipath systems, SDMA concepts and Smart antennas implementation issues.

**Textbooks/References**

1. Antennas- Kraus, John Wiley and Sons;
2. Antenna Theory Analysis and Design- Balanis, John Wiley and Sons
3. Antenna Theory- Collin and Zucker, McGraw Hill,
4. Smart Antennas for Wireless Communication: IS-95 and Third Generation CDMA applications- Liberti, Rappaport, PHI
EC-741 Wireless Sensor Networks

1. Introduction

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

2. Network deployment

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

3. Localization and Time synchronization

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

4. Wireless characteristics and Medium-access

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

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

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

6. Data-centric networking

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

7. Transport reliability and congestion control

Basic mechanisms and tunable parameters, Reliability guarantees, Congestion control, Real-time scheduling

Textbooks/References

1. Conventional Telephony and data protocols

2. Voice over IP
   Motivation for VoIP, Challenges in VoIP, Putting Voice Over Internet, VoIP Architectures, Signaling Protocols, Media Gateway Control Protocol, Megaco/H248, H323, Session Initiation Protocol (SIP)

3. Wireless LAN and VoWLAN Challenges
   Network Architecture, 802.11 Framing, Accessing the Medium, PHY, VoWLAN, System Capacity and QoS, Packet Sizes, Packetization Overheads, DCF Overheads, Transmission Rate, Inherent Fairness Among All Nodes, PCF, Admission Control, Security, Roaming/Handoffs in 802.11

4. QoS and Security issues
   802.11e, WME and “Vanilla” WLANs, Traffic Categories, Voice Data Coexistence, Achieving QoS for VoWLAN, System Capacity, Authentication in 802.1, Open System Authentication, Shared Key Authentication, Authentication and Handoffs, Confidentiality in 802.1, Data Integrity in 802.11, Loopholes in 802.11 Security, WPA.

5. Roaming and Power Management

Textbooks/References

EC-743 Digital Image Processing and Pattern recognition

1. Introduction

Steps in Digital Image Processing, Components of an Image Processing system, Applications. Human Eye and Image Formation; Sampling and Quantization, Basic Relationship among pixels- neighbour, connectivity, regions, boundaries, distance measures.

2. Image Enhancement

Spatial Domain-Gray Level transformations, Histogram, Arithmetic/Logical Operations, Spatial filtering, Smoothing & Sharpening Spatial Filters; Frequency Domain- 2-D Fourier transform, Smoothing and Sharpening Frequency Domain Filtering; Convolution and Correlation Theorems;

3. Image Restoration

Inverse filtering, Wiener filtering; Wavelets- Discrete and Continuous Wavelet Transform, Wavelet Transform in 2-D;

4. Image Compression

Redundancies- Coding, Interpixel, Psycho visual; Fidelity, Source and Channel Encoding, Elements of Information Theory; Loss Less and Lossy Compression; Run length coding, Differential encoding, DCT, Vector quantization, entropy coding, LZW coding; Image Compression Standards-JPEG, JPEG 2000, MPEG; Video compression;

5. Image Segmentation

Discontinuities, Edge Linking and boundary detection, Thresholding, Region Based Segmentation, Watersheds; Introduction to morphological operations; binary morphology- erosion, dilation, opening and closing operations, applications; basic gray-scale morphology operations; Feature extraction; Classification; Object recognition.

6. Pattern recognition


Textbooks/References

4. Digital Image Processing and Analysis- Chanda and Mazumdar, PHI