Course Curriculum for Course work of
Ph.D. in Electronics Engineering / Electronics

The Ph. D. course Work will have 20 CH of course work as described below:

CODE	COURSE NAME	CREDIT
EL611	Advanced Trends in Electronics	4CH
EL612Exx	Elective Paper I	4CH
EL613	Research Methodology	4CH
EL614	Advanced Electronics Lab.	4CH
EL615	Review of Research Papers Review Report - 2 Credits,Seminar - 2 Credits	4CH
Total		20CH

List of Electives:

Subject Code (xx)	Name of Subject
01	Advance Communication Theory
02	RF and Microwave System
03	Advance Digital Signal Processing
04	Optical Communication
05	Digital Mobile System
06	Optical Network
07	Advance Optical Communication
08	Mobile Satellite Communication
09	Wireless Network and Mobile Computing
10	Digital Image Processing

Programme Outcome

PO-1	**Critical Thinking:** Take informed actions after identifying the assumptions that frame our thinking and actions
PO-2	**Effective Communication:** Will be able to speak, read, write and listen clearly in person and through electronic media in English and in one Indian Language
PO-3	**Social Interaction (Interpersonal Relation):** Elicit views of others, mediate disagreements and prepared to work in team
PO-4	**Entrepreneurship Capability**: Demonstrate qualities to be prepared to become an entrepreneurship
PO-5	**Ethics:** Recognize different value systems including your own, understand the moral dimensions and accept responsibility for them
PO-6	**Environment and Sustainability:** Understand the issues of environmental contexts and sustainable development
PO-7	**Life-Long Learning**: Acquire the ability to engage in independent and life-long learning in the context of socio-technological changes

ADVANCE TRENDS IN ELECTRONICS

Course Objective: To impart advance knowledge on the design, characteristics and principles of operation of semiconductor devices along with their circuital application.Also to provide basic concepts of modern transmission technology and data communication.

Course Outcome: CO1: Understand the advance concepts of design and device technologies

CO2: Analyse the various semiconductor devices for application in circuit.
CO3: Use of various solid-state devices and their application in different modern electronic circuits, instruments, interfaces and Communication technologies.
C04: The assignment and project are carried out on application of various semiconductor devices in different circuits.

UNIT – I(10 Hours)
Theories of Nucleation, Growth Processes, epitaxial growth, Basic device design requirements: Substrate preparation and Insulation, Monolithic Integrated Circuit Fabrication, Metal-semiconductor contacts, Temperature and Frequency effects - Electric Breakdown, installation. Photonics and its modern applications.

UNIT – II(10 Hours)
Device Technologies: NMOS, CMOS, ECL, BIFET, BICMOS, BIMOS, HEMT, CCD, I^2LTechnologies, PLL and its applications, DAC, ADC and memory organisation.

UNIT – III(10 Hours)

Fixed voltage regulators, LM series adjustable voltage regulators, IC based Power Amplifier, IC based function generator. Basics of microprocessor, interfacing of Microprocessor with other instruments. Microcontroller and its uses.

UNIT – IV(12 Hours)

Mobile Communication: Basic of PSTN, GSM, GPRS, GPS, LTE (Long Term Evolution)
Data Communication; LAN, WLANs (Wireless LANs), IEEE 802.xx standard, Network protocol, IP/UTP, Packet data transfer and Circuit Switch data transfer. Internet and Cyber Security.

[TOTAL: 42 Hrs.]

TEXT BOOKS:

1. "Hand book of thin film technology" L.I.Maissel and R.I.Glang, McGraw Hill Book Co.NewYork,1970.
2. "The Material Science of Thin Films" M. ohring, Academic press, NewYork 1992.
3. Ramakant Gayakwad, Operational amplifier and integrated circuits by PHI learning PublishingCompany.
4. H.Taub and D. Schilling, Digital Integrated Electronics, McGraw-Hill, Publishing Company.
5. Microprocessor and Microcontroller: RS. Gaonkar

REFERENCE BOOKS:

1. Data Communication networking:Behrouz A. Forouzan, McGraw-Hill

2. Electronic Principles ; Author: A P Malvino ; Publisher: TMH
3. Digital Logic and Computer Design; Author: M. Mano; Publisher: PHI
4. Microprocessor: B. Ram

LIST OF ELECTIVE COURSES:

ADVANCE COMMUNICATION THEORY

Course Objective: To Provide knowledge about advanced techniques of signal Characterization, representation, channel impairments and synchronization in communication system design.

Course Outcome:
CO1: Understand the advance principle of modern communication system-
CO2: Analyse the various concepts signal conversion and propagation Techniques
CO3: Be able to design a practical communication system at the block diagram level undercertain constraints and requirements
C04:Execution and Design of the signal transmission project and assignment on Trans-receiver system with mathematical modelling.

UNIT – I (12 hours)

Random Variables and Processes
Review of Random variable: Moment generating function, Chernoff bound, Markov's Inequality, Chebyshev,s inequality, Central limit Theorem, Chi square, Rayleigh and Rician distributions, Correlation, Covariance matrix- Stationary processes, wide sense Stationary processes, ergodic process, cross correlation and autocorrelation functions- Gaussian process- Communication over Additive Gaussian Noise Channels Characterization of Communication Signals and Systems- Signal space representation- Connecting Linear Vector Space to Physical Waveform Space- Scalar and Vector Communication over Memory less Channels.

UNIT – II (12 hours)

Optimum waveform receiver in additive white Gaussian noise (AWGN) channels - Cross Correlation receiver, Matched filter receiver and error probabilities.
Optimum Receiver for Signals with random phase in AWGN Channels- Optimum Receiver for Binary Signals- Optimum receiver for M-ary orthogonal signals- Probability Of error for envelope detection of M-ary orthogonal signals. Optimum waveform receiver For coloured Gaussian noise channels- Karhunen Loeve expansion approach, whitening.

UNIT – III (12 hours)

Synchronization in Communication Systems, Carrier Recovery and Symbol Synchronization in Signal Demodulation- Carrier Phase Estimation- Effect of additive Noise on the phase estimate- Maximum Likelihood phase estimation- Symbol Timing Estimation- Maximum Likelihood timing estimation- Receiver structure with phase and Timing recovery-Joint Estimation of Carrier phase and Symbol Timing- Frequency offset Estimation and tracking.

UNIT – IV (12 hours)
Communication over Band limited Channels - Communication over band limited

Channels- Optimum pulse shaping- Nyquist criterion for zero ISI, partial response **Signalling**- Equalization Techniques- Zero forcing linear Equalization- Decision Feedback equalization- Adaptive Equalization.

[**TOTAL: 48 Hrs.]**

TEXT BOOKS:

1. J.G. Proakis, "Digital Communication", MGH 4TH edition, 1995.

REFERENCE BOOKS:

1. Edward. A. Lee and David. G. Messerschmitt, "Digital Communication", Allied Publishers (second edition).
2. J Marvin.K.Simon, Sami. M. Hinedi and William. C. Lindsey, "Digital Communication Techniques", PHI.
3. William Feller, "An introduction to Probability Theory and its applications", Vol 11, Wiley 2000.
4. Sheldon.M.Ross, "Introduction to Probability Models", Academic Press, 7th edition.

RF & MICROWAVE SYSTEM

Course Objective: To develop understanding modelling and design of microwave devices, non-linear circuits using different methods like harmonic balanced method – programmable Microwave tuning system

Course Outcome:

CO1: Students will able to understand different passive and active devices

CO2: Students will able to analyse and design process of microwave devices.

CO3: Practically calculate different parameters, design and measurement of devices

CO4: Assignment of developing an understanding of modelling, design and measurement wave interaction along with project.

UNIT – I (12 hours)

Definitions and use of S Parameters with passive and active devices - Noise analysis in Linear two port networks - Modeling of microwave bipolar transistor - Microwave FETDC Biasing- Impedance matching - S-parameter matrix and properties of S-parameters.

UNIT – II (12 hours)

Unilateral and non-unilateral design - One stage and multistage design - Low-noise Amplifiers - High-power amplifiers - Balanced amplifiers - Feedback - Design examples - Small-signal distributed amplifiers.
Resonators – Dielectric resonators – YIG resonators – Varactor resonators – Resonator Measurements – Two-port oscillator design – Noise Lesson's oscillator model – Low noise Design. Non-linear oscillator model

UNIT – III (12 hours)

Diode mixer theory - Single diode mixers - Single-balanced mixers - Double balanced Mixers - FET mixer theory - Balanced FET Mixers - Spectral mixer circuits - Image Rejection mixer - single side band modulator performance - Simple sub harmonically Pumped mixer circuit configuration.

UNIT – IV (12 hours)

Integrated microwave workstation approach - Non-linear tools - Field drivers design - Designing non-linear circuits using the harmonic balanced method - programmable Microwave tuning system - Introduction to MMIC considering layout effects - Microwave integrated circuit components.

[**TOTAL: 48 Hrs.]**

TEXT BOOKS:

1. *I.J.Bhal & P.Bhartia, Microwave Solid state Circuit Design, Wiley, 2003.*
2. George.D.Vandelin, Anthony M.Pavis and Ulrich L.Rohde, "Microwave circuits design using linear and non-linear techniques", John Wiley and sons 1990.

REFERENCE BOOKS:

1. Samuel T.Liao, "Microwave Circuits and analysis and amplifier design", PHI, 1987.
2. Jeffrey Frey and Kul.Bhasin, "Microwave Integrated Circuits", Artech House, 1985.

ADVANCE DIGITAL SIGNAL PROCESSING

Course Objectives : At the completion of this course, the student should have in depth knowledge of processing digital signals. To help the students to understand and solve complex problems in power spectrum estimations and signal processing. Also, to have an idea about adaptive filters to deal with the effects of channel on random signals.

Course Outcomes (COs)

At the end of this course, the learner will be able to:

CO1. Acquire the basics of multi rate digital signal processing. select linear filtering techniques to engineering problems.

CO2. Student will learn different types of adaptive filters and subsequently use them based on the requirements.

CO3. Student will able to learn the various adaptive filter algorithms and can apply for different signal processing application

CO4. Describe the statistical properties of the conventional spectral estimators..

Module 1 (13 hours)

Review of sampling theory. Sampling rate conversion by integer and rational factors. Efficient realization and applications of sampling rate conversion. Wiener filtering. Optimum linear prediction. Levinson- Durbin algorithm. Prediction error filters.

Module 2 (14 hours)

Adaptive filters. FIR adaptive LMS algorithm. Convergence of adaptive algorithms. Fast Algorithms. Applications; Noise canceller, echo canceller and equalizer.

Module 3 (13 hours)

Recursive least–squares algorithms. Matrix inversion lemma. Convergence analysis of the RLS algorithm. Adaptive beam forming. Kalman filtering.

Module 4 (14 hours)

Spectrum estimation. Estimation of autocorrelation. Periodogram method. Nonparametric methods. Parametric methods.

Text Books:

1. J.G.Proakis et al, Advanced Digital Signal Processing, McGraw –Hill, 1992

2. S.Haykin, Adaptive Filter Theory (3/e), Prentice- Hall, 1996

Reference Books:

1. D.G.Manolakis et al, Statistical and Adaptive Signal Processing, McGraw-Hill, 2005
2. Marple, Spectral Analysis,
3. M.H.Hays, Statistical Digital Signal Processing and Modeling, John-Wiley.

OPTICAL COMMUNICATION

Course Objectives : To expose the students to the basics of signal propagation through optical fibers, fiber impairments, components and devices and system design.

Course Outcomes (COs)

At the end of this course, the learner will be able to:

CO1. Acquire the basics of signal propagation in optical fiber.

CO2. Student will learn various fiber optic components for communication & networking

CO3. Student will able to learn the various modulation and demodulation technique used for optical communication

CO4. Student will able to learn transmission system model, power penalty in transmitter and receiver optical amplifiers, crosstalk, dispersion.

CO5. Can analyze the non-linearity in fiber and compute optical fiber link design parameters

UNIT –I:
Signal propagation in Optical Fibers: Geometrical Optics approach and Wave Theory approach, Loss and Bandwidth, Chromatic Dispersion, Non Linear effects- Stimulated Brillouin and Stimulated Raman Scattering, Propagation in a Non-Linear Medium, Self-Phase Modulation and Cross Phase Modulation, Four Wave Mixing, Principle of Solitons.

UNIT –II:
Fiber Optic Components for Communication & Networking: Couplers, Isolators and Circulators, Multiplexers, Bragg Gratings, Fabry-Perot Filters, Mach Zender Interferometers, Arrayed Waveguide Grating, Tunable Filters, High Channel Count Multiplexer Architectures, Optical Amplifiers, Direct and External Modulation Transmitters, Pump Sources for Amplifiers, Optical Switches and Wavelength Converters.

UNIT –III:
Modulation and Demodulation: Signal formats for Modulation, Subcarrier Modulation and Multiplexing, Optical Modulations – Duobinary, Single Side Band and Multilevel Schemes, Ideal and Practical receivers for Demodulation, Bit Error Rates, Timing Recovery and Equalization, Reed-Solomon Codes for Error Detection and Correction.

UNIT -IV:

Transmission System Engineering: System Model, Power Penalty in Transmitter and Receiver, Optical Amplifiers, Crosstalk and Reduction of Crosstalk, Cascaded Filters, Dispersion Limitations and Compensation Techniques.

UNIT –V:

Fiber Non-linearities and System Design Considerations: Limitation in High Speed and WDM Systems due to Non-linearities in Fibers, Wavelength Stabilization against Temperature Variations, Overall System Design considerations – Fiber Dispersion, Modulation, Non-Linear Effects, Wavelengths, All Optical Networks.

TEXT BOOKS:

1. Optical Networks: A Practical Perspective - Rajiv Ramaswami and Kumar N. Sivarajan, 2nd Ed., 2004, Elsevier Morgan Kaufmann Publishers (An Imprint of Elsevier).
2. Optical Fiber Communications – Gerd Keiser, 3rd Ed., 2000, McGraw Hill.

REFERENCE BOOKS:

1. Optical Fiber Communications: Principles and Practice – John.M.Senior, 2nd Ed., 2000, PE.
2. Fiber Optics Communication – Harold Kolimbris, 2nd Ed., 2004, PEI
3. Optical Networks: Third Generation Transport Systems – Uyless Black, 2nd Ed., 2009, PEI
4. Optical Fiber Communications – Govind Agarwal, 2nd Ed., 2004, TMH.
5. Optical Fiber Communications and Its Applications – S.C.Gupta, 2004, PHI.

DIGITAL MOBILE SYSTEM

Course Objectives : To expose the students to understand mobile radio communication principles and to study the cellular systems and wireless system standards.

Course Outcomes (COs)

At the end of this course, the learner will be able to:

CO1. Discuss the cellular system design and technical challenges.

CO2. Summarize the principles and applications of wireless systems and standards

CO3. Analyze and design CDMA system functioning and can analyze multi-user CDMA system.

CO4. Understand and compare various 3rd generation technology used in mobile communication.

Module-1 (10Hr)

Overview & Classification of Mobile Communication Systems. Mobile Communication Channel. Modelling of Propagation Loss. Diversity reception. Cellular System Concepts. Ways of increasing system capacity. First Generation Cellular Telephony.

Module-2 (10 Hr)

GSM Cellular Telephony. GSM Architecture. Radio Transmission Parameters of GSM. GSM Logical Channels. GSM Burst Structures. Call setup Procedures & Handover in GSM System. Data Transmission in GSM. HSCSD, GPRS, EDGE.

Module-3 (10 Hr)

CDMA in Mobile Communication Systems. Spreading Sequences. Basic Transmitter & Receiver Schemes in CDMA Systems. RAKE Receiver. Multi Carrier CDMA. IS- 95 System. Digital Cordless Telephony .Wire Less Local Loops.

Module-4 (10 Hr)

Third Generation Mobile Communication Systems. IMT 2000. Concepts of UMTS. UTRA FDD Mode, UTRA TDD Mode. WCDMA. CDMA 2000. Application of Smart Antennas in Cellular Telephony. Satellite Mobile Communication Systems. Iridium, Global Start, ICO Systems.

Recommended Books:

1) Hazysztof Wesolowski, Mobile Communication Systems, Wiley.
2) Theodore S. Rappaport, Wireless Communications Principles & Practice, Pearson Education
3) Jochen Schiller, Mobile Communications, Pearson Education.
4) Raj Pandya, Mobile & Personal Communication Systems and Service, PHI.

OPTICAL NETWORK

Course Objectives : To expose the students to understand optical network and to study the technology, routing strategy adopted for optical network.

Course Outcomes (COs)

At the end of this course, the learner will be able to:

CO1. Understand and apply WDM Technology and Issue in WDM optical networks

CO2. Apply wavelength routing algorithms in various application of optical communication

CO3. Learn and design wavelength convertible networks

CO4. Understand the design and reconfiguration of virtual topology in optical network and provisioning for network survivability.

Module 1 (13 hours)

WDM Technology and Issue in WDM optical networks: Introduction – Optical networks – WDM – WDM optical networking evolution – Enabling Technologies for WDM optical networks – WDM optical network architecture – Issues in Wavelength routed networks – Next generation optical Internet networks.

Module 2 (13 hours)

Wavelength Routing Algorithms: Introduction – Classification of RWA algorithms –

RWA algorithms –Fairness and Admission control – Distributed control protocols – Permutation routing and Wavelength requirements.

Wavelength Rerouting Algorithms: Introduction – Benefits of Wavelength routing – Issues in Wavelength routing – Ligthpath Migration – Rerouting schemes – Algorithm AG – Algorithm MWPG – Rerouting in WDM networks with Sparse Wavelength conversion – Rerouting in Multifiber Networks – Rerouting in Multifiber Unidirectional Ring networks.

Module 3 (13 hours)

Wavelength Convertible Networks: Introduction – Need for Wavelength converters – Wavelength convertible switch architecture – Routing in convertible networks – Performance evaluation of convertible networks – Networks with Sparse Wavelength conversion – Converter placement problem – Converter allocation problem.

Module 4 (14 hours)

Virtual Topology Design: Introduction – Virtual topology design problem – Virtual topology design sub problems – Virtual Topology Design Heuristics – Regular virtual topology design – predetermined virtual topology and lightpath routes – Design of multi fiber networks.
Virtual Topology Reconfiguration: Introduction – Need for virtual topology reconfiguration – Reconfiguration due to Traffic changes – Reconfiguration for Fault restoration.
Network Survivability and Provisioning: Failures and Recovery – Restoration schemes – Multiplexing techniques – Distributed control protocols. Optical Multicast routing – Next Generation optical Internet networks.

Reference Books:

1. C. Siva Ram Murthy and Mohan Gurusamy, "WDM Optical Networks: Concepts, Design and Algorithms", Prentice Hall India, 2002.
2. Rajiv Ramasami and Kumar N. Sivarajan, "Optical Networks: A Practical Perspective", A Harcourt publisher's international company, 2000.

ADVANCE OPTICAL COMMUNICATION

Course Objectives : To describe the building blocks of an Optical networks & to familiarise with the advanced technology used for optical communication.

Course Outcomes (COs)

At the end of this course, the learner will be able to:

CO1. Understand various optical components used for optical communication. Learn first generation optical networks and their layered architecture.

CO2. Learn to use optical communication techniques

CO3.Understand OTDM technology for data transmission

CO4. Understand and design the architecture of FTH and PON Technology

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Module 1 (14 hours)

Components

Introduction to optical components – optical amplifiers –types – issues in optical amplifiers – photonic switching – cross connect – wavelength conversion – multiplexer – de multiplexer – filters – tuneable filters – introduction to OICs and its applications.

First Generation Optical Networks

SONET/SDH- multiplexing, elements of a SONET/SDH infrastructure- SONET/SDH physical layer. Computer interconnects-ESCON, Fiber channel, HIPPI. Metropolitan area networks – FDDI, ATM. Layered architecture – SONET/SDH layers – Second generation optical network layers.

Module 2 (13 hours)

WDM Technology

Introduction – WDM optical networking evolution – enabling technologies for WDM optical networks – WDM optical network architecture – DWDM – issues in WRN.

Module 3 (13 hours)

OTDM Technology Important issues of OTDM – optical solitons – applications of solitons. Optical pulse compression – fiber grating compressor – soliton effect compressor.

Module 4 (14 hours)

FTH and PON Technology

Proposed architecture and issues of Fiber to the home (FTH) – Passive optical networks (PON) – Near space communication – Open air optical communication – Inter satellite link hops (ISL). Introduction to all optical networks (AON). Military, civil, consumer and industrial applications.

Reference Books:

1. Rajiv Ramaswami and Kumar N. Sivarajan, “Optical networks – A Practical Perspective”, A Harcourt Publishers International Company, 2000.
2. R.G. Junsperger, “Integrated Optics – Theory and Technology, Springer Series in Optical Sciences”, 3rd Edition 1991.
3. Gerg Keiser, “Optical Fiber Communications”, McGraw Hill International Edition, 1991.
4. John Gowar, “Optical Communications Systems”, 2nd Edition PHI of India, 1995.
5. John M. Senior, “Optical Fiber Communications Principles and Practice”,. PHI, 1992.
6. G.P. Agarwal, “Non-Linear Optics”, Academic Press.

7. StamatiosV.Kartalopoulos,"Understanding SONET/SDH and ATM Communication Network for Next Millennium", PHI, 2000.
8. C.SivaRam Murthy and Mohan Gurusamy, "WDM Optical Networks: Concepts, Design and Algorithms" PHI, India, 2002.

MOBILE SATELLITE COMMUNICATION

Course Objectives : Students will study the basics of satellite system and to introduce various aspects in the design of systems for satellite communication.

Course Outcomes (COs)

At the end of this course, the learner will be able to:

CO1 Study of Satellite system engineering, orbital mechanism, orbital effects on communication.

CO2. Able to understand the communication satellite design.

CO3.Understand the system architecture required for mobile satellite communication

CO4.Understand the complete satellite system and know the applications of satellites in different areas.

Module 1 (13 hours)

Introduction to Satellite Communication: Satellite Orbits – Satellite Constellations – Orbital Mechanics –Equation of orbit – Orbital Elements – Look angle determination – Orbital perturbation – Satellite coverage –Space environment – Eclipse – Sun Transit outage – Limits of visibility – sub satellite point – launching procedures and Launch Vehicles.

Module 2 (14 hours)

Radio link and satellite access: Spectrum issues – Propagation characteristics and frequency considerations– Radio link analysis – Modulation – coding and multiple access schemes and comparison of multiple access schemes.
Spacecraft Technology: Satellite subsystems – Satellite for MSS, Intersatellite links – Emerging Technologies – Launching Satellite constellation- Gateways – Mobile Terminals – Environmental issues.

Module 3 (13 hours)

System architecture: System planning – Service Distribution model – Investment Routes – Regulatory issues– Traffic Forecast – Air interface –system development – network considerations and network management – Licensing issues.

Module 4 (14 hours)

Satellite system & services: Representative MSS system – Distress and Safety Systems navigation systems – Direct Satellite broadcast – Direct TV Broadcast system – Very Small Aperture Terminal systems- Terrestrial Cellular system – Future Trends – Broadband systems – ATM over Satellite – Role of Satellite in Feature Networks.

Text books:

1. M.Richharia, "Mobile Satellite Communications-Principles & Trends", Pearson Education, 2003
2. T.Pratt and Bostian, "Satellite Communications", John Wiley, 2001.
3. W.L.Prichand and A.Sciulli, "Satellite Communication systems Engineering", Prentice Hall, 1986
4. Tri.T.Ha, "Digital Satellite Communication Systems Engineering", McGraw Hill, 1998

WIRELESS NETWORKS AND MOBILE COMPUTING

Course Objectives : To study about the basics of wireless networks and mobile computing. An ability to explain the architecture, functioning, protocols, capabilities and application of various wireless communication networks. To study about various network security attacks and key management.

Course Outcomes (COs)

At the end of this course, the learner will be able to:

CO1 Understand the basics of wireless networks and mobile computing. Demonstrate an ability to explain multiple access techniques for Wireless Communication

CO2. Explore the wireless local area networks (LANs) and Mobile IP.

CO3. Analyze various protocols of all layers for mobile and wireless communication networks.

CO4. Understand and know the wireless security needed for wireless networks.

Module 1 (13 hours)

Introduction Introduction to wireless networks and mobile computing-Challenges of mobile computing-Mobile channel characteristics-Folding and shadowing communication issues-Review of cellular schemes, model and methodology.

Medium Access Control

Hidden /Exposed terminals-Near / Far terminals-SDMA, FDMA, TDMA and CDMA.

Module 2 (14 hours)

Wireless LANS:

Infrared radio transmission, infrastructure Vs Ad hoc Networks, IEEE 802.11: Architecture. MAC layer- Synchronization, power management, roaming-IEEE 802.11b,

802.11a, new developments. Blue tooth overview.
Mobile IP Overview, network elements, packet delivery agent discovery, registration - Tunnelling and encapsulation optimization, IPv6, IP micro mobility support, DHCP and mobile IP, mobile transport layer- Traditional TCP and implications on mobility, indirect and snooping TCP - TCP over 2.5G/3G networks- Performance enhancing process.

Module 3 (14 hours)

Mobile Computing File systems and WWW architectures for mobile computing – WAP Architecture, protocols wireless applications, environment WML, push architecture, push/pull services, WAP 1.72 stacks, I-mode, WAP 2.0 - J2ME- BREW.

Module 4 (13 hours)

Wireless Security Public key infrastructure and certification authorities- wireless public key infrastructure- Characteristics of SIM - Security protocols- Authentication.

Text Book:

1. "Mobile Communication", John Schiller, Addison Wesley-2003.

Reference Books:
1. "Principles of Wireless Networks - A Unified Approach ",K.Pahlvanand P.Krishnamurthy", Pearson Education, 2004.
2. "Introduction to Wireless and Mobile Systems", D.P.Agarwal and Qing.An Zeng, Thamson- Brooks.cole, 2003.
3. "Wireless Network Evolution: 2G to 3G", V.K.Garg - Prentice Hall, 2002.
4. "Mobile and Wireless Networks",V.Blook - Prentice Hall , 1996.
5. "Mobile IP Design-Principles and practice",C.E.Perkins - Addison Wesley ,1998.
6. "Ad Hoc Wireless Networks- Architectures and Protocols", Siva Ram Murthy and B.S.Manoj Prentice Hall, 2004.
7. "Wireless Personal Communication Systems", DJ.Goodman-Addisson Wesley, 1997.

Digital Image Processing

Course Objectives : To treat the 2D systems as an extension of 1D system design and discuss techniques specific to 2D systems.

Course Outcomes (COs)

At the end of this course, the learner will be able to:

CO1. understand the need for image transforms, different types of image transforms and their properties.

CO2. learn different techniques employed for the enhancement of images. Implement algorithms that perform basic image processing and develop any image processing application.

CO3. learn different causes for image degradation and overview of image restoration techniques.

CO4. understand the need for image compression and segmentation.

Module I

Digital Image Fundamentals:Components of image processing system, image fundamentals, image sampling and quantization, basic relationships between pixels, color image fundamentals – RGB, YC bCr, HSI models, 2D-transforms –DFT, DCT, KLT, slant transform, Hough transform, Properties of transforms and applications, Fundamentals on wavelet transform.

Module II

Image Enhancement: Enhancement in spatial domain: basic gray level transformations, histogram processing, smoothing and sharpening of spatial filters. Enhancement in frequency domain: Introduction to filtering in frequency domain, smoothing and sharpening of frequency domain filters.

Module III

Image Restoration: Degradation model, restoration in presence of noise only – spatial filtering, linear, position invariant degradations, estimating degradation functions, inverse filtering, Wiener filtering.

Module IV

Image compression and segmentation: Redundancy and compression models, Lossless coding – Run length coding, Huffman coding, vector quantization, JPEG, concepts of fractals , fractal image ompression. Edge detection, Boundary description, Morphological image processing, Region based segmentation – region growing, region merging and splitting.

TEXT BOOKS

1. Rafael C. Gonzalez, Richard E. Woods, ‘Digital Image Processing', Pearson, Second Edition, 2004.
2. Anil K. Jain, ‘Fundamentals of Digital Image Processing', Pearson 2002.

REFERENCES

1. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins,' Digital Image Processing using MATLAB', Pearson Education, Inc., 2004.
2. William K. Pratt, ‘ Digital Image Processing' , John Wiley, New York, 2002