RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electronics & Communication Engineering, VIII-Semester

EC801- Optical Fibre Communication

PREREQUISITE:-Engineering Physics, Communication Engineering

COURSE OUTCOME:-

Students should be able to:

1. Understand Optical Fiber Communication System and itsparameters.
2. Analyze transmission characteristics of optical fiber
3. Understand the construction and operation of various optical sources anddetectors.
4. Performance analysis of opticalreceivers and study of fiber joints
5. Brief introduction of optical fibernetworks and amplifiers

Unit 1. Introduction to vector nature of light, propagation of light, propagation of light in a cylindrical dielectric rod, Ray model, wave model. Different types of optical fibers, Modal analysis of fiber. Optical fibres : Structure & wave guiding fundamentals, basic optical laws.

Unit 2. Signal degradation in Optical Fibre : Signal degradation on optical fiber due to dispersion and attenuation, intermodal and intramodal dispersion, Fabrication of fibers and measurement techniques like OTDR

Unit 3. Optical sources and detectors: LEDs, LASER diodes, Basic concepts of optical Sourcesvarious laser and LED structures, Optical detectors: basic principle of photo detection, PIN and avalanche photo diode, phototransistor, photo detector noise, detector response time.

Unit 4. Optical transceivers; Direct detection and coherent receivers, noise in detection process, digital receiver performance calculation, BER, System design, power budgeting, rise time budgeting; fibre joints, and splicing techniques, Optical fibre connectors.

Unit 5.Optical networks and amplifiers- Optical networks : Topologies, networks SONET and SDH. Optical amplifiers - EDFA, Raman amplifier, and WDM systemsPassive Optical Networks.

TEXT BOOKS RECOMMENDED:-

1. Senior J.M., Optical Fibre Communications: Principles & Practice, 2nd ed. 2001,PHI.
2. Agrawal Govind P., Fibre Optic Communication Systems, 5th ed. 2001, John Wiley & Sons, studentsed.
3. Black Uyless, Optical Networks and 3rd Genration Transport Systems, 3rd ed. 1998,Pearson.

REFERENCE BOOKS RECOMMENDED:-

1. Keiser G, Optical Fibre Communication, 5th ed. 2006, McGrawHill.
2. Mynbanv and Scheiner, Fibre Optic Communication Technology, 2nd ed 2010, PearsonEdu.
3. Djfar K Mynbaev &Scheiner, Fibre Optic Communication Technology, 5th ed. 2005,Pearson

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Electronics & Communication Engineering, VIII-Semester

Departmental Elective EC 802 (A) AI & Signal Processing

Course Objective:
To impart knowledge about Artificial Intelligence and to give understanding of the main abstractions and reasoning for intelligent systems and signal processing.

Course Outcomes:
1. Ability to develop a basic understanding of AI building blocks presented in intelligent agents.
2. Ability to choose an appropriate problem-solving method and knowledge representation technique.
3. Ability to analyze the strength and weaknesses of AI approaches to knowledge-intensive problem-solving.

4. Understand real time applications of Fourier transform.

5. Describe discrete time systems in terms of difference equations.

UNIT-I

Introduction of AI

What is AI? Foundations of AI, History of AI, Agents and environments, The nature of the Environment, Problem solving Agents, Problem Formulation, Search Strategies

UNIT-II

Knowledge and Reasoning

Knowledge-based Agents, Representation, Reasoning and Logic, Prepositional logic, First-order logic, Using First-order logic, Inference in First-order logic, forward and Backward Chaining

UNIT-III
Learning
Learning from observations, Forms of Learning, Inductive Learning, Learning decision trees, why learning works, Learning in Neural and Belief networks.

Unit IV
Orthogonal transforms
DFT, DCT and Haar; Properties of DFT; Computation of DFT: FFT and structures, Decimation in time, Decimation in frequency; Linear convolution using DFT; Digital filter structures: Basic FIR/IIR filter structures, FIR/IIR Cascaded lattice structures, Parallel allpass realization of IIR transfer functions.

Unit V

Multirate signal processing

Basic structures for sampling rate conversion, Decimators and Interpolators; Multistage design of interpolators and decimators; Polyphase decomposition and FIR structures; Computationally efficient sampling rate converters, Lagrange interpolation, Spline interpolation; Quadrature mirror filter banks; Applications in subband coding;

References:

1. Stuart Russell, Peter Norvig: “Artificial Intelligence: A Modern Approach”,2nd Edition, Pearson Education, 2007

2. Artificial Neural Networks B. Yagna Narayana, PHI

3. Artificial Intelligence , 2nd Edition, E.Rich and K.Knight (TMH).

4. Artificial Intelligence and Expert Systems – Patterson PHI.

5.. S K Mitra: “Digital Signal Processing: A Computer-Based Approach” (McGraw Hill)

6. E C Ifeacthor and B W Jervis “Digital Signal Processing A Practical Approach” (Pearson)

7.R. Chassaing and D. Reay, Digital signal processing and applications with TMS320C6713 and TMS320C6416, Wiley, 2008.

8.J. G. Proakis and D. G. Manolakis, Digital Signal Processing:

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New Scheme Based On AICTE Flexible Curricula

Electronics & Communication Engineering, VIII-Semester

Departmental Elective EC 802 (B) Wireless Communication

Course Objective:

Understand the functioning of wireless communication system and evolution of different wireless communication systems and standards, comparison of recent technologies used for wireless communication, explanation of architecture, functioning, protocols, capabilities and application of various wireless communication networks.

Course Outcomes:

1. Explain and compare the various cellular systems and its components
2. Apply and analyze mobile communication concepts
3. Describe network and system architecture, channel concept and system Operations in TDMA and CDMA systems
4. Apply and analyze radio propagation models, coding and modulation Techniques in Wireless Communication systems.
5. Analyze improved data services in cellular communication

Unit-I

Introduction

Applications and requirements of wireless services: history, types of services, requirements for the services, economic and social aspects.

Technical challenges in wireless communications: multipath propagation, spectrum limitations, limited energy, user mobility, noise and interference-limited systems.

Propagation mechanism: free space loss, reflection and transmission, diffraction, scattering by rough surfaces, wave guiding.

Unit-II

Wireless Propagation channels

Statistical description of the wireless channel: time invariant and variant two path models, small-scale fading with and without a dominant component, Doppler spectra, temporal dependence of fading, large scale fading.

Wideband and directional channel characteristics: causes of delay dispersion, system theoretic description of wireless channels, WSSUS model, condensed parameters, ultra wideband channels, directional description.

Unit-III

Channel models: Narrowband, wideband and directional models, deterministic channel-modeling methods.

Channel sounding: Introduction, time domain measurements, frequency domain analysis, modified measurement methods, directionally resolved measurements.

Antennas: Introduction, antennas for mobile stations, antennas for base stations.

Unit-IV
Transceivers and signal processing: Structure of a wireless communication link: transceiver block structure, simplified models. Modulation formats, demodulator structure, error probability in AWGN channels, error probability in flat-fading channels, error probability in delay and frequency-dispersive fading channels.

Unit V
Diversity: Introduction, microdiversity, macrodiversity and simulcast, combination of signals, error probability in fading channels with diversity reception, transmit diversity.
Equalizers: Introduction, linear equalizers, decision feedback equalizers, maximum likelihood sequence estimation (Viterbi detector), comparison of equalizer structures, fractional spaced equalizers, blind equalizers.

References:
1. Molisch: Wireless Communications, Wiley India.
2. Taub and Schilling: Principles of Communication Systems, TMH.
3. Haykin: Mordern Wireless Communication, Pearson Education.
4. Upena Dalal: Wireless Communication, Oxford University Press.
5. Rappaport: Wireless Communication, Pearson Education.
6. Price: Wireless Communication and Networks, TMH.

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Electronics & Communication Engineering, VIII-Semester

Departmental Elective EC 802 (C) 5G Technology

Course Outcomes

1. Describe 5G Technology advances and their benefits
2. Distinguish the key RF, PHY, MAC and air interface changes required to support 5G
3. Demonstrate Device to device communication and millimeter wave communication
4. Implementation options for 5G
5. Modeling of MIMO system

Unit I : Overview of 5G Broadband Wireless Communications: Evaluation of mobile technologies 1G to 4G (LTE, LTEA, LTEA Pro) , An Overview of 5G requirements, Regulations for 5G,Spectrum Analysis and Sharing for 5G.

Unit II : The 5G wireless Propagation Channels: Channel modeling requirements, propagation scenarios and challenges in the 5G modeling, Channel Models for mmWave MIMO Systems.

Unit III : Transmission and Design Techniques for 5G: Basic requirements of transmission over 5G, Modulation Techniques – Orthogonal frequency division multiplexing (OFDM), generalized frequency division multiplexing (GFDM), filter bank multi-carriers (FBMC) and universal filtered multi-carrier (UFMC), Multiple Accesses Techniques – orthogonal frequency division multiple accesses (OFDMA), generalized frequency division multiple accesses (GFDMA), non-orthogonal multiple accesses (NOMA).

Unit IV : Device-to-device (D2D) and machine-to-machine (M2M) type communications – Extension of 4G D2D standardization to 5G, radio resource management for mobile broadband D2D, multi-hop and multi-operator D2D communications.

Unit V : Millimeter-wave Communications – spectrum regulations, deployment scenarios, beam-forming, physical layer techniques, interference and mobility management, Massive MIMO propagation channel models, Channel Estimation in Massive MIMO, Massive MIMO with Imperfect CSI, Multi-Cell Massive MIMO, Pilot Contamination, Spatial Modulation (SM).

Textbooks:

1. Martin Sauter “From GSM From GSM to LTE–Advanced Pro and 5G: An Introduction to Mobile Networks and Mobile Broadband”, Wiley-Blackwell.
2. Afif Osseiran, Jose.F.Monserrat, Patrick Marsch, “Fundamentals of 5G Mobile Networks” , Cambridge University Press.
3. Athanasios G.Kanatos, Konstantina S.Nikita, Panagiotis Mathiopoulos, “New Directions in Wireless Communication Systems from Mobile to 5G”, CRC Press.
4. Theodore S.Rappaport, Robert W.Heath, Robert C.Danials, James N.Murdock “Millimeter Wave Wireless Communications”, Prentice Hall Communications.

References

1. Jonathan Rodriguez, “Fundamentals of 5G Mobile Networks”, John Wiley & Sons.
2. Amitabha Ghosh and Rapeepat Ratasuk “Essentials of LTE and LTE-A”, Cambridge University Press.

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Electronics & Communication Engineering, VIII-Semester

Open Elective EC 803 (A) Wireless Network

PREREQUISITES: - Communication systems, Digital Communication, Telecommunication switching system, Computer Networks, Mobile and Wireless Communication

COURSE OUTCOMES:-

1. Review the concepts of wireless and mobilecommunication
2. Understand LTE and OFDM technologies for mobile telephony
3. Understand the basic concepts of wireless sensor network
4. Understand mobile networking and compare transport layer protocols for mobile and traditionalnetworks
5. Understand the technology and standards of IoT, ZigBee

Unit 1 Review of Cellular Networks

Mobile telephony, GSM, CDMA/CD, Universal Mobile Telecommunication System (UMTS). Advancement and migrations. WLAN- PHY Layer and MAC Layer-IEEE 802.11 (a, b, g, ac), HIPERLAN, Wireless ATM, WiMAX- PHY Layer and MAC Layer-IEEE 802.16 (fixed and mobile).

Unit 2 LTE systems

Introduction to 3GPP, LTE & LTE-A standards, LTE uplink/downlink, E-UTRAN architecture-Mobility and resource management, services, UTRAN- Architecture , HSDPA, HSUPA, OFDM, OFDMA, SISO system, MIMO system, OFDM-MIMO.

Unit 3 Wireless Sensor Networks

Introduction to wireless sensor network (WSN), WSN-Architecture, Coverage and placement, Topology management in WSN, Applications, Mobile WSN, Technologies for sensor nodes & networks, operating environment, Under water WSN, Security of WSN, MAC, Routing and Transport protocols for WSN

Unit 4 Wireless routing Protocols

Medium access problems in wireless networks, Traditional routing, Mobile network layer-Mobile IP, Introduction to IPv4 and IPv6, Data forwarding procedure in Mobile IP (IPv4 and IPv6), Mobility management, Protocol trade-offs, Congestion window management, Mobile transport layer- Traditional TCP, mobile TCP, Indirect TCP, Reno, New-Reno, Tahoe, Vegas. UDP.

Unit 5 Internet of things (IoT) and GPS systems

IoT architecture, Main design principles and needed capabilities, IoT Devices and gateways, Case studies: Sensor body area network, Control of a smart home, Smart vehicles, Smart manufacturing and smart factory. Emerging IoT standards, IoT-protocols, IoT Local and wide area networking, IEEE 802.15 WPAN, Bluetooth-pico net, scatter net, Protocol stack, Interface between 802.11 and Bluetooth. Geolocation service techniques and standards. Introduction to GPS-aided GEO augmented navigation (GAGAN), E.911, ZigBee, UWB and RFID.

Text Books:

1. Kaveh Pahlavan, Prashant Krishnamoorthy – *Principle of wireless networks- A unitedapproach*- Pearson Education,2002
2. Vijay K. Garg – *Wireless communication and networking* – Morgan-Kaufmann series in networking- Elsevierpublication
3. Feng Zhao and Leonidas Guibas – *Wireless Sensor Networks, An informationprocessing approach* - Morgan Kaufmannpublication

Reference Books:

1. Kazem Sohraby, Daniel Minoli and TaiebZnati- *Wireless Sensor Networks: Technology, Protocols and Applications* -Wileypublication
2. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos,David Boyle, "*From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence*", 1st Edition, Academic Press,2014.
3. Ramji Prasad "*OFDM for wirelesscommunication*"
4. Steve Rackley "*Wireless NetworkingTechnology.*

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Electronics & Communication Engineering, VIII-Semester

Open Elective EC 803 (B) Digital Image Processing

Course Objectives

To study the image fundamentals and mathematical transforms necessary for image processing, image enhancement techniques, image restoration procedures, and image compression.

Course Outcomes:

1. Understand the basic elements of digital image processing
2. Develop and analyse the algorithm for discrete fourier transformations.
3. Understand the concept of Image enhancement by analyzing different filtering techniques.
4. Applying different models and techniques to understand the concept of image restoration
5. Analyze and implement different image encoding methods

Unit-I

Digital Image Processing (DIP)

Introduction, examples of fields that use DIP, fundamental steps in DIP, components of an image processing system.

Digital Image Fundamentals: elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels.

Unit-II

Image Transforms

Two-dimensional (2D) impulse and its shifting properties, 2D continuous Fourier Transform pair, 2D sampling and sampling theorem, 2D Discrete Fourier Transform (DFT), properties of 2D DFT.

Other transforms and their properties: Cosine transform, Sine transform, Walsh transform, Hadamard transform, Haar transform, Slant transform, KL transform.

Unit-III

Image Enhancement

Spatial domain methods: basic intensity transformation functions, fundamentals of spatial filtering, smoothing spatial filters (linear and non-linear), sharpening spatial filters (unsharp masking and high boost filters), combined spatial enhancement method.

Frequency domain methods: basics of filtering in frequency domain, image smoothing filters

(Butterworth and Gaussian low pass filters), image sharpening filters (Butterworth and Gaussian high pass filters), selective filtering.

Unit-IV

Image Restoration

Image degradation/restoration, noise models, restoration by spatial filtering, noise reduction by frequency domain filtering, linear position invariant degradations, estimation of degradation function, inverse filtering, Wiener filtering, image reconstruction from projection.

Unit-V

Image Compression

Fundamentals of data compression: basic compression methods: Huffman coding, Golomb coding, LZW coding, Run-Length coding, Symbol based coding.
Digital image watermarking, representation and description- minimum perimeter polygons algorithm (MPP).

References:

1. Gonzalez and Woods: Digital Image Processing, Pearson Education.
2. Anil Jain: Fundamentals of Digital Image Processing, PHI Learning.
3. Annadurai: Fundamentals of Digital Image Processing, Pearson Education.
4. Sonka, Hlavac and Boyle: Digital Image Processing and Computer Vision, Cengage Learning.
5. Chanda and Majumder: Digital Image Processing and Analysis, PHI Learning.
6. Jayaraman, Esakkirajan and Veerakumar: Digital Image Processing, TMH.
7. William K. Pratt, Digital Image Processing, Wiley India.

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Electronics & Communication Engineering, VIII-Semester

Open Elective EC 803 (C) Speech Processing

Course Objectives

To study speech production and related parameters of speech and to understand different speech modeling procedures such as Markov and their implementation issues.

Course Outcomes:

1. Model speech production system and describe the fundamentals of speech.
2. Extract and compare different speech parameters.
3. Choose an appropriate statistical speech model for a given application.
4. Design a speech recognition system.
5. Use different speech synthesis techniques.

Unit-I

Basic Concepts of Speech Processing

Speech Fundamentals: Articulatory Phonetics – Production and Classification of Speech Sounds; Acoustic Phonetics – acoustics of speech production; Review of Digital Signal Processing concepts; Short-Time Fourier Transform, Filter-Bank and LPC Methods.

Unit-II

Speech Analysis

Features, Feature Extraction and Pattern Comparison Techniques: Speech distortion measures – mathematical and perceptual – Log Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Likelihood Distortions, Spectral Distortion using a Warped Frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths.

Unit-III

Speech Modeling

Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-estimation, Implementation issues.

Unit-IV

Speech Recognition

Large Vocabulary Continuous Speech Recognition: Architecture of a large vocabulary continuous speech recognition system – acoustics and language models – ngrams, context dependent sub-word units; Applications and present status.

Unit-V
Speech Synthesis

Text-to-Speech Synthesis: Concatenative and waveform synthesis methods, subword units for TTS, intelligibility and naturalness – role of prosody, Applications and present status.

References:

2.Lawrence Rabinerand Biing-Hwang Juang, “Fundamentals of Speech Recognition”, Pearson Education, 2003.

3.Daniel Jurafsky and James H Martin, “Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”, Pearson Education.

4.Steven W. Smith, “The Scientist and Engineer’s Guide to Digital Signal Processing”, California Technical Publishing.

5.Thomas F Quatieri, “Discrete-Time Speech Signal Processing – Principles and Practice”, Pearson Education.

6.Claudio Becchetti and Lucio Prina Ricotti, “Speech Recognition”, John Wiley and Sons, 1999.

7.Ben gold and Nelson Morgan, “Speech and audio signal processing”, processing and perception of speech and music, Wiley- India Edition, 2006 Edition.

8.Frederick Jelinek, “Statistical Methods of Speech Recognition”, MIT Press.

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Electronics & Communication Engineering VIII-Semester

EC 804- Advanced Communication Engg. Lab

1. Amplitude Shift Keying Modulation and Demodulation
2. Frequency shift keying Modulation and Demodulation
3. BPSK Generation and Detection
4. DPSK Generation and detection.
5. QPSK Generation and detection
6. Time Division Multiplexing of 2 Bandlimited Signals
7. Analog and Digital Communication Link Using Optical Fiber
8. Study of Manchaster Coding & Decoding
9. Measurement of frequency ,guided wavelength,power,VSWR and attenuation in a microwave test bench
10. Study Of Dipole Antenna Radiation Pattern (Simple Dipole and Folded Dipole antenna)
11. To find the Gain and Directivity of Yagi-Uda Antenna, Dipole antenna and Patch antenna
12. Determination of coupling and isolation characteristics of a stripline directional coupler.
13. Power Division and Isolation characteristics of a microstrip 3dB power divider