



NATIONAL INSTITUTE OF TECHNOLOGY ANDHRA PRADESH

Department of Electronics and Communication Engineering

M. Tech. (Advanced Communication Systems and Signal Processing (ACSP))

Course Structure

I - Year I - Semester

S. No.	Course Code	Course Title	L	T	P	Credits	Cat. Code
1	19PEC101	Core I Wireless Communication	4	0	0	4	PCC
2	19PEC102	Core II Adaptive Signal Processing	4	0	0	4	PCC
3	19PEC103	Core-III: Detection and Estimation Techniques	4	0	0	4	PCC
4		Department Elective – I	3	0	0	3	DEC
5		Open Elective – I	3	0	0	3	OEC
6	19PEC121	Advanced Communications Laboratory	0	0	3	2	PCC
		Total	18	0	6	20	

I - Year II - Semester

S. No.	Course Code	Course Title	L	T	P	Credits	Cat. Code
1	19PEC126	Core-IV: Advanced Communication Systems	4	0	0	4	PCC
2	19PEC127	Core-V: Adaptive Signal Processing for image and video	4	0	0	4	PCC
3		Department Elective – II	3	0	0	3	DEC
4		Department Elective - III	3	0	0	3	DEC
5		Open Elective – II	3	0	0	3	OEC
6	19PEC145	Laboratory-II: Advanced DSP Lab	0	0	3	2	PCC
7	19PEC146	Seminar – I	0	0	3	2	PCC
		Total	18	0	6	21	

II - Year I - Semester

S. No.	Course Code	Course Title	L	T	P	Credits	Cat. Code
1		Mandatory Elective Course - I (ERA/NPTEL/SWAYAM/MIT)				2	PCC
2		Mandatory Elective Course - II (ERA/NPTEL/SWAYAM/MIT)				2	PCC
3	19PEC151	Comprehensive Viva				2	PCC
4	19PEC152	Dissertation Part A				8	PCC
		Total				14	

II - Year II - Semester

S. No.	Course Code	Course Title	L	T	P	Credits	Cat. Code
1	19PEC176	Dissertation Part B				16	PCC
		Total				16	

List of Electives

Department Elective I

- **19PEC105** **Communication Networks**
- **19PEC106** **Information Theory and coding**
- **19PEC104** **Wireless Broadband Networks**
- **19PEC107** **Multicarrier Communication Systems and OFDM**

Department Elective II:

- **19PEC129** **Real-Time Digital Signal Processing**
- **19PEC128** **Multimedia Communications**

Department Elective III:

- **19PEC131** **Soft Computing**
- **19PEC130** **Artificial Intelligence and Neural Networks**

Open Elective I: **Research Methodology and IPR**

Open Elective II: **Advanced Linear Algebra and Optimization**
 Convex optimization and graph theory

19PEC101

WIRELESS COMMUNICATIONS

L T P C 3 1 0 3

Introduction Evolution of wireless communication systems, Examples of wireless communication systems.

The cellular concept – system design fundamentals Concept of frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, Trunking and grade of service, Improving coverage and capacity in cellular systems. The cellular concept – system design fundamentals Concept of frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, Trunking and grade of service, Improving coverage and capacity in cellular systems.

Propagation models Free space propagation model, Two-ray ground reflection model, Distance power loss, Macro-cell propagation model, Micro-cell propagation model, Shadowing model, Multipath effects in mobile communication, Models for multipath reception.

Equalization, diversity and channel coding Fundamentals of equalization, Adaptive equalizers, Linear and nonlinear equalization, Algorithms for adaptive equalization, Diversity techniques, Fundamentals of channel coding, Overview of error detection and correction codes.

Multiple access techniques Introduction to multiple access, Frequency division multiple access, Time division multiple access, Spread spectrum multiple access, Space division multiple access, Packet radio, Orthogonal frequency division multiple access; Introduction to wireless systems and standards.

Text Book:

1. Wireless Communications: Principles and Practice by Theodore S. Rappaport; Pearson / PHI Publication

References:

1. Wireless Communications and Networks: 3G and Beyond by Iti Saha Misra; Tata McGraw Hill Publication
2. Mobile Cellular Telecommunications: Analog and Digital Systems by William C. Y. Lee; Tata McGraw Hill Publication
3. Wireless and Digital Communications by Dr. Kamilo Feher; PHI Publication

19PEC102

ADAPTIVE SIGNAL PROCESSING

CREDIT: 4 L-T-P: 4-0-0

Adaptive Filter Structures and Algorithms : Introduction to Adaptive systems, Adaptive Linear combiner, Minimum Mean-Square Error, Wiener-Hopf Equation, Error Performance Surface, LMS algorithm, Convergence of weight vector, Learning Curve, FX-LMS algorithm (Filtered X-LMS) and its application to ANC, Types of LMS, RLS algorithm, Matrix Inverse Lemma for RLS, Computational complexity of LMS and RLS, Convergence Analysis.

Advancements in Transforms : Short time Fourier Transform (STFT), Multi Resolution Analysis, Wavelet Transform, Continuous Wavelet Transform (CWT), Inverse CWT, Discrete Wavelet Transform, Sub-band coding and implementation of DWT, Applications (signal and image compression, de-noising, detection of discontinuous and breakdown points in signals), S-transform, Frequency selective filtering with wavelet and S-transform.

Applications: Direct Modelling or System Identification, Inverse Adaptive

Modelling (Equalization), Adaptive Noise Cancellation, Adaptive filters for time series and stock market prediction, Biomedical Applications (Cancellation of 50-Hz interference in Electro-Cardiography, Cancelling donor heart interference in heart-transplant electrocardiography, Cancelling Maternal ECG in Fetal Electrocardiography),

Echo Cancellation in Long distance Telephone Circuits, Adaptive self tuning filter, Adaptive line enhancer, Adaptive filters for classification and data mining.

References -

- [1] B. Widrow and S. D. Stearns : Adaptive Signal Processing, Prentice Hall.
- [2] D. G. Manolakis, V. K. Ingle, S. M. Kogon : Statistical and Adaptive Signal Processing, McGraw Hill.
- [3] S. S. Haykin : Adaptive Filter Theory, 4th Edition, Prentice Hall.
- [4] A. H. Sayed : Fundamentals of Adaptive Filtering, John Wiley & Sons.

19PEC103

DETECTION AND ESTIMATION TECHNIQUES 4 - 0- 0 4 CREDITS

Introduction: Representations and models for random processes, Probability Spaces, Random variables, distribution and density functions, expectation, conditional probability, Bayes theorem, General Gaussian models. Hypothesis testing: Binary hypothesis testing, MAP criteria, bayes risk, Neyman-Pearson theorem, multiple hypothesis tests, Performance of Binary Receivers in AWGN, Sequential Detection and Performance.

Signal detection with random parameters: Detection of known signals in noise, Matched filter, Performance evaluations, Composite Hypothesis Testing, Unknown Phase, Unknown Amplitude, Unknown Frequency, White and Colored Gaussian Noise for Continuous Signals, EstimatorCorrelator.

Detection of multiple hypotheses: Bayes Criterion, MAP Criterion, M-ary Detection Using Other Criteria, Signal-Space Representations, Performance of M-ary Detection Systems, Sequential Detection of Multiple Hypotheses,

Linear models, Rayleigh fading sinusoid.

Fundamentals of estimation theory: Formulation of the General Parameter Estimation Problem, Relationship between Detection and Estimation Theory, Types of Estimation Problems. Properties of estimators: Unbiasedness, efficiency, Criteria for good estimators, Minimum variance unbiased estimation, Cramer-Rao lower bound, asymptotic properties. Parameter estimation: Random parameter, Bayes estimation, Mean square error (MSE), linear minimum mean-square estimates, linear square estimation, Maximum Likelihood Estimation, Least Square Estimation, Generalized Likelihood Ratio Test, Linear minimum variance estimator, BLUE.

Applications: Detection and Estimation in Non-Gaussian Noise Systems, Characterization of Impulsive Noise, Detector Structures in Non-Gaussian Noise, Selected Examples of Noise Models, Receiver Structures, and Error-Rate Performance, Estimation of Non-Gaussian Noise Parameters.

Text Books:

- [1] Harry L. Van Trees, "Detection, Estimation, and Modulation Theory, Part I," John Wiley & Sons, Inc. 2001.
- [2] Steven M.kay, "Fundamentals of Statistical signal processing, volume-1: Estimation theory". Prentice Hall 1993.
- [3] Steven M.kay, "Fundamentals of Statistical signal processing, volume-2: Detection theory". Prentice Hall 1993
- [4] A.Papoulis and S.Unnikrishna Pillai, "Probability, Random Variables and stochastic processes, 4ed. The McGraw-Hill 2002.

ADVANCED COMMUNICATIONS LABORATORY

List of experiments

- 1) To study the cyclic encoding and decoding of BCD bit sequence.
- 2) To study the error detection & correction of bit sequence. Study and Analysis of Frequency Division Multiplexing.
- 3) To study about Data Formatting &Carrier Modulation transmitter trainer:- Data Formatting (line coding techniques) Carrier Modulation
- 4) To study about data Re-Formatting &Carrier Demodulation Transmitter Trainer:- Data Re-Formatting (line coding techniques) Carrier Demodulation
- 5) Signal Sampling and Reconstruction Effect of Different Sampling Frequencies
- 6) Effect of varying the Sampling Frequency Duty Cycle Study of second order and fourth order low pass filter Effect of different Fault Switches Study of Sample Signals and Sample/Hold signal through mic.
- 7) Study and analysis of continuous variable Slope Delta Modulator.
- 8) Study of various line coding techniques Study of PAM, PPM and PWM techniques.
- 9) Study and analysis of Delta Modulation and Adaptive Delta Modulation.
- 10) Generate and observe Pulse-Code Modulation and Demodulation
- 11) Generate and observe differential Pulse-Code Modulation & Demodulation.

19PEC126

ADVANCED COMMUNICATION SYSTEMS [3 0 0 3]

Spread Spectrum Communication: Direct sequence and frequency hopped spread spectrum, spreading sequences and their correlation functions, Acquisition and tracking of spread spectrum signals

Code Division Multiple Access (CDMA): DS-SS on AWGN channels, DS-SS on frequency selective fading channels, Performance analysis of cellular DS-SS, Capacity estimation, Power control effect of imperfect power control on DS-SS performance, Soft Hand offs, Spreading/coding tradeoffs, multi carrier CDMA, IS95A CDMA systems, 3rd Generation CDMA systems, Multi user detection, Optimum receivers, SIC, PIC receivers and performance. Networks & Services: Network Transmission System Design Services, Characterization of networks & teleservices, The Telephone Network – Past, Present & Future, and Network issues.

Data Communication Networks: Basic principles of data communication – synchronous and asynchronous transmission – digital data transmission formats NRZ, RZ, AMI, ASI & Manchester coding, Error correcting codes, Hamming codes, Orthogonal codes, Switching – Circuit switching, Message switching, Packet switching, Standard communication interface multipliers and concentrators, Protocols (BOP-COP – standard networks and standards, OSI, (D) ARPANET, NICNET, SNA, SELS etc. Lan types of LAN – WAN, Digital telephony, Basic principle of ISDN – E Mail – Voice mail.

Transmission Principles: Transmission aspects, Signals and Impairments, Digital Speech Transmission Digitisation of Speech & Audio. Teletraffic: Digital Networks, Network Synchronization, Digital Switching, Signaling, ISDN & ATM: Integrated Services Digital Network – ISDN, Broadband ISDN & ATM, Network Aspects: Intelligent Network, Network Management, and Introduction to Network management softwares.

Text Books:

1. Andrew J Viterbi, “CDMA Principles of spread spectrum communications”, Addition Wesley, (1995).
2. J S Lee and L E Miller, “CDMA systems engineering handbook”, Artech House, (1998).
3. Marvin K Simon, Jim K Omura, Robert A Scholtz, Bary Klevit, “Spread Spectrum Communications”, (1995).
4. Sergio Verdu, “Multiuser Detection”, Cambridge University Press, (1998).
5. Andrew S Tanenbaum, “Computer Networks”, Prentice Hall of India.

19PEC127

ADAPTIVE SIGNAL PROCESSING FOR IMAGE AND VIDEO L T P C 3 1 0 3

Digital image fundamentals Image acquisition, representation, visual perception, quality measures, sampling and quantization, basic relationship between pixels, imaging geometry, color spaces, Video spaces, analog and digital video interfaces, video standards.

Two dimensional systems Properties, analysis in spatial, frequency and transform domains.

Image transforms DFT, DCT, Sine, Hadamard, Haar, Slant, KL transform, Wavelet transform. Image enhancement – point processing, spatial filtering,

Image restoration Inverse filtering, de-blurring. Video processing – display enhancement, video mixing, video scaling, scan rate conversion.

Image compression lossless and lossy compression techniques, standards for image compression – JPEG, JPEG2000. 6. Video compression Motion estimation, intra and interframe prediction, perceptual coding, standards - MPEG, H.264 Image segmentation – feature extraction, region oriented segmentation, descriptors, morphology, Image recognition.

Text/Reference Books:

1. R. C. Gonzalez and R E Woods, Digital Image Processing, Pearson Education, 2002
2. A K Jain, Fundamentals of Digital Image Processing, Pearson Education, 1989
3. W Pratt, Digital Image Processing, Wiley, 2001
4. Al Bovik, Handbook of Image and Video, Academic Press, 2000
5. Keith Jack, Video Demystified, LLH, 2001

ADVANCED DSP LAB

Computers include various software and applications

- Intel Quad Core Desktop Computer
- Intel Pentium IV Desktop Computer
- Intel Core I7 Desktop Computer

List of Experiments:

- 1) Introduction to Code Composer Studio-I
- 2) Introduction to Code Composer Studio-II
- 3) Introduction to the Addressing Modes
- 4) FFT and Bit Reversal Operation
- 5) FFT and its Applications
- 6) Audio Codec and its Applications
- 7) Real Time Data Exchange
- 8) FIR filtering by interfacing Matlab with Code Composer Studio
- 9) Introduction to Interrupts
- 10) Digital communication using Binary Phase Shift Keying

19PEC105

COMMUNICATION NETWORKS

Principles Of Networks networking principles, Network services, High performance networks, Network elements, network mechanisms, layered architecture Packet Switched Networks Principles, OSI & TCP/IP models, transmission media, routing algorithms, Congestion control algorithms, Internetworking, Ethernet(IEEE 802.3), Tokenring (IEEE 802.5),Token bus (IEEE802.4), FDDI., Network security(cryptography, symmetric key algorithms, private key algorithms, digital signatures, authentication protocols) The Internet And TCP/IP Networks & Circuit Switched Networks Overview of Internet protocols, Internet control protocols, Elements of transport Protocols, TCP & UDP , Performance of TCP/IP networks, SONET, DWDM, Solitons, Optical Networks fiber principles (elements of optical fiber communication, acceptance angle, Numerical aperture, modes, fiber types), optical links(point to point links,attenuation,optical budgeting, dispersion),splices ,connectors optical Lans,non Semiconductors, optical amplifiers,Erbium doped Fiber mplifiers, couplers/splitters, optical switches ATM networks Main features of ATM, Addressing , signaling, routing, ATM header structure

TEXT BOOKS

1. Jean Walrand and Pravin variya , “ High performance Communication networks”, 2nd edition, Harcourt and Morgan Kauffman, London 2000
2. Andrew S. Tanenbaum, “Computer networks”, PHI Private limited, new Delhi

REFERENCES

1. Gerd Keiser, MC Graw Hill International edition, optical fiber communication , third edition
2. John M Senior, PHI limited, optical fiber communication , third edition
3. Leon Gracia, Widjaja, “ Communication Networks”, Tata Mc Graw –Hill, New Delhi, 2000.
4. Behroz a. Forouzan, “Data communication and networking “, Tata MC Graw –Hill, New Delhi
5. Sumit Kasera, Pankaj Sethi, “ ATM Networks”, Tata Mc Graw- Hill, New Delhi , 2000

19PEC106

INFORMATION THEORY AND CODING

Entropy and Loss-less Source Coding : Entropy, Entropy of discrete random variables Joint, conditional and

relative entropy- Chain rule for entropy, Mutual information and conditional mutual information, Relative entropy and mutual Information Lossless source coding- Discrete Memory-less sources, Uniquely decodable codes Instantaneous codes- Kraft's inequality .

Channel Capacity and Coding Theorem: Channel Capacity- Discrete memory-less channels (DMC) and channel transition probabilities, Capacity computation for simple channels- Shannon's Channel Coding Theorem for DMC (proof is optional), Converse of Channel Coding Theorem Continuous Sources and Channels: Differential Entropy- Mutual information Waveform channels- Gaussian channels- Shannon-Harley Theorem, Shannon limit, efficiency of digital modulation schemes-power limited and bandwidth limited systems.

Channel Coding- Part-I: Introduction- Error detection and correction, Review of Vector Space, properties, Linear block codes- Construction and decoding, Standard Array decoding, Distance properties. Characteristics of Finite fields- Construction and basic properties of Finite Fields Computations using Galois Field arithmetic- Extension Fields. Cyclic codes – Nonsystematic and systematic codes-Construction and Decoding- Minimal Polynomials, Conjugates and Conjugacy classes, BCH codes – Construction and decoding - Reed Solomon codes, Introduction to low density parity check codes.

Channel Coding- Part-II: Convolutional codes – Encoder representations and Types Maximum likelihood decoding - Viterbi decoding, Hard decision and Soft decision decoding, Transfer function of convolutional codes, Interleaving, Concatenated codes, Introduction to Turbo codes.

Text Books:

1. Thomas M. Cover and Joy A. Thomas, "Elements of Information Theory", John Wiley & Sons, 2006
2. Shu Lin and Daniel. J. Costello Jr., "Error Control Coding: Fundamentals and applications", 2nd Ed., Prentice Hall Inc, 2004.
3. John G. Proakis and M. Salehi, "Digital Communication", 5th Ed., MGH, 2008
4. David J. C. MacKay, "Information Theory, Inference and Learning Algorithms", Cambridge University Press, 2003.

19PEC104

WIRELESS BROADBAND NETWORKS

Evolution of Broadband Wireless; Fixed Broadband Wireless and Mobile Broadband Wireless; WiMAX, 3G & Wi-Fi Systems; Spectrum Options for Broadband Wireless; Technical Challenges for Broadband Wireless - Wireless Radio Channel: Path loss and Shadowing; Spectrum Scarcity, Quality of Service, Mobility, Portability, Security, Supporting IP in Wireless. Orthogonal Frequency Division Multiplexing, Multicarrier Modulation – OFDM; Introduction to Multiple Antenna Techniques. WiMAX; Salient Features of WiMAX – Physical Layer & MAC-Layer Overview; Advanced Antenna Systems; Improved Frequency Reuse; Performance Characterization - Throughput and Spectral Efficiency and Sample Link Budgets and Coverage Range. NETWORK ARCHITECTURE AND SERVICES ASPECTS Design Principles of the WiMAX Network Architecture, QoS, Security, Mobility Management, Location Management, Handoff Management, Mobile IP, TCP in Wireless, Radio Resource Management. LTE AND EVOLUTION TO 4G (LTE System Overview, The Evolution from UMTS to LTE; Requirements and Targets for LTE; LTE Radio Access –Transmission Scheme, Spectrum Flexibility, Channel Dependent Scheduling and Rate Adaptation, Inter-Cell Interference Combining, Multi-Antenna Transmission.; Technologies for LTE; Network Architecture – Overall Architecture Overview, Protocol Architecture UNIT V-LTE ADVANCED LTE Advanced – Introduction, Requirements, Main Features, Backward Compatibility, Deployment Aspects, UE Categories for LTE Advanced.

REFERENCES

1. Jeffrey G. Andrews, Arunabha Ghosh and Rias Muhamed, "Fundamentals of WiMAX: Understanding Broadband Wireless Networking", Pearson Education, 2007.
2. Yan Zhang and Hsiao-Hwa Chen, "Mobile WiMAX : toward broadband wireless metropolitan area networks", Auerbach Publications, 2007
3. Moray Rumney, "LTE and Evolution to 4G Wireless: Design and Measurement Challenges", Agilent Technologies, 2008.
4. Stefania Sesia, Issam Toufik, Matthew Baker, "LTE – The UMTS Long Term Evolution: From Theory to Practice", John Wiley & Sons, 2e, 2011.
5. Luis M. Correia, "Mobile Broadband Multimedia Networks: Techniques, Models and Tools for 4G", Elsevier, 2006.

19PEC107

MULTI-CARRIER MODULATION SYSTEMS AND OFDM

Data Transmission using Multiple Carriers, Multicarrier Modulation with Overlapping Subchannels, Mitigation of Subcarrier Fading: frequency equalization, precoding, adaptive loading OFDM: generation of subcarriers using the IFFT, guard time and cyclic extension, windowing, choice of OFDM parameters, OFDM signal processing, implementation complexity of OFDM versus single-carrier modulation, OFDM system model, channel modeling for OFDM systems, applications of OFDM (DAB, DVB, WLANs) Vector Coding Challenges in Multicarrier Systems

Reference Books

- I. B. Djordjevic, Advanced Optical and Wireless Communications Systems. Springer, 2017.
- A. Goldsmith, Wireless Communications. Cambridge: Cambridge University Press, 2005.
- D. Tse, and P. Viswanath, Fundamentals of Wireless Communication. Cambridge University Press, 2005.

19PEC129

REAL-TIME DIGITAL SIGNAL PROCESSING

With the widespread usage of DSPs as part of real-time embedded systems, the breadth of applications in which DSPs can be used is large. These applications include, but are not limited to, modems, faxes, data transmission, data encryption, speech and image processing and compression, computer vision, vehicle navigation, automotive control, seismic and spectral analysis, radar and sonar, ECG monitoring, digital audio and music, hearing aids, digital cellular phones, and video telephones. The objectives of the proposed course is to provide the students with knowledge and hands-on experience in translating DSP and communications concepts into real-time software for embedded systems using DSP boards. The proposed course emphasizes designing and implementing real-time software for embedded systems through the programming of a special type of micro-processor, the DSP, or Digital Signal Processor. Laboratory exercises will be based on writing C and assembly language software for selected DSP boards that are used in current consumer products, and interfacing the DSPs to external devices for test and measurement. The focus of the course is on Real-Time DSP programming. It provides an overview but does not provide in-depth coverage of signals/systems theory, nor does it teach computer programming, since it assumes some knowledge of both.

Text books:

- A. Singh and S. Srinivasan, *Digital Signal Processing: Implementation Using DSP Microprocessors with Examples from TMS320C54XX*, Brooks/Cole, Belmont, California, 2004;
- T. B. Welch, C. H. G. Wright and M. G. Morrow, *Real-Time Digital Signal Processing from MATLAB to C with the TMS320C6x DSK*, Taylor & Francis Group, New York, 2006;
- J. G. Proakis and D. G. Manolakis, *Digital Signal Processing: Principles, Algorithms, and Applications*, 4th ed., Pearson, New Jersey, 2007.

19PEC128 MULTIMEDIA COMMUNICATIONS

Multimedia content, picture, voice, data. Multimedia service in the real time. Classification of the multimedia

services. Picture signal digitalization. Analogue black and white picture signal. Colour picture and RGB signal, Y;Cr,Cb. Resolution of the picture. Structure of the picture signal information, luminescence and chromatic components. Luminescence and colour triangle. NTCS, PAL, SECAM TV standards of video signal transmutations. Luminescence and colour sensitivity of the human eye. Different resolution for luminescence and colour components of the pictures. Inertia of Eye. Picture digital signal compression. Compression principles. Structure of video content, video sequence, picture, partition of picture, macro blocks, block, picture element pixel. Spatial dimension of the picture. Basically principles of the vide compression method. I, P and B pictures in video content. Compression on the block level. Cosines and Wavelet transformation. Quantization and in formations loss. Video compression standards JPEG, JPEG 2000, H261, H263, H264, H265, MPEG2 and MPEG4. Video stream content. Huffman coding. Structure of video frame. Spatial and time error expansion during decompression process. Synchronization of video and audio signal. DVB-T and DVB-C.OFDM and broadcasting of digital signals. Digital television. TV monitor as Multimedia terminal.

1. References:

2. F. Halsall: "Multimedia Communications: Applications, Networks, Protocols, and Standards", 1/e 2000 Addison-Wesley
3. J. Crowcroft, M. Handley, I. Wakeman: "Internetworking Multimedia", 1999 Morgan Kaufmann
4. F. Fluckiger: "Understanding Networked Multimedia: Applications and Technology", 1/e 1996 Prentice Hall
5. N. Sharda: "Multimedia Information Networking", 1/e 1999 Prentice Hall
6. R. Steinmetz, K. Nahrstedt: "Media Coding and Content Processing", 2002 Prentice Hall
7. J. Irwin, Chwan-Hwa Wu: "Emerging Multimedia Computer Communication Technologies", 1/e 1998 Prentice Hall

19PEC130

ARTIFICIAL INTELLIGENCE AND NEURAL NETWORKS

Introduction : AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problemformulation.

Searching : Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Greedy best first search, A* search Game Playing: Adversial search, Games, minimax, algorithm, optimal decisions in multiplayer games, Alpha-Beta pruning, Evaluation functions, cutting of search.

Knowledge Representation & Reasons logical Agents, Knowledge – Based Agents, the Wumpus world, logic, propositional logic, Resolution patterns in propos ional logic, Resolution, Forward & Backward. Chaining.

First order logic. Inference in first order logic, propositional Vs. first order inference, unification & lifts forward chaining, Backward chaining, Resolution.

Characteristics of Neural Networks, Historical Development of Neural Networks Principles, Artificial Neural Networks: Terminology, Models of Neuron, Topology, Basic Learning Laws, Pattern Recognition Problem, Basic Functional Units, Pattern Recognition Tasks by the Functional Units.

Feed forward Neural Networks: Introduction, Analysis of pattern Association Networks, Analysis of Pattern Classification Networks, Analysis of pattern storage Networks. Analysis of Pattern Mapping Networks.Feedback Neural Networks,Analysis of Linear Autoassociative FF Networks, Analysis of Pattern Storage Networks.Competitive Learning Neural Networks & Complex pattern Recognition Introduction.

TEXT BOOKS :

1. Artificial Intelligence – A Modern Approach. Second Edition, Stuart Russel, Peter Norvig, PHI/ Pearson Education.
2. Artificial Neural Networks B. Yagna Narayana, PHI

REFERENCES :

1. Artificial Intelligence , 2nd Edition, E.Rich and K.Knight (TMH).
2. Artificial Intelligence and Expert Systems – Patterson PHI.
3. Expert Systems: Principles and Programming- Fourth Edn, Giarrantana/ Riley, Thomson.
4. PROLOG Programming for Artificial Intelligence. Ivan Bratka- Third Edition – Pearson Education.
5. Neural Networks Simon Haykin PHI
6. Artificial Intelligence, 3rd Edition, Patrick Henry Winston., Pearson Edition.

RESEARCH METHODOLOGY AND IPR

Research Methodology: A review of the Fundamentals, Meaning of Research, Definitions of Research, Objectives of Research, Motivation in Research, General Characteristics of Research, Criteria of Good Research, Types of Research, empiricism, deductive and inductive theory. Characteristics of scientific method –Understanding the language of research-Concept, Construct, Definition, Variable, Research Process.

The Research Problem: Scientific Thinking, What is a Research Problem, Selecting the Problem, Sources of the Problem, Defining a Problem, Statement of a Problem, Delimiting a Problem, Evaluation of a Problem

Review of Literature: Meaning of Review of Literature, Need of Review of Literature, Objectives of Review of Literature, Sources of Literature, The Functions of Literature, How to Conduct the Review of Literature, Some Hints for the Review of Literature, Precautions in Library Use, Reporting the Review of Literature,

The Research Hypotheses: Meaning of Hypothesis, Definitions of Hypothesis, Nature of Hypothesis, Functions of Hypothesis, Importance of Hypothesis, Kinds of Hypothesis, Characteristics of a Good Hypothesis, Variables in a Hypothesis, Formulating a Hypothesis, Testing the Hypothesis

The Research Approach: The Philosophical Background, The Qualitative Approach, The Quantitative Approach, The Mixed-Methods Approach, Criteria for Selecting a Research Approach

The Research Strategies: What are the Research Strategies?, Which Strategy to Choose?, Case Studies, Experiments, Ethnography, Phenomenology, Ground Theory (GT), Action Research, Mixed-methods, Longitudinal

Qualitative and Quantitative Research: Qualitative research –Quantitative research

–Concept of measurement, causality, generalization, replication. Merging the two approaches.

Measurement: Concept of measurement–what is measured? Problems in measurement in research –Validity and Reliability. Levels of measurement –Nominal, Ordinal, Interval, Ratio.

Data Collection Methods: Questionnaires, Interviews, Focus Groups, Observation

Sampling: Meaning and Definition of Sampling, Functions of Population and Sampling, Methods of Sampling, Characteristics of a Good Sample, Size of a Sample, The Sample Cycle, Probability Sample –Simple Random Sample, Systematic Sample, Stratified Random Sample & Multi-stage sampling. Determining size of the sample –Practical considerations in sampling and sample size

Data Analysis: Data Preparation –Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis –Cross tabulations and Chi-square test including testing hypothesis of association.

Interpretation of Data and Paper Writing: Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, When and where to publish ?, Ethical issues related to publishing, Plagiarism and Self-Plagiarism, Use of Encyclopedias, Research Guides, Handbook etc., Academic Databases for Computer Science Discipline.

Use of tools / techniques for Research: methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism

Books Recommended:-

1. Business Research Methods –Donald Cooper & Pamela Schindler, TMGH, 9th edition
2. Business Research Methods –Alan Bryman & Emma Bell, Oxford University Press.
3. Research Methodology –C.R.Kothar