ANNEXURE -II

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING, SCHOOL OF STUDIES IN ENGINEERING AND TECHNOLOGY, GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.)

SCHEME OF Pre-PhD, COURSE WORK
EFFECTIVE FROM 2021-22

S.N.	NAME OF SUBJECT	SUBJECT CODE	PERIODS / WEEK L - T - P	ESE DURATION	ESE MARKS		CREDIT
					MAX	MIN	
1.	Research Methodology in Engineering	ECDATT1	3 - 1 - 0	3 Hrs	100	40	4
2.	Elective-I		3 - 1 - 0	3 Hrs	100	40	4
3.	Elective-II		3 - 1 - 0	3 Hrs	100	40	4
4.	Seminar	ECDASC1	-	-	Qualified/Not qualified		-
Total			9 - 3 - 0	9 Hrs	300	165*	12

LIST OF ELECTIVES

S.N.	NAME OF SUBJECT	SUBJECT CODE	S.N.	NAME OF SUBJECT	SUBJECT CODE
1.	Vacuum Technology	ECDATP1	12.	Digital Image Processing	ECDATP12
2.	Sensors Measurement Science & Technology	ECDATP2	13.	Network Security & Cryptography	ECDATP13
3.	Artificial Intelligence	ECDATP3	14	Modern Digital Communication	ECDATP14
4.	Optimization Techniques	ECDATP4	15.	Machine Learning	ECDATP15
5.	Antenna For Modern Wireless Communication	ECDATP5	16.	Optical Communication System	ECDATP16
6.	Wireless Communication & Network	ECDATP6	17.	Next Generation Network	ECDATP17
7.	Finite Element Method	ECDATP7	18.	Advanced Digital Signal Processing	ECDATP18
8.	Introduction to Signal Processing	ECDATP8	19.	Computer Vision	ECDATP19
9.	Introduction to Embedded & IOT System	ECDATP9	20.	Digital Communication Receiver	ECDATP20
10.	Microstrip Antenna	ECDATP10	21.	Optical Instrumentation	ECDATP21
11.	Estimation & Detection Theory	ECDATP11	22.	Satellite Communication	ECDATP22

ESE: End Semester Examination, **L**: Lecture, **T**: Theory, **P**: Practical
Max: Maximum Marks in ESE
Min: Minimum Pass Marks in each subject as 40%

- Duration of the semester will be 6 months.
- *Candidate has to score minimum 55% of aggregate marks to qualify in ESE.
- Two subjects as Electives (4 credits each) can be taken from the list of Electives

RESEARCH METHODOLOGY IN ENGINEERING

SUB CODE	L	T	P	DURATION	ESE	CREDITS
ECDATT1	**03**	**01**	**0**	**3 HRS**	**100**	**4**

Unit 1: Philosophy and Ethics

Introduction to philosophy: nature and scope, concept, branches. Ethics: Definition, moral philosophy, nature of moral judgments and reactions.

Ethics with respect to science and research. Intellectual honesty and research integrity. Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP).Redundant publication duplicate and overlapping publications, salami slicing. Selective reporting and misrepresentation of data.

Unit 2: Errors in Measurements

Types of Errors, Mean Deviation, Standard Deviation and Probable Errors, Propagation of Errors with Summation, Difference, Product and Quotient.

Curve fitting, Method of least square fit, least square fit (straight line) to linear equations and equation reducible to linear equations. Least square fit (parabola) to quadratic equations and equations reducible to quadratic equations.

Unit 3: Data Processing & Analysis

Literature Survey, Defining the equation and formulating hypothesis/hypotheses. Collection of research data, tabulating and cataloging, Sampling and methods of data analysis. Laboratory Safety Measures, Maintenance of equipment's and proper storage and disposal of materials.

Unit 4: Scientific Presentation and Writing Skills

Survey of literature and presentation of data, one seminar paper-preparation in PowerPoint (which include texts, graphs, pictures, tables, references etc.)-Oral in PowerPoint/poster, development of communication skills in presentation of scientific seminars- eye to eye contact, facing the audience, question & answer sessions etc.

Steps to better writing, flow method, organization of material and style, drawing figures, graphs, tables, footnotes, references etc in research paper.

Unit 5: Publication Ethics.

1. Publication ethics: definition, introduction and importance.2. Best practice/standards setting initiatives and guidelines: COPE, WAME, etc. 3. Conflicts of interests 4. Publications misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types 5. Violation of publication ethics, authorship and contributor ship6. Identification of publication misconduct complains and appeals 7. Predatory publishers and journals.

Reference Books

1. D B Resnik, The Ethics of Science: An Introduction, Routledge Publisher, USA (1998).
2. Callahand D & Bok S, Ethics Teaching in Higher Education, Plenum Press, New York, USA (1996).
3. Kanpur J N, Ethical values for excellence in Education and Science, VishwaPrakashan, New Delhi (1996).
4. A. N Tripathi, Human Values, New Age International Publication, New Delhi (2008).
5. A Wilson: Handbook of Science Communication, Institute of Physics publishing, Bristol Philadelphia (1998).
6. Science Communication: Theory and practice; Stocklmayer, Gore MM, Bryant C (Eds), Springer (2002).
7. Laszios P., Communicating Science: A Practical Guide, Springer (2006).
8. C R Kothari, Research Methodology: Methods and Technology, 2nd revised edition, New Age International Publication 2004.
9. K. N. Krishanaswamy, A I Sivakumar, M Mathiranjan, Management Research Methodology: Integration Principles, Methods and Techniques, Pearson Education, New Delhi 2006.
10. C K Sharma, M K Jain; Research Methodology, Shree Publications, New Delhi.

VACUUM TECHNOLOGY

SUB CODE	L	T	P	DURATION	ESE	CREDITS
ECDATP1	**03**	**01**	**0**	**3 HRS**	**100**	**4**

Unit-1: Fundamentals of Vacuum Technology: vacuum nomenclature and definitions, Gas properties, Molecular process and Kinetic theory, Throughput, Pumping speed, Evacuation rate, Out gassing rate, Leak rate, Gas How, Conductance, Flow calculations.

Unit-2: Vacuum generation: Diaphragm pump, Rotary pump, Diffusion pump, Cryogenic pump, Turbo -molecular pump, Sputter-ion pump and Getter pumps.

Unit-3: Vacuum Measurement scale, Gauges and Leak detection: U.H.V. techniques, Mass Spectrometer.

Unit-4: Surface Physics and its Relation to Vacuum Science: Adsorptions, Chemisorptions, Isotherms, Desorption's and Photo-activation.

Unit-5: Materials for Vacuum tubes, Chemical and Thermal Cleaning, Sputtering Techniques, Brazing, Spot, Arc, Electron beam and Laser welding, Vacuum and Protected Atmosphere Furnaces, Jigs and Tools Processing of Electron-Beam Devices.

References Books:

1. Vacuum Science and Technology, V V Rao, T B Ghosh, K L Chopra
2. Vacuum Journal, Science direct, Elsevier Publication
3. Journal of Vacuum Science and Technology A, IEEE Transaction
4. Journal of Vacuum Science and Technology B, IEEE Transaction

SENSORS & MEASUREMENT SCIENCE AND TECHNOLOGY

SUB CODE	L	T	P	DURATION	ESE	CREDITS
ECDATP2	**03**	**01**	**0**	**3 HRS**	**100**	**4**

Unit-1: Generalized Configurations and Functional Descriptions of Measuring Instruments: Functional elements Transducers, Analog and Digital modes of operation, Input-Output configuration of Instruments and Measurement systems, Static and Dynamic Characteristics of Instruments, Static calibration.

Unit-2: Motion Sensor and Measurement: Fundamental Standards, Relative Displacements-Translational & Rotational, Relative Velocity, Relative Acceleration Measurements, Seismic Displacement Pickups, Seismic Velocity Pickups, Seismic Acceleration Pickups.

Unit-3: Force, Torque and Power Measurement Methods of Force Measurement: Elastic Force Transducers, Torque Measurement on Rotating Shafts, Shaft Power Measurement, Vibrating, Wire Force Transducers.

Unit-4: Pressure Measurement: Methods of Pressure Measurements, Deadweight Gages, Manometers, Elastic Transducers, Vibrating Cylinder and other Resonant Transducers, Dynamic Testing of Pressure measuring Systems, High and Low Pressure Measurement systems.

Unit-5: Temperature Measurements: Standards and Calibration, Thermal-Expansion Methods, Thermoelectric Sensors, Electrical-Resistance Sensors, Junction Semiconductor Sensors, Digital Thermometers, Radiation Methods.

References Books:

1. Measurement Systems, E Doebelin, D N Manik, McGraw Hill Publication
2. Sensor Technology Handbook, Jon S Wilson, Elsevier, 2004, ISBN-10: 0750677295
3. Journal of Sensors and Actuators, Science direct, Elsevier Publication
4. Journal of Sensors and Actuators A:Physical, Science direct, Elsevier Publication,

ARTIFICIAL INTELLIGENCE

SUB CODE	L	T	P	DURATION	ESE	CREDITS
ECDATP3	03	01	0	3 HRS	100	4

Unit-1: Definition of Al, Brie(history of Al, General problem Solving Approaches in Al-Learning Systems, Knowledge representation and reasoning, Planning, Knowledge Acquisition, Intelligence search, Logic Programming, Sort computing, Applications of Al techniques, Characteristic requirement for the realization of intelligent system, Programming languages for Al, Architecture for Al machine.

Unit-2: Cognitive perspective of pattern recognition- Template Matching, Prototype matching, feature based approach, Computational approach; Cognitive models of memory Atkinson-Shiffrin's model, Tuiving's model, Parallel distributed processing approach: Understanding of problem; Cybernetic view to cognition.

Unit-3: Production rules, Working memory, Control Unit/Interpreter, Conflict Resolution strategies, Types of production systems-Commutative Production system, Decomposable Production system, Forward verses Backward reasoning, Merits of a Production system-Isolation of knowledge and control strategy, Direct Mapping onto State-space, Modular Structure of Production rules, Knowledge base Optimization in production system.

Unit-4: Production Solving by Intelligent Search. General problem solving approaches- Breadth first search, depth first search, Iterative deepening search, Hill Climbing; Simulated annealing; Heuristic Search- for OR Graph, Iterative deepening algorithm, AND-OR Graph, Adversary Search- MINIMAX algorithm, Alpha-Beta heuristics.

Unit-5: Logic of Propositions and Predicates- Formal definition, Propositional Logic-Semantic method for Ilworern proving, Syntactic method for theorem proving, Resolution in Propositional Logic, Predicate Logic. Unification of Predicates, Robinson's Interference Rule, Types of Resolution, Soundness and Completeness of Logic,

References Books:

1. Artificial Intelligence and Soft Computing, Amil Konar
2. Journal of Artificial Intelligence, Science-Direct, Elsevier Publication
3. IEEE Transaction on Computational Intelligence and AI

OPTIMIZATION TECHNIQUES

SUB CODE	L	T	P	DURATION	ESE	CREDITS
ECDATP4	**03**	**01**	**0**	**3 HRS**	**100**	**4**

Objective: Aims to teach various optimization techniques for wireless communication and antenna design.

Outcome: Understand the fundamental optimization techniques in wireless communication for real time application.

Unit I: Introduction Linear Programming

Linear Programming: Graphical method, simplex method, Non-Simplex Method, revised simplex method, Big-ICI method, 2-phase method, alternate optimal solutions, unbounded LPs, degeneracy and convergence, duality in linear programming, sensitivity analysis, dual simplex method.

Unit II: Non-Linear Programming

Non-Linear Programming: Nonlinear Programming - Elimination methods, Interpolation methods, unconstrained optimization techniques - Direct search methods - Indirect search methods. Constrained Optimization methods - Direct methods, Indirect methods.

Unit III: Dynamic Programming

Dynamic Programming Multistage decision process, Concept of optimization and principle of optimality, computational procedure in dynamic programming

Unit IV: Optimization Methods

Simulated annealing, Particle Swarm optimization, Ant colony optimization, Bee colony optimization, Bat Algorithms, Firefly Algorithms

Unit V: Advanced Topics in Optimization

Advanced Topics in Optimization for wireless communication and antenna design

References books:

1. Singiresu S Rao, "Engineering Optimization: .Theory and Practice", 4th Edition, John Wiley and Sons.. 2009
2. K. Deb, "Optimization for Engineering Design Algorithms and Examples", Prentice-Hall of India Pvt. Ltd., New Delhi, 1995.

3. Edwin K P Chong and Stanislaw S Zak, “An Introduction to Optimization", Fourth Edition. John Wiley and Sons, 2013
4. S. S. Rao, "Engineering Optimization: Theory and practice", New Age International Pvt. Ltd., New Delhi, 2000.

ANTENNAS FOR MODERN WIRELESS COMMUNICATION

SUB CODE	L	T	P	DURATION	ESE	CREDITS
ECDATP5	03	01	0	3 HRS	100	4

Unit 1: Concepts of Radiation and Antenna Fundamentals

Fundamental parameters of antennas, Near and Far Field regions, S Parameters, Antenna Measurements: Radiation pattern, gain, directivity, phase and polarization measurement

Unit 2: Printed Antenna

Microstrip Antennas & Dielectric Resonator Antenna: Radiation mechanism - parameters and applications - feeding methods.

UNIT 3: Reconfigurable Antenna

Reconfigurable methodologies, Design Considerations for Reconfigurable systems, Reconfigurable Planar/printed antenna configurations, Active reconfigurable systems, Concept of Smart Antenna

Unit 4: Array of Antennas

Linear and planar array fundamentals, Mutual Coupling in Arrays, Multidimensional Arrays, Phased Arrays, Array Feeding Techniques, Array optimization techniques

Unit 5: MIMO System

Concept of MIMO: Types of MIMO Systems, Design Parameters of MIMO system.

Reference Books:

1. Jordan E C and Bahl-lain K G, "Electromagnetic Waves and Radiating Systems", 2nd Edition, PL.:arson Education.
2. BaIanis C A, "Antenna Theory: Analysis and Design". 4th Edition, John Wiley and Sons, New Jersey, 2016.
3. Kraus J D and Viarhefka R J, "Antennas for All Applications", 3rd Edition, Tata McGraw Hill, 2001.
4. Girish Kumar and Ray K P, "Broadband Microstrip Antennas", Artech House, 2003.

WIRELESS COMMUNICATION & NETWORK

SUB CODE	L	T	P	DURATION	ESE	CREDITS
ECDATP6	**03**	**01**	**0**	**3 HRS**	**100**	**4**

Unit 1: Overview of wireless communication, cellular communication, different generations of cellular communication system, satellite Communication including, wireless local loop, cordless phone,

Unit 2: Recent wireless technologies: multicarrier modulation, OFDM, MIMO system, diversity-multiplexing trade-off, MIMO-OPOM system, smart-antenna; beamforming and MIMO, cognitive radio,

Unit 3: Multiple access techniques in wireless communication: contention-free multiple access schemes (FDMA TDMA, CDMA, SDMA and Hybrid), contention-based multiple access schemes (ALOHA and CSMA).

Unit 4: Wireless personal area networks (Bluetooth, UWB and Zig-Bee), wireless local area networks (IEEE 802.11, network architecture, medium access methods, WLAN standards

Unit 5: Ad-hoc wireless networks: Design Challenges in Ad-hoc wireless networks, concept of cross layer design, security in wireless networks MANET and WS.N. Wireless system protocols.

Reference Books:

Textbooks:

1. Andrea Goldsmith, "Wireless Communications", Cambridge University Press, 2005.
2. Sanjay Kumar, "Wireless Communication the Fundamental and Advanced Concepts" River Publishers, Denmark, 2015 (Indian reprint).

Reference books:

1. Vijay K Garg, "Wireless Communications and Networks'', Morgan Kaufmann Publishers an Imprint of Elsevier, USA 2009 (Indian reprint)
2. J. Schiller, "Mobile Communication" 2/e, Pearson Education, 2012.
3. Iti Saha vilisra, "Wireless Communication and Networks: 3G and Beyond", 2/e, McGraw Hill (India) Private Ltd, New Delhi, 2013.

FINITE ELEMENT METHOD

SUB CODE	L	T	P	DURATION	ESE	CREDITS
ECDATP7	03	01	0	4 HRS	100	4

Historical background, Basic concept of the Finite Element Method, Basic equation N in el asticity, Elemental shapes, nodes, nodal unknowns and coordinate systems, A general procedure for Finite Element Analysis, Application to the continuum, Discretization of the domain, Governing equations for continuum, Pre-processor, Processer and Post processor.

Basic concept of interpolation functions. Shape function in one, two and three dimension, Finding of shape function by Polynomial, Lagrange polynomial, Serendipity family and Hermite polynomial, Construction of shape function by degrading technique.

Strain displacement and elemental stillness matrix, Assembling stillness equation, boundary conditions and solution, spring and bar elements, direct approach, Strain energy, Castigliano's first theorem, Minimum potential energy, Gaferkin's method and Variational method, Isoparametric formulations.

Finite Element Analysis: liars, Beams Trusses and Rigid frame, Plates and shells, Heat transfer, Fluid and solid mechanics, Introduction to non-linear Finite Element rylcihods, Adaptive finite analysis, Automatic mesh generation, Choice of new mesh. Transfer variables,

Reference Books:

1. Rao S.S., "The Finite Element Method in Engineering", Elsevier Science & Technology.
2. Hutton D.V., "Fundamental of Finite Element Analysis", McGraw Hills.
3. Cook R.D., Malkus, D.S. and Plesha, M.E., "Concepts and Applications of Finite Element Analysis", 3 rd Ed,, John Wiley et Sons.
4. Bathe K.J., "Finite Element Procedures", Prentice I tall of India, New Delhi.
5. Huebner and Thorton, EA., "The Finite Element Methods for Engineers" John Wiley & Sons,
6. Zienewiccz 0.C. and Taylor, RI, “The Finite Element Methods", Vol. I, Vol. 2 and Flo 1.3, McGraw Hill.
7. Belytshko, T., Liu, W.K. and Moran, B., “Non-linear Finite Elements for Continua and Structures", McGraw Hills.

INTRODUCTION TO SIGNAL PROCESSING

SUB CODE	L	T	P	DURATION	ESE	CREDITS
ECDATP8	03	01	0	3 HRS	100	4

Course Objective:

The objectives of the course are to make the students:

1. Review of signal and system, Fourier transforms, the Z-transform
2. To impart knowledge of mathematical concept involved in signal processing.
3. To introduce mathematical modeling for Statistical Signals processing.
4. To apply optimization techniques for signal processing applications.

Unit-I

Discrete and Continuous time signals and systems, LTI systems, Convolution, Difference equations, z-transforms, Fourier transform and its properties.

Unit -II

Sampling and reconstruction, Review of vector spaces, Eigenvectors and Eigen-values. Hilbert transforms, matched filtering, equalization. Coherent and Non-coherent detection.

Unit-III

Probability theory review, Random variables, statistical averages, Random processes, Transmission of random process through an LTI system.

Unit-IV

Statistical Signal Processing: Power Spectrum Estimation Parametric and Maximum Entropy Methods, Wiener, Kalman Filtering, and the Poisson process, Levinson Durbin Algorithms Least Square Method.

Unit -V

Optimization techniques for linear and nonlinear problems, Applications in various areas of signal processing.

Text/Reference Books:

1. Proakis, John G. - Digital signal processing: principles algorithms and applications, PHI.
2. Oppenheim, Alan V - Discrete-time signal processing, Pearson Education India.
3. Vaidyanathan, Parishwad P - Multirate systems and filter banks, Pearson Education India.
4. Monson H. Hayes, “Statistical Digital Signal Processing And Modeling”, 1st Edition, Wiley India Pvt Ltd, 2008.

5. Vaidyanathan, Palghat P- The theory of linear prediction, Morgan and Claypool Publishers.
6. Haykin, Simon S. - Adaptive filter theory, Pearson Education India.
7. Henry Stark and John W. Woods, "Probability and Random Processes with Applications to Signal Processing", Prentice Hall, 3rd Edition 2001
8. Sanjit K. Mitra. "Digital Signal Processing: A computer based approach." McGraw Hill. 1998.
9. Steven M. Kay, "Fundamentals of Statistical Signal Processing, Volume I: Estimation Theory", Prentice Hall, 1993

MOOCs:

1. https://nptel.ac.in/courses/108/108/108108109/
2. https://nptel.ac.in/courses/117/105/117105075/

Course Outcomes:

At the end of the course the student will be able to:

1. Apply the basic concept of frequency domain analysis for signal processing.
2. Utilize the linear analysis concept for signal processing.
3. Describe and apply probability theory concept for random signals.
4. Apply basic statistical signal processing filtering techniques.
5. Design and demonstrate basic optimization techniques for the applications based on signal processing.

INTRODUCTION TO EMBEDDED & IOT SYSTEM

SUB CODE	L	T	P	DURATION	ESE	CREDITS
ECDATP9	**03**	**01**	**0**	**3 HRS**	**100**	**4**

Course Objective:

This course will enable student to:

1. To introduce the Building Blocks of Embedded System
2. To understand the life cycle and applications of embedded system.
3. To understand the fundamentals about IoT, IoT Access technologies and IOT case studies.
4. To understand the design methodology and different IoT hardware platforms.
5. To study the basics of IoT Data Analytics and supporting services.

UNIT-I

Introduction and functioning: Review of Microcontroller concept. Functional block diagram of 8051 microcontroller. Introduction to Embedded system, characteristic of Embedded system. Functional building blocks of embedded systems, processor and controller.

UNIT-II

Life cycles and Applications: Interfacing of memory between analog and digital blocks, interfacing with external systems, Temperature control, stepper motor and keyboard interface. user interfacing, Embedded Life cycle, Water Fall Model , Spiral Model, RAD Model.

UNIT-III:

Introduction to IOT: Definition and characteristics of IOT, Physical design of IOT, Logical design of IOT, IoT Protocols, IoT communication models, IoT Communication APIs, IOT enabling technologies: Wireless Sensor Networks, Cloud Computing, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Agriculture,Industry, and health and life style.

UNIT IV:

IoT and M2M- Software defined networks, network function virtualization, difference between SDNand NFV for IoT, Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER.

Design Methodology, Embedded computing logic, Microcontroller, System on Chips, IoT system building blocks IoT Platform overview: Overview of IoT supported Hardware platforms such as: Raspberry pi, Arduino Board details.

UNIT V:

Data Analytics and Supporting Services: Data Analytics: Introduction, Structured Versus Unstructured Data, Data in Motion versus Data at Rest, IoT Data Analytics Challenges, Data Acquiring, Organizing in IoT/M2M,

Supporting Services: Computing Using a Cloud Platform for IoT/M2M Applications/Services, Everything as a service and Cloud Service Models.

Text/Reference Books:

1. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017

2. Internet of Things – A hands-on approach, ArshdeepBahga, Vijay Madisetti, Universities Press, 2015

3. Internet of Things: Architecture, Design Principles And Applications, Rajkamal, McGraw Hill Higher Education.

4. The Internet of Things – Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi and Wiley, 2012

Course Outcomes:

At the end of this course, students will be able to

1. Understand the basics of Embedded System.
2. Implement the state of the Architecture of an Embedded system.
1. Understand the basics of IoT and Implement the state of the Architecture of an IoT.
3. Understand design methodology and hardware platforms involved in IoT.
4. Understand how to analyze and organize the data.

MICROSTRIP ANTENNA

SUB CODE	L	T	P	DURATION	ESE	CREDITS
ECDATP10	03	01	0	3 HRS	100	4

Course Objective:

This course will enable student to

1. To introduce the basic concept of Rectangular Microstrip Antenna
2. To introduce different Microstrip Antenna feeding techniques
3. To learn different parameters of Rectangular Microstrip Antenna
4. To learn the effect of various parameters on performance of Rectangular Microstrip Antenna
5. To develop the concept of antenna design to control different Antenna characteristics

Unit-1:

Rectangular Microstrip Antenna- Concept, Various Designs, Advantages, Problems, Applications

Unit-2:

Microstrip Antenna feeding techniques- Coaxial feed, Microstrip Line feed, EM Coupled feed, Aperture coupled feed

Unit-3:

Rectangular Microstrip Antenna- Resonance Frequency, Characterization, Design Equations, Design Examples

Unit-4:

Effect of various parameters on performance of Rectangular Microstrip Antenna – Feed point location, Effect of width, Effect of thickness, Effect of probe diameter, Effect of Loss tangent, Effect of Dielectric constant

Unit-5:

Rectangular Microstrip Antenna patterns for different Dielectric constant, Dual Polarization, Effect of finite ground plane, Square and Circular Microstrip Antenna characteristics

Text/Reference Books:

1. Microstrip Antenna Design Handbook, Ramesh Garg, Prakash Bhartia, Inder J. Bahl, A. Ittipiboon
2. Broadband Microstrip Antennas, Girish Kumar, K.P. Ray
3. Microstrip and Printed Antennas: NEW TRENDS, TECHNIQUES AND APPLICATIONS by Debatosh Guha, Yahia M. M. Antar

Course Outcome:

At the end of the semester, the students will be able to

1. Outline the different Microstrip Antenna feeding techniques
2. Outline the basic concept of Smart Antenna
3. Apply the Conceptof different parameters of Rectangular Microstrip Antenna for its design
4. Apply the Conceptof effect of various parameters on performance of Rectangular Microstrip Antenna
5. Apply the Conceptof antenna design to control different Antenna characteristics

ESTIMATION & DETECTION THEORY

SUB CODE	L	T	P	DURATION	ESE	CREDITS
ECDATP11	03	01	0	3 HRS	100	4

Course Objective:

This course will enable student:

1. To teach students the basics of estimation and detection theory.
2. To introduce the students to estimation bounds.
3. To introduce classical and Bayesian estimators like ML, LS, and MMSE to students.
4. To teach hypothesis testing and a number of detectors of signals in noise.
5. To introduce the likelihood ratio test and GLRT. Exposing the students to applications of estimation and detection is another important goal.

UNIT-I

Recap of probability and linear algebra, Introduction of estimation in signal processing, Minimum variance unbiased estimation, Unbiased estimators, Minimum variance criterion,existence of minimum variance unbiased estimator, Cramer-Rao lower bound (CRLB), scalar parameters, Signal in white Gaussian noise.

UNIT-II

Linear models, General minimum variance unbiased estimation, Sufficient statistic, finding minimum variance unbiased estimators, Best linear unbiased estimators (BLUE),Finding the BLUE, Signal processing example.

UNIT-III

MaximumLikelihood Estimators(MLE), finding the MLE, Properties of the MLE, MLE for transformed parameters, Extension to a vector parameter, Introduction to Least Square (LS) Approach, Linear least square estimation, Geometrical interpretations of LS estimation, Some examples.

UNIT-IV

Bayesian estimators, Priors and Posteriors probabilities, Choosing a Prior PDF, General Bayesian estimators, Minimum mean square estimators (MMSE), Maximum A Posteriori (MAP) Estimators, Linear MMSE Estimation.

UNIT-V

Basics of statistical decision theory, Simple hypothesis testing, Likelihood ratio testing, Neyman-Pearson detectors, Detection of known signals in noise, Composite hypothesis testing, Generalized likelihood ratio tests (GLRTs), Deterministic signals with unknown parameters.

Suggested Books & References: -

1. S. M. Kay, "Fundamentals of Statistical Signal Processing: Estimation Theory, vol. I" Prentice-Hall, 1993.
2. S. M. Kay, "Fundamentals of Statistical Signal Processing: Detection Theory, vol. II" Prentice-Hall, 1998.
3. H. Vincent Poor, "An Introduction to Signal Detection and Estimation" Springer, Second Edition, 1998
4. H. L. Van Trees, "Detection, Estimation, and Modulation Theory, Part I," John Wiley, 1968

Course Outcome:

At the end of the semester, the students will be able to

1. Understand the principle of estimation and detection.
2. Learn different estimation and detection techniques like ML, LS, MMSE.
3. Solve problems that involve estimation of the signal parameters or detection of the presence of a signal.
4. Compare and evaluate the performance of different estimation technique in different setups.
5. Apply these skills to solve problems with practical context.

DIGITAL IMAGE PROCESSING

SUB CODE	L	T	P	DURATION	ESE	CREDITS
ECDATP12	03	01	0	3 HRS	100	4

Course Objective:

The objectives of the course are to make the students:

1. To provide the fundamental knowledge on digital image processing.
2. To develop the ability to understand and implement various digital image processing algorithms.
3. To facilitate the students for analyze and implement various real time digital image processing applications.

Unit-I

Image Representation and Image Processing Paradigm: Introduction and signal digitization**,** Pixel relationship, Camera models & imaging geometry.

Image Enhancements: Image operations, Image interpolation, Image transformation, histogram equalization and specifications.

Unit-II

Image Filtering and restoration: Noise models, Image Restoration Spatial and Frequency Domain Filtering, Estimation of Degradation Model and Restoration Techniques.

Unit-III

Color Image Processing: Color models, Color transformations, Color image smoothing and sharpening; Color Segmentation.

Wavelets and Multi-resolution image processing- Background of Wavelet transform, Multi-resolution expansions, wavelet transform in one and two dimensions.

Unit-IV

Image Compression:-Fundamentals and models of Image Compression; Lossless compression; Lossy compression, Image compression standards.

Unit-V

Image Segmentation: Detection of discontinuities, edge linking and boundary detection, thresholding, region-based segmentation, Segmentation Using Morphological Watersheds.

Text/Reference Books:

1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, 3rd Edition, Pearson Education 2010

2. Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India.2nd edition 2011
3. William K. Pratt, Digital Image Processing, 4th edition, John Wiley, 2007.
4. John C. Russ, The Image Processing Handbook, 6th edition, CRC Press,2011
5. Maria M. P. Petrou and Costas Petrou, Image Processing: The Fundamentals, 2nd Edition, John Wiley & Sons, Ltd, 2010.

MOOCs:

1. https://nptel.ac.in/courses/117/105/117105079/
2. https://nptel.ac.in/courses/117/105/117105135/

Course Outcomes:

Upon successful completion of the course, students will be able to

1. Apply the mathematical knowledge for basic understanding for image enhancement
2. Demonstrate image restoration process and its respective filters required.
3. Illustrate the color image processing and various multi-resolution techniques
4. Outline the various image compression techniques and their applications.
5. Design the various image segmentation operations for a meaningful partition of objects

NETWORK SECURITY & CRYPTOGRAPHY

SUB CODE	L	T	P	DURATION	ESE	CREDITS
ECDATP13	03	01	0	3 HRS	100	4

Course Objectives:

This course will enable student to:

1. To provide deeper understanding into cryptography, its application to network security, threats/vulnerabilities to networks and countermeasures.
2. To explain various approaches to Encryption techniques, strengths of Traffic Confidentiality, Message Authentication Codes.
3. To familiarize Digital Signature Standard and provide solutions for their issues.
4. To familiarize with cryptographic techniques for secure communication of two parties over an public channel; verification of the authenticity of the source of a message.

UNIT –I: INTRODUCTION: Security trends, The OSI Security Architecture, Security Attacks, Security Services and Security Mechanisms, A model for Network security. CLASSICAL ENCRYPTION TECHNIQUES: Symmetric Cipher Modes, Substitute Techniques, Transposition Techniques, Rotor Machines, Stenography**.**

UNIT –II: BLOCK CIPHER AND DATA ENCRYPTION STANDARDS: Block Cipher Principles, Data Encryption Standards, the Strength of DES, Differential and Linear Crypt Analysis, Block Cipher Design Principles.

ADVANCED ENCRYPTION STANDARDS: Evaluation Criteria for AES, the AES Cipher. MORE ON SYMMETRIC CIPHERS: Multiple Encryption, Triple DES, Block Cipher Modes of Operation, Stream Cipher and RC4.

INTRODUCTION TO NUMBER THEORY: Prime Numbers, Fermat's and Euler's Theorem, Testing for Primality, The Chinese Remainder Theorem, Discrete logarithms.

UNIT –III:PUBLIC KEY CRYPTOGRAPHY AND RSA: Principles Public key crypto Systems, Diffie Hellman Key Exchange, the RSA algorithm, Key Management, , Elliptic Curve Arithmetic, Elliptic Curve Cryptography.

MESSAGE AUTHENTICATION AND HASH FUNCTIONS: Authentication Requirement, Authentication Function, Message Authentication Code, Hash Function, Security of Hash Function and MACs.

HASH AND MAC ALGORITHM: Secure Hash Algorithm, Whirlpool, HMAC, CMAC.

DIGITAL SIGNATURE: Digital Signature, Authentication Protocol, Digital Signature Standard

UNIT –IV:AUTHENTICATION APPLICATION: Kerberos, X.509 Authentication Service, Public Key Infrastructure.

EMAIL SECURITY: Pretty Good Privacy (PGP) and S/MIME.

IP SECURITY: Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management.

UNIT –V: **WEB SECURITY:** Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET), Intruders, Viruses and related threats.

FIREWALL: Firewall Design principles, Trusted Systems**.**

Text/Reference Books:

1. William Stallings, "Cryptographyand Network security Principles and Practices", Pearson/PHI.
2. Wade Trappe, Lawrence CWashington, "Introduction to Cryptographywith coding theory", Pearson.
3. W. Mao, "Modern Cryptography – Theory and Practice", Pearson Education.
4. Charles P.Pfleeger, Shari Lawrence Pfleeger – Securityin computing –Prentice Hall of India.

Course Outcomes:

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

1. Identify basic security attacks and services and Use symmetric and asymmetric key algorithms for cryptography
2. Design a security solution for a given application
3. Analyze Key Management techniques and importance of number Theory.
4. Understanding of Authentication functions the manner in which Message Authentication Codes and Hash Functions works.
5. To examine the issues and structure of Authentication Service and Electronic Mail Security

MODERN DIGITAL COMMUNICATION

SUB CODE	L	T	P	DURATION	ESE	CREDITS
ECDATP14	03	01	0	3 HRS	100	4

Course Objective:

This course will enable student to:

1. Understand and appreciate the need of various modulation and spread spectrum techniques.
2. Analyze the properties of basic Modulation techniques and apply them to Digital Communication
3. Apply different types of coding techniques to design the optimum receiver for channels with ISI and AWGN.
4. Design and develop the different types of modulation techniques, equalizer to improve the performance under fading channels for various applications.

UNIT I

Baseband Modulation: Line coding - types, criterions for choosing a line code, power spectra. Matched filter – maximization of output SNR, properties, RF and baseband design, integrate and dump filter. Signal space representation, Gram-Schmidt orthogonalization, correlation receiver, equivalence of matched filter and correlation receiver. Baseband transmission of digital signal, eye pattern, intersymbol interference, Nyquist criterion for zero ISI. Pulse Shaping - raised cosine filtering. Correlative coding – duobinary coding, modified duobinary coding, generalized partial response signaling.

UNIT II

Optimum receivers: channels with ISI and AWGN, linear equalization and decision feed back equalization, adaptive linear and adaptive decision feedback equalizer.

UNIT III

Passband Transmission: Signal space and mathematical representation, transmitter, receiver (coherent and non coherent detection), Carrier modulation – Linear modulation schemes: M-ary ASK, PSK, QAM, FSK etc. Nonlinear Modulation schemes: CPFSK, MSK, GMSK . Non coherent modulations schemes: DPSK Spectral properties of various modulation schemes and their comparison. probability of error for various modulation schemes in AWGN channel. Clock and carrier recovery, synchronization issues.

UNIT IV

Error Control Codes: Examples of the use of error control codes, basic notions, Characterization of Error control codes performance of error control codes, comparison of uncoded and coded systems.

Linear Block Codes, Cyclic Codes. Convolution Coding, Representation, properties of convolution codes, Reed Solomon coding, Interleaving and concatenated codes, Turbo Codes.

UNIT V

Spread Spectrum Signals for Digital Communication: Model of spread spectrum digital communication system, Direct sequence spread spectrum signals, Frequency hopped spread spectrum signals, CDMA, Time hopping SS, Synchronization of SS systems.

Text/Reference Books:

1.Bernard Sklar, "Digital Communication, Fundamentals and Application", Pearson Education Asia, 2nd Edition, 2001.

2. Simon, Hinedi, Lindsey, "Digital Communication Techniques, Signal Design and Detection", Prentice Hall of India Private Limited, New Delhi - 11, 1999.

3. John .G.Proakis, "Digital Communication", McGraw Hill Inc 2001.

4. Simon Haykin, "Digital Communications", John Wiley and Sons, 1998.

5. B.P.Lathi, "Modern Digital and Analog and communication systems", 3rd Edition Oxford university press 1998.

Course Outcomes:

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

1. Understand baseband data transmission over AWGN and band-limited channels
2. Understand and explain different digital modulation schemes
3. Analyze the performance of optimum receivers for different modulation schemes for AWGN channels
4. Analyze different techniques for carrier recovery and symbol synchronization in signal demodulation.
5. Understand and explain the concepts of spread spectrum for digital communication system.

MACHINE LEARNING

SUB CODE	L	T	P	DURATION	ESE	CREDITS
ECDATP15	03	01	0	3 HRS	100	4

Course Objective:

The objectives of the course are to make the students:

1. To provide foundation for Machine learning.
2. Introduce the concept of learning patterns from data.
3. Introduce the linear regression technique and SVM
4. Introduce the basic neural network and concept behind deep learning.
5. Introduce a few standard clustering techniques.

Unit I:

Introduction, Basic definitions, types of learning, hypothesis space and inductive bias, evaluation, cross-validation. Linear regression, Decision trees, overfitting

Unit II:

Instance based learning, Feature reduction, Collaborative filtering based recommendation. Probability, Probability and Bayes learning.

Unit III:

Supervised Learning, Logistic Regression, Support Vector Machine(SVM), Kernel function.

Unit IV:

Neural network, Perceptron, multilayer network, back propagation, introduction to deep neural network.

Unit V:

Computational learning theory, PAC, Sample complexity, VC Dimension, Ensemble learning. Clustering: k-means, adaptive hierarchical clustering, Gaussian mixture model.

Text Books/References:

1. "Machine Learning: A Probabilistic Perspective" Book by Kevin P. Murphy, The MIT Press, 2012.
2. "Pattern Recognition and Machine Learning " Book by Christopher M. Bishop, Springer, 2011
3. Tom Mitchell, Machine Learning, McGraw Hill, 2017.
4. T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, 2e, 2011.
5. Yuxi (Hayden) Liu, "Python Machine Learning by Example", Packet Publishing Limited, 2017.

MOOCs:

1. https://nptel.ac.in/courses/106/105/106105152/
2. https://nptel.ac.in/courses/106/106/106106198/
3. https://nptel.ac.in/courses/106/106/106106139/

Course Outcomes:

After completion of course, students would be able to:

1. Identify and classify elementary machine learning concepts.
2. Apply Bayesian concepts in learning data.
3. Apply support vector machine concept on discrete data set.
4. Explain neural networks and identify the role of deep learning in a large data set.
5. Apply basic clustering techniques for a given data set

OPTICAL COMMUNICATION SYSTEM

SUB CODE	L	T	P	DURATION	ESE	CREDITS
ECDATP16	03	01	0	3 HRS	100	4

Course Objective:

1. To understand the transmission mechanism of optical fiber communication system .
2. To understand the working of light source.
3. To introduce the concept of optical detector and various parameter associated with it.
4. To get the concept of design of system link and its characteristics.
5. To introduce the concept of optical fiber cable and working principle of amplifier.

Unit 1

Introduction to Guided optical communication system : Review of Unguided optical communication system, Guided optical communication, Optical Fibres Types, Materials, Elements, Fabrication techniques. Signal degradation

Unit 2

Sources for communication: Review of LED, modulation circuits, Laser Diode, Opto mechanical switches, Photonic & digital switches.

Unit 3

Detectors for communication: Noise Sources, Noise in Optical detector, Receiver noises preamplifiers, Low impedance, High impedance, Trans impedance amplifiers.

Unit 4

System design considerations: Multiplexing, regenerative repeaters, Link Power Budget Analysis, Line coding, Coherent systems homodyne and heterodyne detection.

Unit 5

Optical fiber cable componenets and amplifier. Optical Fiber Cables, Connectors, Joints, Splicers, Couplers, Fiber amplifiers, Raman Fiber Amplifier, Brillowin fiber Amplifier, Solitons Communication.

Text Books:

1. Optical Fiber Communication G Keiser (4th Ed, TMH)
2. Optical Fiber Communications J M Senior (Pearson Publication)

References Books:

1 Introduction to Optical Fibre Communication Suematsu and Iga, (John Wiley)

2 Fiber Optic Communication – Joseph C Palais, (PHI)
3 Optical Communication Components and Systems – J H Franz, V K Jain (Narosa Publishing House)
4 Optical Fiber Communication Systems J Gowar (Prentice Hall India,)
5 Fiber Optic Communication Systems D C Agarwal (S Chand).
6 An Introduction to Fiber Optic Systems – John Powers(McGraw Hill Irwin)
7 Fiber optic Communications Technology – Djafar K Mynbaev & Lowell L Scheiner, (Pearson Education)

Course Outcomes:

At the end of the semester students will be able to

1. Outline the performance of OFC system.
2. Distinguish between various emission approaches and also light source based on it
3. Outline the noise performance of optical detector.
4. Outline the design of system link and performance of the OFC system.
5. Distinguish between the working of electrical and optical amplifier and analyse the performance of optical amplifiers.

NEXT GENERATION COMMUNICATION TECHNOLOGIES

SUB CODE	L	T	P	DURATION	ESE	CREDITS
ECDATP17	03	01	0	3 HRS	100	4

Course Objective:

1. Tolearn the new communication technologies such as OFDM, MIMO, and massive MIMO used in Next Generation communication systems.
2. To analysis the performance such as capacity/spectral efficiency and energy efficiency of the MIMO and massive MIMO system.

UNIT – I

Introduction and Preliminaries: Introduction to point-to-point Multi-input Multi-output (MIMO), multiuser MIMO, massive MIMO, Coherence Time, Coherence Bandwidth, Coherence Interval.TDD Coherence Interval structure, Coherence Interval in the context of OFDM modulation, Small-scale and Large-scale fading, Normalized signal model, and SNR.

UNIT –II

OFDM: Principle of Orthogonal Frequency Division Multiplexing (OFDM), Multiple access – OFDMA, Implementation of transceivers, Frequency-selective channels, Cyclic Prefix (CP), Performance in the frequency-selective channel, Pilot based channel estimation, Peak-to-average power ratio, Inter-carrier-interference, Parameter adaptation.

UNIT –III

MIMO Systems: Introduction to MIMO systems, Diversity in wireless channel, Introduction to fading distributions, Analytical MIMO channel models, Independent and identically distributed (uncorrelated) MIMO fading model, Fully correlated MIMO channel model, MIMO channel parallel decomposition.

UNIT –IV

MIMO Channel Capacity and Power Allocation: Power allocation in MIMO systems, Uniform power allocation, Adaptive power allocation, MIMO channel capacity, Capacity of i.i.d. Rayleigh fading MIMO channels, Capacity of separately correlated Rayleigh fading MIMO channel.

UNIT –V

Massive MIMO Systems: Definition of Massive MIMO, Correlated Rayleigh fading, Uplink, and downlink system model, Impact of Spatial channel correlation, Channel hardening and favorable propagation, Pilot transmission and channel estimation, Spectral Efficiency (SE), Transmit

precoding and Receive decoding, Single-cell uplink and downlink SE expressions, Asymptotic analysis, Energy efficiency.

Text Books/References:

1. D. Tse and P. Vishwanath, "Fundamentals of Wireless Communications," Cambridge Univ. Press, 2005.
2. J. Goldsmith, "Wireless Communications," Cambridge Univ. Press, 2005.
3. R. S. Kshetrimayum, "Fundamentals of MIMO Wireless Communications,"Cambridge University Press,2017.
4. T. L. Marzetta, E. G. Larsson, H. Yang, and H. Q. Ngo, "Fundamentals of Massive MIMO," Cambridge Univ. Press, 2016.
2. Emil Björnson, Jakob Hoydis, and Luca Sanguinetti, "Massive MIMO Networks: Spectral, Energy, and Hardware Efficiency," Foundations and Trends® in Signal Processing: Vol. 11: No. 3-4, pp 154-655 (2017).

Course Outcome:

1. The student will learn and understand the different physical layer wireless communication technologies used in 4G and 5G communication systems.
2. The student will be able to apply the concept of Coherence Bandwidth, Coherence Time, Coherence Interval, Small-scale and Large-scale fading to analyze the physical layer performance of 4G and 5G communication systems.
3. The student will evaluate the channel capacity of the MIMO and massive MIMO Systems.
4. The student will analyze the communication system performance under OFDMA.
5. The student will evaluate the spectral efficiency and energy efficiency of massive MIMO technology used in 5G.

ADVANCED DIGITAL SIGNAL PROCESSING

SUB CODE	L	T	P	DURATION	ESE	CREDITS
ECDATP18	03	01	0	3 HRS	100	4

Course Objective:

The objectives of the course are to make the students:

1. To impart knowledge about the sampling / reconstruction of signals and their analysis in frequency domain
2. To introduce the fundamental concepts for filter designs, and multi-rate processing.
3. To enable the students to understand the efficient algorithms and their use in real time implementation

Unit-1

Multirate Digital Signal Processing: Decimation and Interpolation, Applications of multirate signal processing, Digital filter banks, two channel quadrature mirror filter banks.

Unit-2

Linear prediction and Optimum Linear Filters: Random signals, Stationary Random Process. Forward and Backward Linear Prediction, The Levinson-Durbin Algorithm. Properties of the Linear Prediction-Error Filters.

Unit-3

Adaptive filters: Applications of Adaptive Filters-Adaptive Channel Equalization, Adaptive noise cancellation, Linear Predictive coding of Speech Signals, Adaptive direct form filters.

Unit-4

Power Spectrum Estimation: Parametric and Non parametric Methods for Power Spectrum Estimation, Methods for the AR Model Parameters, ARMA Model for Power Spectrum Estimation.

Unit-5

Wavelet Transform: Origin of Wavelets, Wavelets and other reality transforms History and future of wavelets, Short Time Fourier Transform, Continuous Wavelet, and Discrete Wavelet Transform

Text/Reference Books:

1. John G. Proakis, Dimitris G. Manolakis, “Digital Signal Processing, Principles, Algorithms and Applications”, Pearson, Fourth edition, 2007.
2. S. Haykin, “Adaptive Filter Theory” Prentice Hall, Englewood Cliffs, NJ, 1991.
3. K P Soman, Ramachandran, Resmi, “Insight into Wavelets- from Theory to Practice”, PHI, Third Edition, 2010.

4. P.P.Vaidyanathan, “Multi rate systems and filter banks”, Prentice Hall, 1993.
5. S.Mallet,“A Wavelet tour of Signal Processing”, Academic Press, 1998.

MOOCs:

1. https://nptel.ac.in/courses/117/105/117105075/
2. https://nptel.ac.in/courses/117/101/117101123/
3. https://nptel.ac.in/courses/117/101/117101001/

Course Outcomes:

At the end of the course the student will be able to:

1. Apply knowledge of Multi-rate signal processing and concept of decimators and interpolators.
2. Analyze the signals using prediction based filtering
3. Design adaptive filters for a given application
4. Implement various estimation algorithm for signal analysis
5. Understand advanced signal processing techniques, including wavelet transform

COMPUTER VISION

SUB CODE	L	T	P	DURATION	ESE	CREDITS
ECDATP19	03	01	0	3 HRS	100	4

Course Objective:

The objectives of the course are to make the students:

- To provide the fundamental concept of Computer Vision.
- To develop understanding about stereo vision concepts.
- To identify and analyze various features and its extraction techniques in an Image.
- To study basic motion detection and object tracking.
- To Design and develop vision based basic applications.

Unit-I

Image Formation Models: Fundamentals of Image processing and Linear algebra, 2-D Projective Geometry, Homography and Properties of homography, Camera Geometry.

Unit-II

Stereopsis: Camera and Epipolar Geometry; 3-D reconstruction framework; Camera-calibration, Stereo Vision.

Unit-III

Image Descriptors and Features: Texture, Colour, Edge, Histogram of Oriented Gradients (HOG), Scale Invariant Feature Transform (SIFT), Speeded up Robust, Features(SURF).

Unit-IV

Motion Detection and Estimation: Background Subtraction and Modelling, Optical Flow, Kanade–Lucas–Tomasi (KLT), Motion Tracking in Video. Mean Shift and Cam shift object Tracking. **Fundamental Pattern Recognition Concepts**: Classification & Clustering.

Unit-V

Applications of Computer Vision: Medical Images, Biometrics, Image Fusion, Document Image Processing, OCR. Deep Neural Architecture and Applications.

Text Books/References Books:

1. D. Forsyth and J. Ponce,"Computer Vision - A modern approach", 2nd Edition, Pearson Prentice Hall, 2012
2. Szeliski, Richard, "Computer Vision: Algorithms and Applications", 1st Edition, SpringerVerlag London Limited, 2011.

3. Richard Hartley and Andrew Zisserman, “Multiple View Geometry in Computer Vision”, 2nd Edition, Cambridge University Press, 2004.
4. K. Fukunaga,“Introduction to Statistical Pattern Recognition”,2ndEdition, Morgan Kaufmann, 1990.
5. Rafael C. Gonzalez and Richard E. Woods,” Digital Image Processing”, 3rd Edition, Prentice Hall, 2008.
6. B. K. P. Horn, “Robot Vision”, 1st Edition, McGraw-Hill, 1986.
7. E. R. Davies“Computer and Machine Vision: Theory, Algorithms, Practicalities”, 4th Edition, Elsevier Inc,2012.

MOOCs:

1. https://nptel.ac.in/courses/106/105/106105216/
2. https://nptel.ac.in/courses/106/106/106106224/

Course Outcome:

At the end of this course, students will be able to

1. Explain the concept behind Image formation and camera models.
2. Comprehend the concept of calibration and stereo vision.
3. Identify and extract features in Images
4. Apply basic level object tracking techniques in frame sequence.
5. Identify vision relevant problems and Develop vision-based applications.

DIGITAL COMMUNICATION RECEIVER

SUB CODE	L	T	P	DURATION	ESE	CREDITS
ECDATP20	03	01	0	3 HRS	100	4

Course Objective:

1. To gain knowledge about basic principles of digital communication techniques and Detection of Binary Signal in Gaussian Noise.
2. To gain knowledge about Coherent and Non-coherent Detection
3. To gain knowledge about receivers for AWGN channel and Fading channels.
4. To gain knowledge about concepts of synchronization and
5. To gain knowledge about concepts of adaptive equalization techniques.

Unit-I

Review of Digital Communication Techniques: Base band communication; signal space representation, linear and nonlinear modulation techniques, Error tracking and Spectral characteristics of digital modulation.

Detection of Binary Signal in Gaussian Noise: Detection of Binary signal in Gaussian Noise: Maximum Likelihood Receiver Structure, The Matched Filter, Correlation Realization of Matched Filter, Optimum error performance, Error performance of Binary Signaling.

Unit-II

Coherent and Noncoherent Detection: Coherent Detection: Coherent Detection of PSK,Sampled Matched Filter, Coherent Detection of Multiphase Shift Keying, Coherent Detection of FSK. Noncoherent Detection: Detection of Differential PSK, Binary Differential PSK example, Noncoherent Detection of FSK, Required Tone Spacing for Noncoherent Orthogonal FSK.

Unit-III

Optimum Receivers for AWGN Channel: Correlation demodulator, matched filter, maximum likelihood sequence detector, optimum receiver for CPM signals, M-ary orthogonal signals, envelope detectors for M-aryand correlated binary signals.

Receivers for Fading Channels: Characterization of fading multiple channels, statistical models, flat and frequency selective fading, diversity technique, Optimal receivers for data detection, coded waveform for fading channel.

Unit-IV

Synchronization Techniques: Carrier and signal synchronization, carrier phase estimation-PLL, Decision directedloops, symbol timing estimation, maximum likelihood and non-decision directed timing estimation, joint estimation.

Unit-V

Adaptive Equalization: Zero forcing algorithm, LMS algorithm, adaptive decision-feedback equalizer and Equalization of Trellis-coded signals. Kalman algorithm, blind equalizers and stochastic gradient algorithm.

Text Books:

1. Digital Communications, 2ndEd, Bernard Sklar, Pearson Education, 2001.
2. Digital Communication Microwave Applications By Kamilo Feher, PHI, 1987.
3. Heinrich Meyer, Mare Moeneclacy, Stefan.A.Fechtel, " Digital communication receivers ", Vol I & Vol II, John Wiley, New York, 1997.
4. H.Meyr & G.Ascheid, Synchronization in Digital Communications, John Wiley, 1990
5. Simon Marvin, "Digital communication over fading channel; An unified approach to performance Analysis ", John Wiley, New York, 2000.
6. U. Mengali & A.N.D"Andrea, Synchronization Techniques for Digital Receivers, Kluwer, 1997

Reference Books:

1. Digital Communication, Prokis, John G. Tata McGraw Hill.
2. Digital Communication Technique, Signal Design & Detection By Simon, Marvin K, Hinedi,Sami M & Lindsey, William C, PHI.
3. Heinrich Meyer, Mare Moeneclacy, Stefan.A.Fechtel, " Digital communication receivers ", Vol I & Vol II, John Wiley, New York, 1997.
4. H.Meyr & G.Ascheid, Synchronization in Digital Communications, John Wiley, 1990
5. John.G.Proakis, "Digital communication "4th Edition, McGraw-Hill, New York, 2001.
6. R.G. Gallager, "Principles of Digital Communication", New York, Cambridge University Press, 2008

Course Outcomes:

At the end of this course students will able to:

1. Analyse concept of basic modulation technique and detection technique of Binary Signal in Gaussian Noise
2. Apply concept of Coherent and Non-Coherent detection technique.
3. Design the optimum receiver for AWGN channels and Analyse concept ofReceivers for Fading Channels
4. Apply Synchronization Techniques for Receivers and various estimation techniques
5. Design and develop the different types of equalizers

OPTICAL INSTRUMENTATION

SUB CODE	L	T	P	DURATION	ESE	CREDITS
ECDATP21	03	01	0	3 HRS	100	4

Course Objective:

1. To understand the measuring methods and instruments of electrical quantities.
2. To understand the concept of optical instrumentation.
3. To get the concept of optical switching and various instruments.
4. To get the concept of optical fiber sensors.
5. To get the measurement concept of optical instrumentation.

UNIT-I

Performance characteristics of instruments: Instrument characteristics - accuracy, resolution, precision, expected value, error and sensitivity. Errors in measurement, speed of response, fidelity, lag and dynamic error.

UNIT-II

Optical Instruments: Interferometric configurations, MachZender, Michelson and FabriPerot configurations components and construction, OTDR and applications.

UNIT-III

Fiber optic components and devices : Direction couplers, beam splitters, switches modulations, connectors, polarizer, polarization controllers, amplifiers, wavelength filters, wavelength division multiplexers, fiber optic isolators.

UNIT-IV

Fibre optic sensors: General features, intensity sensors, simple fibre-based sensors for displacement, temperature and pressure. Fibre Bragg grating based sensors.

UNIT-V

Measurements methods in optical fiber : General experimental consideration, pulse dispersion and bandwidth, Cut off wavelength, mode field diameter and birefringence of single mode fiber.

Text/Reference Books:

1. B. P. Pal : Fundamentals of Fibre Optics in Telecommunication and Sensor Systems, New Age, New Delhi.
2. K. Ghatak and K. Thyagarajan, Introduction to Fiber Optics, Cambridge.
3. S.M. Senior : Optical Fibre Communication: Principles and Practice, PHI, New Delhi.
4. A.K.Ghatak, M.R. Shenoy : Fibre Optics Measurements, Viva, New Delhi.

Course Outcomes

At the end of the semester students will be able to

1. To understand the measuring methods and instruments of electrical quantities.
2. To understand the concept of optical instrumentation.
3. •To get the concept of optical switching and various instruments.
4. •To get the concept of optical fiber sensors.
5. To get the measurement concept of optical instrumentation.

SATELLITE COMMUNICATION

SUB CODE	L	T	P	DURATION	ESE	CREDITS
ECDATP22	03	01	0	3 HRS	100	4

Course Objective:

1.To know the evolution of Satellite communication and its concept

2. To know the orbital mechanism and different satellite subsystems.

3. To know the role of different factors affecting satellite and link budget equation.

4. To know the various types of multiple access techniques for satellite communication.

5. To know the basics and details of Earth station.

UNIT-I

An overview of satellite communication, Satellite orbits, Kepler's law, Orbital Elements, Eclipse effect, Sun transit outage, Placement of a satellite in a geostationary orbit, Station keeping and Stabilization.

UNIT-II

Satellite Link Design: Basic transmission theory, Friss transmission equation, EIRP, Completion Link design, System noise temperature G/T ratio, Noise figure and Noise temperature.

UNIT-III

Communication Satellite Subsystems: Space Platform (Bus) and Communication Subsystem (Payload), Satellite Antennas, Frequency reuse Antennas.

UNIT-IV

Earth Stations: Earth station antennas, Tracking, Equipment for earth stations, Equipment Reliability and Space qualification

UNIT-V

Analogue Satellite Communication Vs Digital Satellite Communication, Multiple Access Techniques : FDMA Concept, MCPC & SCPC, TDMA frame efficiency and super frame structure, Frame Acquisition and Synchronisation, CDMA concept, PN system, Spread spectrum, DSSS, DS CDMA, FHSS, FH CDMA.

Text/Reference Books:

1. "Satellite Communication", T. Pratt & C. W. Bostian.

2. "Digital Satellite communication", Tri T. Ha, McGraw Hill.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Visualize the architecture of satellite systems as a means of high speed, high range communication system.
2. State various aspects related to satellite systems such as orbital equations, sub-systems in a satellite, link budget.
3. Solve numerical problems related to orbital motion and design of link budget for the given parameters and conditions.
2. Explain how satellite is controlled to become stationary w.r.t a point on the earth.
3. Explain how a single satellite is shared by large number of earth stations on the earth by using multiple access schemes.