List of New Course(s) Introduced

Department : *Electronics and Communication Engineering*

Programme Name : *B.Tech.*

Academic Year : 2021-22

List of New Course(s) Introduced

Sr. No.	Course Code	Name of the Course
1	EC205TPC09	Digital Communication
2	EC206TPC11	CMOS Digital VLSI Design
3	EC206TPC12	Data Communication & Computer Networks
4	EC206TPC13	Microprocessor & Microcontroller
5	EC206TES07	Electronic Measurements and Sensors
6	EC206TPE02	Advance Signal Processing
7	EC206TPE03	Renewable Energy Sources
8	EC07TPE09	Digital Image Processing
9	EC07TPE10	Analog & Digital VLSI
10	EC07TPE11	Estimation and Detection Theory
11	EC07TPE12	Advanced Power Electronics
12	EC07TPE15	Machine Learning
13	EC08TPE16	Millimeter Wave Technology
14	EC08TPE17	Video Processing
15	EC08TPE18	Biomedical Electronics
16	EC08TPE19	Next Gen. Comm. Technology
17	EC08TOE05	Intellectual Property Rights
18	EC08TOE07	Introduction to IOT
19	ECPATT1	Linear Algebra
20	ECPATT2	Wireless Communication & Network
21	ECPATT3	Optoelectronic Devices
22	ECPATP1	Introduction to Signal Processing
23	ECPATP2	Introduction to Embedded & IOT System
24	ECPATP3	Microstrip Antenna
25	ECPATP4	Estimation & Detection Theory
26	ECPATP5	Digital Image Processing
27	ECPATP6	Network Security & Cryptography

28	ECPATP7	Modern Digital Communication
29	ECPATP8	Antenna for Modern wireless Communication
30	IPPATC1	Research Methodology & IPR
31	ECPALT1	Optoelectronic Device Laboratory
32	ECPBTT1	Advanced VLSI Fabrication
33	ECPBTT2	Millimeter Wave Technology
34	ECPBTP1	Machine Learning
35	ECPBTP2	Optical Communication System
36	ECPBTP3	Next Generation Communication Technologies
37	ECPBTP4	Advanced Digital Signal Processing
38	ECPBTP5	Computer Vision
39	ECPBTP6	Digital Communication Receiver
40	ECPBTP7	Optical Instrumentation
41	ECPBTP8	Satellite Communication
42	MSPBTO1	Business Analysis
43	IPPBTO2	Industrial Safety
44	IPPBTO3	Operations Research
45	CEPBTO4	Cost Management of Engineering Projects
46	MEPBTO5	Composite Materials
47	CHPBTO6	Waste to Energy
48	ECPBTO7	Internet of Things
49	ELPBTX1	English for Research Paper Writing
50	PEPBTX2	Stress Management by Yoga
51	CEPBTX3	Disaster Management
52	LAPBTX4	Constitution of India
53	ECPBLT1	Wireless Communication laboratory
54	ECPBLT2	RF & Microwave Component Design Laboratory
55	ECPCPT1	Dissertation Stage–I
56	ECPDPT1	Dissertation Stage–II
57	ECDATP8	Introduction to Signal Processing
58	ECDATP9	Introduction to Embedded & IOT System
59	ECDATP10	Microstrip Antenna
60	ECDATP11	Estimation & Detection Theory
61	ECDATP12	Digital Image Processing
62	ECDATP13	Network Security & Cryptography

63	ECDATP14	Modern Digital Communication
64	ECDATP15	Machine Learning
65	ECDATP16	Optical Communication System
66	ECDATP17	Next Generation Network
67	ECDATP18	Advanced Digital Signal Processing
68	ECDATP19	Computer Vision
69	ECDATP20	Digital Communication Receiver
70	ECDATP21	Optical Instrumentation
71	ECDATP22	Satellite Communication

विभागाध्यक्ष (इलें. एवं संचार अभियाँत्रिकी)
H.O.D. (Elect. & Comm. Engineering)
प्रौद्योगिकी संस्थान
Institute of Technology
गु. घा. वि., बिलासपुर (छ.ग.)
G. G. V. Bilaspur (C.G.)

STRESS MANAGEMENT BY YOGA

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
PEPBTX2	2	0	0	2 hours	40	60	100	2

Course Outcomes:

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

1. Develop healthy mind in a healthy body thus improving social health also.
2. Improve efficiency

Syllabus Contents:

- Definitions of Eight parts of yog. (Ashtanga).
- Yam and Niyam, Do's and Don't's in life, i) Ahinsa, satya, astheya, bramhacharya and aparigraha, ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan.
- Asan and Pranayam, i) Various yog poses and their benefits for mind &body, ii) Regularization of breathing techniques and its effects-Types of pranayam.

References:

1. 'Yogic Asanas for Group Tarining-Part-I" :Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata.

DISASTER MANAGEMENT

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
CEPBTX3	2	0	0	2 hours	40	60	100	2

Course Outcomes:

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

1 Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.

2 Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives

3 Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations

4 Critically understand the strengths and weaknesses of disaster management approaches,

planning and programming in different countries, particularly their home country or the countries

they work in

Syllabus Contents:

- Introduction Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.
- Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.
- Disaster Prone Areas in India, Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with special reference to Tsunami; Post-Disaster Diseases and Epidemics.
- Disaster Preparedness and Management: Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and other agencies, Media Reports: Governmental and Community Preparedness.
- Risk Assessment: Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk

CONSTITUTION OF INDIA

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
LAPBTX4	2	0	0	2 hours	40	60	100	2

Course Outcomes:

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

1 Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.

2 Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.

3 Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.

4 Discuss the passage of the Hindu Code Bill of 1956.

Syllabus Contents:

- History of Making of the Indian Constitution: History Drafting Committee, (Composition & Working).
- Philosophy of the Indian Constitution: Preamble, Salient Features
- Contours of Constitutional Rights & Duties: Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.
- Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, appointment and Transfer of Judges, Qualifications, Powers and Functions.
- Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: ZilaPachayat. Elected officials and their roles, CEO ZilaPachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.
- Election Commission: Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.

References:

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.

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:

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

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.

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

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

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.

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.

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)

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

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.

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.

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.

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.

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