Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Information Technology, Pune-48

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Syllabus for

F.Y. M.Tech. (E&TC)

(Pattern 2018: R1)

w.e.f: A.Y. 2019-20

Department of Electronics & Telecommunication Engineering

VISION:

- Excellence in Electronics & Telecommunication Engineering Education

MISSION:

- Provide excellent blend of theory and practical knowledge. sustainable development of society
- Establish centre of excellence in post graduate studies and research.
- Prepare engineering professionals with highest ethical values and a sense of responsible citizenship.

First Year M. Tech. (FYMT)
(Electronics and Telecommunication Engineering) Semester I
(Pattern 2018: R1)

Course Code	Course	Course Type	Teaching Scheme		Examination Scheme					Total	Credits
					Formative Assessment			Summative Assessment			
			L	P	ISE		CE	ESE	OR		
					T1	T2					
ETPA11181	Image and Video Processing	TH	3	-	20	10	20	50	-	100	3
ETPA11182	Advanced Embedded Processors and Programming	TH	3	-	20	10	20	50	-	100	3
ETPA11183	Program Elective I	TH	3	-	20	10	20	50	-	100	3
ETPA11184	Program Elective II	TH	3	-	20	10	20	50	-	100	3
ETPA11185	Laboratory I	CE-OR	-	4	-	-	50	-	50	100	2
ETPA11186	Laboratory II	CE-OR	-	4	-	-	50	-	50	100	2
ETPA11187	Research Methodology & IPR	CE	2	-	-	–	50	-	--	50	2
ETPA11188	Program Elective III	CE	3	-	-	–	50	-	--	50	3
AP1	Audit Course I	AU	-	-	-	-	-	-	-	-	-
	Total		17	8	80	40	280	200	100	700	21

Course code	Program Elective I
ETPA11183A	Artificial Intelligence
ETPA11183B	Advanced Digital Signal Processing
ETPA11183C	Biomedical Signal Processing

Course code	Program Elective II
ETPA11184A	IOT and applications
ETPA11184B	Data Networks and Security
ETPA11184C	Joint Time Frequency Analysis

Course code	Program Elective III
ETPA11188A	Image and Video Compression
ETPA11188B	Wireless Sensor Networks
ETPA11188C	Estimation and Detection Theory

Audit Course I and II

1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Education
5. Constitution of India
6. Pedagogy Studies
7. Stress Management by Yoga
8. Personality Development through Life Enlightenment Skills.

BoS Chairman Dean Academics Director

First Year M. Tech. (FYMT)
(Electronics and Telecommunication Engineering) Semester II
(Pattern 2018: R1)

Course Code	Course	Course Type	Teaching Scheme		Examination Scheme					Total	Credits
					Formative Assessment			Summative Assessment			
			L	P	ISE		CE	ESE	OR		
					T1	T2					
ETPA12181	Digital Design and Verification	TH	3	-	20	10	20	50	-	100	3
ETPA12182	Machine Learning	TH	3	-	20	10	20	50	-	100	3
ETPA12183	Program Elective IV	TH	3	-	20	10	20	50	-	100	3
ETPA12184	Program Elective V	TH	3	-	20	10	20	50	-	100	3
ETPA12185	Laboratory III	CE-OR	-	4	-	-	50	-	50	100	2
ETPA12186	Laboratory IV	CE-OR	-	4	-	-	50	-	50	100	2
ETPA12187	Mini project	CE	-	4	-	-	50	-	50	100	2
IOEP12188	Open Elective	CE	3				50			50	3
AP2	Audit Course II	AU	-	-	-	-	-	-	-	-	-
	Total		15	12	80	40	280	200	150	750	21

Course code	Program Elective IV
ETPA12183A	Computer Vision
ETPA12183B	Statistical Information Processing
ETPA12183C	System on Chip Design

Course code	Program Elective V
ETPA12184A	Remote Sensing
ETPA12184B	Low Power CMOS Design
ETPA12184C	Communication Buses and Interfaces

Course code	Open Elective
IOEP12188A	Project Planning and Management
IOEP12188B	Ethical Hacking
IOEP12188C	Product Design Engineering

Audit Course I and II

1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Education
5. Constitution of India
6. Pedagogy Studies
7. Stress Management by Yoga
8. Personality Development through Life Enlightenment Skills.

BoS Chairman Dean Academics Director

Semester – I

Image and Video Processing (ETPA11181)

Teaching Scheme
Credits : 3
Lectures : 3 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment: 50 Marks

Prerequisite: Students are expected to know the concepts of Digital Signal Processing.

Course Objectives:

- To introduce students to digital images and its acquisition fundamentals
- To learn basic techniques / algorithms used in enhancement, compression and restoration in spatial and frequency domain transformations
- To expose students to the techniques used for image analysis.
- Introduce students to the applications of DIP
- To introduce video processing and compression fundamentals.
- To learn and use MATLAB/OpenCV with Python toolbox

Course Outcomes:

After studying this course students will be able to

1. Understand human visual perception and image and video formation.
2. know how to process two dimensional image data
3. use Image transform for image enhancement and compression
4. apply segmentation algorithms for object recognition in images and video.
5. apply deblurring algorithms for image and video restoration.
6. Use knowledge acquired in preprocessing of images in machine vision applications.

Unit I : Digital Image and Video Fundamentals

Digital image, its type, format, scale. Elements of human visual perception, Simple image formation model, Image sampling and quantization –Gray and Spatial resolution, basic relationships between pixels, Image statistics. Elements of human visual perception, Image statistics. Digital video, Sampled Video, Video Transmission.

Unit II : Image Enhancement in Spatial and Frequency domain

Spatial domain methods: point processing - intensity transformations, histogram processing, image subtraction, image averaging; Spatial filtering - smoothing filter, sharpening filter. 2D-DFT, FFT, Motion-compensated filtering, frame rate conversion, de interlacing, video resolution enhancement.

Unit III : Image and Video Compression

Image Compression: Fundamentals,. 2D-DCT, KL, Hadamard Image compression using DCT, zig-zag scanning, still image compression standard - baseline JPEG. Vector Quantization. Video compression fundamentals. Video formats, Motion estimation and detection, MPEG 2/4 Video Compression Standard. Image and Video quality assessment.

Unit IV : Image and Video Segmentation

Image Segmentation: Fundamentals, line and edge detection, Thresholding and labeling, Edge linking Hough transform, Region oriented segmentation region splitting and merging, Segmentation using watersheds. Scene Change Detection, Spatiotemporal Change Detection, Motion Segmentation, Simultaneous Motion Estimation and Segmentation Semantic Video Object Segmentation.

Unit V : Image and Video Restoration

Image Degradation model - Inverse filtering, Wiener filter, Multi frame Image Restoration, Intensity Flicker Correction. Color Images, Color fundamentals, Color model, Conversion of color model, Pseudo

coloring.

Unit VI : Object recognition

Basic Morphological operations, Image Feature representation and description-boundary representation, chain code s, boundary descriptors, regional descriptors, Texture analysis. Feature selection and classification.

Text Books :

1. Gonzalez and Woods, "Digital Image Processing", Pearson Education.
2. Alan Bovik, "Handbook of Image and Video Processing", Academic Press.

Reference Books :

1. Pratt William K. "Digital Image Processing", John Wiley & sons
2. Joshi, Madhuri A., Mehul S. Raval, Yogesh H. Dandawate, Kalyani R. Joshi, and Shilpa P. Metkar. Image and Video Compression: Fundamentals, Techniques, and Applications. CRC Press, 2014.
3. S. Jayaraman, S. Esakkiraian "Digital Image Processing", Tata McGraw-Hill Education

Advanced Embedded Processors and Programming (ETPA11182)

Teaching Scheme
Credits : 3
Lectures : 3 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment: 50 Marks

Prerequisite :
1. Microcontroller architecture
2. C programming
3. Basics of Linux

Course Objectives:
- To understand and able to design an application specific systems.
- To understand advanced embedded architecture for applications.
- To understand design and implementation of OS based embedded systems.
- To understand open source platform for embedded system

Course Outcomes:
Upon learning the course the student will be able to
1. understand design of embedded system.
2. use OS in embedded application.
3. use modern architecture for embedded system.
4. use Linux for embedded system development.
5. use open platform for embedded system development.

Unit I : Advanced Processor Architecture
Philosophy of RISC design, Advantages of RISC architecture for embedded applications, Development tool chain insights (GNU), guidelines for Selection of hardware and memory architecture, embedded C programming, embedded system design challenges.

Unit II : Parallel Processing and Pipelining Processing
Parallel Processing - Architectural Classification, Applications of parallel processing, Instruction level Parallelism and Thread Level Parallelism, Explicitly Parallel Instruction Computing (EPIC) Architecture
Pipeline Architecture - Principles and implementation of Pipelining, Classification of pipelining processors, Design aspect of Arithmetic and Instruction pipelining, Pipelining hazards and resolving techniques, Data buffering techniques, Advanced pipelining techniques, VLIW (Very Long Instruction Word) processor.

Unit III : Cortex architecture
Introduction to ARM CORTEX series, Design Philosophy, processors series, versions, features and applications. CMSIS standard for ARM Cortex. Survey of CORTEX based controllers A-R-M. ARM-CM3 Based Microcontroller LPC1768: Features, Architecture (Block Diagram & Its Description), Interrupt structure, modes of operations. On chip facility for control, compute and communication applications, Architectural features for digital signal processing.

Unit IV: Embedded/Real time OS and concurrent programming
Types and basic philosophy of Embedded/Real time OS, porting onto embedded architecture, application programming interfaces (API),concurrent programming techniques, Latency hiding techniques, Principles of multithreading, Issues and solutions.
Parallel Programming Techniques: Message passing program development. Message passing libraries

for parallel programming interface, Message Passing Interfaces (MPI). Introduction to CUDA kernel and programming basics

Unit V : Embedded Linux

Linux for embedded systems, embedded Linux development system, kernel architecture and configuration, file systems, porting Linux on ARM architecture, bootloaders, tool utilities such as Minicomp, Busybox, Redboot, Libc, Device drivers- concept, architecture, types, sample character device driver

Unit VI : Open hardware /development systems and Case study

Arduino open platform (IDE), development using ATMega328p based Uno board, structure of Arduino programs, introduction to Arduino library, sample GPIO program. Case study of implementation with control, compute and communication modules using Arduino platform.

Text Books :

1. Joseph Yiu, "The Definitive Guide to the ARM Cortex-M", Newness, ELSEVIER
2. Andrew Sloss, Dominic Symes, Chris Wright, "ARM System Developer's Guide – Designing and Optimizing System Software", ELSEVIER
3. Kai Hwang, Faye A. Briggs, "Computer Architecture and Parallel Processing" McGraw
4. Hill Education, 2012.
5. Christopher Hallinan, "Embedded Linux Primer -A Practical, Real-World Approach"2nd edition, Prentice Hall.
6. Parag H. Dave, Himanshu H. Dave," Embedded systems" Concepts, design and programming, Pearson India

Reference Books :

1. Kai Hwang, "Advanced Computer Architecture", McGraw Hill Education, 1993.
2. Kai Hwang, "Scalable Parallel Computing", McGraw Hill Education, 1998.
3. Harold S. Stone "High-Performance Computer Architecture", Addison-Wesley, 1993.

Elective 1A: Artificial Intelligence (ETPA11183A)

Teaching Scheme
Credits : 3
Lectures : 3 Hrs /week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment: 50 Marks

Course Objectives:

- To learn various types of algorithms useful in Artificial Intelligence (AI).
- To convey the ideas in AI research and programming language related to emerging technology.
- To understand the concepts of probabilistic reasoning, fuzzy logic and natural language processing.
- To understand the numerous applications and huge possibilities in the field of AI that go beyond the average human imagination.

Course Outcomes:

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

1. Understand the concept of Artificial Intelligence, search techniques and knowledge representation issues.
2. Understanding reasoning and fuzzy logic for artificial intelligence.
3. Understanding natural language processing.
4. Apply and integrate various artificial intelligence techniques in intelligent system development as well as understand the importance of maintaining intelligent systems.

Unit I : Introduction to AI

The AI Problems, The Underlying Assumption, AI Techniques, The Level Of The Model, Criteria For Success, Some General References, One Final Word Problems, State Space Search & Heuristic Search Techniques: Defining The Problems As A State Space Search, Production Systems, Production Characteristics, Production System Characteristics, And Issues In The Design Of Search Programs, Additional Problems. Generate- And-Test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means- Ends Analysis, Intelligent Agents, Problem Solving.

Unit II : Knowledge Representation

Knowledge Representation Issues: Representations and Mappings, Approaches to Knowledge Representation. Using Predicate Logic: Representation Simple Facts In Logic, Representing Instance And Isa Relationships, Computable Functions And Predicates, Resolution. Representing Knowledge Using Rules: Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning.

Unit III : Reasoning

Symbolic Reasoning Under Uncertainty: Introduction To No monotonic Reasoning, Logics For Non-monotonic Reasoning. Statistical Reasoning: Probability And Bays' Theorem, Certainty Factors And Rule-Base Systems, Bayesian Networks, Dempster Shafer theory.

Unit IV : Learning

Learning from observations: forms of learning, Inductive learning, Learning decision trees, Ensemble learning, Knowledge in learning, Logical formulation of learning, Explanation based learning, Learning using relevant information, Inductive logic programming, Statistical learning methods, Learning with complete data, Learning with hidden variable, EM algorithm, Instance based learning, Neural networks - Reinforcement learning, Passive reinforcement learning, Active reinforcement learning, Generalization

in reinforcement learning

Unit V : Perception and Expert System

Visual perception-Waltz's algorithm, Introduction to Expert System, Architecture and functionality, Example Expert system Fuzzy Logic. Weak Slot-and-Filler Structures: Semantic Nets, Frames. Strong Slot-and-Filler Structures: Conceptual Dependency, Scripts, CYC

Unit VI : Natural Language Understanding

Natural Language Processing: Introduction, Syntactic Processing, Semantic Analysis, Semantic Analysis, Discourse And Pragmatic Processing, Spell Checking Connectionist Models: Introduction: Hopfield Network, Learning In Neural Network, Application Of Neural Networks, Recurrent Networks, Distributed Representations, Connectionist AI And Symbolic AI.

Text Books :

1. Stuart Russell, Peter Norvig, "Artificial Intelligence", A Modern Approach, Pearson Education/Prentice Hall of India
2. Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw-Hill.

Reference Books :

1. Nils J. Nilsson, "Artificial Intelligence: A new Synthesis", Harcourt Asia Pvt. Ltd
2. George F. Luger, "Artificial Intelligence-Structures and Strategies for Complex Problem Solving", Pearson Education/ PHI

Elective 1B: Advanced Digital Signal Processing (ETPA11183B)

Teaching Scheme
Credits : 3
Lectures : 3 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment: 50 Marks

Prerequisite :
1. Digital Signal Processing
2. Fundamentals of Matrices

Course Objectives:
- To build an understanding of Multirate DSP.
- To introduce the concept of Adaptive filters.
- To introduce concept of Linear Prediction and efficient computation of LPC.
- To build an understanding of estimation of Power Spectrum of Random Processes

Course Outcomes:
Upon learning the course the student will be able to
1. To understand theory of multirate DSP, solve numerical problems and write algorithms
2. Use Adaptive filtering for real life applications.
3. Compute linear prediction coefficients in efficient manner.
4. To know applications of DSP at block level.

Unit I : DSP Fundamentals
Overview of DSP, Characterization in time and frequency, FFT Algorithms, Digital filter design and structures: Basic FIR/IIR filter design &structures, design techniques of linear phase FIR filters, IIR filters by impulse invariance, bilinear transformation, FIR cascaded lattice structure, and IIR Serial and Parallel structures.

Unit II : Multirate DSP
Need of Multi rate DSP, Decimation and Interpolation, Sampling rate conversion by a non-integer factor, multistage decimator & interpolator, poly phase filters, QMF, digital filter banks, Applications in subband coding and CD Hi-fi systems.

Unit III : Linear Prediction
Stationary random process, Linear prediction & optimum linear filters, forward-backward linear prediction filters, solution of normal equations, AR Lattice and ARMA Lattice-Ladder Filters, Wiener Filters for Filtering and Prediction.

Unit IV : Adaptive filters
Need of Adaptive filters, main components of adaptive filters, Wiener Hopf equation, LMS algorithm, various configuration and applications of adaptive filters, Recursive Least Square algorithm.

Unit V : Power Spectrum Estimation
Estimation of spectra from finite duration observation of signals; Estimation of autocorrelation and power spectrum of random signals; Non-parametric methods for power spectrum estimation – Periodogram method, modified periodogram method, Bartlett method, Minimum-Variance Spectral Estimation, Eigenanalysis Algorithms for Spectrum Estimation

Unit VI : Applications of DSP
Application of DSP & Multi rate DSP, Application to Radar, introduction to wavelets, application to image processing, design of phase shifters, DSP in speech processing & other applications

Text Books :

1. John G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing: Principles, algorithms and applications" Fourth edition, Pearson Prentice Hall.
2. E.C. Ifeachor, B.W. Jervis, "Digital Signal Processing: A practical approach", 2nd ed., Pearson Education.

Reference Books :

1. Bruce W. Suter, "Multirate and Wavelet Signal Processing", 1st Edition, Academic Press, 1997.
2. M. H. Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley & Sons Inc., 2002.
3. S. Haykin, "Adaptive Filter Theory", 4th Edition, Prentice Hall, 2001.
4. D. G. Manolakis, V. K. Ingle and S. M. Kogon, "Statistical and Adaptive Signal Processing", McGraw Hill, 2000.

Elective 1C: Biomedical Signal Processing (ETPA11183C)

Teaching Scheme
Credits : 3
Lectures : 3 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment: 50 Marks

Prerequisite :
1. Digital Signal Processing
2. Fundamentals of signal processing
3. Basics of JTFA

Course Objectives:
- To introduce the students to various bio signals and methods to acquire them.
- To introduce various time and frequency domain techniques for biomedical signal analysis.
- To make students aware of classification techniques for biomedical signal classification.

Course Outcomes:
Upon learning the course the student will be able to
1. Understand different types of biomedical signal.
2. Identify and analyze different biomedical signals.
3. Propose solutions to applications related to biomedical signal processing.

Unit I : Introduction to bio signals
Acquisition, Generation of Bio-signals, Origin of bio-signals, Types of bio-signals, ECG, EEG, Study of diagnostically significant bio-signal parameters, sources of contamination of biomedical signals.

Unit II : Acquisition of bio signals
Electrodes for bio-physiological sensing and conditioning, Electrode-electrolyte interface, polarization, electrode skin interface and motion artefact, biomaterial used for electrode, Types of electrodes (body surface, internal, array of electrodes, microelectrodes), Practical aspects of using electrodes, Acquisition of bio-signals (signal conditioning) and Signal conversion (ADC's and DAC's) Processing, Digital filtering, grounding, shielding.

Unit III : Time frequency analysis of signals
Biomedical signal processing by Fourier analysis, STFT, Wigner Ville distribution, Biomedical signal processing by wavelet (time frequency) analysis, Analysis (Computation of signal parameters that are diagnostically significant) (ECG can be taken as a reference bio signal).

Unit IV : Digital filters for signal processing
Classification of signals and noise, Spectral analysis of deterministic, stationary random signals and non-stationary signals, Coherent treatment of various biomedical signal processing methods and applications, Review of FIR, IIR filters, Adaptive filter configurations for noise cancellation (ECG separation of mother and fetal can be taken as application).

Unit V : Statistical analysis techniques and MRA
Principal component analysis, Correlation and regression, Analysis of chaotic signals Application areas of Bio–Signals analysis Multiresolution analysis (MRA) and wavelets, Principal component analysis(PCA), Independent component analysis (ICA).

Unit VI : Soft computing approaches for biomedical signal classification
Pattern classification–supervised and unsupervised classification, Neural networks, Support vector

Machines, Hidden Markov models. Examples of biomedical signal classification examples.

Text books :

1. D C Reddy, "Biomedical Signal Processing", McGraw Hill, 2005.
2. Katarzyn J. Blinowska, Jaroslaw Zygierewicz, "Practical Biomedical Signal Analysis Using MATLAB", 1st Edition, CRC Press, 2011
3. John L Semmlow, Biosignal and Biomedical Image Processing MATLAB-Based Applications, Second Edition, Marcel Dekker, Inc, 2008

Reference Books:

1. W. J. Tompkins, "Biomedical Digital Signal Processing", Prentice Hall, 1993.
2. Eugene N Bruce, "Biomedical Signal Processing and Signal Modeling", John Wiley & Son's publication, 2001.
3. Myer Kutz, "Biomedical Engineering and Design Handbook, Volume I", McGraw Hill, 2009.

Elective 2A: IOT and Applications (ETPA11184A)

Teaching Scheme
Credits : 3
Lectures : 3 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment: 50 Marks

Prerequisite :
1. Microcontrollers
2. Computer Networks

Course Objectives :
- To Understanding concept of IOT.
- To Study different types of IOT platforms and services.
- To study Security and privacy aspects of IOT implementation.
- To study real life examples and Applications of IOT Systems.

Course Outcomes :
Upon learning the course the student will be able to
1. Understand the concept of IOT and M2M.
2. Study IOT architecture and applications in various fields.
3. Study the security and privacy issues in IOT.

Unit I : IoT & Web Technology
The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.

Unit II : M2M to IoT
A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

Unit III : IoT Architecture
State of the Art – Introduction, State of the art, Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

Unit IV : IoT Applications for Value Creations
Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth.

Unit V : Internet of Things Privacy
Security and Governance Introduction, Overview of Governance, Privacy and Security Issues

Unit VI : IOT Applications
Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart

Cities, Security.
Text Books : 1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014. 2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013.
Reference Books : 1. Cuno Pfister, "Getting Started with the Internet of Things", O'Reilly Media, 2011.

Elective 2B: Data Networks and Security (ETPA11184B)

Teaching Scheme
Credits : 3
Lectures : 3 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment: 50 Marks

Course Objectives:

- Build a foundation in computer networks concepts and protocols and interfaces.
- Estimate the key concepts and practices employed in modern computer networking
- Understand the computer security concepts
- Discriminate of security mechanism at various levels of computer networking and to be familiar with security

Course Outcomes:

After completion of the course the student is able to

1. Learn about networking issues and differentiating TCP/IP and 7-Layer OSI models
2. Describe and understand the overview of security principles
3. Understanding of network security related issues and mitigating mechanisms

Unit I : Data and Computer Communication Networks

Data Communication, Transmission Methodologies, Data Link Layer, Multiple Access & Local Area Networks, Connecting Devices and Backbone Networks, Network Layer and Transport Layer, Application Layer.

Unit II : Mobile & Wireless Networks

Wireless Links and Network Characteristics, WiFi: 802.11 Wireless LANs,, ad-hoc wireless networks & security, wireless sensor networks, Cellular Mobile Wireless Networks, Mobile IP, Managing Mobility in Cellular Networks, Wireless and Mobility: Impact on Higher-Layer Protocols Evolution of Modern Mobile Wireless Communication System.

Unit III : Cryptography and Network Security

Introduction to the Concept of Security, Cryptographic Techniques, Computer-based Symmetric and Asymmetric Key,Cryptographic Algorithms, Public Key Infrastructure (PKI), Internet Security Protocols, Network Security.

Unit IV : Database Security

Data management technologies, Information security, Information Management Technologies, Security policies, Policy enforcement & related issues, Design principles, Multilevel relational data models, Security impact on database function, inference problem,

Unit V : Software Security

Defining a discipline, A Risk Management Framework, Code review with a tools, Architectural risk analysis, Software penetrating testing, Risk Based security Testing, An Enterprise S/W security program, Security knowledge

Unit VI : Security Issues in Mobile Communication:

Mobile Communication History, Security – Wired Vs Wireless, Security Issues in Wireless and Mobile

Communications, Security Requirements in Wireless and Mobile Communications, Security for Mobile Applications, Advantages and Disadvantages of Application – level Security

Text Books :

1. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", Fifth Edition, Pearson Education, 2012.
2. Behrouz A. Forouzan, Firoz Mosharaf, "Computer Networks: A Top-Down Approach," Tata McGraw Hill, 2012.
3. Michael E. Whitman, Herbert J.Mattord, "Principles of Information Security", CENGAGE Learning, 5th Edition.
4. William Stallings, "Cryptography and Network Security". Pearson Education, 4th Edition
5. Pallapa Venkataram, Satish Babu, "Wireless & Mobile Network Security" TMH, 2010.

Reference Books :

1. Larry L. Peterson & Bruce S. Davie, "Computer Networks: A Systems approach", Fifth edition, Elsevier, 2012.
2. Mark Dye, "Network Fundamentals", Pearson Education.
3. Forouzan Mukhopadhyay, Cryptography and Network Security", Mc Graw Hill, 2nd Edition

Elective 2C: Joint Time Frequency Analysis (ETPA11184C)

Teaching Scheme
Credits : 3
Lectures : 3 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment: 50 Marks

Prerequisite :
1. Digital Signal Processing
2. Fundamentals of Signals and systems

Course Objectives:
- To provide students the basic foundation of vector spaces
- To make students understand the essence of multi resolution analysis
- To introduce students to different family of wavelets
- T make students understand the different application areas of Joint time frequency analysis

Course Outcomes:
Upon learning the course the student will be able to
1. Introduce Transforms in signal processing.
2. Understand Time -Frequency Analysis & Multiresolution Analysis.
3. Implement wavelets in various problems like image compression, denoising *etc.*

Unit I : Introduction
Review of Fourier Transform, Parseval Theorem and need for joint time-frequency Analysis. Concept of non-stationary signals, Short-time Fourier transform (STFT), Uncertainty Principle, Localization/Isolation in time and frequency, Hilbert Spaces, Fundamentals of Hilbert Transform.

Unit II : Bases for Time-Frequency Analysis
Wavelet Bases and filter Banks, Tilings of Wavelet Packet and Local Cosine Bases, Wavelet Transform, Real Wavelets, Analytic Wavelets, Discrete Wavelets, Instantaneous frequency, Quadratic time-frequency energy, Wavelet Frames, Dyadic wavelet Transform, Construction of Haar and Roof scaling function using dilation equation and graphical method.

Unit III : Multiresolution Analysis
Haar Multiresolution Analysis, MRA Axioms, Spanning Linear Subspaces, nested subspaces, Orthogonal Wavelets Bases, Scaling Functions, Conjugate Mirror Filters, Haar 2-band filter Banks, Study of upsamplers and downsamplers, Conditions for alias cancellation and perfect reconstruction, Discrete wavelet transform and relationship with filter Banks, Frequency analysis of Haar 2-band filter banks, scaling and wavelet dilation equations in time and frequency domains, case study of decomposition and reconstruction of given signal using orthogonal framework of Haar 2-band filter bank

Unit IV : Wavelets
Daubechies Wavelet Bases, Daubechies compactly supported family of wavelets, Daubechies filter coefficient calculations, Case study of Daub-4 filter design, Connection between Haar and Daub-4, Concept of Regularity, Vanishing moments. Other classes of wavelets like Shannon, Meyer

Unit V : Bi-orthogonal wavelets and Applications

Construction and design. Case study of bi-orthogonal 5/3 tap design and its use in JPEG 2000. Wavelet Packet Trees, Time-frequency localization, compactly supported wavelet packets, case study of Walsh wavelet packet bases generated using Haar conjugate mirror filters till depth level 3. Lifting schemes for generating orthogonal bases of second-generation wavelets.

Unit VI : Applications of JTFA

Applications of JTFA: Scalograms, Time-Frequency distributions: fundamental ideas, Applications: Speech, audio, image and video compression

Text Books:

1. S. Mallat, "A Wavelet Tour of Signal Processing," Academic Press, Second Edition, 1999.
2. L. Cohen, "Time-frequency analysis", Prentice Hall, 1995.

Reference Books:

1. G. Strang and T. Q. Nguyen, "Wavelets and Filter Banks", Wellesley-Cambridge Press, Revised Edition, 1998.
2. I. Daubechies, "Ten Lectures on Wavelets", SIAM, 1992.
3. P. P. Vaidyanathan, "Multirate Systems and Filter Banks", Prentice Hall, 1993.
4. M. Vetterli and J. Kovacevic, "Wavelets and Subband Coding", Prentice Hall, 1995

LABORATORY I (ETPA11185)

Teaching Scheme
Credits : 2
Practical : 4 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment (Oral): 50 Marks

List of Experiments :
Students can use MATLAB/ OpenCV with Python for the practical assignments. (4 Hrs/Practical)

1. Implementation of filters: The case study consisting of application of nearly all kind of filters for enhancing of the image.

2. Implementation of Encoding and decoding scheme in JPEG image compression standard. The entropy coding step can be excluded. The performance of the JPEG with different quality factors should be analyzed.

3. A case study for measuring various parameters such as area, perimeter, shape of the objects in an image. This also includes counting the number of different objects in an image. The complete process involves edge detection for segmentation/segmentation using techniques like thresholding, region growing etc, morphological operations.

4. Implementation of Motion estimation and compensation algorithm for generating motion vectors sequence of images.

5. Implementation of MSE, PSNR, SC, IF, MSSIM, NC and edge SSIM quality metrics for evaluation of any compression scheme. (Preferably JPEG with different quality factors).

LABORATORY II (ETPA11186)

Teaching Scheme
Credits : 2
Practical : 4 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment (Oral): 50 Marks

List of Experiments:

1. Porting of embedded/real time OS onto cortex architecture.
2. DC motor speed control using cortex architecture.
3. Porting Linux on Cortex/ARM9 architecture.
4. Device driver programming for embedded platforms.
5. Performance evaluation of multi/many core architecture.

Research Methodology & IPR (ETPA11187)

Teaching Scheme

Credits : 2
Lectures : 2 Hrs/week

Examination Scheme

Formative Assessment: 50 Marks

Course Objectives :

- To introduce to the concept of research and research problem
- To understand research ethics
- Get introduced to the concept of Intellectual property rights
- To understand developments in IPR

Course Outcomes :

The students will be able to:

1. Define research and formulate a research problem
2. Write a research proposal to a suitable funding agency
3. Define concept of Intellectual property rights.
4. Select Patents/ Designs/ Trademarks/ Copyright and analyze them through case studies.

Unit I : Introduction to Research and Research problem

Meaning of research, types of research, process of research, Objectives of research, Sources of research problem, Criteria / Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem, defining a research problem (Real life example or case study). Literature Review: objectives, Significance, sources (Review of journal paper/s). Research hypotheses, Qualities of a good Hypothesis, Null Hypothesis & Alternative Hypothesis. Hypothesis Testing -Logic & Importance.

Unit II : Report, Research proposal and funding agencies

Need of effective documentation, types of reports, report structure, Format of research proposal, Individual research proposal, Institutional research proposal, Funding for the proposal, Different funding agencies. Plagiarism and its implications. Research briefing, presentation styles, elements of effective presentation, writing of research paper, presenting and publishing paper.

Unit III : Introduction to IPR and Patenting

Introduction and the need for intellectual property right (IPR), IPR in India – Genesis and Development, IPR in abroad, Some important examples of IPR. Nature of Intellectual Property: Patents, Designs, Trademarks and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development, patenting under PCT, patent license, patentable and non-patentable inventions. Drafting of a patent, Filing of a patent.

Unit IV : Patent Rights and Development

Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. International cooperation on Intellectual Property. Administration of Patent System. New developments in IPR; IPR of Biological Systems, Traditional knowledge Case Studies, understanding of IPR issues in cyber world

Text books:

1. Dr. C. R. Kothari, Research Methodology: Methods and Trends', New Age International Publishers.
2. Wayne Goddard and Stuart Melville, Research Methodology: An Introduction'
3. Ranjit Kumar, Research Methodology: A Step by Step Guide for Beginners'

4. Prabuddha Ganguly, "Intellectual Property Rights", Tata Mc-Graw Hill.
5. Robert P. Merges, Peter S. Menell, Mark A. Lemley "Intellectual Property in New"

Reference books:

1. Deepak Chawla and Neena Sondhi, Research Methodology**:** concepts and cases, Vikas Publishing House Pvt. Ltd.
2. Louis Cohen, Manion, Morrison, Research Methods in Education, Routledge (Taylor & Francis Group) /Cambridge University Press India Pvt. Ltd.
3. Sekaran Uma and Roger Bougie, Research Methods for Business, Wiley, India.
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007

Elective 3A: Image and Video Compression (ETPA11188A)

Teaching Scheme
Credits : 3
Lectures : 3 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment: 50 Marks

Prerequisite:

Course Objectives:

- To introduce students to various techniques such as Wavelets, DCT etc used for compressing Still Image and Videos.
- To introduce students to widely used Image and Video standards like JPEG2000, MPEG, H.264.
- To develop ability to select proper algorithm/ modify if required to suit specific application.

Course Outcomes:

By the end of the course, students will able to

1. Understand overview of compression standards like JPEG 2000, MPEG1, MPEG2
2. Gain knowledge of features of various compression standards.
3. Develop ability to choose compression standard for the given application.
4. Cognize techniques used in data compression.
5. Comprehend various video compression standards like MPEG4, H.263 and H.264 etc.
6. Know various audio coding techniques like mp3 and Dolby AC3.

Unit I : Image Compression using Vector Quantization

Introduction, Advantages of Vector Quantization over Scalar Quantization, The Linde-Buzo-Gray Algorithm, Tree-Structured Vector Quantizers, Structured Vector Quantizers, Variations on the Theme, Concept of Fractals and compression using fractals.

Unit II : Wavelet based Image Compression

Introduction, Wavelets, Multiresolution Analysis and the Scaling Function, Implementation Using Filters, Image Compression, Embedded Zerotree Coder, Set Partitioning in Hierarchical Trees, JPEG 2000 compression standard- Preprocessor, Core encoder, Post processing, ROI encoding, scalability

Unit III : Video Compression basics

Analog and digital video, Temporal Redundancy, Motion estimation, Video Signal Representation

Unit IV : Video Compression Standards – I

MPEG1-Video structure, Group of Pictures, Picture slice, Macro- block and block, Motion estimation, Coding of I, P, B and D type pictures, Video Buffer, MPEG2- Difference between MPEG1 and MPEG2, scalability feature, applications.

Unit V : Video Compression Standards – II

MPEG4- Video object plane, shape coding, H.263 and H.264- Video coding for low bit rates, motion vector coding, coefficient coding, protection against error. Overview of MPEG-7 and MPEG -21

Unit VI : Audio Coding

Introduction , Spectral Masking, Temporal Masking, Psychoacoustic Model, MPEG Audio Coding, Layer II Coding, Layer III Coding—mp3, Dolby AC3 (Dolby Digital)

Text Books :

1. Sayood, Khalid. "Introduction to data compression". Newnes, 2012.

2. Joshi, M. A., Raval, M. S., Dandawate, Y. H., Joshi, K. R., & Metkar, S. P. (2014). "Image and Video Compression: Fundamentals, Techniques, and Applications, CRC Press.

Reference Books :

1. Mohammed Ghanbari, Standard Codecs: Image Compression to Advanced Video Coding", IEE publication.
2. V. Bhaskaran and K. Konstantinides, "Image video compression standards: algorithms and architecture," Kluwer Academic Publishers
3. Joan Mitchell "MPEG and Video compression standard" Springer
4. Iain E. G. Richardson "H.264 and MPEG-4 Video Compression" Wiley publication

Elective 3B: Wireless Sensor Networks (ETPA11188B)

Teaching Scheme
Credits : 3
Lectures : 3 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment: 50 Marks

Prerequisite :
1. Wireless Communication.

Course Objectives:
- To understand the concept of wireless sensor network.
- To grasp the functionalities of specialized protocols used in WSN.
- To understand the parameters related to QoS in WSN.
- To familiarize the security issues related to WSN.

Course Outcomes:
After successfully completing the course the student will be able to
6. Use appropriate model of WSN
7. Comprehend energy efficient MAC protocols.
8. Apply the knowledge of WSN to solve any engineering problem related to WSN
9. Analyze WSN to meet QoS
10. Develop secure solutions for identified WSN.
11. Apply data aggregation techniques suitable for given applications.

Unit I : Introduction to Wireless Sensor Networks
Course Information, Introduction to Wireless Sensor Networks: Motivations, Applications, Performance metrics, History and Design factors, Network Architecture**:** Traditional layered stack, Cross-layer designs, Sensor Network Architecture, Hardware Platforms: Motes, Hardware parameters

Unit II : Medium Access Control Protocols
Contention-Free and Contention-Based Medium Access , Wireless MAC Protocols, CSMA, MACA and MACAW, IEEE 802.11, IEEE 802.15.4 and ZigBee, Characteristics of MAC Protocols in Sensor Networks , Contention-Free MAC Protocols, Traffic-Adaptive Medium Access, Y-MAC, DESYNC-TDMA, Low-Energy Adaptive Clustering Hierarchy, Lightweight Medium Access Control , Contention-Based MAC Protocols , Power Aware Multi-Access with Signaling, Sensor MAC, Timeout MAC, Pattern MAC, Routing-Enhanced MAC, Data-Gathering MAC, Preamble Sampling and Wise MAC, Receiver-Initiated MAC, Hybrid MAC Protocols, Zebra MAC, Mobility Adaptive Hybrid MAC

Unit III : Routing protocols
Introduction, MANET protocols, Routing protocols for WSN: Resource-aware routing, Data-centric, Geographic Routing, Broadcast, Multicast Opportunistic Routing Analysis: Analysis of opportunistic routing (Markov Chain)

Unit IV : QoS, Data Gathering and Management
Quality of service/reliability, Transport protocols, Coverage and deployment - Sensing models, Coverage measures, Uniform random deployments: Poisson point processes, Coverage of random deployments: Boolean sensing model, Coverage of random deployments: general sensing model, Coverage determination, Coverage of grid deployments, Reliable data transport, Single packet delivery, Block delivery, Congestion control and rate control.

Unit V : Privacy and Security in WSN
Fundamentals of Network Security, Challenges of Security in Wireless Sensor Networks, Security

Attacks in Sensor Networks, Denial-of-Service, Attacks on Routing, Attacks on Transport Layer, Attacks on Data Aggregation, Privacy Attacks, Protocols and Mechanisms for Security, Symmetric and Public Key Cryptography, Key Management, Defenses Against DoS Attacks, Defenses Against Aggregation Attacks, Defenses Against Routing Attacks, Security Protocols for Sensor Networks TinySec, Localized Encryption and Authentication Protocol, IEEE 802.15.4 and ZigBee Security

Unit VI : Specialized features

Energy preservation and efficiency; security challenges; fault tolerance, Issues related to Localization, connectivity and topology, Sensor deployment mechanisms; coverage issues; sensor Web; sensor Grid, Open issues for future research, and Enabling technologies in wireless sensor network.

Text Books :

1. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice," Wiley.
2. Holger Karl, Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks," Wiley.

Reference Books :

1. Edgar H. Callaway, Jr. and Edgar H. Callaway, "Wireless Sensor Networks: Architectures and Protocols," CRC Press.
2. Anna Hac, "Wireless Sensor Network Designs," John Wiley & Sons.
3. Robert Faludi, "Building Wireless Sensor Networks: A Practical Guide to the ZigBee Mesh Networking Protocol," Shroff Publishers.

Elective 3C: Estimation and Detection Theory (ETPA11188C)

Teaching Scheme
Credits : 3
Lectures : 3 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment: 50 Marks

Prerequisite :
1. Fundamentals of probability.

Course Objectives:
- To make students understand linear models and their relationship with probability distributions
- To make students aware of Computation of Cramer Rao Lower Bounds
- To estimate parameters with multiple criteria: minimum variance, maximum likelihood, Bayesian assumptions
- To make students learn to Detect multiple types of signals: deterministic signals, random signals, signals with unknown parameters

Course Outcomes:
At the end of the course, student will be able to
1. Acquire basics of statistical decision theory used for signal detection and estimation.
2. Examine the detection of deterministic signals using statistical models.
3. Examine the detection of random signals using statistical models.
4. Examine the performance of signal parameters using optimal estimators.
5. Analyze signal estimation in discrete-time domain using filters.
6. Cognize various applications of estimation and detection theory.

Unit I : Statistical Decision Theory
Bayesian, minimax, and Neyman-Pearson decision rules, likelihood ratio, receiver operating characteristics, composite hypothesis testing, locally optimum tests, detector comparison techniques, asymptotic relative efficiency.

Unit II : Detection of Deterministic Signals
Matched filter detector and its performance; generalized matched filter; detection of sinusoid with unknown amplitude, phase, frequency and arrival time, linear model.

Unit III : Detection of Random Signals
Estimator-correlator, linear model, general Gaussian detection, detection of Gaussian random signal with unknown parameters, weak signal detection.

Unit IV : Estimation of Signal Parameters
Minimum variance unbiased estimation, Fisher information matrix, Cramer-Rao bound, sufficient statistics, minimum statistics, complete statistics; linear models; best linear unbiased estimation; maximum likelihood estimation, invariance principle; estimation efficiency; Bayesian estimation: philosophy, nuisance parameters, risk functions, minimum mean square error estimation, maximum a posteriori estimation.

Unit V : Signal Estimation in Discrete-Time
Linear Bayesian estimation, Weiner filtering, dynamical signal model, Discrete Kalman filtering.

Unit VI : Applications of Estimation and Detection
Applications in various domains viz. Control systems, Object tracking, non- linear prediction etc.

Text Books :

1. H. L. Van Trees, "Detection, Estimation and Modulation Theory: Part I, II, and III", John Wiley, NY, 1968.
2. S. M. Kay, "Fundamentals of Statistical Signal Processing: Estimation Theory", Prentice Hall PTR, 1993.

Reference Books :

1. S. M. Kay, "Fundamentals of Statistical Signal Processing: Detection Theory", Prentice Hall PTR, 1998.
2. Signal Detection and Estimation Second Edition by Mourad Barkat, Pearson education

Semester - II

Digital Design and Verification (ETPA12181)

Teaching Scheme
Credits : 3
Lectures : 3 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment: 50 Marks

Prerequisite :
1. Digital Electronics
2. OOP concepts

Course Objectives:
- To learn how to design and test gate/RTL level digital circuits using Verilog HDL.
- To learn to build efficient verification testbenches using SystemVeriog.
- To get familiar with Verilog and SystemVerilog design and verification EDA tools.

Course Outcomes:
At the end of this course, students will be able to
1. Get familiar with front end design using Verilog and verification techniques and create reusable test environments using SystemVerilog.
2. Verify increasingly complex designs more efficiently and effectively.
3. Use EDA tools for design and verification efficiently.

Unit I : Fundamentals of Verilog HDL
Introduction, Lexical conventions, Data types, Operators, Modules and ports, Gate-level modeling, Dataflow modeling, Behavioral modeling, Tasks and functions. Timing and Delays, Switch-level modeling, User-defined primitives, Logic synthesis with Verilog HDL.

Unit II : Arithmetic Circuits Design
Unsigned and signed number representation, Addition and subtraction of signed numbers, Arithmetic overflow, Ripple-carry adder, Carry-lookahead adder, BCD adder, Design of adders using Verilog, Multiplication of unsigned and signed numbers, Array multiplier, Fixed-point and floating-point numbers.

Unit III : Combinational and Sequential Building Blocks
Multiplexers, Synthesis of logic functions using multiplexers, Multiplexer synthesis using Shannon's expansion, Design of arithmetic comparator, Verilog constructs for Flip-Flops, Registers, and Counters. Verilog constructs for Moore and Mealy FSM.

Unit IV : SystemVerilog - I
Verification guidelines, Verification process, Verification plan, Data types, Arrays, Linked lists, procedural statements and routines, Tasks and functions, Routine Arguments, Basic OOP concepts, Object Deallocation, Class Routines, Scoping Rules, Dynamic Objects.

Unit V : SystemVerilog - II
Design and testbench interface, Stimulus Timing, SystemVerilog Assertions, The Four-Port ATM Router, Randomization in SystemVerilog, The pre_randomize and post_randomize Functions, Iterative and Array Constraints, Working with Threads, Events, Semaphores, Mailboxes, Building a Testbench with Threads and IPC

Unit VI : SystemVerilog - III
Introduction to Inheritance, Factory Patterns, Composition, Inheritance, and Alternatives, Coverage Types, Functional Coverage Strategies, Anatomy of a Cover Group, Parameterized Cover Groups,

Analyzing Coverage Data, Measuring Coverage Statistics During Simulation, Virtual Interfaces with the ATM Router, Connecting to Multiple Design Configurations, Procedural Code in an Interface.

Text Books :

1. Samir Palnitkar, "Verilog HDL: A guide to Digital Design and Synthesis," Prentice Hall, 2nd Edition, 2003.
2. Stephen Brown and Zvonko Vranesic, "Fundamentals of Digital Logic with Verilog Design," TMH.
3. Chris Spear, "SystemVerilog for Verification," Springer.

Reference Books :

1. Douglas Smith, "HDL Chip Design: A Practical Guide for Designing, Synthesizing & Simulating ASICs & FPGAs Using VHDL or Verilog", Doone publications, 1998.
2. Stuart Sutherland, Simon Davidmann, and Peter Flake, "SystemVerilog for Design," Springer.

Machine Learning (ETPA12182)

Teaching Scheme
Credits : 3
Lectures : 3 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment: 50 Marks

Course Objectives:

- Explore supervised and unsupervised learning paradigms of machine learning used for regression and classification.
- To design and analyze various machine learning algorithms using neural networks
- To explore Deep learning technique and various feature extraction strategies.

Course Outcomes:

By the end of the course, students will able to

1. Compare and contrast pros and cons of various machine learning techniques.
2. Mathematically analyze various models of classification and regression.
3. Use techniques for dimensionality reduction and clustering.
4. Solve classification problems using back propagation and deep learning convolutional neural networks.

Unit I : Introduction to Machine Learning

Basics of Machine Learning, Types of machine learning, Supervised learning- Classification and regression Linear regression and Logistic regression, Unsupervised learning, Parametric vs non-parametric models, Overfitting. Decision trees, Feature reduction.

Unit II : Classification - I

Classification using KNN, decision trees, conditional probability, Bayesian decision theory- naïve Bayes, logistic regression, Discriminant Functions. Probabilistic Discriminative Models Multivariate Data, Parameter Estimation, Multivariate Classification, Multivariate Regression

Unit III : Classification - II

Kernel Methods: Support Vector machines and Relevance Vector Machines, Classification improvement using ada-boost algorithm. Dimensionality Reduction: Principal Components Analysis, Factor Analysis, Multidimensional Scaling, Linear Discriminant Analysis.

Unit IV : Multilayer Perceptron

Artificial neuron model, concept of bias and threshold, Activation functions, Mc Culloch-Pits Neuron Model, learning paradigms, concept of error energy, gradient descent algorithm and application of linear neuron for linear regression. Multilayer perceptron (MLP) and back propagation algorithm, Application of MLP for classification.

Unit V : Deep Learning

Improvement of the Deep Neural Network: Vanishing Gradient, Overfitting, Computational Load, ReLU Function, Dropout. Architecture of ConvNet, Convolution Layer, Pooling Layer, Applications of CNN's.

Unit VI : Features for Machine learning and Practical Applications

Image features, Time-series features and related applications, Natural language Processing, Use of competitive learning and Self organizing feature maps. The k-means clustering algorithm.

Text Books :

1. Ethem Alpaydın "Introduction to Machine Learning" Second Edition The MIT Press 2010.
2. Peter Harrington," Machine learning in Action", Manning, 2017**.**
3. Laurene Fausett ," Fundamentals of Neural Networks: Architectures, Algorithms And Applications, Pearson Education, Inc, 2008

Reference Books :

1. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012
2. Christopher Bishop, "Pattern Recognition and Machine Learning", Springer, 2007
3. Henrik Brink," Real World Machine Learning, Manning 2016.

Elective 4A: Computer Vision (ETPA12183A)

Teaching Scheme
Credits : 3
Lectures : 3 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks

Course Objectives:

- To introduce students to Projections, Camera Models and Camera Calibration used for image formation. Computer Vision fundamentals, applications and challenges and complexities in Computer Vision Systems.
- To introduce students to Stereo Imaging techniques, Multi-View geometry and 3D reconstruction algorithms.
- To study the techniques and algorithms used for Object tracking in Videos.
- To introduce image registration techniques.
- To develop and test basic Computer Vision algorithms in MATLAB/OpenCV.

Course Outcomes:

By the end of the course, students will able to

1. Develop understanding of image formation and working of camera as image sensor.
2. Understand need and procedure of camera calibration.
3. Have knowledge of stereo imaging, its applications and challenges.
4. Conceptualize and understand computer vision algorithms for motion tracking.
5. develope understanding of infrared/thermal imaging.
6. to select and calibrate camera based on the application requirements.
7. to work with real time 3D problems based on the understanding of stereo vision techniques and algorithms.
8. to apply Object tracking and Recognition techniques in real life applications like Surveillance Security, vehicle and industry.

Unit I : Introduction to Computer Vision and Image Formation

Purpose, state of the art , Applications , Challenges in computer vision, CMOS CCD image sensors, Projective Geometry, Camera parameters, Camera model and Camera calibration • Binocular imaging systems, Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Rectification Digital camera, Bayers pattern. Smart Camera and its applications

Unit II : Feature Detection and Matching

Points and patches, Edges, Lines, Segmentation: Active contours, Level set representations, Fourier and wavelet descriptors, Graph-Cut and energy-based methods, 2D and 3D feature-based alignment, Feature matching.

Unit III : Stereo Imaging

Concept, triangulation, Correspondence, Epipolar geometry, rectification, RANSAC algorithm, dynamic programming. 3D reconstruction. Multi-view stereo: Volumetric and 3D surface reconstruction. Shape from silhouettes

Unit IV : Motion and Object tracking

Basics of motion, corner detector, and optical flow by Lucas Kanade mean shift tracking, Kalman filter, Object Tracking, condensation. Scale Invariant Feature Transform, Spatio- Temporal Analysis,

Dynamic Stereo; Motion parameter estimation, Structure from motion, Motion Tracking in Video

Unit V : Image Registration

Motion Models, Direct (pixel-based) Alignment, Feature-Based Registration, Global Registration, and Compositing. Panorama creation, Introduction to image based rendering. High dynamic range imaging.

Unit VI : Applications of Computer Vision

Thermal and Infrared Imaging. Range Imaging, In Vehicles: Lane Detection., Stereo Obstacle Detection, Laser Obstacle Detection, Vehicle Detection. Biometrics, document processing, Surveillance, Inspection of Cereal Grains. Machine learning in computer vision.

Text Books :

1. Richard Szeliski, Computer vision algorithms and applications, springer
2. Mubarak Shah, Fundamentals of Computer Vision, Online book
3. Emanuele Trucco, Alessandro Verri, "Introductory Techniques for 3-D Computer Vision", Prentice Hall, 1998

Reference Books :

1. Linda Shapiro and George Stockman: Computer Vision, Prentice Hall
2. E. R. Davies"Computer and Machine Vision: Theory, Algorithms, Practicalities", 4th Edition, Elsevier Inc, 2012.
3. Alexander Hornberg," Handbook of Machine and Computer Vision "Wiley-VCH Verlag 2017

Elective 4B: Statistical Information Processing (ETPA12183B)

Teaching Scheme
Credits : 3
Lectures : 3 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks

Prerequisite :
1. Digital Signal Processing
2. Fundamentals of Matrices

Course Objectives:
- To introduce concept of Linear Prediction and efficient computation of LPC.
- To build an understanding of estimation of Power Spectrum of Random Processes
- To understand the theoretical framework upon which error-control codes are built
- To equip students with the basic understanding of the fundamental concept of entropy and information theory.

Course Outcomes:
Upon learning the course the student will be able to
1. Compute linear prediction coefficients in efficient manner.
2. Analyze the discrete time signals by estimating power spectrum using various methods.
3. Formulate, design and implement the appropriate source coding scheme based on given practical constraint.
4. Formulate and implement the appropriate channel coding scheme based on given practical constraint.

Unit I : Review of random variables
Probability Concepts, distribution and density functions, moments, independent, uncorrelated and orthogonal random variables; Vector-space representation of Random variables, Vector quantization, Central Limit theorem, Discrete & Continuous Random Variables. Random process: Expectations, Moments, Ergodicity, Discrete-Time Random Processes Stationary process, autocorrelation and auto covariance functions, Spectral representation of random signals, Properties of power spectral density, Gaussian Process and White noise process.

Unit II : Random signal modelling
MA(q), AR(p), ARMA(p,q) models, Hidden Markov Model & its applications, Linear System with random input , Forward and Backward Predictions, Levinson Durbin Algorithm.

Unit III : Statistical Decision Theory: Parameter Estimation Theory:
Bayes' Criterion, Binary Hypothesis Testing, M-ary Hypothesis Testing, Minimax Criterion, Neyman-Pearson Criterion, Composite Hypothesis Testing. Maximum Likelihood Estimation, Generalized Likelihood Ratio Test, Some Criteria for Good Estimators, Bayes' Estimation Minimum Mean-Square Error Estimate, Minimum, Mean Absolute Value of Error Estimate Maximum A Posteriori Estimate, Multiple Parameter Estimation Best Linear Unbiased Estimator, Least-Square Estimation Recursive Least-Square Estimator.

Unit IV : Spectral analysis
Estimated autocorrelation function, Periodogram, Averaging the periodogram (Bartlett Method), Welch modification, Parametric method, AR(p) spectral estimation and detection of Harmonic signals.

Unit V : Information Theory and Coding:
Introduction, Uncertainty, Information and Entropy, Source coding theorem, Huffman, Shanon Fano, Arithmetic, Adaptive coding, RLE, LZW Data compaction, LZ-77, LZ-78. Discrete Memory less channels, Mutual information, channel capacity, Channel coding theorem, Differential entropy and mutual information for continuous ensembles.

Unit VI : Application of Information Theory:
Group, Ring & Field, Vector, GF addition, multiplication rules. Introduction to BCH codes, Primitive elements ,Minimal polynomials, Generator polynomials in terms of Minimal polynomials, Some examples of BCH codes, & Decoder, Reed- Solomon codes & Decoder, Implementation of Reed Solomon encoders and decoders

Text Books :

1. Monson Hayes, "Statistical Digital Signal Processing and Modelling", Wiley.
2. John G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing: Principles, algorithms and applications" Fourth edition, Pearson Prentice Hall.
3. Ranjan Bose, "Information Theory coding and Cryptography", McGraw-Hill Publication, 2nd Edition.
4. J C Moreira, P G Farrell, "Essentials of Error-Control Coding", Wiley Student Edition

Reference Books :

1. Papoulis and S.U. Pillai, "Probability, Random Variables and Stochastic Processes", 4th Edition, McGraw-Hill, 2002.
2. D.G. Manolakis, V.K. Ingle and S.M. Kogon, "Statistical and Adaptive Signal Processing", McGraw Hill, 2000.
3. Mourad Barkat , "Signal Detection and Estimation", Artech House, 2nd Edition, 2005.
4. R G. Gallager, "Information theory and reliable communication", Wiley, 1st edition, 1968.
5. F. J. MacWilliams and N. J. A. Sloane, "The Theory of Error-Correcting Codes", New York, North-Holland, 1977.
6. Rosen K.H, "Elementary Number Theory", Addison-Wesley, 6th edition, 2010.
7. Shu lin and Daniel j, Cistellojr., "Error control Coding" Pearson, 2nd Edition.
8. Todd Moon, "Error Correction Coding : Mathematical Methods and Algorithms", Wiley Publication

Elective 4C: System on Chip Design (ETPA12183C)

Teaching Scheme
Credits : 3
Lectures : 3 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks

Prerequisite :
1. Digital Electronics
2. Processor architectures

Course Objectives:
- To understand Application Specific Integrated Circuits design flow.
- To get familiar with No Instruction Set Computing architecture and different simulation models.
- To understand utilization of low power techniques for SoC design.

Course Outcomes:
At the end of the course, students will be able to:
1. Identify and formulate a given problem in the framework of SoC based design approaches.
2. Design SoC based system for engineering applications.
3. Realize impact of SoC on electronic design philosophy and Macro-electronics thereby incline towards entrepreneurship & skill development.

Unit I : ASIC
Overview of ASIC types, design strategies, CISC, RISC and NISC approaches for SOC architectural issues and its impact on SoC design methodologies, Application Specific Instruction Processor (ASIP) concepts.

Unit II : NISC
NISC Control Words methodology, NISC Applications and Advantages, Architecture Description Languages (ADL) for design and verification of Application Specific Instruction set Processors (ASIP), No-Instruction-Set-computer (NISC)- design flow, modeling NISC architectures and systems, use of Generic Netlist Representation - A formal language for specification, compilation and synthesis of embedded processors.

Unit III : Simulation
Different simulation modes, behavioural, functional, static timing, gate level, switch level, transistor/circuit simulation, design of verification vectors, Low power FPGA, Reconfigurable systems, SoC related modeling of data path design and control logic, Minimization of interconnects impact, clock tree design issues.

Unit IV : Low power SoC design
Design synergy, Low power system perspective- power gating, clock gating, adaptive voltage scaling (AVS), Static voltage scaling, Dynamic clock frequency and voltage scaling (DCFS), building block optimization, building block memory, power down techniques, power consumption verification.

Unit V : Synthesis
Role and Concept of graph theory and its relevance to synthesizable constructs, Walks, trails paths, connectivity, components, mapping/visualization, nodal and admittance graph. Technology independent and technology dependent approaches for synthesis, optimization constraints, Synthesis report analysis Single core and Multi core systems, dark silicon issues, HDL coding techniques for minimization of power consumption, Fault tolerant designs.

Unit VI : Case Study

Case study for overview of cellular phone design with emphasis on area optimization, speed improvement and power minimization.

Note: Students will prepare and present a term paper on relevant identified current topics (in batches of three students per topic) as a part of theory course.

Text Books :

1. Hubert Kaeslin, "Digital Integrated Circuit Design: From VLSI Architectures to CMOS Fabrication", Cambridge University Press, 2008.
2. Bashir M. Al-Hashimi, "System on chip-Next generation electronics", The IET, 2006.
3. Rochit Rajsuman, "System-on- a-chip: Design and test", Advantest America R & D Center, 2000

Reference Books :

1. P Mishra and N Dutt, "Processor Description Languages", Morgan Kaufmann, 2008.
2. Michael J. Flynn and Wayne Luk, "Computer System Design: System-on-Chip". Wiley, 2011

Elective 5A: Remote Sensing (ETPA12184A)

Teaching Scheme
Credits : 3
Lectures : 3 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment: 50 Marks

Prerequisite :
1. Digital Signal Processing

Course Objectives:
- To build an understanding of Remote Sensing.
- To impart knowledge of data acquisition.
- To understand analysis methods of captured information.

Course Outcomes:
Upon learning the course the student will be able to
1. Understand basic concepts, principles and applications of remote sensing, particularly the geometric and radiometric principles.
2. Provide examples of applications of principles to a variety of topics in remote sensing, particularly related to data collection, radiation, resolution, and sampling.

Unit I : Physics of Remote Sensing
Electro Magnetic Spectrum, Physics of Remote Sensing-Effects of Atmosphere-Scattering–Different types–Absorption-Atmospheric window-Energy interaction with surface features –Spectral reflectance of vegetation, soil and water atmospheric influence on spectral response patterns-multi concept in remote sensing.

Unit II : Data Acquisition
Types of Platforms–different types of aircrafts-Manned and Unmanned space crafts–sun synchronous and geo synchronous satellites –Types and characteristics of different platforms –LANDSAT, SPOT, IRS, INSAT, IKONOS, QUICKBIRD etc.

Unit III : **Photographic products**
B/W, color, color IR film and their characteristics – resolving power of lens and film - Optomechanical electro optical sensors –across track and along track scanners multispectral scanners and thermal scanners–geometric characteristics of scanner imagery - calibration of thermal scanners

Unit IV: Scattering System
Microwave scatterometry, types of RADAR –SLAR –resolution –range and azimuth –real aperture and synthetic aperture RADAR. Characteristics of Microwave Image topographic effect-different types of Remote Sensing platforms –airborne and space borne sensors -ERS, JERS, RADARSAT, RISAT - Scatterometer, Altimeter-LiDAR remote sensing, principles, applications.

Unit V : Thermal And Hyper Spectral Remote Sensing
Sensors characteristics-principle of spectroscopy imaging spectroscopy–field conditions, compound spectral curve, Spectral library, radiative models, processing procedures, derivative spectrometry, thermal remote sensing –thermal sensors, principles, thermal data processing, applications.

Unit VI : Data Analysis
Resolution–Spatial, Spectral, Radiometric and temporal resolution-signal to noise ratio-data products and their characteristics-visual and digital interpretation–Basic principles of data processing –

Radiometric correction–Image enhancement–Image classification–Principles of LiDAR, Aerial Laser Terrain Mapping

Text Books :

1. Lillesand. T. M. and Kiefer. R. W., "Remote Sensing and Image interpretation", 6th Edition, John Wiley & Sons, 2000.
2. John R. Jensen, "Introductory Digital Image Processing: A Remote Sensing Perspective", 2nd Edition, Prentice Hall,1995

Reference Books :

1. Richards, John A., Jia, Xiuping, "Remote Sensing Digital Image Analysis", 5th Edition, Springer-Verlag Berlin Heidelberg, 2013.
2. Paul Curran P.J. Principles of Remote Sensing, 1st Edition, Longman Publishing Group, 1984.
3. Charles Elachi, Jakob J. van Zyl, "Introduction to the Physics and Techniques of Remote Sensing", 2nd Edition, Wiley Series, 2006.
4. Sabins, F.F.Jr, "Remote Sensing Principles and Image Interpretation", 3rd Edition, W. H. Freeman & Co, 1978.

Elective 5B: Low Power CMOS Design (ETPA12184B)

Teaching Scheme
Credits : 3
Lectures : 3 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment: 50 Marks

Prerequisite :
1. Digital CMOS circuit design
2. MOSFET theory

Course Objectives:
- To know sources of power dissipation in CMOS circuits.
- To understand various power optimization techniques.
- To get familiar with low power clocking techniques.
- To understand low power memory and processor design methods.

Course Outcomes:
At the end of the course, students will be able to:
1. Identify the sources of power dissipation in digital IC systems & understand the impact of power on system performance and reliability.
2. Characterize and model power consumption & understand the basic analysis methods.
3. Understand leakage sources and reduction techniques.

Unit I : Sources of Power Dissipation:
Sources of power dissipation in digital ICs, degree of freedom, recurring themes in low-power, emerging low power approaches, dynamic dissipation in CMOS, effects of Vdd & Vt on speed, constraints on Vt reduction, transistor sizing & optimal gate oxide thickness, impact of technology scaling, technology innovations.

Unit II : Low Power Circuit Techniques:
Power consumption in circuits, flip-flops & latches, high capacitance nodes, energy recovery, reversible pipelines, high performance approaches.

Unit III : Low Power Clock Distribution:
Power dissipation in clock distribution, single driver versus distributed buffers, buffers & device sizing under process variations, zero skew Vs. tolerable skew, chip & package co-design of clock network.

Unit IV : Logic Synthesis for Low Power estimation techniques:
Power minimization techniques, Low power arithmetic components- circuit design styles, adders, multipliers.

Unit V : Low Power Memory Design:
Sources & reduction of power dissipation in memory subsystem, sources of power dissipation in DRAM & SRAM, low power DRAM circuits, low power SRAM circuits.

Unit VI : Low Power Microprocessor Design:
Power management support, architectural tradeoffs for power, choosing the supply voltage, low-power clocking, implementation problem for low power, comparison of microprocessors for power & performance.

Text Books :
1. P. Rashinkar, Paterson and L. Singh, "Low Power Design Methodologies", Kluwer

Academic, 2002.
2. Kaushik Roy, Sharat Prasad, "Low power CMOS VLSI circuit design", John Wiley sons Inc. 2000.
3. James B. Kuo, "Low voltage CMOS VLSI Circuits", Wiley, 1999.

Reference Books :

1. A.P. Chandrasekaran and R.W.Broadersen, "Low power digital CMOS design", Kluwer, 1995
2. Gary Yeap, "Practical low power digital VLSI design", Kluwer, 1998.

Elective 5C: Communication Buses and Interfaces (ETPA12184C)

Teaching Scheme
Credits : 3
Lectures : 3 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment: 50 Marks

Prerequisite :
1. Basics of communications.
2. Basics of field bus.

Course Objectives:
- To understand various serial communication protocol.
- To be able to select communication protocol for embedded application.
- To understand handshake mode of signal transaction for data communication.
- To understand field bus protocol and their applications.

Course Outcomes:
At the end of the course, students will be able to:
1. Select a particular serial bus suitable for a particular application.
2. Develop APIs for configuration, reading and writing data onto serial bus.
3. Design and develop peripherals that can be interfaced to desired serial bus.

Unit I : Serial Buses I:
Serial Busses Physical interface, Data and Control signals, features. Synchronous and asynchronous mode of operation. wired Vs wireless protocols

Unit II : Serial Buses II:
Comparison of RS232, RS485, I^2C, SPI protocols. Limitations and suitability of each protocol. Frame formats and initialization of these protocol in sample hardware (ARM7/Cortex)

Unit III : CAN and MODBUS
CAN: Architecture, features, designers benefits, Data transmission, bus arbitration method, Layers, Frame formats (standards and extended), advantages , applications primarily in automotive
MODBUS: Architecture, features, designers benefits, Data transmission, applications in control application.

Unit IV : PCIe:
PCI basics, PCIe Revisions, PCIe architecture, Configuration overview, Address space and transaction routing, TLP elements, Flow control, Quality of service, DLLP elements, HaAck/Nak protocol, Error detection and handling, and Power management.

Unit V : USB:
USB - Transfer types, enumeration, Descriptor types and contents, Device driver, sample driver with PIC32

Unit VI : Data Streaming Serial Communication Protocol:
Serial Front Panel Data Port (SFPDP) using fiber optic and copper cable, Ethernet communication networks.

Text Books :
1. Jan Axelson, "Serial Port Complete - COM Ports, USB Virtual Com Ports, and Ports for Embedded Systems ", Lakeview Research, 2nd Edition.

2. Jan Axelson, "USB Complete", Penram Publications.
3. Mike Jackson, Ravi Budruk, "PCI Express Technology", Mindshare Press.
4. Wilfried Voss, "A Comprehensible Guide to Controller Area Network", Copperhill Media Corporation, 2nd Edition, 2005.

Reference Books :

1. Serial Front Panel Draft Standard VITA 17.1 – 200x.
2. Technical references on www.can-cia.org, www.pcisig.com, www.usb.org

LABORATORY III (ETPA12185)

Teaching Scheme
Credits : 2
Practical : 4 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment (Oral): 50 Marks

List of Experiments :
Students can use Xilinx ISE/Modelsim or any other compatible EDA tools for the practical assignments.

A. To write Verilog design code and test the design by writing testbench code for

1. N-bit shift register.
2. Random Access Memory (RAM).
3. 4 x 4 Multiplier using structural model.
4. A simple processor to perform load, move, add, and sub operations.

B. To write SystemVerilog code to design and verify

1. FIFO memory
2. RAM
3. UART

LABORATORY IV (ETPA12186)

Teaching Scheme
Credits : 2
Practical : 4 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment (Oral): 50 Marks

List of Experiments :
Students can use MATLAB/ Tensorflow with Python for the practical assignments.

1. Implement simple logic network using MP neuron model
2. Implement a simple linear regressor with a single neuron model
3. Implement and test MLP trained with back-propagation algorithm
4. Implement and test RBF network
5. Implement SOFM for character recognition.
6. Implement SVM classifier for classification of data into two classes. Student can use datasets such as iris flower classification etc.
7. Implement and test Multiclass SVM classifier.
8. Implement and test CNN for object recognition using pretrained network like Alexnet/VGG/Googlenet.

Mini Project (ETPA12187)

Teaching Scheme

Credits : 2
Practical : 4 Hrs/week

Examination Scheme

Formative Assessment: 50 Marks

Objectives:

1. To enable the students to apply fundamental knowledge for understanding state of the art information about any topic relevant to curriculum
2. To make the students aware of ethical and professional practices
3. To enhance communication skills of the students
4. To study modern tools with an understanding of their limitations

Outcomes:

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

1. Write a detailed report about the topic in the prescribed format
2. Present the contents of the topic effectively through oral presentation
3. Demonstrate project work (hardware and/or software).

Mini Project shall be on any topic of student's own choice approved by the faculty. The continuous evaluation will be based on the continuous work of the student to achieve set objectives, technical contents of the topic to assess understanding of the student about the same. Students should prepare a power point presentation for its delivery in 15 minutes. The student should submit duly certified spiral bound report having the following contents.

- Introduction
- Literature Survey
- Theoretical contents/fundamental topics
- Relevance to the present national and global scenario (if relevant)
- Merits and Demerits
- Field Applications / case studies / Experimental work / software application / Benefit cost/ feasibility studies
- Conclusions
- References

A. Report shall be typed on A4 size paper with line spacing 1.5 on one side of paper.
   Left Margin : - 25 mm
   Right Margin : - 25 mm
   Top Margin : - 25 mm
   Bottom Margin : - 25 mm
B. Size of Letters
   Chapter Number: - 12 font size in Capital Bold Letters- Times New Roman
   Chapter Name: - 12 Font size in Capital Bold Letters- Times New Roman
   Main Titles (1.1, 3.4 etc):- 12 Font size in Bold Letters- Sentence case. Times New Roman
   Sub Titles (1.1.4, 2.5.3 etc):- 12 Font size in Bold Letters-Sentence case. Times New Roman
   All other matter: - 12 Font size sentence case. Times New Roman
C. No blank sheet be left in the report
D. Figure name: - 12 Font size in sentence case-Below the figure.
E. Table title -12 Font size in sentence case-Above the table.

Open Elective: Project Planning and Management (IOEP12188A)

Teaching Scheme
Credits : 3
Lectures : 3 Hrs/week

Examination Scheme
Formative Assessment : 50 Marks

Course Objectives:

- To impart knowledge of project life cycle.
- To introduce students to Project Identification Process, Project Initiation
- To understand studies related to Pre-Feasibility Study and Project feasibility Studies.
- To construct CPM, PERT network for a project.
- To introduce students to Steps in Risk Management, Risk Identification, Risk Analysis and Reducing Risks
- To introduce students to process of project Performance Measurement, Evaluation and closeout.

Course Outcomes:

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

1. understand phases of project life cycle
2. understand the Project Identification Process, Project Initiation.
3. Understand Pre-Feasibility Study and Project feasibility Studies of a project.
4. construct CPM, PERT network for a project.
5. understand the concept of Risk Management
6. understand the process of project Performance Measurement, Evaluation and closeout.

Unit I :	**Basics of Project Management (PM)**
Introduction, Need, Project Management Knowledge Areas and Processes, Concept of Organizational Structure and types, The Project Life Cycle (preferably with case study), Essentials PM.	
Unit II :	**Project Identification and Selection**
Introduction, Project Identification Process, Project Initiation, Pre-Feasibility Study, Feasibility Studies, Project Break-even point. Case study is preferred.	
Unit III :	**Project Planning**
Introduction, Need for Project Planning, Work Breakdown Structure (WBS), LOB, CPM and PERT, Network Cost System, Resource Allocation, Scheduling, Project Cost Estimate and Budgets.	
Unit IV :	**Project Risk Management and Quality Management**
Introduction, Risk, Risk Management, Role of Risk Management in Overall Project Management, Steps in Risk Management, Risk Identification, Risk Analysis, Reducing Risks. Introduction to Quality, Quality Concepts, Value, Engineering. Case study is preferred.	
Unit V :	**Project Performance Measurement, Evaluation and closeout**
Introduction, Performance Measurement, Productivity, Project Performance Evaluation, Benefits and Challenges of Performance Measurement and Evaluation, Controlling the Projects. Project Close-out, Steps for Closing the Project, Project Termination, and Project Follow-up. Case study is preferred.	
Unit VI :	**Operation Research in Management**
Introduction, Operation Research as tool for Decision Support System, Overview of OR	

Research Techniques, Formulation of Linear Programming Problem, Linear Programming Models, Assumptions of Linear Programming, Graphical Method and Simplex method for solving LP problem.
Text Books : 1. Premkumar Gupta and D.S. Hira, "Operations Research." S. Chand Publications 2. K. Nagrajan, "Project Management," New Age International Ltd. 3. Ahuja H. N., "Project Management," John Wiely, New York.

Open Elective: Ethical Hacking (IOEP12188B)

Teaching Scheme
Credits : 3
Lectures : 3 Hrs/week

Examination Scheme
Formative Assessment : 50 Marks

Course Objectives :

- Understand basics of network security and hacking.
- Aware of legal perspective of cybercrime including Indian IT ACT 2008.
- Learn techniques of gathering network information.
- Identify security tools including, but not limited to intrusion detection and firewall software.
- Learn to perform different kind of attacks.
- Understand functioning of various protocols

Course Outcomes :

After completion of the course, student will be able to

1. Use basics knowledge of network security and hacking.
2. Understand and use the IT Laws as and when required.
3. Gather required information to perform a attack.
4. Use various tools and methods for Vulnerability Assessment.
5. Perform different attacks on Dummy scenario.
6. Analyze the use of protocols studied

Unit I :	**Introduction to Network and security**

Basics of Computer Networks: OSI Model, TCP/IP Model, Network topology (Physical & logical), Network Hardware Components: Connectors, Repeaters, hubs, NICs, Bridges and Switches.
Basics of Computer Networks Security: Essential Terminology, Elements of Information Security, Types of Hackers, Steps for Ethical hacking, Types of Attacks.

Unit II :	**Legal Perspective**

The Indian IT Act, Challenges to Indian law, Cybercrime scenario in India, 2008 amendments to Indian IT Act, Intellectual property in the cyberspace.

Unit III :	**Information Gathering Techniques**

Active information gathering, passive information gathering, Trace route, Interacting with DNS Servers, SNMP and SMTP attacks.

Unit IV :	**Port Scanning and Vulnerability Assessment**

Target Enumeration and Port Scanning Techniques: Scanning for Open Ports and Services, Types of Port Scanning, Firewall/IDS Evading Techniques
Vulnerability Assessment: Vulnerability Scanners and How Do They Work, Pros and Cons of a Vulnerability Scanner, Vulnerability Assessment with Nmap, Nessus

Unit V :	**Network Sniffing**

Introduction, Types of Sniffing, ARP Protocol Basics, ARP Attacks, Denial of Service Attacks, Man in the Middle Attacks.

Unit VI :	**Remote Exploitation**

Understanding Network Protocols: TCP,UDP,ICMP, Server Protocols: FTP,HTTP,SMTP

Text Books :

1. Rafay baloch, "Ethical hacking and Penetration Testing guide", CRC press, 2015, ISBN: 13: 978-1-4822-3162-5 (eBook - PDF)
2. Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber Crimes, Computer

Forensics and Legal Perspectives", WILEY Publications, 2015.

Reference Books :

1. Behrouz Fourzon, "Data Communication and Computer Networks", Pearson Education, 5th edition.
2. Andrew S. Tanenbaum, "Computer Networks", International Economy Edition, 5th edition.

Open Elective: Product Design Engineering (IOEP12188C)

Teaching Scheme
Credits : 3
Lectures : 3 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks

Course objectives:

- To understand basic techniques for particular phases of product development.
- Make and manage design teams for product development in a company.

Course Outcomes:

Upon completion of this course, the student will be able to:

1. Describe an engineering design and development process
2. Employ engineering, scientific, and mathematical principles to execute a design from concept to finished product
3. Create 3D solid models of mechanical components from the perspective of aesthetic, ergonomic and functional requirement using CAD software
4. Work collaboratively on a team.
5. Create new product based on mechanical design engineering.
6. Investigate contemporary issues and their impact on provided solution.

Unit 1 – Introduction to Product Design

Characteristics of Successful Product Development, Innovative Thinking, Challenges to Product Development, Product Development Process, Concept Development, Economics – Cost Vs Performance, Design Considerations

Unit 2 – Product Development Process

Product development process- Identification of customer needs- customer requirements, product development process flows. Product specifications and concept generation, concept selection, concept screening, concept testing, reverse engineering, product architecture

Unit 3 –Product Design Tools

Creativity and Problem Solving –Creativity methods-Theory of Inventive Problem Solving (TRIZ), Product function tree, Life cycle analysis, Quality Function Deployment, Competing Product Analysis, SWOT analysis, Failure Mode Effect Analysis.

Unit 4 – Design for Manufacture and Assembly

Design for assembly, design for disassembly, design for environment, design for graphics and packaging

Unit 5 – Rapid Prototyping

Understanding Prototypes, Principles of Prototyping, Prototyping Technologies, Planning for Prototypes

Unit-6: Product Testing and Validation

Time value of Money, Analytical technique, Product and Process, Evaluation of component, subassembly, assembly, Reliability Goals, Computer simulations and Bench test results, Comprehensive test plans and reports.

Text Books:

1. Product Design-Techniques in Reverse Engineering and New Product Development, Kevin Otto,

Kristion Wood, Pearson Education, ISBN 978-81-7758-821-7.
2. Karl T.U. And Steven D.E., Product Design and Development, McGraw Hill, Ed 2000.

Reference Books :

1. Dieter GE, Engineering Design-Material and Processing Approach, McGraw Hill, Ed 2000