SCHEME OF INSTRUCTION & EXAMINATION

B.E. VIII- Semester

(ELECTRONICS AND COMMUNICATION ENGINEERING)

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs /Wk	CIE	SEE	Duration in Hrs	
Theory Course										
1	PE5XXEC	Professional Elective-V	3	-	-	3	30	70	3	3
2	PE5XXEC	Professional Elective-VI	3	-	-	3	30	70	3	3
3	OE6XXYY	Open Elective-III	3	-	-	3	30	70	3	3
Practical/Laboratory Course										
4	PW704EC	Major Project Phase-II	-	-	18	18	50	100	3	8
Total			**9**	**-**	**18**	**27**	**140**	**310**	**12**	**17**

PE: Professional Elective **OE:** Open Elective **PW:** Project Work

L: Lecture **T:** Tutorial **P:** Practical **D:** Drawing
CIE: Continuous Internal Evaluation **SEE:** Semester End Examination (Univ. Exam)

EC: Electronics and Communication Engineering

Note:

1. Each contact hour is a clock hour.
2. The duration of the practical class is two clock hours, however it can be extended wherever necessary, to enable the student to complete the experiment.

Professional Elective-V		
S. No.	**Course Code**	**Course Title**
1.	PE517EC	Speech Signal Processing
2.	PE518EC	Wireless Sensor Networks
3.	PE519EC	Nano Technology and its Applications
4.	PE520EC	Radar Systems

Professional Elective-VI		
S. No.	**Course Code**	**Course Title**
1.	PE521EC	Design of Fault Tolerant Systems
2.	PE522EC	Real Time Operating Systems
3.	PE523EC	Global Navigational Satellite Systems
4.	PE524EC	Computer Vision and Pattern Recognition

Open Elective – III		
S. No.	**Course Code**	**Course Title**
1	OE801 EE	Smart Building Systems*
2	OE802 EE	Programmable Logic Controllers *
3	OE803 AE	Automotive Maintenance*
4	OE804 ME	Mechatronics*
5	OE805 CE	Essentials of Road Safety Engineering*
6	OE806 CS	Software Engineering*
7	OE807 AS	Data Visualization*
8	OE808 AL	Human Computer Interaction*
9	OE809 DS	Cognitive Science and Analytics*
10	OE810 CB	Principles of Blockchain Technologies*
11	OE811 IT	Mobile Computing*
12	OE812 EC	Principles of Embedded Systems*
13	OE813 EC	Fundamentals of Fuzzy Logic*

***NOTE:** These subjects will not be offered to students of parent department

PROFESSIONAL ELECTIVE-V

SPEECH SIGNAL PROCESSING

PE517EC	
Instruction: 3 periods per week	*Duration of SEE:- 3 hours*
CIE: 30 marks	*SEE:- 70 marks*
Credits: 3	
*Prerequisite: Digital Signal Processing (PC$)*EC)*	

Course Objectives:

1. Understand the basic mechanism of human speech production and digital representation of speech wave forms.
2. Understand Short-time analysis, Synthesis techniques and Speech Synthesizers.
3. Understand the various problems with Automatic speech recognition.

Course Outcomes: On successful completion of the course, the students will be able to

1.Grasp the basic mechanism of human speech production.
2. Understand digital representation of speech wave forms.
3. Do Short-time analysis and Synthesis techniques.
4. Analyze Speech Synthesizers.
5. Understand the various problems with Automatic speech recognition

UNIT – I
Introduction to Speech Processing: The mechanism of Speech production, Acoustic Phonetics, Source-Filter model of speech production. Representation of Speech waveforms: Delta modulation, Adaptive delta modulation, Differential PCM, Adaptive differential PCM
UNIT – II
Time-domain models for Speech processing: Short -Time Energy function, Zero crossing rate,End point detection, Pitch Period Estimation, Vector quantization. Format Tracking
UNIT – III
Speech Signal Analysis: Short-Time Fourier analysis, Auto correlation function, Linear Predictive Analysis, Pitch Synchronous Analysis.Homomorphic Speech Processing: The Complex Cepstrum of Speech and its properties,Applications of Cepstral Processing.
UNIT – IV
Speech Synthesis: Format Synthesis, Linear Predictive Synthesis, Introduction to Text-to-speech, Articulatory speech synthesis. Speech Coders: Sub-band coding, Transforms coding, Channel decoder, Formant decoder, Linear Predictive decoder, Vector Quantizer coder.
UNIT – V
Automatic Speech Recognition: Problems in Automatic Speech Recognition, Dynamic warping, Hidden Markov models, Speaker Identification / verification.

Suggested Reading:

1.	L R Rabiner& R W Schafer, "Digital Processing of Speech Signals", PHI,1978.
2.	F J Owens, "Signal Processing of Speech", Macmillan,2000.
3.	Papamchalis, "Practical Approaches to Speech Coding", PHI,1987.
4.	Daniel Jurefskey&Jemes H. Martin, "Speech and Language Processing", Pearson Education,2003.
5.	Thomas W. Parsons, "Voice and Speech Processing", Mc GRAWHILL,1986
6.	https://archive.nptel.ac.in/courses/117/105/117105145/#

WIRLESS SENSOR NETWORK

PE518EC	
Instruction: 3 periods per week	*Duration of SEE:- 3 hours*
CIE: 30 marks	*SEE:- 70 marks*
Credits: 3	
Prerequisites: DCCN (PE672EC)	

Course Objectives:

1.To make students understand the basics of wireless sensor network.
2. To understand the concept of networking in WSN.
3. To introduce the hardware and software platforms and tool in WSN

Course Outcomes: On successful completion of the course, the students will be able to

1. To understand deployment strategies, challenges and technologies for WSN.
2. To understand network architecture.
3. Describing the communication, energy efficiency computing, storage and transmission .
4.Establishing the infrastructure and simulation
5..Explain the concept of security ,and attacks in WSN and Introduction to 5G

UNIT – I
Introduction to Wireless Sensor Networks WSN, Current Trends. Challenges for Wireless Sensor Networks-Characteristics requirements-required mechanisms.Difference between mobile ad-hoc and sensor networks, Applications of sensor networks.Enabling Technologies for Wireless Sensor Networks.
UNIT – II
Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments Network Architecture , Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts. Operating system and execution environment, Introduction to Tiny OS.
UNIT – III
Physical Layer and Transceiver Design Considerations, MAC Protocols for WSN, Low duty cycle protocols and Wakeup Concepts-S-MAC, Zigbee MAC Layer, Mediation device proto Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses.Routing Protocols- Energy-Efficient Routing, Geographic Routing. Programming Management.
UNIT – IV
Topology Control, Clustering, Time Sync, Localization and Positioning, Sensor Tasking.Operating Systems for Wireless Sensor Networks, Sensor Node Hardware – Berkeley Modes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming. Network slicing for industrial WSN
UNIT – V

Security Architectures, Survey of Security protocols for Wireless Sensor Networks and their Comparisons. 5G network Architecture, 5G Challenges in WSN and its Scope.Real time applications of WSN: Autonomy, Green Houses, Robustness and Reliability.SWOT (Strength, Weakness, Opportunities, and Threat) Analysis of WSNs.

Suggested Reading:

1.	Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks," John Wiley, 2005.
2.	Feng Zhao and Leonidas J. Guibas, "Wireless Sensor Networks - An Information Processing Approach," Elsevier, 2007.
3.	FazemSohraby, Daniel Minoli, and TaiebZnati, "Wireless Sensor Networks- Technology, Protocols and Applications," John Wiley, 2007.
4.	Anna Hac, "Wireless Sensor Network Designs," John Wiley, 2003. 5. Y Wang," A Survey of Security issues in Wireless Sensor Networks", IEEE Communications Survey and Tutorials, 2006
5.	WaltenegusDargie, Christian Poellabauer,"Fundamental of wireless sensor networks-theory and Practice" , john Wiley& sons Publication ,2011.
6	https://archive.nptel.ac.in/courses/106/105/106105160/

NANOTECHNOLOGY AND ITS APPLICATIONS

PE519EC	
Instruction: 3 periods per week	*Duration of SEE:- 3 hours*
CIE: 30 marks	*SEE:- 70 marks*
Credits: 3	
*Prerequisites: VLSI Design (*PC414EC*)*	

Course Objectives:

1. To understand the classification of systems in Nano technology and Nano materials
2. To analyze the Nano Structured materials applications using TEM
3. To understand the principles of Nano electronic devices

Course Outcomes: On successful completion of the course, the students will be able to

1. Understand the classification of systems in Nano technology and Nano materials
2. Describe the characteristics of Nano Materials
3. Demonstrate the Nano Structured materials application using TEM
4. Analyze the applications of Nano technology.
5. Understand the principles of Nano electronic devices.

UNIT – I

Emergence of nanotechnology with special reference to Feynman. Definition of anostructures. Building blocks of nanotechnology, Time and length scale in structures, energy landscapes. Nano sized effects: Surface to Volume Ratio, Energy at the Nanoscale-Quantum Effects. Classifications of Nano systems: 1D, 2D, 3D. Size Dependent Properties Nanomaterials.

UNIT – II

Synthesis and Characterization of Nanomaterials-Introduction, Sol-gel method, Ball milling. Physical methods & Chemical methods with examples: Inert gas condensation, Arc discharge, plasma synthesis & Nanocrystals by chemical reduction, photochemical synthesis, electrochemical synthesis. Semiconductor nanocrystals by arrested precipitation, Nano chemical routes.

UNIT – III

Nano structured material's Applications-Metal-Metal Nano composites, Polymer-Metal Nano composites, Dielectric and CMR based nanocomposites. Nano Semiconductors, MRAM devices. Thermo Electric Materials (TEM):Concept of phonon, Thermal conductivity, Specific heat, Exothermic & Endothermic processes. One dimensional TEM, Composite TEM, Applications.

UNIT – IV
Applications of Nanotechnology-Industrial applications of nanomaterials, in the areas of electronics, photonics, biology, health and environment, remediation of pollution, photocatalysis and other nanocatalysts, global warming. Toxicity of nanoparticles, exposure to nanoparticles and CNTs and influence on respiratory systems.
UNIT – V
Nanoelectronics: Nanoscale MOSFET–Resonant Tunneling Transistor Single-Electron Transistors; Single-Electron Dynamics; Nanorobotics and Nano manipulation; Mechanical Molecular Nanodevices; Nanocomputers: Optical Fibers for Nano devices; Photochemical Molecular Devices; DNA-Based, Gas-Based Nanodevices.

Suggested Reading:

1.	Charles P. Poole, Frank J. Owens, "*Introduction to Nanotechnology*", Wiley Inter science,2003.
2.	Mick Wilson, Kamal Kannangara & Geoff Smith, "*Nanotechnology: Basic Science &Emerging Technologies*," Overseas Press India Private Limited, 2005.
3.	A. Inoue & K. Hashimoto(Eds.), "*Amorphous and Nanocrystalline Materials: Preparation, Properties and Applications*," Springer, 2013
4.	K.Goser,P. Glosekotter and J.Dienstuhl, "*Nanoelectronics and nanosystems : fromtransistors to molecular and quantum devices"*, Springer 2005
5.	*Properties and applications"*,Imperial College Press, 2006.
6	https://archive.nptel.ac.in/courses/117/108/117108047/

RADAR SYSTEMS

PE 520 EC	
Instruction: 3 periods per week	*Duration of SEE:- 3 hours*
CIE: 30 marks	*SEE:- 70 marks*
Credits: 3	
Prerequisites: Digital Communications (PC413EC)	

Course Objectives:

1.To derive Radar equation and its dependence on various parameters.
2.To understand the concept of Doppler effect and get acquainted with the working principles of different types of Radars for surveillance &Tracking.
3.To explain the designing of a Matched Filter and understand Radar Receivers, displays and antennas.

Course Outcomes: On successful completion of the course, the students will be able to

1.Demonstrate the basic principle of Radar system and develop Radar range equation. Illustrate the importance of various parameters to enhance range estimation for accurate prediction.
2.Illustrate and understand the functioning of CW Radar, their variations and displays in Radar.
3.Explain types of MTI, non-coherent MTI Radar
4.Illustrate on radar tracking methods and differences among them.
5.Derive the matched filter response characteristics and explain about antennas used in radars.

UNIT – I
Radar Systems: Description of basic Radar system and its elements, Radar equation, block diagram and operation of a Radar, Radar frequencies, applications of Radar, prediction of range performance, minimum detectable signal, receiver noise figure, effective noise temperature, signal to noise ratio, false alarm time and probability of false alarm, integration, of Radar pulses, Radar cross- section of target, pulse-repetition frequency and range ambiguities,system losses.
UNIT – II
CW and FMCW Radars: Doppler effects, CW Radar, FMCW Radar, multiple frequency CW Radar, low noise front-ends, A-scope, B-scope, PPI displays, duplexers.
UNIT – III

MTI and Pulse Doppler Radar: MTI radar, delay line canceller, multiple and staggered PRF,blindspeeds, limitations to MTI performance, MTI using range gated Doppler filters, Pulse DopplerRadar, non-coherent Radar.
UNIT – IV
Tracking Radar: Sequential lobing, conical scan, mono-pulse-amplitude comparison and phase comparison methods, tracking in range and in Doppler, acquisition, comparison of trackers.
UNIT – V
Detection of Radar signals in noise: Matched filter receiver – response characteristics and derivation, correlation function and cross-correlation receiver, efficiency of non-matched filters, matched filter with non-white noise **Radar Antennas:** Antenna parameters- Parabolic reflectorantennas, Cassegrain antenna,Cosecant - squared antenna pattern, Introduction to Phased array antennas – Basic conceptsradiation pattern, beam steering and beam width changes.

Suggested Reading:

1.	Skolnik, Merrill I, “Introduction to Radar Systems”, 3/e, MGH, 2002.
2.	Barton. David K, “Modern Radar System Analysis”, 1/e, Aretech House, 2004.
3.	Peebles PZ, “Radar Principles”, John – Willey, 2004.
4.	Paul A Lynn, "Radar Systems", Springer, 3/e, 2021.
5.	Harold Roy Reamer, "Radar Systems Principles", Springer, 1997

PROFESSIONAL ELECTIVE-VI

DESIGN OF FAULT TOLERANT SYSTEMS

PE521EC	
Instruction: 3 periods per week	*Duration of SEE:- 3 hours*
CIE: 30 marks	*SEE:- 70 marks*
Credits: 3	
Prerequisite: Digital Electronics (EC303EC) & Electronic Devices(PC401EC)	

Course Objectives:

1. Gain the basic concepts and metrics of reliable systems and able to comprehend the methods involved in testing
2. Appreciating the techniques involved in developing reliable and fault tolerant modules using redundancy and Gain insight into practical applications of reliable systems.
3. Study testability, built–in-test & test compression in concepts.

Course Outcomes: On successful completion of the course, the students will be able to

1. Apply the metrics like MTBF, MTTR and Availability to calculate reliability of a system.
2. Acquire knowledge on conventional test generation techniques to test combinational and sequential logics.
3. Gain the knowledge on techniques involved in developing reliable and fault tolerant modules using redundancy.
4. Acquire knowledge on Design for testability concepts.
5. Apply design for testability (DFT) techniques to improve observability and controllability of circuits and gain knowledge on test data compression and IDDQ testing.

UNIT – I
Basic concepts of Reliability: Failures and faults, Reliability and failure rate, Relation between reliability & mean time between failure, Maintainability & Availability, reliability of series and parallel systems. Modeling of faults , Test generation for combinational logic Circuits: conventional methods-path sensitization & Boolean difference. Random testing- transition count testing and signature analysis.
UNIT – II
Fault Tolerant Design-I: Basic concepts, static redundancy- Triple modular redundancy(TMR),NMR and use of error correcting codes, dynamic, hybrid and self purging redundancy, Sift-out Modular Redundancy (SMR),Fault tolerant design of memory system using error detection and correcting using hamming codes.
UNIT – III

Fault Tolerant Design-II: Time redundancy, software redundancy, fail-soft operation, Practical fault tolerant systems- Space shuttle, COPRA and ESS. Introduction to fault tolerant design of VLSI chips. Self checking circuits: Design of totally self checking checkers, checkers using m-out of n codes, self totally checking PLA design.
UNIT – IV
Design for testability: Ad-hoc methods, Full scan design, Partial scan design, Boundary scan Built-in self-test: RAM BIST Logic BIST Random and weighted random pattern testability BIST Pattern generator and response analyzer, Scan-based BIST architecture Test point insertion for improving random testability.
UNIT – V
Test Data Compression: Test stimulus compression Test response compaction, IDDQ testing, IDDQ detect defects, IDDQ test patterns, measurement, Case studies, Limitations of IDDQ Testing Design for IDDQ testability. Analog/Mixed-signal testing: Measurement DSP-based testing, IEEE 1149.4 High-speed IO testing.

Suggested Reading:

1.	Parag K. Lala, "Fault Tolerant & Fault Testable Hardware Design",PHI, 2007
2.	Parag K. Lala, "Digital systems Design using PLD's", BS Publication 2003.
3.	Laung-Terng Wang, Cheng-Wen Wu, Xiaoqing Wen "Test Principles and Architectures: Design for Testability" Elsevier, 2006.
4.	MironAbramovici, Melvin A. Breuer and Arthur D. Friedman, Digital Systems Testing and Testable Design, John Wiley & Sons Inc 1990.
5.	Ml Bushnell And V D Agrawal "Essentials Of Electronic Testing For Digital, Memory And Mixed-Signal Vlsi Circuits", Kluwer Academic Publishers-2000

REAL TIME OPERATING SYSTEMS

PE522EC	
Instruction: 3 periods per week	*Duration of SEE:- 3 hours*
CIE: 30 marks	*SEE:- 70 marks*
Credits: 3	
Prerequisite: Computer Organization and Architecture (EC404EC)	

Course Objectives:

1. To introduce the principles shared by different real-time operating systems and their use in the dev embedded multitasking application software. f circuits.
2. To provide broad understanding of Real Time Operating Systems.
3. To understand the applications of these Real Time features using case studies.

Course Outcomes: On successful completion of the course, the students will be able to

1. Explain the concepts of a real time operating systems and compare its features with a general-purpose OS
2. Analyze various scheduling algorithms related to RTOS.
3. Summarize the concepts related to concurrency, synchronization and deadlock.
4. Compare different real time operating systems.
5. Explain the file system of RTOS.

UNIT – I
Operating Systems, Computer-System Organization, Computer-System Architecture, Operating-System Structure, Operating-System Operations, Process Management, Memory Management, Storage Management, Protection and Security, Kernel Data Structures, Computing Environments, Open-Source Operating Systems, Introduction to Real time operating systems.
UNIT – II
Hard versus Soft Real-Time System: Jobs and Processors, release time, deadlines, and timing constraints, hard and soft timing constraints, hard real time systems, Uniprocessor Scheduling: Types of scheduling, scheduling algorithms: FCFS, SJF, Priority, Round Robin, Multilevel feedback queue scheduling, Thread scheduling, Multiprocessor scheduling concept, RealTime scheduling concept, Differences between real time and non real time scheduling.

UNIT – III
Concurrency: Principles of Concurrency, Mutual Exclusion H/W Support, Software approaches, Semaphores and Mutex, Message passing, Monitors, Classical problems of Synchronization: Readers-Writers problem, Producer Consumer problem, Dining Philosopher problem. Deadlock: Principles of deadlock, Deadlock prevention, Deadlock Avoidance, Deadlock detection, Recovery from Deadlock
UNIT – IV
Elementary Concepts of VxWorks: Multitasking, Task State Transition, Task Control – Task Creation and Activation, Task Stack, Task Names and IDs, Task Options, Task Information, Task Deletion and Deletion Safety. Memory Management – Virtual to Physical Address Mapping. Comparison of RTOS – VxWorks, µC/OS-II and RT Linux for Embedded Applications.
UNIT – V
File System, Concepts of –Process, Concurrent Execution & Interrupts. Process Management – forks & execution. Basic level Programming with System calls, Shell programming and filters, UNIX Signals, POSIX Standards

Suggested Reading:

1.	Operating System Concepts – Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, 8th edition, Wiley-India, 2009
2.	Andrew S. Tanenbaum, 'Modern Operating Systems', 4/e, Pearson Edition,2014.
3.	Jane W.S.Liu, "Real Time Systems," 1/e, Pearson Education, Asia, 2002.
4.	Jean J Labrose, 'Embedded Systems Building Blocks Complete and Ready-to-use Modules in C', 2/e, CRC Press 1999.
5.	Wind River Systems, 'VxWorks Programmers Guide 5.5', Wind River Systems Inc.2002
6.	https://onlinecourses.nptel.ac.in/noc20_cs16/preview

GLOBAL NAVIGATION SATELLITE SYSTEMS

PE523EC	
Instruction: 3 periods per week	*Duration of SEE:- 3 hours*
CIE: 30 marks	*SEE:- 70 marks*
Credits: 3	
Prerequisite: Digital Communication (PC413EC)	

Course Objectives:

1. Study the fundamentals, signal structures and error sources of Global Position System(GPS).
2. Introduce the architectures of different GPS based augmentation systems
3. Familiarize with the basic concepts of other GNSS constellations

Course Outcomes: On successful completion of the course, the students will be able to

1. Understand the fundamentals of GPS
2. Describe the different types of GNSS Signals and GNSS Datum.
3. Analyze the GPS errors and their modeling techniques.
4. Explain various GPS data processing and GPS integration techniques.
5. Discuss the augmentation systems and regional navigation satellite systems

UNIT – I
GPS Fundamentals: Basics of satellite communications**,** trilateration, transit**,** Principle of operation, GPS Orbits, Orbital mechanics and satellite position determination, Time references, Geometric Dilution of Precision: GDOP, VDOP, PDOP. Solar and Sidereal day, GPS and UTC time, SPS and PPS services, GPS co-ordinate system-ECI, ECEF and WGS-84.
UNIT – II
GPS Signal Structure and GPS modernization: GPS signals, C/A and P-Codes, GPS Signal generation, Spoofing and anti- spoofing. Error sources in GPS: Satellite and receiver clock errors, Ephemeris error, Atmospheric errors, Receiver measurement noise and UERE, GPS modernization-new GPS III Satellites, new operational control segment, future applications and its current status.
UNIT – III
GPS Augmentation systems: Differential GPS. Classification of Augmentations Systems, operating principles of different types of SBAS- Wide area augmentation system (WAAS) architecture, GPS Aided GEO Augmented Navigation (GAGAN), European Geostationary Navigation Overlay Service (EGNOS), MTSAT Satellite-based Augmentation System (MSAS) etc. SBAS current status. Ground based augmentation systems(GBAS)/Local area augmentation system (LAAS) concept, National and International Status of implementation of LAAS. Relative advantages and limitations of SBAS over

GBAS.
UNIT – IV
Various GNSSs: Architecture and features of Russian Global Navigation Satellite System (GLONASS), European Navigation System (Galileo), Chinese Global Navigation System (BieDou-2/COMPASS), GNSS Applications.
UNIT – V
Regional Navigation Satellite Systems (RNSS): Navigation with Indian Constellation (NavIC), Japan's Quasi-Zenith Satellite System (QZSS), Chinese Area Positioning System (CAPS). **GPS Integration:** GPS/GIS, GPS/INS, GPS/Pseudolite, GPS/Cellular integrations.

Suggested Reading:

1.	Elliot D. Kaplan, "Understanding GPS Principles and Applications", 2/e, Artech House 2005
2.	Rao G.S., "Global Navigation Satellite Systems – with Essentials of Satellite Communications", TMH 2010
3.	Sateesh Gopi, "Global Positioning System: Principles and Applications", 5/e, TMH 1999
4.	Paul D Groves, "Principles of GNSS, Inertial, and Multi-Sensor Integrated Navigation Systems", Artech House Publishers 2008
5.	Basudeb Bhatta," Global Navigation Satellite Systems: Insights into GPS, GLONASS, Galileo, Compass", B.S. Publications 2010
6	https://onlinecourses.nptel.ac.in/noc21_ce77

COMPUTER VISION AND PATTERN RECOGNITION

PE524EC	
Instruction: 3 periods per week	*Duration of SEE:- 3 hours*
CIE: 30 marks	*SEE:- 70 marks*
Credits: 3	
Prerequisite: Digital Image & Video Processing (PC501EC)	

Course Objectives:

1. To review image processing techniques and understand shape and region analysis for computer vision.
2. To study some applications of computer vision algorithms.
3. To study some fundamental concepts, theories, and algorithms for pattern recognition and its application.

Course Outcomes: On successful completion of the course, the students will be able to

1. Implement fundamental image processing techniques required for computer vision.
2. Perform binary shape analysis and shape recognition using boundary tracking techniques.
3.Understand the ideas to develop applications using computer vision techniques.
4.Understand the concept of pattern recognition and different paradigms for pattern recognition.
5.Understand the theory, benefits, inadequacies and possible applications of various pattern recognition algorithms.

UNIT – I
Image Processing Foundations: Review of image processing techniques , operations , thresholding techniques , edge detection techniques ,corner and interest point detection ,mathematical morphology ,texture.
UNIT – II
Shapes and Regions: Binary shape analysis , connectedness , object labelling and counting , size filtering ,distance functions , skeletons and thinning , deformable shape analysis , boundary tracking procedures ,, active contours , shape models and shape recognition , centroidal profiles, handling occlusion , boundary length measures , boundary descriptors.
UNIT – III
Applications: Application: Photo album , Face detection , Face recognition , Eigen faces , Active appearance and 3D shape models of faces Application: Surveillance , foreground background separation – particle filters, tracking and occlusion. Application: In-vehicle vision system for locating roadways.
UNIT – IV
Introduction to Pattern Recognition: Data Sets for Pattern Recognition and different Paradigms, Data Structures for Pattern Representation, Representation of Clusters, Proximity Measures, Size of Patterns,

Abstractions of the Data Set, Feature Extraction and Selection.
UNIT – V
Nearest Neighbour Based Classifier: Nearest Neighbour Algorithm, Variants of the NN Algorithm and its use for Transaction Databases. **Clustering:** Importance and its types, Clustering Large Data Sets.An Application-Hand Written Digit Recognition: Description of the Digit Data and its Preprocessing, Classification Algorithms, Selection of Representative Patterns and results.

Suggested Readings:

1.	Computer Vision: Models, Learning, and Inference - Simon J. D. Prince, Cambridge University Press, 2012
2.	Feature Extraction & Image Processing for Computer Vision - Mark Nixon and Alberto S. Aquado - Third Edition, Academic Press, 2012
3.	Computer & Machine Vision - E. R. Davies- Fourth Edition, Academic Press, 2012
4.	Pattern Recognition: An Algorithmic Approach - M. Narasimha Murthy, V. Susheela Devi, Springer Pub, 1st Edition.
5.	Pattern Recognition and Classification – Geoff Dougherty, Springer Pub, 2013.
6.	https://onlinecourses.nptel.ac.in/noc23_ee119/preview

MAJOR PROJECT PHASE-II

PW704EC	
Instruction: -18 hrs per week	*Duration of SEE:- 3 hrs*
CIE: 50 marks	*SEE:- 100 marks*
Credits: 8	

Course Objectives:

1. To familiarize tools and techniques of systematic literature survey and documentation.
2. To expose the students to industry practices and team work.
3. To encourage students to work with innovative and entrepreneurial ideas

Course Outcomes: On successful completion of the course, the students will be able to

1. Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to the real-world problems.
2. Evaluate different solutions based on economic and technical feasibility.
3. Effectively plan a project and confidently perform all aspects of project management
4. Demonstrate effective written and oral communication skills.
5. Find relevant sources (e.g., library, Internet, experts) and gathers information for preparing reports and other relevant documentation.

The aim of Major Project Phase–II is to implement and evaluate the proposal made as part of Major Project Phase-I. Students can also be encouraged to do full time internship as part of Major Project Phase–II based on the common guidelines for all the departments. The students placed in internships need to write the new proposal in consultation with industry coordinator and project guide within two weeks from the commencement of instruction.
The department will appoint a project coordinator who will coordinate the following:
1.Re-grouping of students - deletion of internship candidates from groups made as part of
Major Project Phase-I.
2. Re-Allotment of internship students to project guides.
3. Project monitoring at regular intervals.
All re-grouping/re-allotment has to be completed by the 1st week of VIII semester so that students get sufficient time for completion of the project. All projects (internship and departmental) will be monitored at least twice in a semester through student presentation for the award of sessional marks. Sessional marks are awarded by a monitoring committee comprising of faculty members as well as by the supervisor.

The first review of projects for 25 marks can be conducted after completion of five weeks. The second review for another 25 marks can be conducted after 12 weeks of instruction. Common norms will be established for the final documentation of the project report by the respective departments. The students are required to submit draft copies of their project report within one week after completion of instruction.
Note: Three periods of contact load will be assigned to each project guide.

OPEN ELECTIVE – III

PRINCIPLES OF EMBEDDED SYSTEMS

OE812 EC	
Instruction: 3 periods per week	*Duration of SEE:- 3 hours*
CIE: 30 marks	*SEE:- 70 marks*
Credits: 3	
Prerequisites: NIL	

Course Objectives:

1. To understand the fundamentals of embedded systems.
2. To study the block diagram and advanced hardware fundamentals
3. To study the software architecture of embedded systems.

Course Outcomes: On successful completion of the course, the students will be able to

1. Acquire an overview of what an embedded system implies.
2. Understand the architecture of a microprocessor and microcontroller to enable to design embedded applications using them.
3. Apply theoretical learning to practical real time problems for automation.
4. Understand how to build and debug an embedded system application.
5. Analyze and design real world applications and interface peripheral devices to the microprocessor

UNIT – I

Fundamentals of embedded systems: Definition of Embedded system, Examples of Embedded Systems, Typical Hardware, Terminology, Gates, A few other basic considerations, Timing Diagrams, Memory.

UNIT – II

Advanced hardware fundamentals: Microprocessors, Buses, Direct Memory access, Interrupts, Other Common Parts, Built-Ins on the Microprocessor, Problem, Conventions used in Schematics, Microprocessor Architecture, Interrupts Basics, Shared Data Interrupt Latency.

UNIT – III

Software architecture of embedded systems: Round- Robin, Round-Robin with Interrupts, Function-Queue- Scheduling Architecture, Real- Time Operating System Architecture, Selecting an Architecture.

UNIT – IV

Embedded software development tools: Host and Target Machines, Cross ROM compilers, Cross Assemblers and Tool Chains, Linkers /Locaters for Embedded Software, Getting Embedded Software into Target System: PROM programmers, Emulators, In-Circuit Emulators.

UNIT – V

Debugging techniques: Testing on your host machine, case study, Instruction Set –details .Simulators-brief study The assert Macro - Using Laboratory Tools.

Suggested Reading:

1.	David. E. Simon, "An Embedded Software Primer", Low price edition, Pearson Education, New Delhi, 2006.
2.	Frank Vahid and Tony Givargis "Embedded System Design: A Unified Hardware/Software. Approach". John Wiley & Sons, October 2001.
3.	Rajkamal, "Embedded systems: Programming, architecture and Design", second edition, McGraw-Hill Education (India), March 2009.
4.	Shibu K V, "Introduction to Embedded systems", 1/e, McGraw Hill Education,2009.
5.	Andrew N. Sloss, Dominic Symes, Chris Wright," ARM System Developer's Guide Designing and Optimizing System Software" Elsevier2015.
6	https://archive.nptel.ac.in/courses/108/102/108102169/#

FUNDAMENTALS OF FUZZY LOGIC

OE813 EC	
Instruction: 3 periods per week	*Duration of SEE:- 3 hours*
CIE: 30 marks	*SEE:- 70 marks*
Credits: 3	
Prerequisite:NIL	

Course Objectives:

1. The concepts of regular sets, Fuzzy sets & Fuzzy relations
2. Membership functions, Different Fuzzification&Defuzzification methods
3. Fuzzy Associative Memories, FAM system Architecture

Course Outcomes: On successful completion of the course, the students will be able to

1. To distinguish Crisp sets & Fuzzy sets and perform operations on Fuzzy sets
2. Define Fuzzy relations & apply operations on different Fuzzy relations
3. To convert crisp sets to Fuzzy sets using different Fuzzification methods
4. To convert Fuzzy sets to Crisp sets using different Defuzzification methods
5. To understand Fuzzy Associative Memories & FAM system Architecture

UNIT – I
Basics of Fuzzy sets: Introduction to Fuzzy sets, Crisp sets Vs Fuzzy sets, Operation on Fuzzy sets, Properties of Fuzzy sets, Extensions of Fuzzy set concepts: Other kind of Fuzzy sets, Further operations on Fuzzy sets, Extension principle: Operations of Type-2 Fuzzy sets, Consistency Degree of Two Fuzzy sets.
UNIT – II
Fuzzy Relations: Basics of Fuzzy relations, Fuzzy relation representation, Graph representation of binary Fuzzy relation: Bipartite graph, Simple Fuzzy graph, Operations on Fuzzy relations, Properties of Fuzzy relations, Various types of Binary fuzzy relations: Similarity relations, Resemblance relations & Fuzzy Partial Ordering.
UNIT – III
Properties of Membership functions, Fuzzification: Membership Functions, Features of the Membership function, Fuzzification, Comparisons of Fuzzy sets and Crisp or Fuzzy readings, Different Fuzzification methods: Intuition, Inference, Rank ordering, Neural Networks, Genetic Algorithms, Inductive Reasoning.
UNIT – IV
Defuzzification: Defuzzification to scalars, Different Defuzzification methods: Max membership

principle (Height method), Centroid method (Center of area or Center of gravity), Weighted average method, Mean max membership (Middle-of-maxima), Center of sums, Center of largest area, First (or last) of maxima.
UNIT – V
Fuzzy Associative Memories (FAM): FAMs as Mappings, Fuzzy Hebb FAMs, Bi-directional FAM theorem for Correlation-Minimum Encoding, Correlation-Product Encoding, Superimposing FAM rules, FAM system Architecture, Fuzzy logic control (FLC) system: Basic structure and operation of FLC system.

Suggested Reading:

1.	Timothy J. Ross, “Fuzzy Logic with Engineering Applications”, John Wiley & Sons, Third Edition 2010.
2.	C.T. Lin and C.S.George Lee, "Neural Fuzzy Systems", PH PTR, 2006.
3.	Bant A KOSKO, "Neural Networks and Fuzzy Systems", PH PTR, 2012.
4.	Altrock, C.V., "Fuzzy Logic and Neuro Fuzzy Applications explained", PH PTR, 2000.
5.	George J.Klir, Bo Yuan, “Fuzzy Sets & Fuzzy Logic”, Prentice Hall PTR, 2010.
6.	https://onlinecourses.nptel.ac.in/noc21_ee49/preview