ANNA UNIVERSITY, CHENNAI
NON - AUTONOMOUS COLLEGES AFFILIATED ANNA UNIVERSITY
M.E. ELECTRONICS AND COMMUNICATION ENGINEERING (INDUSTRY INTEGRATED)
REGULATIONS – 2021
CHOICE BASED CREDIT SYSTEM

Prerequisite for the programme: Offered if commitment for summer internship followed by projects is available for all students from industry and for collaboration with industry in delivering lectures for the subjects in all semesters in the curriculum.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

1. To enable graduates to possess skills to develop new innovation in the field of Electronics and Communication Engineering (Industry Integrated) using analytical reasoning and state-of-the-art approaches derived from the Engineering Sciences and Engineering practice.

2. To enable graduates to create useful systems, components, or processes through agile, skillful, and innovative analysis and design, while respecting economic, environmental, cultural, and ethical standards or constraints and acquire technical and managerial leadership positions in their chosen fields.

3. To enable graduates to engage in lifelong learning, adapt to evolving Technology, work in multidisciplinary research for designing innovative products & solutions.

4. To become Entrepreneurs, understand current professional issues and apply latest technologies for the betterment of the nation and society.

PROGRAM OUTCOMES (POs)

1. An ability to independently carry out research/investigation and development work to solve practical problems

2. An ability to write and present a substantial technical report/document

3. Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program

4. To apply the core aspects of Electronics and Communication Engineering principles such as Signal Processing, Embedded Systems, Networking and Semiconductor Technology for designing end to end electronic products catering industry requirements.

5. To identify and utilize the strengths of current technologies used in industries in the field of Microelectronics, Signal Processing and Communication System domains in implementing ICT enabled services for societal needs

6. To identify industrial needs and provide suitable design solutions for implementing IoT, Cyber Physical Systems for given specifications
## M.E. ELECTRONICS AND COMMUNICATION ENGINEERING (INDUSTRY INTEGRATED) REGULATIONS – 2021

### CHOICE BASED CREDIT SYSTEM

### I TO IV SEMESTERS CURRICULA AND SYLLABI

#### SEMESTER I

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*Audit course is optional

**Note:** Summer internship (in Industry) (30 days min)
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|        |                                      |          |                  |                        |         |
|        | 12                                      | 0            | 14                | 26                     | 21       |

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**TOTAL**

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|        | Practical                          |          |                  |                        |         |
|        |                                      |          |                  |                        |         |
|        | 0                                      | 0            | 24                | 24                     | 12       |

**TOTAL NO. OF CREDITS: 76**

### PROFESSIONAL ELECTIVES

#### SEMESTER II, ELECTIVE I

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### AUDIT COURSES (AC)

Registration for any of these courses is optional to students

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MA4156  LINEAR ALGEBRA, PROBABILITY AND QUEUEING THEORY  L T P C
                          3 1 0 4

COURSE OBJECTIVES:
The objective of this course is to enable the student to
• grasp the basic concepts of Probability, Random variables, correlation and regression.
• characterize the phenomena which evolve with respect to time in a probabilistic manner.
• encourage students to develop a working knowledge of the ventral ideas of linear algebra.
• acquire skills in analyzing Queueing Models.
• develop a fundamental understanding of linear programming models and apply the simplex method for solving linear programming problems.

UNIT – I  LINEAR ALGEBRA  12

UNIT – II  PROBABILITY AND RANDOM VARIABLES  12

UNIT – III  RANDOM PROCESSES  12

UNIT – IV  QUEUEING THEORY  12

UNIT – V  LINEAR PROGRAMMING  12

COURSE OUTCOMES:
After the completion of the course, the student will be able to
• apply various methods in Linear Algebra to solve the system of linear equations.
• use two-dimensional random variables, correlations and regression in solving application problem.
• apply the ideas of Random Processes.
• understand the basic characteristic features of a queueing system and acquire skills in analyzing queueing models.
• apply the Simplex method for solving linear programming problems.

REFERENCES:

RM4151 RESEARCH METHODOLOGY AND IPR L T P C 2 0 0 2

UNIT I RESEARCH DESIGN
Overview of research process and design, Use of Secondary and exploratory data to answer the research question, Qualitative research, Observation studies, Experiments and Surveys.

UNIT II DATA COLLECTION AND SOURCES
Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data - Preparing, Exploring, examining and displaying.

UNIT III DATA ANALYSIS AND REPORTING
Overview of Multivariate analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation.

UNIT IV INTELLECTUAL PROPERTY RIGHTS

UNIT V PATENTS

TOTAL : 30 PERIODS

REFERENCES:
COURSE OBJECTIVES:

- To study the architecture and programming of PIC microcontrollers.
- To learn interfacing with PIC microcontrollers.
- To understand the ARM processor architecture.
- To program using ARM Instruction Set.
- To design and develop embedded applications.

UNIT I  PIC MICROCONTROLLER – ARCHITECTURE

RISC Vs CISC Architectures – PIC Architecture and Assembly Language Programming - Program Memory Organization- Branch, Call and Time Delay Loop - PIC I/O Port Programming - Arithmetic and Logic Instructions and Programs - PIC Bank Switching, Table Processing, Macros And Modules PIC Configuration Registers-PIC Hardware Connection-ROM Loaders.

UNIT II  PIC INTERFACING

PIC Timer / Counter Programming - Timers 0 And 1- Programming Timers 2 and 3 -Serial Port Programming -Interrupt Programming -Flash / EEPROM Programming - Standard and Enhanced CCP Modules -Compare Mode Programming - Capture Mode Programming- PWM Programming- ECCP Programming.

UNIT III  ARM ARCHITECTURE


UNIT IV  ARM PROGRAMMING

ARM Instruction Set - Data Processing Instructions – Branch Instructions — Load Store Instructions – Software Interrupt Instruction – Program Status Register Instructions – Conditional Execution - Thumb Instruction Set-Thumb Programmers Model-Thumb Branch Instructions- Thumb Data Processing Instructions-Thumb Single Register Data Transfer- Thumb Multiple Register Data Transfer Instructions - Thumb Implementation.

UNIT V  EMBEDDED APPLICATIONS


SUGGESTED ACTIVITIES:

1: Interfacing PIC microcontrollers with peripherals.
2: Assignments on programming ARM processors.
3: Design embedded systems for real – time applications.

COURSE OUTCOMES:

CO1: Understand the architecture of a PIC microcontroller.
CO2: Program using PIC microcontrollers.
CO3: Program using ARM processors.
CO4: Design interfacing circuits with PIC microcontrollers.
CO5: Design embedded applications to solve real world problems.

TOTAL: 45 PERIODS

REFERENCES:

II4101 INDUSTRIAL AUTOMATION AND CONTROL L T P C 3 0 0 3

COURSE OBJECTIVES:
The students will be able to
- Understand PLC Instructions
- Develop Ladder Logic for working models
- Use SCADA programming
- Interface various sensors with Arduino for industrial Automation

UNIT I PROGRAMMABLE LOGIC CONTROLLERS
Programmable Logic Controllers (PLCs) – architecture-Types- features -Programming a PLC using ladder/connected Component workbench-Input & Output Modules- Bit Instructions- Timer & Counter Instructions- Comparison & Data Handling Instructions- Program Control Instructions- Sequencing Instructions- PLC Programming Exercises for Industrial Applications- DOL starter- Star Delta starter- Automatic water level controller- Conveyor-Lift-Bottle filling and process control applications-Analog I/Os - High speed counter- PTO PWM and RTC

UNIT II SCADA SYSTEM
Evolution of SCADA, Various SCADA architectures, advantages and disadvantages of each system, SCADA System Components: Schemes- Remote Terminal Unit (RTU), Intelligent Electronic Devices (IED), Communication Network, SCADA Server Data acquisition systems, SCADA applications in Automation, SCADA – Memory tag, Device tag, Alarm logging, Data logging, OPC server- HMI Systems – DCS- DCS integration with PLC and Computers - Features of DCS

UNIT III ARDUINO AND SENSORS FOR INDUSTRIAL AUTOMATION AND CONTROL
UNIT IV DATA ACQUISITION SYSTEM

Data acquisition of digital and analog signals (input and output) – Stand alone, LabVIEW compatible, Mat lab compatible, Real time data acquisition and storing using different data acquisition cards. Retrieving the stored data for analysis – High level language programming for using data acquisition system

UNIT V PROCESS CONTROL AND PNEUMATICS

Process control- P, PI, PD,PID–Tuning methods- Statistical Process Control, Model Predictive Control, Fuzzy Logic Based Control, Neural-Network Based Control


COURSE OUTCOMES:
The students will be able to

- Program PLC for Industrial Applications
- Interface PLC with working models
- Control Applications using SCADA programming
- Develop industrial Automation using Arduino with various sensors

REFERENCES:

COURSE OBJECTIVES:
The students will be able to
- understand the basics of Virtual Instrumentation
- differentiate analog and digital I/Os
- use LabVIEW for experiments
- analyze tools and applications in VI

UNIT I REVIEW OF DIGITAL INSTRUMENTATION 8
Representation of Analog signals in the Digital domain – Review of quantization in amplitude and time axis, sample and hold, sampling theorem, ADC and DAC types.

UNIT II FUNDAMENTALS OF VIRTUAL INSTRUMENTATION 10
Concept of virtual instrumentation – PC based data acquisition – Typical on board DAQ card, Resolution and sampling frequency - Multiplexing of analog inputs – Single-ended and differential inputs – Different strategies for sampling of multi-channel analog inputs. Concept of universal DAQ card - Use of timer-counter and analog outputs on the universal DAQ card.

UNIT III CLUSTER OF INSTRUMENTS IN VI SYSTEM 10

UNIT IV GRAPHICAL PROGRAMMING ENVIRONMENT IN VI 10
Concepts of graphical programming language LabVIEW – Concept of VIs and sub VI – Graphs & charts – Dataflow programming - Loops – Case and sequence structures - Types of data – Arrays & clusters – Formula nodes –math scrip integration - Local and global variables – String and file I/O – Building executables and installers – Web publishing tools

UNIT V ANALYSIS TOOLS AND SIMPLE APPLICATIONS IN VI 7
Build virtual instruments like oscilloscope, FFT analyzer – Windowing and filtering tools – Introduction of Electrical power measurement suite - Simple temperature ON/OFF controller – P-I-D controller design - Simulation of a simple second order system – Building autonomous embedded system using FPGA target

TOTAL:45 PERIODS

COURSE OUTCOMES:
The students will be able to
- use VI basics for Industrial Applications
- develop Virtual Instrumentation using LabVIEW
- use DAQ for Real Time Applications

REFERENCES:
1. Jovitha Jerome, Virtual Instrumentation using LabVIEW, PHI publications, 2010

EL4151 MODERN DIGITAL COMMUNICATION SYSTEMS  L T P C
3 0 0 3

COURSE OBJECTIVES:
- To understand the coherent and non coherent receivers and their performance under AWGN channel conditions
- To understand the effect of signalling through bandlimited channels and Equalization techniques used to overcome ISI
- To understand different channel models, channel capacity and different block coding techniques
- To understand the principle of convolutional coding and different decoding techniques
- To understand the basics of OFDM as a multicarrier communication and CDMA as a multiuser communication technique.

UNIT I COHERENT AND NON-COHERENT COMMUNICATION 9

UNIT II EQUALIZATION TECHNIQUES 9

UNIT III BLOCK CODED DIGITAL COMMUNICATION 9
Architecture and performance – Binary block codes; – Shannon’s channel coding theorem; Channel capacity; Matched filter; Concepts of Spread spectrum communication – Coded BPSK and DPSK demodulators– Linear block codes; Hamming; Golay; Cyclic; BCH ; Reed – Solomon codes. Space time block codes.

UNIT IV CONVOLUTIONAL CODED DIGITAL COMMUNICATION 9

UNIT V MULTICARRIER AND MULTIUSER COMMUNICATIONS 9
Single Vs multicarrier modulation, orthogonal frequency division multiplexing (OFDM), Modulation and demodulation in an OFDM system, An FFT algorithmic implementation of an OFDM system, Bit and power allocation in multicarrier modulation, Peak-to-average ratio in multicarrier modulation. Introduction to CDMA systems, multiuser detection in CDMA systems – optimum multiuser receiver, suboptimum detectors, successive interference cancellation.
COURSE OUTCOMES:
Upon completion of the course, the students will be able to
CO1: Differentiate coherent and non coherent receivers and analyse their performance under
AWGN channel conditions
CO2: Illustrate the effect of signalling through bandlimited channels and Equalization techniques
used to overcome ISI
CO3: Determine the channel capacity and design various block coding techniques to combat
channel errors
CO4: Construct convolutional coders and analyze the performance of different decoding
techniques.
CO5: Describe the basics of OFDM as a multicarrier communication and CDMA as a multiuser
communication technique.

TOTAL: 45 PERIODS
REFERENCES:
4. Lathi B P and Zhi Ding, “Modern Digital and Analog communication Systems”, Oxford University

EL4161 DIGITAL COMMUNICATION SYSTEMS LABORATORY

COURSE OBJECTIVES:
- To study & measure the performance of digital communication systems.
- To provide a comprehensive knowledge of Wireless Communication.
- To learn about the design of digital filter and its adaptive filtering algorithms.

LIST OF EXPERIMENTS (MATLAB/SCILAB/CABVIEW)
USE APPROPRIATE SIMULATION TOOLS FOR THE FOLLOWING EXPERIMENTS:

1. Generation & detection of binary digital modulation techniques using SDR
2. Spread Spectrum communication system-Pseudo random binary sequence generation-Baseband DSSS.
3. MIMO system transceiver design using MATLAB/SCILAB/LABVIEW
4. Performance evaluation of simulated CDMA system
5. Channel Coder/decoder design (block codes / convolutional codes/ turbo codes)
6. OFDM transceiver design using MATLAB /SCILAB/LABVIEW
7. Channel equalizer design using MATLAB (LMS, RLS algorithms)
8. Design and Analysis of Spectrum Estimators (Bartlett, Welch) using MATLAB
9. BER performance Analysis of M-ary digital Modulation Techniques (coherent & non
   coherent) in AWGN Environment using MATLAB/SCILAB/LABVIEW
10. Design and performance analysis of Lossless Coding Techniques - Huffman
COURSE OUTCOMES:
Upon the completion of course, students are able to

- Implement the adaptive filtering algorithms
- Generate and detect digital communication signals of various modulation techniques using MATLAB.
- Evaluate cellular mobile communication technology and propagation model.
- Apply mathematical formulation to analyze spectrum estimation of a signal and bit rate determination of a transmission link
- Analyze the performance of optimization algorithms for equalizing the channel or noise/echo cancellation
- Able to design synchronization algorithm for Digital Communication systems

TOTAL : 45 PERIODS

COURSE OBJECTIVE:

- To develop skills in writing programs and simulation of experiments.

Programming and Simulation for laboratory experiments and Industrial Applications to be performed (10 to 14 experiments)

1. Generation of standard discrete time deterministic and random signals using simulation tools
2. Generation and detection of digital modulation techniques using simulation tools
3. Bit Error Rate Analysis of different modulation scheme in AWGN and Rayleigh fading environments using simulation tools
4. Outage Analysis of communication system in AWGN and Rayleigh fading environments using simulation tools
5. Communication system analysis using Universal Software Radio Platform
6. Design of electronic circuits for the given application and analyze its performance using simulation tools
7. Design and Testing of electronic circuits for the given application using simulation tools
8. Design and simulation of Potential Distribution/Field of the MOSFET using finite difference method.
9. Design and simulation of P-Channel and N-Channel MOSFET
10. Implementing Data communication with WIFI module

   i. Analog sensor monitoring
   ii. Digital input monitoring

11. Implementing IOT with sensors monitoring

   i. Analog sensor monitoring
   ii. Digital input monitoring
12. Implementing IOT with actuator control
   i. ON-OFF control
   ii. Analog control
13. Miniproject/Case Study

COURSE OUTCOMES:
On the successful completion of the course, the students will be able to
CO1: To design, simulate, test and analyze electronic circuits/systems for given specifications/applications
CO2: To design and simulate experiments and industrial applications based on communication systems using simulation tools
CO3: To simulate experiments using available hardware and tools and implement them

II4201            ASIC AND FPGA DESIGN    L T P C  3 0 0 3

COURSE OBJECTIVES:
The students will be able to
- study the design flow of different types of ASIC.
- familiarize the different types of programming technologies and logic devices.
- learn the architecture of different types of FPGA.
- gain knowledge about partitioning, floor planning, placement and routing including circuit extraction of ASIC

UNIT I OVERVIEW OF ASIC AND PLD  9
Types of ASICs - Design flow – CAD tools used in ASIC Design – Programming Technologies: Antifuse – static RAM – EPROM and EEPROM technology, Programmable Logic Devices: ROMs and EPROMs – PLA –PAL. Gate Arrays – CPLDs and FPGAs

UNIT II ASIC PHYSICAL DESIGN  9
System partition -partitioning - partitioning methods – interconnect delay models and measurement of delay - floor planning - placement – Routing: global routing - detailed routing - special routing - circuit extraction - DRC

UNIT III LOGIC SYNTHESIS, SIMULATION AND TESTING  9

UNIT IV FIELD PROGRAMMABLE GATE ARRAYS  9

UNIT V SOC DESIGN  9
COURSE OUTCOMES:
The students will be able to
CO1: analyze the synthesis, Simulation and testing of systems.
CO2: apply different high performance algorithms in ASICs.
CO3: discuss the design issues of SOC.

TOTAL: 45 PERIODS

REFERENCES:

II4202 WIRELESS COMMUNICATION AND NETWORKING L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the characteristics of wireless channels and the fundamental limits on the capacity of wireless channels
- Understand various types of local area networks, WiMax and wide area networks.
- Understand various wireless networking standards such as 3G and 4G.
- To interwork between WLAN and WWAN.
- To have a good understanding of emerging wireless networks such as Adhoc, Sensor networks and cooperative wireless networks.

UNIT I THE WIRELESS CHANNEL
Overview of wireless systems – Physical modeling for wireless channels – Time and Frequency coherence – Statistical channel models – Capacity of wireless Channel - Capacity of Flat Fading Channel — Channel Distribution Information known – Channel Side Information at Receiver – Channel Side Information at Transmitter and Receiver – Capacity with Receiver diversity – Capacity comparisons – Capacity of Frequency Selective Fading channels.

UNIT II 3G EVOLUTIONS

UNIT III 4G AND BEYOND
Introduction to LTE-A – Requirements and Challenges, network architectures – EPC, E-UTRAN architecture - mobility management, resource management, services, channel - logical and transport channel mapping, downlink/uplink data transfer, MAC control element, PDU packet formats, scheduling services, random access procedure.
UNIT IV  
5G COMPONENTS  
Introduction to WLAN – IEEE 802.11and HIPERLAN, Bluetooth, WiMAX. Characteristics of MANETs, Table-driven and Source-initiated On Demand routing protocols, Hybrid protocols, Wireless Sensor networks- Classification, MAC and Routing protocols.

UNIT V  
INTERWORKING CONCEPTS AND COOPERATIVE WIRELESS NETWORKS  
Interworking objectives and requirements, Schemes to connect WLANs and 3GNetworks, Session Mobility, Interworking Architectures for WLAN and GPRS. Introduction to User cooperation and cognitive systems- Relay channels- A general three node relay channel- Wireless relay channel- User cooperation in wireless networks- Two user cooperative network

COURSE OUTCOMES:  
On successful completion of this course, student will be able to  
CO1: Understand the concepts of wireless LAN, WAN and various wireless standards.  
CO2: Work with different wireless networks.  
CO3: Familiarize with advanced wireless networks such as Adhoc, Sensor networks and cooperative wireless networks.

REFERENCES:  

II4203  
ADVANCED IN INTERNET OF THINGS

OBJECTIVES:  
- To understand the fundamentals of Internet of Things  
- To learn about the basics of IoT protocols  
- To build a small low cost embedded system using Raspberry Pi.  
- To apply the concept of Internet of Things in the real world scenario.

UNIT I  
INTRODUCTION TO IoT  
Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels & Deployment Templates - Domain Specific IoTs - IoT and M2M - IoT System Management with NETCONF-YANG- IoT Platforms Design Methodology
UNIT II  IoT ARCHITECTURE  9
M2M high-level ETSI architecture - IETF architecture for IoT - OGC architecture - IoT reference model - Domain model - information model - functional model - communication model - IoT reference architecture

UNIT III  IoT PROTOCOLS  9

UNIT IV  BUILDING IoT WITH RASPBERRY PI & ARDUINO  9

UNIT V  ADVANCED INTERNET OF THINGS  9
Smart Convergent technologies for IoT- SDN and NFV for IoT- The impact of IoT in 5G Mobile Communication- Fog Computing and Internet of Things- Big data Analytics in IoT- Energy harvesting and Power Management for IoT-Wearable Computing and Mixed reality and Internet of Everything- Privacy and Security in IoT- The world of future – Internet of Everything

TOTAL : 45 PERIODS

OUTCOMES
Upon completion of this course, the students should be able to:
• Analyze various protocols for IoT
• Develop web services to access/control IoT devices.
• Design a portable IoT using Raspery Pi
• Deploy an IoT application and connect to the cloud.
• Analyze applications of IoT in real time scenario

REFERENCES:
6. Mike Miller, The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World, Que Publishing, 2015

MP4291 

CYBER PHYSICAL SYSTEMS

L T P C

3 0 2 4

COURSE OBJECTIVES:

- To learn about the principles of cyber-physical systems
- To familiarize with the basic requirements of CPS.
- To know about CPS models
- To facilitate the students to understand the CPS foundations
- To make the students explore the applications and platforms.
- To provide introduction to practical aspects of cyber physical systems.
- To equip students with essential tools to implement CPS.

UNIT I 
INTRODUCTION TO CYBER-PHYSICAL SYSTEMS 6


UNIT II 
CPS - REQUIREMENTS 12


UNIT III 
CPS MODELS 9


UNIT IV 
CPS FOUNDATIONS 9

Symbolic Synthesis for CPS- Security in CPS-Synchronization of CPS-Real-Time Scheduling for CPS

UNIT V 
APPLICATIONS AND PLATFORMS 9


LIST OF EXPERIMENTS (30)

1. Installation of Xilinx SDK, LABVIEW, MatLab and Cybersim
2. Installation of, myRIO iRobot Create Wiring, Kobuki Wiring
3. CPS DEsign with the iRobot Create
4. CPS Design with the Kobuki.
5. Write a program in MATLAB to implement open loop system stability.
6. Write a program in MATLAB to implement timed automation.

COURSE OUTCOMES:
CO1: Explain the core principles behind CPS
CO2: Discuss the requirements of CPS.
CO3: Explain the various models of CPS.
CO4: Describe the foundations of CPS.
CO5: Use the various platforms to implement the CPS.

TOTAL: 45+30=75 PERIODS

REFERENCES
7. documentation | KOBUKI (yujinrobot.com)

II4211  INTERNET OF THINGS APPLICATIONS LABORATORY L T P C
0 0 4 2

OBJECTIVES: The students will be able to
- Understand concepts of IoT and Cyber Physical Systems

LIST OF EXPERIMENTS:
Internet of Things Applications using the following experiments:
- Raspberry Pi – GPIO and Cloud
- Design and Develop Cloud based master and slave systems using Internet
- Explore different communication methods with IoT devices.
- To interface LED/Buzzer with platform/ Aurdino /Raspberry Pi. and write an embedded C program to turn on / off LED/Buzzer with specified delay
- To interface DC/stepper motor using relay with open platform/ Aurdino /Raspberry Pi and write an embedded C program to turn on motor if push button is pressed.
- Develop simple application – testing infrared sensor – IoT Applications – using open platform/Raspberry Pi.
- Develop simple application to interface with DHT11 sensor and write a program to display temperature humidity readings in LCD.

- Implement IoT with sensors monitoring: Analog sensor monitoring, Digital input monitoring

- Implement IoT with actuator control: ON-OFF control, Analog control

- Develop Internet of Medical Things (IoMT) Application using open platform/Ardino, Raspberry Pi and sensors such as temperature, ECG, Pulse etc.

- Deploy IoMT applications using platforms.

- Electromechanical modelling of QUBE Servo Inertia Disk system

- Analysis of Physical system with RIO hardware integration (Step response, time domain, stability)

- Mathematical modelling of Second-order system with PID Controller design control

- Mathematical modelling of Pendulum system and design a balance control and swing-up control

**OUTCOMES: The students will be able to**

- Develop IoT and Cyber Physical System based Real Time Applications

### II4212  
**TERM PAPER WRITING AND SEMINAR**  

L T P C  
0 0 2 1

In this course, students will develop their scientific and technical reading and writing skills that they need to understand and construct research articles. A term paper requires a student to obtain information from a variety of sources (i.e., Journals, dictionaries, reference books) and then place it in logically developed ideas. The work involves the following steps:

1. Selecting a subject, narrowing the subject into a topic
2. Stating an objective.
3. Collecting the relevant bibliography (atleast 15 journal papers)
4. Preparing a working outline.
5. Studying the papers and understanding the authors contributions and critically analysing each paper.
6. Preparing a working outline
7. Linking the papers and preparing a draft of the paper.
8. Preparing conclusions based on the reading of all the papers.
9. Writing the Final Paper and giving final Presentation

Please keep a file where the work carried out by you is maintained.

Activities to be carried out
<table>
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<th>Activity</th>
<th>Instructions</th>
<th>Submission week</th>
<th>Evaluation</th>
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<td>Selection of area of interest and Topic</td>
<td>You are requested to select an area of interest, topic and state an objective</td>
<td>2nd week</td>
<td>3 % Based on clarity of thought, current relevance and clarity in writing</td>
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<tr>
<td>Stating an Objective</td>
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<tr>
<td>Collecting Information about your area &amp; topic</td>
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<td>3rd week</td>
<td>3% (the selected information must be area specific and of international and national standard)</td>
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| Collection of Journal papers in the topic in the context of the objective – collect 20 & then filter | • You have to provide a complete list of references you will be using- Based on your objective -Search various digital libraries and Google Scholar  
• When picking papers to read - try to:  
• Pick papers that are related to each other in some ways and/or that are in the same field so that you can write a meaningful survey out of them,  
• Favour papers from well-known journals and conferences,  
• Favour “first” or “foundational” papers in the field (as indicated in other people’s survey paper),  
• Favour more recent papers,  
• Pick a recent survey of the field so you can quickly gain an overview,  
• Find relationships with respect to each other and to your topic area (classification scheme/categorization)  
• Mark in the hard copy of papers whether complete work or section/sections of the paper are being considered | 4th week        | 6% (the list of standard papers and reason for selection)                      |
| Reading and notes for first 5 papers         | Reading Paper Process  
• For each paper form a Table answering the following questions: | 5th week        | 8% (the table given should indicate your |
| What is the main topic of the article? | What was/were the main issue(s) the author said they want to discuss? | Why did the author claim it was important? | How does the work build on other’s work, in the author’s opinion? | What simplifying assumptions does the author claim to be making? | What did the author do? | How did the author claim they were going to evaluate their work and compare it to others? | What did the author say were the limitations of their research? | What did the author say were the important directions for future research? Conclude with limitations/issues not addressed by the paper (from the perspective of your survey) | understanding of the paper and the evaluation is based on your conclusions about each paper |

| Reading and notes for next5 papers | Repeat Reading Paper Process | 6th week | 8% | (the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper) |

| Reading and notes for final 5 papers | Repeat Reading Paper Process | 7th week | 8% | (the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper) |

| Draft outline 1 and Linking papers | Prepare a draft Outline, your survey goals, along with a classification / categorization diagram | 8th week | 8% | (this component will be evaluated based on the linking and classification among the papers) |

| Abstract | Prepare a draft abstract and give a presentation | 9th week | 6% | (Clarity, purpose and conclusion) | 6% Presentation & Viva Voce |
| Introduction | Write an introduction and background sections | 10th week | 5% (clarity) |
| Sections of the paper | Write the sections of your paper based on the classification / categorization diagram in keeping with the goals of your survey | 11th week | 10% (this component will be evaluated based on the linking and classification among the papers) |
| Your conclusions | Write your conclusions and future work | 12th week | 5% (conclusions – clarity and your ideas) |
| Final Draft | Complete the final draft of your paper | 13th week | 10% (formatting, English, Clarity and linking) 4% Plagiarism Check Report |
| Seminar | A brief 15 slides on your paper | 14th & 15th week | 10% (based on presentation and Viva-voce) |

TOTAL: 30 PERIODS

II4301 ROBOTICS AND AUTOMATION L T P C 3 0 0 3

OBJECTIVES:
The students will be able to
- understand the basics of robotics for industrial needs
- understand how to select robotics according to different applications
- analyse material handling techniques

UNIT I INTRODUCTION: 7
Types of industrial robots - Load handling capacity - general considerations in Robotic material handling - material transfer - machine loading and unloading - CNC machine tool loading, Robot centered cell- robots for Industrial automation.

UNIT II ROBOTS FOR INSPECTION: 9

UNIT III END EFFECTORS: 10
Gripper force analysis and gripper design for typical applications - design of multiple degrees of freedom - active and passive grippers - Forward and inverse kinematics, DH matrices and Trajectory control.

UNIT IV SELECTION OF ROBOT 10
Factors influencing the choice of a robot - robot performance testing - economics of robotisation
- Impact of robot on industry and society.

UNIT V  MATERIAL HANDLING: 9
Concepts of material handling - principles and considerations in material handling systems design - conventional material handling systems - industrial trucks, monorails, rail guided vehicles, conveyor systems, cranes and hoists - advanced material handling systems - automated guided vehicle systems - automated storage and retrieval systems (ASRS) - bar code technology - radio frequency identification technology.

OUTCOMES: The students will be able to
- assemble basic robot for industrial automation
- select robots for industrial applications
- use robots for material handling

REFERENCES:

EL4391  OPTICAL NETWORKS  L T P C 3 0 0 3

COURSE OBJECTIVES:
- Understand the concepts of optical components and networks.
- To gain an understanding of various issues in designing a high speed, and huge bandwidth optical network.
- To acquire knowledge of architecture and standards of optical networks.
- Thorough knowledge about the routing and access mechanism in optical networks.
- Thorough understanding of the scientific and engineering principles underlying the photonics technology.

UNIT I  OPTICAL SYSTEM COMPONENTS 9
UNIT II  OPTICAL NETWORK ARCHITECTURES  9
Introduction to Optical Networks; WDM networks, SONET / SDH, Metropolitan-Area Networks, Layered Architecture; Broadcast and Select Networks- Topologies for Broadcast Networks, Media-Access Control Protocols, Wavelength Routing Architecture. WOBAN and OTDM networks. Introduction to ASON.

UNIT III  WAVELENGTH ROUTING NETWORKS  9
The Optical layer, Node Designs, Optical layer cost tradeoff, Routing and Wavelength Assignment algorithms, Virtual Topology design, Architectural variations

UNIT IV  PACKET SWITCHING AND ACCESS NETWORKS  9

UNIT V  NETWORK DESIGN AND MANAGEMENT  9
Transmission system Engineering-system model, Power penalty-transmitter, receiver, Optical amplifiers, crosstalk, dispersion, wavelength stabilization; overall design consideration; Control and Management-Network management functions, Configuration management, Performance management, Fault management. Optical safety, Service interface.

COURSE OUTCOMES:
On completion of the course the student will be
CO1: able to design state-of-the-art optical networks.
CO2: able to implement optical network protocols.
CO3: able to design high speed networks using optical fibers
CO4: able to simulate access network
CO5: able to design the optical network infrastructure and network management methods.

TOTAL: 45 PERIODS

REFERENCES

NE4251  NETWORK SECURITY  L T P C
3 0 0 3

COURSE OBJECTIVES:
- To learn the fundamentals of cryptography and its application to network security.
- To understand the mathematics behind cryptography.
- To learn about the security issues in internet protocol.
- To understand the security issues in other layers
- To study about intrusion detection and prevention system and wireless hacking.
UNIT I  INTRODUCTION TO NETWORK SECURITY

UNIT II  SYMMETRIC AND ASYMMETRIC CIPHERS

UNIT III  SECURITY ISSUES IN INTERNET PROTOCOL

UNIT IV  SECURITY IN OTHER LAYERS

UNIT V  INTRUSION DETECTION AND PREVENTION SYSTEM(IDPS) AND WIRELESS HACKING

COURSE OUTCOMES:
CO1: To design cryptographic algorithms and carry out their implementation.
CO2: To carry out cryptanalysis on cipher.
CO3: To be able to design and implement security based internet protocols.
CO4: To carry out system security for other layers.
CO5: To understand the importance of intrusion detection and prevention system and wireless hacking.

TOTAL PERIODS: 45

REFERENCES
COURSE OBJECTIVES:
- To give the knowledge of soft computing theories fundamentals
- To provide the mathematical background for carrying out the optimization associated with
  neural network learning
- To familiarize the ideas of fuzzy sets, fuzzy logic, use of heuristics and Fuzzy Logic Control
  Systems
- To introduce the mathematical background for genetic algorithms
- To expose the hybrid soft computing systems and its applications

UNIT I  SOFT COMPUTING FUNDAMENTALS  9
Introduction: Soft Computing Constituents – From Conventional AI to Computational Intelligence –
Applications - Introduction, characteristics- learning methods - taxonomy - Evolution of neural
networks - Artificial Neural Network (ANN): Fundamental Concept – Basic Terminologies – Neural
Network Architecture – Learning Process – Fuzzy logic: Introduction – crisp - sets- fuzzy sets -
crisp relations and fuzzy-relations: Cartesian product

UNIT II  NEURAL NETWORKS  9
Fundamental Models of ANN: McCulloch- Pitts Model –Hebb Network – Linear Separability
Pitts Model –Hebb Network - Supervised Learning Networks: Perceptron Network – Adaline and
Madaline Networks – Back Propagation Network – Radial Basis Function Network - Unsupervised
Learning Networks: Kohonen Self Organizing Network – ART network - Hopfield Network - Special
function optimization.

UNIT III  FUZZY COMPUTING AND MODELING  9
Fuzzy Equivalence and Tolerance Relation – Value assignments- Fuzzy Composition- Membership
Functions–Fuzzification- Defuzzification: lambda cuts - Fuzzy Arithmetic – Extension Principle –
Formation of Rules – Decomposition of Rules – Aggregation of Rules – Approximate Reasoning –

UNIT IV  GENETIC ALGORITHM AND APPLICATIONS  9
Genetic Algorithm: Fundamental Concept – Basic Terminologies – Traditional Vs Genetic
Algorithm - Elements of GA - Encoding - Fitness Function – Genetic Operators: Reproduction –
CrossOver - Inversion and Deletion - Mutation – Simple and General GA - The Schema Theorem-
difference between GA and GP- Applications of GA. Multi-objective Optimization- Real-life case
studies - optimization of traveling salesman problem using genetic algorithms

UNIT V  HYBRID SOFT COMPUTING AND APPLICATIONS  9
Case Studies: Neuro-fuzzy Hybrid system- genetic neuro hybrid systems - genetic fuzzy hybrid and
fuzzy genetic hybrid systems - simplified fuzzy ARTMAP – Applications: A fusion approach of
multispectral images with SAR - Knowledge Leverage Based TSK Fuzzy System Modeling - Fuzzy
C-Means algorithms for very large Data. Hybrid GA for Feature Selection- Multiobjective Genetic
Fuzzy Clustering for pixel classification- Clustering Wireless Sensor Network Using Fuzzy Logic
and Genetic Algorithm
COURSE OUTCOMES:
After completion of the course, the student will be able to:
CO1: Apply various soft computing concepts for practical applications
CO2: Choose and design suitable neural network for real time problems
CO3: Use fuzzy logic rules and reasoning to handle uncertainty and develop decision making and expert system
CO4: Describe the importance of genetic algorithms for solving combinatorial optimization problems
CO5: Analyze the various hybrid soft computing techniques and apply in real time problems

TOTAL: 45 PERIODS

REFERENCES:

II4092 SYSTEM ON CHIP LTPC
3 0 0 3

OBJECTIVE:
- To introduce architecture and design concepts underlying system on chips.
- Students can gain knowledge of designing SoCs.
- To impart knowledge about the hardware-software design of a modest complexity chip all the way from specifications, modeling, synthesis and physical design.

UNIT I SYSTEM ARCHITECTURE: OVERVIEW
Components of the system – Processor architectures – Memory and addressing – system level interconnection – SoC design requirements and specifications – design integration – design complexity – cycle time, die area and cost, ideal and practical scaling, area-time-power tradeoff in processor design, Configurability.

UNIT II PROCESSOR SELECTION FOR SOC
UNIT III MEMORY DESIGN

UNIT IV INTERCONNECT ARCHITECTURES AND SOC CUSTOMIZATION

UNIT V FPGA BASED EMBEDDED PROCESSOR

TOTAL:45 PERIODS

OUTCOMES:
Upon successful completion of the program the students shall
CO1: Explain all important components of a System-on-Chip and an embedded system, i.e.
CO2: digital hardware and embedded software;
CO3: Outline the major design flows for digital hardware and embedded software;
CO4: Discuss the major architectures and trade-offs concerning performance, cost and power
CO5: consumption of single chip and embedded systems;

REFERENCES:

OBJECTIVES:
The students will be able to
- understand Industry 4.0
- apply IoT and IIoT for Industry 4.0
- understand CPS for Industry 4.0

UNIT I
Introduction to Industry 4.0 The Various Industrial Revolutions - Digitalisation and the Networked Economy - Drivers, Enablers, Compelling Forces and Challenges for Industry 4.0 - Comparison of
Industry 4.0 Factory and Today's Factory - Trends of Industrial Big Data and Predictive Analytics for Smart Business Transformation

UNIT II
Road to Industry 4.0 - Internet of Things (IoT) & Industrial Internet of Things (IIoT) & Internet of Services - Smart Manufacturing - Smart Devices and Products - Smart Logistics - Smart Cities - Predictive Analytics

UNIT III

UNIT IV
Role of data, information, knowledge and collaboration in future organizations - Resource- based view of a firm - Data as a new resource for organizations - Harnessing and sharing knowledge in organizations - Cloud Computing Basics - Cloud Computing and Industry 4.0

UNIT V
Industry 4.0 IIoT case studies - Opportunities and Challenges - Future of Works and Skills for Workers in the Industry 4.0 Era - Strategies for competing in an Industry 4.0 world – Society 5.0

OUTCOMES:
The students will be able to
CO1: use Industry 4.0 for Industrial Applications
CO2: use IoT and IIoT for Industry 4.0
CO3: apply smart devices Industrial Applications

TEXT BOOKS
1. Alasdair Gilchrist, Industry 4.0: The Industrial Internet of Things

II4001 BROADBAND ACCESS TECHNOLOGIES

OBJECTIVES:
The students will be able to
- explain fundamental concepts related to broadband access technologies.
- understand the current and emerging wired and wireless access technologies.
- acquire knowledge about cable modems and fiber access technologies.
- have an exposure to different systems standards for next generation broadband access networks.

UNIT I REVIEW OF ACCESS TECHNOLOGIES
Phone-Line modem, cable-access, ISDN, Emerging Broad band Technologies, Cable DSL, Fiber and Wireless, Standards for access network.
UNIT II DIGITAL SUBSCRIBER LINES 10
Asymmetric Digital subscriber lines (ADSL) – Rate Adaptive subscriber line (RADSL)-ISDN Digital subscriber line (IDSL) - High bit rate DSL (HDSL)-Single line DSL (SDSL) - very high bit rate DSL (VDSL) - Standards for XDSL & Comparison.

UNIT III CABLE MODEM 10

UNIT IV FIBER ACCESS TECHNOLOGIES 10
Optical Fiber in access networks, Architecture and Technologies- Hybrid fiber – Coax (HFC) system, Switched Digital Video (SDV) – Passive optical networks (PON) – FTTX (FTTH, FTTB, FTTC, FTT cab) comparison, Broadband PON , Gigabit-Capable PON.

UNIT V BROAD BAND WIRELESS 10
Fixed Wireless, Direct Broadcast Satellite (DBS), Multi channel multi point distribution services (MMDS), Local multi point distribution services (LMDS), and Wideband integrated Digital Interactive Services (WIDIS), Mobile Wireless 3G – IMT 2000 - Introduction to LTE-A.

OUTCOMES: The students will be able to
to design systems meeting out the requirements of the recent standards.
• meet out the industry requirements for man power in next generation networks.
• contribute towards the enhancement of the existing wireless technologies.

REFERENCES:
OBJECTIVES:
- To understand smart antenna environments
- To learn channel models
- To learn algorithms for Multi target decision

UNIT I

UNIT II

UNIT III

UNIT IV
Optimal spatial filtering – adaptive algorithms for CDMA. Multi target decision – directed algorithm.

UNIT V
DOA estimation – conventional and subspace methods. ML estimation techniques. Estimation of the number of sources using eigen decomposition. Direction finding and true ranging PL systems. Elliptic and hyperbolic PL systems. TDOA estimation techniques.

TOTAL :45 PERIODS

OUTCOMES:
- To compare algorithms for target decision
- To explain DOA estimation techniques

REFERENCES:
COURSE OBJECTIVES:
- To gain broad conceptual understanding of the various aspects of electromagnetic (EM) interference and compatibility
- To develop a theoretical understanding of electromagnetic shielding effectiveness
- To understand ways of mitigating EMI by using shielding, grounding and filtering
- To understand the need for standards and to appreciate measurement methods
- To understand how EMI impacts wireless and broadband technologies

UNIT I  INTRODUCTION & SOURCES OF EM INTERFERENCE  9
Introduction - Classification of sources - Natural sources - Man-made sources - Survey of the electromagnetic environment.

UNIT II  EM SHIELDING  9
Introduction - Shielding effectiveness - Far-field sources - Near-field sources - Low-frequency, magnetic field shielding - Effects of apertures

UNIT III  INTERFERENCE CONTROL TECHNIQUES  9

UNIT IV  EMC STANDARDS, MEASUREMENTS AND TESTING  9
Need for standards - The international framework - Human exposure limits to EM fields - EMC measurement techniques - Measurement tools - Test environments.

UNIT V  EMC CONSIDERATIONS IN WIRELESS AND BROADBAND TECHNOLOGIES  9
Efficient use of frequency spectrum - EMC, interoperability and coexistence - Specifications and alliances - Transmission of high-frequency signals over telephone and power networks - EMC and digital subscriber lines - EMC and power line telecommunications.

SUGGESTED ACTIVITIES:
1. Investigate various case studies related to EMIC. Example: Chernobyl Disaster in 1986.
2. Develop some understanding about the design of EM shields in electronic system design and packaging.

COURSE OUTCOMES:
Upon completion of this course, the student will be able to
- CO1: Demonstrate knowledge of the various sources of electromagnetic interference
- CO2: Display an understanding of the effect of how electromagnetic fields couple through apertures, and solve simple problems based on that understanding
- CO3: Explain the EMI mitigation techniques of shielding and grounding
- CO4: Explain the need for standards and EMC measurement methods
- CO5: Discuss the impact of EMC on wireless and broadband technologies

TOTAL: 45 PERIODS
REFERENCES

II4003 HEALTH CARE TECHNOLOGIES AND INTERNET OF MEDICAL THINGS LT PC 3 0 03

OBJECTIVES:
The students will be able to
- know the principles and applications of biomedical devices
- comprehend the basics of healthcare technologies
- understand the applications of computer in medicine
- comprehend the telemedicine technology
- understand the applications of IoT for medical field and IoMT

UNIT I BIOMEDICAL TRANSDUCERS AND AMPLIFIERS
Introduction to Anatomy & Physiology of Human Body - Categories and Characteristics of Transducer - Signal conditioning units - Multichannel data acquisition system - various types recorders - necessity for low noise pre amplifiers - Difference amplifier - Chopper amplifier - Different types of electrode and its equivalent circuits.

UNIT II BIOPOTENTIAL RECORDING & MEASUREMENTS
ECG, EEG, EMG, PCG, EOG, ERG lead system and recording methods - typical waveform - frequency spectrum - abnormal waveform.


UNIT III COMPUTER APPLICATIONS IN MEDICINE

UNIT IV TELEMEDICINE APPLICATIONS
Telemedicine - Tele radiology: Definition - Basic parts of teleradiology system: Image Acquisition system Display system - Tele pathology - multimedia databases - Medical information storage and management for telemedicine- patient information medical history - medical images diagnosis and
treatment. Hospital information system - Telemedicine access to health care services –
Introduction to robotics surgery - Telesurgery. Telecardiology – Teleoncology - Telemedicine in
neurosciences – Mobile Telemedicine.

UNIT V CONNECTED HEALTH

E-Health – E-health services security and interoperability - Internet of Things (IoT) in Medical
Field – Internet of Medical Things (IoMT) - Applications of IoMT – M- Helath - Connected Health
–Innovations in Healthcare Techs.

OUTCOMES:
By the completion of this course the student will to

Identify various functional blocks present in biosignal acquisition system

- Design the data acquisition system.
- Analyze different biopotential characteristics and recording methods of biosignals.
- Develop measurement systems by selecting different types of sensors, signal conditioning
circuits for acquiring and recording various physiological parameters.
- Use the Applications of Computers in Medicine
- Differentiate the Protocols behind encryption techniques for secure transmission of data.
- Use the techniques, skills, and tools necessary for Telemedicine
- Apply new knowledge as needed in Connected Health including IoMT in healthcare

REFERENCES:
1. Leslie Cromwell, Fred J. Weibell and Erich A. Pfeiffer’s, Biomedical Instrumentation
   and Measurements, Biomedical Instrumentation and Measurements, Prentice Hall, 2001
2. Joseph J Carr and John m Brown – Introduction to Biomedical equipment Technology
3. Webster J.G Medical Instrumentation application and design, John Wiley and sons New
   York 3rd edition 1999
   publication, New Delhi 2nd edition 2003
5. Bernard Fong, A.C.M. Fong, C.K. Li, Telemedicine Technologies: Information
6. Magnuson, J.A., Fu, Jr., Paul C. (Eds.), Public Health Informatics and Information systems,
8. Wootton, R., Craig, J., Patterson, V. (Eds.), Introduction to Telemedicine. Royal Society of
9. Teresa L. Thompson, Roxanne Parrott, Jon F. Nussbaum, TheRoutledge Handbook of
10. Ahmed, Mobyen Uddin, Begum, Shahina, Fasquel, Jean-Baptiste (Eds.), Internet of
    Things (IoT) Technologies for HealthCare, Proceedings of 4th International Conference,
    Publishing, 2020
OBJECTIVES:

- To enable the student to understand the evolving paradigm of cognitive radio communication and the enabling technologies for its implementation.
- To enable the student to understand the essential functionalities and requirements in designing software-defined radios and their usage for cognitive communication.
- To expose the student to the evolving next-generation wireless networks and their associated challenges.

UNIT I INTRODUCTION TO SDR

Definitions and potential benefits—software radio architecture evolution—foundations, technology tradeoffs and architecture implications—Antenna for Cognitive Radio.

UNIT II SDR ARCHITECTURE

Essential functions of the software radio—architecture goals—quantifying degrees of programmability—top level component topology—computational properties of functional components—interface topologies among plug and play modules, architecture partitions.

UNIT III INTRODUCTION TO COGNITIVE RADIOS

Marking radio self-aware, the cognition cycle—organization of cognition tasks—structuring knowledge for cognition tasks—Enabling location and environment awareness in cognitive radios—concepts, architecture, design considerations.

UNIT IV COGNITIVE RADIO ARCHITECTURE

Primary Cognitive Radio functions, Behaviors, Components, A–Priori Knowledge taxonomy, observe—phase data structures, Radio procedure knowledge encapsulation—components of orient, plan, decide phases, act phase knowledge representation, design rules.

UNIT V NEXT GENERATION WIRELESS NETWORKS

The XG Network architecture—spectrum sensing—spectrum management—spectrum mobility, spectrum sharing—upper layer issues—cross—layer design.

TOTAL: 45 PERIODS

OUTCOMES:

- The student would be able to appreciate the motivation and the necessity for cognitive radiocommunication strategies.
- The student would be able to evolve new techniques and demonstrate their feasibility using mathematical validations and simulation tools.
- The student would be able to demonstrate the impact of the evolved solutions in future wireless network design.

REFERENCES:


IF4092 COMPUTER VISION  L T P C  3 0 0 3

COURSE OBJECTIVES:
- Articulate & apply standard computer vision concepts
- Implement standard image processing tasks
- Applying Clustering concept for Image Classification
- Identify practical constraints in computer vision application
- Architecture of an existing computer vision pipeline based on deep learning models

UNIT I COMPUTER VISION  8

UNIT II PIXEL-BASED MANIPULATIONS & TRANSFORMATION  8

UNIT III STRUCTURE IDENTIFICATION  11

UNIT IV CLUSTERING IMAGES & IMAGE RETRIEVAL  9

UNIT V IMAGE CLASSIFICATION USING DEEP LEARNING


SUGGESTED ACTIVITIES:
1. Identify and List various noises in the Image.
2. Identify Image Manipulation
3. Add colour descriptors and improve the search results.
4. Hierarchical k-means is a clustering method that applies k-means recursively to the clusters to create a tree of incrementally refined clusters
5. Image Classification using CNN

TOTAL:45 PERIODS

COURSE OUTCOMES:
CO1: Understand the basic knowledge, theories and methods of computer vision.
CO2: to understand the essentials of image processing concepts through mathematical interpretation.
CO3: Demonstrate a knowledge of a broad range of fundamental image processing and image analysis techniques
CO4: Apply Clustering algorithms for clustering.
CO5: Analyse cognitive tasks including image classification, recognition and detection through deep learning.

REFERENCES
1. Pro Processing for Images and Computer Vision with OpenCV, Bryan WC Chung, Apress, 2017
3. A PRACTICAL INTRODUCTION TO COMPUTER VISION WITH OPENCV, Kenneth Dawson-Howe, Wiley, 2014
COURSE OBJECTIVES:
- to introduce the concepts of Micro Electro Mechanical devices.
- to know the fabrication process of microsystems.
- to know the design concepts of micro sensors and micro actuators.
- to familiarize concepts of Quantum Mechanics and Nano systems.

UNIT I  OVERVIEW
New trends in Engineering and Science: Micro and Nanoscale systems, introduction to design of MEMS and NEMS, MEMS and NEMS – applications, devices and structures. Materials for MEMS: Silicon, Silicon compounds, polymers, metals

UNIT II  MEMS FABRICATION TECHNOLOGIES

UNIT III  MICRO SENSORS

UNIT IV  MICRO ACTUATORS

UNIT V  NANOSYSTEMS AND QUANTUM MECHANICS
Atomic Structures and Quantum Mechanics, Molecular and Nanostructure Dynamics: Schrodinger Equation and Wave Function Theory, Density Functional Theory, Nanostructures and Molecular Dynamics, Electromagnetic Fields and their Quantization, Molecular Wires and Molecular Circuits

COURSE OUTCOMES:
At the end of this course, the student will be able to:
CO1: Discuss micro sensors
CO2: Explain micro actuators
CO3: Outline nanosystems and Quantum mechanics
CO4: Design micro actuators for different applications
CO5: Analyze atomic structures

REFERENCES

II4005 WIRELESS ADHOC AND SENSOR NETWORKS L T P C 3 0 0 3

OBJECTIVES: The students will be able to
- understand the basics of Ad-hoc & Sensor Networks.
- learn various fundamental and emerging protocols of all layers.
- study about the issues pertaining to major obstacles in establishment and efficient manage of Ad-hoc and sensor networks.
- understand the nature and applications of Ad-hoc and sensor networks.
- understand various security practices and protocols of Ad-hoc and Sensor Networks.

UNIT I MAC & TCP IN AD HOC NETWORKS

UNIT II ROUTING IN AD HOC NETWORKS

UNIT III MAC, ROUTING & QOS IN WIRELESS SENSOR NETWORKS

UNIT IV SENSOR MANAGEMENT

UNIT V SECURITY IN AD HOC AND SENSOR NETWORKS

TOTAL : 45 PERIODS
LIST OF EXPERIMENTS
Wireless Adhoc and Sensor Networks
Any 10 experiments:

1. Network Simulator installation of wireless sensor network.
2. Write TCL script for transmission between mobile nodes.
3. Write TCL script for sensor nodes with different parameters.
4. Generate TCL script for UDP and CBR traffic in WSN nodes.
5. Implementation of routing protocol in NS2 for AODV protocol.
7. Implementation of routing protocol in NS2 for TORA protocol
8. Study other wireless sensor network simulators (Mannasim, Contiki,).
9. Communication: Write code to send & receive data over wireless radio
10. Localisation: Centroid method using signal strength for weights
11. Power Management: Explore functionality on SPOTs to take current and voltage measurements.
12. Security: Experiment with Eschenauer-Gligor key management scheme
13. Contour tracking: Implement a lightweight distributed algorithm where nodes compute the contours using purely local information
14. Alternative Platforms & Tools:
   • Introduce TinyOS and NesC;
   • Build and deploy Blink, CntToRfmAndLeds, RfmToLeds.
   • Learn to use the TOSSIM simulator.

OUTCOMES:
Upon Completion of the course, the students should be able to:
- Identify different issues in wireless ad hoc and sensor networks.
- To analyze protocols developed for ad hoc and sensor networks.
- To identify and address the security threats in ad hoc and sensor networks.
- Establish a Sensor network environment for different type of applications.

REFERENCES:
II4006 REAL TIME SYSTEMS L T P C
3 0 0 3

OBJECTIVES:

- To learn real time operating system concepts, the associated issues & Techniques.
- To understand design and synchronization problems in Real Time System.
- To explore the concepts of real time databases.
- To understand the evaluation techniques present in Real Time System.

UNIT I REAL TIME SYSTEM AND SCHEDULING

UNIT II SOFTWARE REQUIREMENTS ENGINEERING

UNIT III INTERTASK COMMUNICATION AND MEMORY MANAGEMENT

UNIT IV REAL TIME DATABASES
Real time Databases – Basic Definition, Real time Vs General Purpose Databases, Main Memory Databases, Transaction priorities, Transaction Aborts, Concurrency control issues, Disk Scheduling Algorithms, Two– phase Approach to improve Predictability – Maintaining Serialization Consistency – Databases for Hard Real Time Systems.
UNIT V  VALUATION TECHNIQUES AND CLOCK SYNCHRONIZATION


OUTCOMES:
Upon completion of this course, the students should be able to:

- Apply principles of real time system design techniques to develop real time applications.
- Make use of database in real time applications.
- Make use of architectures and behaviour of real time operating systems.
- Apply evaluation techniques in application.

List of Experiments
Real Time Systems
Any ten experiments

3. Develop DFD model (level-0, level-1 DFD and Data dictionary) of the project.
4. Develop Structured design for the DFD model developed.
5. Develop UML Use case model for a problem.
6. Develop sequence diagram.
7. Develop Class diagrams
9. Study and usage of any Design phase CASE tool
10. Performing the Design by using any Design phase CASE tools.
11. Develop test cases for unit testing and integration testing
12. Develop test cases for various white box and black box testing techniques.
13. Use MATLAB/Simulink to Control Qball
   - Safely turn on/off the qball and change the batteries,
   - Establish a wireless connection between qball and workstation
   - Work with Quarc and MATLAB/Simulink and compile and run models on both workstation and qball sides.
   - Receive and monitor the sensor data on the workstation,
   - Read back the joystick data on workstation
   - Send command to control rotors speed.
14. Develop socket programming class to do the following class objectives
   - Establish a TCP/IP connection
   - Bind to a TCP port
   - Listen to connection requests
   - Accept connection requests
   - Receive data
   - Send data
15. Develop Communication Program with Target and Display Sensors
    Develop a cqstreamclient class to receive and display data of sensors of the Qball
16. Joystick Interface
• Develop a driver for joystick and build a cjoystick class
• Read back the joystick X,Y,Z and RZ data and display the data
17. Maneuver Qball by Joystick
Objectives
- Use ctimer class and cjoystick class to read back the joystick X,Y,Z and RZ data
- Develop a cqstreamsrv class to send the joystick data to qball
- Use ctimer class and cqstreamclient class to read the qball sensors and display it
- Use qball_motor_control Simulink model to send the sensors data to SPC and receive commands from SPC to control the motors speeds.

REFERENCES:

II4007 SOFTWARE DEFINED NETWORKS

Objectives
• To learn about what software defined networks are
• To understand the separation of the data plane and the control plane
• To learn about the use of SDN in data centers
• To learn about different applications of SDN

UNIT I INTRODUCTION
History of Software Defined Networking (SDN) – Modern Data Center – Traditional Switch Architecture – Why SDN – Evolution of SDN – How SDN Works – Centralized and Distributed Control and Date Planes

UNIT II OPEN FLOW & SDN CONTROLLERS
Open Flow Specification – Drawbacks of Open SDN, SDN via APIs, SDN via Hypervisor Based Overlays – SDN via Opening up the Device – SDN Controllers – General Concepts

UNIT III DATA CENTERS
Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE
UNIT IV  SDN PROGRAMMING
Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs – Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications.

UNIT V  SDN
Juniper SDN Framework – IETF SDN Framework – Open Daylight Controller – Floodlight Controller – Bandwidth Calendaring – Data Center Orchestration

LIST OF LAB EXPERIMENTS:

Software Defined Network (SDN) experiments
(using Mininet and POX Controller)

Any ten experiments

Lab 1: basic mininet operations
Lab 2: manually control the switch
Lab 3: move the rules to the POX controller
Lab 4: set different forwarding rules for each switch in the controller
Lab 5: set traffic to different output queues (QoS issue)
Lab 6: FlowVisor
Lab 7: Multiple Tables Test
Lab 8: IP Load Balancer
Lab 9: Traffic measurement 1, Traffic measurement 2 (IP -> IP with mask --> TCP/UDP/ICMP)
Lab 10: Duplicate Packets
Lab 11: Bridge remote mininet using VXLAN
Lab 12: Using l2_multi to find a shortest path
   (implement Floyd-Warshall algorithm: find the shortest paths between all pairs of vertices.)
Lab 13: Using l2_bellmanford to find a shortest path
   (Bellman-Ford algorithm: computes the shortest paths from a single source to all of the other vertices)

TOTAL :45 PERIODS
Lab 14: Traffic Volume Control

Lab 15: A host with two interfaces

Ring Topology
Three Hosts
switch_host1  switch_host2  switch_host3
application layer routing

Lab 16: IPv6 example

Lab 17: IPv4 GRE Tunnel

OUTCOMES:
Upon completion of the course, the students will be able to
- Critically analyze and appreciate the evolution of software defined networks
- Point out the various components of SDN and their uses
- Explain the use of SDN in the current networking scenario
- Design and develop various applications of SDN

TEXT BOOKS:

REFERENCES:

CP4252  MACHINE LEARNING  L T P C 3 0 2 4

COURSE OBJECTIVES:
- To understand the concepts and mathematical foundations of machine learning and types of problems tackled by machine learning
- To explore the different supervised learning techniques including ensemble methods
- To learn different aspects of unsupervised learning and reinforcement learning
- To learn the role of probabilistic methods for machine learning
- To understand the basic concepts of neural networks and deep learning

UNIT I  INTRODUCTION AND MATHEMATICAL FOUNDATIONS
UNIT II SUPERVISED LEARNING

UNIT III UNSUPERVISED LEARNING AND REINFORCEMENT LEARNING

UNIT IV PROBABILISTIC METHODS FOR LEARNING

UNIT V NEURAL NETWORKS AND DEEP LEARNING
Neural Networks - Biological Motivation - Perceptron - Multi-layer Perceptron - Feed Forward Network - Back Propagation - Activation and Loss Functions - Limitations of Machine Learning - Deep Learning - Convolution Neural Networks - Recurrent Neural Networks - Use cases

SUGGESTED ACTIVITIES:
1. Give an example from our daily life for each type of machine learning problem
2. Study at least 3 Tools available for Machine Learning and discuss pros & cons of each
3. Take an example of a classification problem. Draw different decision trees for the example and explain the pros and cons of each decision variable at each level of the tree
4. Outline 10 machine learning applications in healthcare
5. Give 5 examples where sequential models are suitable.
6. Give at least 5 recent applications of CNN

PRACTICAL EXERCISES:
1. Implement a Linear Regression with a Real Dataset (https://www.kaggle.com/harrywang/housing). Experiment with different features in building a model. Tune the model's hyperparameters.
2. Implement a binary classification model. That is, answers a binary question such as "Are houses in this neighborhood above a certain price?" (use data from exercise 1). Modify the classification threshold and determine how that modification influences the model. Experiment with different classification metrics to determine your model's effectiveness.
3. Classification with Nearest Neighbors. In this question, you will use the scikit-learn's KNN classifier to classify real vs. fake news headlines. The aim of this question is for you to read the scikit-learn API and get comfortable with training/validation splits. Use California Housing Dataset
4. In this exercise, you'll experiment with validation sets and test sets using the dataset. Split
a training set into a smaller training set and a validation set. Analyze deltas between training set and validation set results. Test the trained model with a test set to determine whether your trained model is overfitting. Detect and fix a common training problem.

5. Implement the k-means algorithm using https://archive.ics.uci.edu/ml/datasets/Codon+usage dataset

6. Implement the Naïve Bayes Classifier using https://archive.ics.uci.edu/ml/datasets/Gait+Classification dataset

7. Project - (in Pairs) Your project must implement one or more machine learning algorithms and apply them to some data.

   a. Your project may be a comparison of several existing algorithms, or it may propose a new algorithm in which case you still must compare it to at least one other approach.
   b. You can either pick a project of your own design, or you can choose from the set of pre-defined projects.
   c. You are free to use any third-party ideas or code that you wish as long as it is publicly available.
   d. You must properly provide references to any work that is not your own in the write-up.
   e. Project proposal You must turn in a brief project proposal. Your project proposal should describe the idea behind your project. You should also briefly describe software you will need to write, and papers (2-3) you plan to read.

List of Projects (datasets available)
1. Sentiment Analysis of Product Reviews
2. Stock Prediction
3. Sales Forecasting
4. Music Recommendation
5. Handwriting Digit Classification
6. Fake News Detection
7. Sports Prediction
8. Object Detection
9. Disease Prediction

COURSE OUTCOMES:
Upon the completion of course, students will be able to
CO1: Understand and outline problems for each type of machine learning
CO2: Design a Decision tree and Random forest for an application
CO3: Implement Probabilistic Discriminative and Generative algorithms for an application and analyze the results.
CO4: Use a tool to implement typical Clustering algorithms for different types of applications.
CO5: Design and implement an HMM for a Sequence Model type of application and identify applications suitable for different types of Machine Learning with suitable justification.

REFERENCES

TOTAL:75 PERIODS
AX4091 ENGLISH FOR RESEARCH PAPER WRITING L T P C
2 0 0 0

COURSE OBJECTIVES:
- Teach how to improve writing skills and level of readability
- Tell about what to write in each section
- Summarize the skills needed when writing a Title
- Infer the skills needed when writing the Conclusion
- Ensure the quality of paper at very first-time submission

UNIT I INTRODUCTION TO RESEARCH PAPER WRITING 6
Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT II PRESENTATION SKILLS 6

UNIT III TITLE WRITING SKILLS 6
Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check

UNIT IV RESULT WRITING SKILLS 6
Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

UNIT V VERIFICATION SKILLS 6
Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first-time submission

TOTAL: 30 PERIODS

COURSE OUTCOMES:
CO1 – Understand that how to improve your writing skills and level of readability
CO2 – Learn about what to write in each section
CO3 – Understand the skills needed when writing a Title
CO4 – Understand the skills needed when writing the Conclusion
CO5 – Ensure the good quality of paper at very first-time submission

REFERENCES:

<table>
<thead>
<tr>
<th>AX4092</th>
<th>DISASTER MANAGEMENT</th>
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COURSE OBJECTIVES:
- Summarize basics of disaster
- Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Develop the strengths and weaknesses of disaster management approaches

UNIT I INTRODUCTION
Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

UNIT II REPERCUSSIONS OF DISASTERS AND HAZARDS

UNIT III DISASTER PRONE AREAS IN INDIA
Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics

UNIT IV DISASTER PREPAREDNESS AND MANAGEMENT
Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT V RISK ASSESSMENT
Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People’s Participation in Risk Assessment. Strategies for Survival

TOTAL : 30 PERIODS
**COURSE OUTCOMES:**
CO1: Ability to summarize basics of disaster
CO2: Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
CO3: Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
CO4: Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
CO5: Ability to develop the strengths and weaknesses of disaster management approaches

**REFERENCES:**

**AX4093 CONSTITUTION OF INDIA**

**COURSE OBJECTIVES:**
Students will be able to:
- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals’ constitutional role and entitlement to civil and economic rights as well as the emergence nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

**UNIT I HISTORY OF MAKING OF THE INDIAN CONSTITUTION**
History, Drafting Committee, (Composition & Working)

**UNIT II PHILOSOPHY OF THE INDIAN CONSTITUTION**
Preamble, Salient Features

**UNIT III CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES**

**UNIT IV ORGANS OF GOVERNANCE**
Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

**UNIT V LOCAL ADMINISTRATION**
District’s Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO, Municipal Corporation. Pachayati raj: Introduction, PRI: Zila
UNIT VI  ELECTION COMMISSION
Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.

COURSE OUTCOMES:
Students will be able to:
- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

SUGGESTED READING
1. The Constitution of India, 1950 (Bare Act), Government Publication.
UNIT III

துவாகு காப்பியங்கள் 6
1. கல்விக்குறிப்பிட்டு புரட்சி
   - கிளீன்பகைக்கான காட்சிகள்
2. தூண்டுசுப் பாதுகாப்பு பலிேலியகால்
   - கிளீன்பகைக்கான அரசியல் பலிேலியகால்

UNIT IV

அருள்நநறித் தமிழ் 6
1. குணகியின் புரட்சி
   - பராமரிக்குறிப்பிட்டு சிலப்பதிகொர கொகத
2. மூகம்
   - ஆலைக்குரிய புதித்த கொகத
3. சிறுபொண்
   - சிறுபொண் (617, 618)
4. தர்க்கவேதியம்
   - தர்க்கவேதியம் நியமம்
5. புறநூர்
   - புறநூர் வல்லலொர்
6. அருள்நநறித் (4)
   - முனை
   - குணகியின் புரட்சி (11)
   - சிறுபொண்
   - மூக்
   - சிறுபொண் (50 (27)
   - புறநூர்
   - அருள்நநறித் தமிழ்

UNIT V

நவீன தமிழ் இலக்கியம் 6
1. உயர்நிலை குண
   - குணகியின் புரட்சி
   - குணகியின் புரட்சி
   - குணகியின் புரட்சி
   - குணகியின் புரட்சி
   - புறநூர்
   - புறநூர்
2. தமிழ் விஜிக்கு புதித்த தமிழ் இலக்கியம்
3. புதித்த தமிழ் இலக்கியம்
4. புதித்த தமிழ் இலக்கியம்
5. அருள்நநறித் தமிழ்
6. அருள்நநறித் தமிழ்
7. புறநூர்

TOTAL : 30 PERIODS
தமிழ் கல்வியுடைய விளக்கங்கள் / புத்தகங்கள்
1. தமிழ் வினாக்கக்கல்லல் கல்விக்கழகம் (Tamil Virtual University)
   - www.tamilvu.org
2. தமிழ் விக்கிப்பி (Tamil Wikipedia)
   - https://ta.wikipedia.org
3. தர்மபுர அழுத்த கல்லிலை
4. பனைகிரிய கல்லிலை
   - தமிழ் பாடல்கற்கமுமா, கதிரை
5. தமிழ் பர்க்கானத் கல்லிலை
   - தமிழ் மாநாட்டிகள் கல்லிலை (thamilvalarchithurai.com)
6. குளியிலை கல்லிலை
   - தமிழ் பாடல்கற்கமுமா, கதிரை