Department of Electronics and Telecommunication Engineering

Course Title: Embedded System Design | **Semester: VII**
Course Code: 26UET701T | **Course Category: PCC**
Teaching Scheme: L – T – P | **Total Credits: 04**
3 – 1 – 0

Course Objectives:
The objective of this course is to:
1) To impart fundamental knowledge of embedded systems, architectures, and design methodologies.
2) To develop understanding of ARM architectures, processor organization, and interrupt mechanisms.
3) To build competency in ARM instruction sets and assembly programming techniques.
4) To enable students to interface microcontrollers with peripheral devices using assembly / Embedded C language.
5) To strengthen skills in using on-chip ADC/DAC, communication protocols, and external modules.
6) To introduce real-time operating system concepts, kernel structures, and task scheduling.

Course Outcome:
At the end of this course, the students shall be able to:
1) Describe embedded system fundamentals, components, and design constraints.
2) Summarize ARM processor architecture, pipeline stages, exceptions, and interrupt handling.
3) Apply ARM instruction sets to write and execute assembly and Thumb programs.
4) Interface ARM7TDMI with external devices using assembly and Embedded C.
5) Demonstrate the use of ADC/DAC modules and communication interfaces in embedded applications.
6) Demonstrate understanding of RTOS concepts including tasks, scheduling, and synchronization mechanisms.

Course Content:

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[08 Hours]

The concept of embedded systems design: Definition, History, Classification of Embedded System, Application areas of embedded systems, Design metric of embedded system, Design challenges in embedded system, Typical embedded system – Core of embedded system, Memory and its types, Sensors & Actuators, Communication interfaces and embedded firmware.

UNIT II

[07 Hours]

Difference between RISC and CISC, **ARM processor fundamentals:** registers, current program status register, pipeline, exception, interrupts (contect switching, service mechnism) and the vector table. Block Diagram of ARM7TDMI Microcontroller(LPC2148), Interrupt structure, Operating Modes.

UNIT III

[07 Hours]

ARM instruction set: data processing, branch, load-store, program status register instructions, loading constants & conditional execution.

Thumb instruction set: data processing, branch, load-store & stack.
Simple assembly language programs.

UNIT IV

[07 Hours]

Interfacing with external systems: Instruction set and programming of ARM7TDMI microcontroller (LPC2148) using assembly and Embedded C, Interfacing of external devices like LED's, 7-segment display, Switches, Stepper motor, concept of Timers and Counters ARM7TDMI Microcontroller.

UNIT V

[08 Hours]

Analyzing Inbuilt of ADC and DAC of ARM7TDMI Microcontroller, Applications based on PWM, USART, Bluetooth module, LCD display, GSM module, GPS Module, on-chip DAC for waveform generation

UNIT VI

[08 Hours]

Embedded / Real-time operating Concepts: Kernel and its types, Architecture of the kernel, Functions of Kernel, Task and task schedular, Interrupt service routines, semaphores, Mutex, Mailboxex, Message ques, Event registers, Pipes, Signals, Timers, memory management.

TEXT BOOKS:

1. Shibu K V,"Introduction to Embedded Systems
2. Raj Kamal, "Embedded Systems ", TMH Publications.
3. Dr. K.V.K.K. Prasad , "Embedded / Real Time Systems", Dreamtech Publications
4. Sloss endrew & Dominic Symes, "ARM system Developers Guide", Morgan Kaufmann , 2004

Reference Books:

1. Frank Vahid, "Embedded System Design", Wiley Publications, New edition 2001.
2. Steve Heath, "Embedded System Design", Neuwans Publications
3. A.P.Godse,"ARM Controller", Technical Publications

Web links:

1. https://www.alldatasheet.com/datasheet-pdf/pdf/118635/PHILIPS/ARM7.html

Department of Electronics and Telecommunication Engineering

Course Title: Embedded System Design | **Semester: VII**
Course Code: 26UET701P | **Course Category: PCC**
Teaching Scheme: L – T – P | **Total Credits: 01**
0 – 0 – 2

Course Objectives:

The objective of this course is to:

1) To develop hands-on skills in ARM7-based assembly and embedded C programming for fundamental data operations.
2) To enable practical understanding of interfacing ARM7 microcontrollers (LPC2148) with LEDs, displays, sensors, motors, and communication modules.
3) To build the ability to design, test, and debug real-time embedded applications using LPC2148 based ARM7 development board.

Course Outcome:
At the end of this course, the students shall be able to:

1) Implement and test ARM7 assembly programs for arithmetic, data manipulation, and control operations.
2) Implement interfacing of LEDs, displays, sensors, motors, and communication modules using LPC2148 based ARM7 microcontroller.
3) Design and demonstrate real-time embedded applications involving communication, PWM control, and external storage interfaces.

List of Experiments: (Perform any 8 – 10 Experiments)

1) To study the LPC2148 based ARM7 development board.
2) To write and demonstrate the LPC2148 program for addition, subtraction & multiplication of 16 / 32 bit number.
3) To write and demonstrate the LPC2148 program to find largest / smallest of a ten data words.
4) To write and demonstrate the LPC2148 program for arranging the multiple data in ascending / descending order.
5) To write and demonstrate the LPC2148 program for the swapping of 16 / 32 bit data.
6) To write and demonstrate the LPC2148 program for factorial of a given number.
7) To write and demonstrate the LPC2148 program for binary to gray & gray to binary number conversion.
8) To write and demonstrate the LPC2148 program for display of number from 10 to 99 on seven segment display using LPC2148 based ARM7 development board.
9) To write and demonstrate the program for flashing of LEDs using LPC2148 based ARM7 development board.
10) To write and demonstrate the program for interfacing ADC and DAC using LPC2148 based ARM7 development board.
11) To write and demonstrate the program for interfacing of a stepper motor and rotate it in clockwise & anti-clock wise direction with equal delay using LPC2148 based ARM7 development board.
12) To write and demonstrate the program for interfacing of real time clock and serial port using LPC2148 based ARM7 development board.
13) To write and demonstrate the program for interfacing LED and PWM using LPC2148 based ARM7 development board.
14) To write and demonstrate the program for sending SMS to any mobile number using LPC2148 based ARM7 development board
15) To write and demonstrate the program for Interfacing of pen drive for writing the predefined file using LPC2148 based ARM7 development board.
16) To write and demonstrate the program for interfacing of 16 x 2 LCD and display message “Hello World” using

17) LPC2148 based ARM7 development board.
18) To write and demonstrate the program for interfacing of GPS module and display current location latitude and logitude using LPC2148 based ARM7 development board.

Beyond/Additional Syllabus Experiments :

1) To write and demonstrate the program for interfacing of OLED and display message “Hello World” using LPC2148 based ARM7 development board.
2) To write and demonstrate the program for interfacing of LM35 & LCD and display current environment temperature on LCD using LPC2148 based ARM7 development board.
3) To write and demonstrate the program for interfacing of servo motor using LPC2148 based ARM7 development board.

Reference Books:

1) A.P.Godse,“ARM Controller”, Technical Publications

Department of Electronics and Telecommunication Engineering

Course Title:Microwave Engineering | **Semester: VII**
Course Code: 26UET721T | **Course Category: PEC(IV)**
Teaching Scheme: L – T – P | **Total Credits: 04**
3 – 1 – 0

Prerequisites: Basic Knowledge of Electromagnetic Waves principle & concepts.

Course Objectives:

The objective of this course is to provide students with understanding of

1. The operating principle and performance analysis of Microwave active devices.
2. The concept and performance analysis of microwave passive devices.
3. Microwave Measurements of various parameters.
4. The significance , operation & various types of Planar Transmission Lines .
5. The concepts, performance parameters & various types of RADAR

Course outcomes:

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

1. Analyze the operating principles and characteristics of linear beam and crossed-field microwave tubes.
2. Describe and compare the various Microwave Solid State Devices.
3. Apply scattering matrix concepts to evaluate the performance of microwave passive components and multi-port networks.
4. Describe microwave measurement techniques for frequency, power, VSWR, impedance, and dielectric
5. Describe and compare planar transmission line structures for microwave integrated circuits.
6. Describe and analyze RADAR systems, performance parameters and applications.

Course Content:

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[09 Hours]

Microwave Active Devices:Linear Beam Tubes

Limitations of Conventional Tubes,Classification of Microwave Active Devices, Two-cavity Klystron,Reflex Klystron ,Traveling Wave Tubes (TWT)

UNIT II

[08 Hours]

Microwave Active Devices:Crossed Field Tubes: Magnetrons and Back word Wave Oscillators.

Microwave Solid State Devices: Transferred Electron Devices Gunn Diode,Gunn Diode - Principles, RWH Theory, Characteristics, Basic modes of operation - Gunn oscillation modes, LSA Mode, IMPATT & TRAPATT Diodes,PIN Diode,Crystal Diode,Varactor Diode ,Parametric Amplifiers.

UNIT III

[08 Hours]

Microwave Passive Devices

Principles of S-parameters,properties of S-parameter,S-parameters for multi-ports ,Waveguide Tees ,Directional Couplers, Matched Terminations,Microwave attenuator,Slotted line,Ferrite devices , Faraday Rotation Principle,Isolator, Circulator

UNIT IV

[06 Hours]

Microwave measurements:
Introduction to Microwave measurements,Definition and Measurement methods of frequency, Power,Attenuation, VSWR,Impedance,Insertion loss ,Dielectric constant ,Q of a cavity resonator, Phase shift.

UNIT V

[06 Hours]

Planar Transmission Lines:
Introduction to Microwave Integrated Circuits.Significance of Planar Transmission Line, Different types of Planar Transmission lines and its comparison,Strip Lines, Micro-strip lines,Losses in Micro-strip lines,Parallel Strip lines,Co-planar Strip lines,Shielded Strip Lines.

UNIT VI

[08 Hours]

RADAR Fundamentals:
Basic principles and fundamentals of RADAR, Classification & Block diagram of basic RADAR, RADAR performance factors,RADAR range equation, Factors influencing maximum range,effects of noise, Pulsed RADAR Systems,Antennas and scanning,Display methods,Moving Target Indication,Applications of RADAR.

Textbooks:

1. Samuel Y.Lieo, Microwave Devices and Circuits,3rd edition ,Pearson Education.
2. Robert E.Collin,Foundation for Microwave engineering,2nd edition,McGraw Hill.

Reference books:

1.D.M.Pozar,Microwave Engineering,2nd Edition ,John Willey & Son.
2.Annapurna Das ,Sisir Das,Microwave Engineering, 4th edition McGraw Hill
3. George Kennedy,Electronic Communication systems , TATA McGraw Hill.
4. M.I.Skolnik ,Introduction to RADAR Systems ,3rd edition
5. M.Kulkarni, Microwave & RADAR Engineering,Umesh publications.

Microwave Engineering Laboratory

Course Title: Microwave Engineering | **Semester: VII**
Course Code : 26UET721P | **Course Category:PEC (IV)**
Teaching Scheme : L-T- P | **Total Credit : 1**
0 - 0 - 2

Course Outcomes:

At the end of this course students will be able to

CO1: Describe the functions of Microwave components and measure & interpret various parameters such as Frequency, Guide Wavelength and Attenuation using Microwave Test Bench.
CO2: Analyse & Evaluate the performance of microwave active and passive devices using experimental methods.
CO3: Apply microwave trainer kits and electromagnetic simulation software to analyze microwave circuits,RADAR and antennas.

List of Experiments:
(Perform any 8 – 10 Experiments given in the following Experiment list or & any others based on syllabus of Microwave Engineering)

S.No	Name of Experiments
1.	To identify and describe the functions of the various components used at UHF & Microwave Frequency Range. [CO1]
2.	Analyze the basic microwave power generation setup. [CO1]
3 A.	Measure and analyze Power/Frequency vs Repeller Voltage characteristics of Reflex Klystron and determine electronic tuning range. [CO1]
3 B.	To observe different modes of Reflex Klystron.[CO1]
4.	To evaluate the performance of various Waveguide Tees i.e. E-plane Tee, H-plane Tee and E-H plane Tee.[CO2]
5.	To demonstrate the relationship between Frequency,Wavelength in free space & Guide Wavelength.[CO2]
6.	To measure Coupling and Directivity of Multihole Directional Coupler.[CO2]
7.	Measure and interpret V–I characteristics of Gunn diode.[CO2]
8.	Measure and analyze large VSWR using Double Minima Method.[CO2]
9.	To plot the radiation pattern of Horn Antenna and calculate its Antenna Gain .[CO2]
10.	To analyse the performance of three port Circulator.[CO2]
11.	Simulate and evaluate port characteristics of Microwave tees using EM simulation software.[CO3]
12	To evaluate the characteristics of Microstrip Transmission Line on Microstrip Trainer kit.[CO3]
13.	To evaluate the performance of Couplers.[CO3]
14.	To evaluate the performance of Power Divider .[CO3]
15.	To analyse the RADAR Range equation .[CO3]

Beyond/Additional Syllabus Experiments :
Mini Project Based on Microwave Engineering & Antenna.

Reference Books:

1. D.M.Pozar,Microwave Engineering,2nd Edition ,John Willey & Son.
2. Annapurna Das ,Sisir Das,Microwave Engineering, 4th edition McGraw Hill

Department of Electronics and Telecommunication Engineering, Nagpur

Course Title: Mixed Signal Design
Course Code: 26UET722T
Teaching Scheme: **L – T – P**
3 – 1 – 0

Semester: VII
Course Category: PEC-IV
Total Credits: 4

Prerequisites: Analog CMOS VLSI Design and Digital System Design

Course Objectives:

The Course Objectives are:

1.To understand the concepts of Switched Capacitors Circuits
2.To understand the concepts of PLLS
3.To understand the concepts of Data Converter Fundamentals.
4.To understand the concepts of Nyquist Rate A/D Converters

Course Outcomes:

At the end of the course the students shall be able to:

1. Analyze the operation of switched capacitor circuits and evaluate the effect of non-idealities in practical switched capacitor implementations.
2. Design and analyze switched capacitor based amplifiers, integrators, and filters including first-order and biquad filter architectures.
3. Analyze the architecture and dynamic behaviour of Phase Locked Loops (PLL) and evaluate the impact of non-idealises such as jitter, PFD/CP mismatches, and lock acquisition.
4. Evaluate the performance parameters and architectures of Nyquist rate Digital-to-Analog Converters including binary-weighted, thermometer coded, and hybrid DACs.
5. Analyze and compare different Nyquist rate Analog-to-Digital Converter architectures such as Flash, SAR, Pipelined, Folding, and Time-Interleaved converters.
6. Describe and evaluate the operation of oversampling data converters including noise shaping, delta-sigma modulators, and decimation/interpolation filtering techniques.

Course Content:

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Unit I: Switched Capacitor Circuits **(07Hrs)**

Introduction to Switched Capacitor circuits basic building blocks, Operation and Analysis, Non-ideal effects in switched capacitor circuits,

UNIT II

Unit II: Applications of Switched Capacitor Circuits **(07Hrs)**

Switched capacitor amplifiers, integrators: first order filters, Switch sharing, Biquad filters with z-transform.

UNIT III

UNIT-II: Phased Lock Loop (PLL) **(08Hrs)**

Basic PLL topology, Dynamics of simple PLL, Charge pump PLLs Lock acquisition, Phase/Frequency detector and charge pump, Basic charge pump PLL, Non-ideal effects in PLLs-PFD/CP non idealities, Jitter in PLLs, Delay locked loops, applications.

UNIT IV

UNIT-III: Data Converter Fundamentals **(08Hrs)**

DC and dynamic specifications, Quantization noise, Nyquist rate D/A converters- Decoder based converters, Binary-Scaled converters, Thermometer-code converters, Hybrid converters

UNIT V

UNIT-IV: Nyquist Rate A/D Converters **(08Hrs)**

Successive approximation converters, Flash converter, Two-step, A/D converters: Interpolating A/D converters, Folding A/D converters, Pipelined A/D converters, Time-interleaved converters.

UNIT VI

UNIT-V: Oversampling Converters **(07Hrs)**

Noise shaping modulators, Decimating filters and Interpolating filters, Higher order modulators, Delta sigma modulators with multi-bit quantizers, Delta sigma D/A.

.

Textbooks:

1. Design of Analog CMOS Integrated Circuits- Behzad Razavi, TMH Edition, 2002
2. Analog Integrated Circuit Design- David A. Johns,Ken Martin, Wiley Student Edition, 2013.

Reference books:

1. CMOS Mixed-Signal Circuit Design - R. Jacob Baker, Wiley Interscience, 2009.
2. CMOS Analog Circuit Design –Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition/Indian Edition, 2010.

NOTE: 8 to 10 Practical's based on above syllabus.

Department of Electronics and Telecommunication Engineering, Nagpur

Course Title: Program Elective-V Mixed Signal Design **Semester: VII**
Course Code: 26UET722P **Course Category: PEC**
Teaching Scheme: L – T – P **Total Credits: 1**
0- 0 - 2

Prerequisites: Analog CMOS VLSI Design and Digital System Design

Course Objectives:

The Course Objectives are:

1. To provide practical exposure to the design and analysis of mixed signal circuits involving both analog and digital components.
2. To develop skills in simulation and implementation of mixed signal building blocks such as ADCs, DACs, sample and hold circuits, PLLs, and oscillators.
3. To enable students to use modern electronic design automation (EDA) tools (such as LTspice, Cadence, etc.) for modelling, simulation, and performance evaluation of mixed signal systems.

Course Outcomes:

At the end of the course the students shall be able to:

1. Design and simulate various Switched Capacitors Circuits using SPICE.
2. Design and simulate various blocks of Phase locked loop (PLL) like phase frequency detector (PFD), voltage controlled oscillator (VCO) and discuss the ideas and concepts of PLL.
3. Simulate overlapping clocks of different phase and discuss the applications of it.
4. Simulate and discuss the digital to analog converter and
5. Simulate and discuss the concept of Nyquist Rate A/D Convertors and Oversampling Convertors.

List of Experiments: -

1. Design a Switched Capacitor Filter (Loop Filter) Circuit.
2. Design a Switched Capacitor Amplifier Circuit.
3. Design a Switched Capacitor Integrator Circuit.
4. Design a circuit of three phase clock generation.
5. Design and Simulate Phase Frequency Detector.
6. Design and Simulate a circuit of voltage controlled oscillator.
7. Design and Simulate a 4-bit R-2R Digital to Analog Converter (DAC).
8. Implementation of Sample and Hold Circuit.
9. Study the implementation of Analog to Digital Converter (ADC).
10. Study the Implementation of Oversampling Convertors.

Department of Electronics and Telecommunication Engineering

Course Title: Digital Image Processing
Course Code: 26UET723T
Teaching Scheme: L – T – P
3 – 1– 0

Semester: VII
Course Category: PEC IV
Total Credits: 04

Prerequisites: Basics of signal processing and Probability theory

Course Objectives:

The objective of this course is to provide students with understanding of

1. The basic concepts of image enhancement,restoration,segmentation,repr& description.
2. The basic algorithms of of image processing and different filtering techniques.
3. The features for image representation and description.
4 The algorithms for image restoration and description.

Course outcomes:

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

1. Describe the fundamentals of digital image processing system.
2. Describe intensity transformation and Histogram processing techniques.
3. Apply different transform techniques of image processing.
4. Apply different edge detection techniques on the images.
5. Apply different image segmentation techniques in image processing.
6. Describe the image restoration and reconstruction methods.

Course Content:

{ SHAPE * MERGEFORMAT }

[08Hours]

Introduction to Digital Image Processing

What is image processing, fundamental steps and components of an image processing system,Different types of images, Visual perception, Image sensing and Acquisition, Quantization, Sampling, color image processing, Revision of Mathematical concepts & tools for image processing.

UNIT II

Intensity Transformation, Filtering in Spatial and Frequency domain [08 Hours]

Image negatives, Log transformations, Histogram processing, Spatial filter: smoothing and Sharpening, Discrete Fourier transform, properties of 2-D DFT, Image smoothing and Sharpening in Fourier domain

UNIT III

Image Transforms [08Hours]

Two-dimensional orthogonal and Unitary transforms, Optimum transform, Properties of Unitary transforms, 2D DFT, Cosine transforms, Hadamard transforms, KL transforms, Comparison of image transforms.

UNIT IV

[05 Hours]

Edge Detection

Gradient and Laplacian based edge detection, Diffusion based edge detection: Isotropic and anisotropic diffusion.

UNIT V

[08 Hours]

Image Segmentation

Fundamentals, Detection of discontinuities: Point, Line and Edge, Thresholding, Region based segmentation: Region Growing, Split and Merge, Morphology Operation.

UNIT VI

[08 Hours]

Image Restoration and Reconstruction

Models of image degradation, noise models, Spatial and Frequency domain based approaches for image restoration, Inverse filtering, Wiener Filtering, Bayesian denoising.

Textbooks:

1.Digital Image Processing by R.C. Gonzalez & R.E. Woods 4thEdition Pearson Education
2.Anil K Jain, " Fundamental of Digital Image Processing", Prentice Hall, 1989.

Reference books:

1. Digital Image processing using MATLAB by R.C. Gonzalez & R.E. Woods, Pearson Education.
2. Digital Image processing by William K. Pratt3rd Edition, 2004, John Wiley.
3.A. C. Bovik, " The essential guide to image processing", Second edition, Academic Press, 2009
4. A. M. Teckalp, " Digital Video Processing", Prentice Hall PTR, 1995

Digital Image Processing Laboratory

Course Title: Digital Image Processing **Semester: VII**
Course Code : 26UET723P **Course Category:PEC IV**
Teaching Scheme : L -T - P **Total Credit : 1**
0 - 0 - 2

Course Outcomes:

At the end of this course students will be able to

1.Apply basic image processing algorithms and filtering techniques for image enhancement.

2.Apply the algorithms for image restoration and segmentation.

3.Apply different segmentation methods of images.

List of Experiments: (Perform any 8 – 10 Experiments)

S.No	Name of Experiments
1.	Simulation and Display of an Image, Negative of an Image(Binary & Gray Scale).
2.	Implementation of Transformations of an Image.
3.	Contrast stretching of a low contrast image, Histogram, and Histogram Equalization.
4.	Implementation of Image Smoothening Filters(Mean and Median filtering of an Image).
5.	Implementation of image sharpening filters and Edge Detection using Gradient Filters.
6	Determination of 2-D DFT.
7	Determination of edge detection using Gradient & Laplacian operators.
8	Implementation of Region based Image segmentation.
9	Implementation of Spatial domain based image restoring techniques.
10.	Determination of edge detection using Gradient & Laplacian operators.
11.	To perform arithmetic operations on images.

Beyond/Additional Syllabus Experiments :
Mini Project Based on Antenna and Wave Propagation

Reference Books:

1. Antenna Theory - C.A. Balanis, John Wiley and Sons.
2. Antennas – John D. Kraus, McGraw-Hill,1988.
3. Prof.Girish Kumar," Antenna Concepts & design",2018.

Department of Computer Science and Engineering

Course Title	**Artificial Intelligence**			**Semester:**	**VII**
Course Code	**26UCS708T**			**Course**	**MDM**
Teaching Scheme	**L**	**T**	**P**	**Total Credits:**	**3**
	2	**1**	**0**		

Course Objective(s)

. To introduce fundamental concepts of Artificial Intelligence

. To develop problem-solving and reasoning skills

. To describe the classical AI techniques and modern approaches

. To provide exposure to search, knowledge representation, learning, and applications

Course Outcomes After successful completion of this course the student will be able to:		**Bloom's Taxonomy Level**
CO1	Explain AI concepts, agents and environments	**2**
CO2	Apply uninformed and informed search strategies	**3**
CO3	Predict knowledge using propositional and predicate logic	**3**
CO4	Apply reasoning techniques for problem solving	**3**

Course Contents

UNIT I: Introduction to Artificial Intelligence **Hours:8**

Artificial intelligence, definition, scope, history, foundations of AI, Turing test, intelligent agents, rational agents, agent simple reflex agent, goal-based agent, utility-based agent, environment types, deterministic, stochastic, static, dynamic, episodic, sequential, AI applications.

UNIT II: Problem Solving and Search Techniques **Hours:8**

Problem formulation, state space, search space, uninformed search, breadth first search, depth first search, uniform cost search, informed search, heuristic search, best first search, A star algorithm, heuristic function, admissibility, optimality, constraint satisfaction problems, backtracking.

UNIT III: Knowledge Representation and Reasoning **Hours:7**

Knowledge representation, knowledge base, propositional logic, predicate logic, syntax, semantics, well-formed formula, inference, unification, forward chaining, backward chaining, resolution, semantic network, frames, ontologies.

UNIT IV: Reasoning Under Uncertainty **Hours:7**

Uncertainty in AI, probabilistic reasoning, probability theory, Bayes theorem, Bayesian network, naïve Bayes fuzzy sets, fuzzy logic, membership function, decision theory, Markov decision process, reasoning over time.

Books Recommended

1. Artificial Intelligence: A Modern Approach – Stuart J. Russell, Peter Norvig (4th Edition, 2020)
2. Artificial Intelligence – Elaine Rich, Kevin Knight, Shivashankar B. Nair (3rd Edition, 2018)

Prerequisites: Nil

Department of Computer Science and Engineering

Course Title	**Artificial Intelligence Lab**			**Semester:**	**VII**
Course Code	**26UCS708P**			**Course**	**MDM**
Teaching Scheme	**L**	**T**	**P**	**Total Credits:**	**1**
	0	**0**	**2**		

Prerequisites: **23UFY1B3T Programming for Problem Solving**
23UFY225T Basic of Computation

Course Objectives

1. To understand fundamental AI concepts and problem-solving techniques.
2. To implement intelligent search, reasoning, and learning algorithms using Python.
3. To design and develop basic AI-based applications for real-world problems.

Course Outcomes

After successful completion of this course the student will be able to:

CO1 Apply AI search and knowledge representation techniques to solve computational problems.

CO2 Implement machine learning and intelligent algorithms using Python.

CO3 Develop AI-based applications using appropriate tools and techniques.

List of Practicals (Each program should be implemented and executed in Python)

1. Implement Breadth First Search (BFS).
2. Implement Depth First Search (DFS).
3. Implement Best First Search Algorithm.
4. Implement A* Search Algorithm.
5. Implement Hill Climbing Algorithm.
6. Solve the Water Jug Problem using Python.
7. Solve the 8-Puzzle Problem using A* Algorithm.
8. Implement Tic-Tac-Toe game using Minimax Algorithm.
9. Implement Naïve Bayes Classifier for classification.
10. Implement K-Nearest Neighbor (KNN) Algorithm.
11. Implement K-Means Clustering Algorithm.
12. Implement Linear Regression using Python.
13. Implement Decision Tree Classifier.
14. Develop a simple Rule-Based Chatbot in Python.

Note: Above list is indicative for all practicals.

Course Title	**Machine Learning**			**Semester**	**VII**
Course Code	**26UCT708T**			**Course Category**	**MDM**
Teaching Scheme	**L**	**T**	**P**	**Total Credits**	**3**
	2	**1**	**0**		

S. No. Course Objective

1. To introducing the basic concepts and techniques of machine learning so that a student can apply machine learning techniques to a problem at hand.
2. To Formulate classification, regression and clustering problems as optimization problems.

Course Outcomes		**BT Level**
After successful completion of course, students will be able to		
CO1	Differentiate between supervised and unsupervised learning and State the need of preprocessing, feature scaling and feature selection.	**2**
CO2	Formulate regression problems as optimization problems.	**3**
CO3	Formulate classification problems as optimization problems.	**3**
CO4	Formulate clustering problems as optimization problems.	**3**

UNIT I — Hours: 9

Introduction: Basic definitions and concepts, Key elements, Supervised and unsupervised learning, Applications of ML

.**Preprocessing:** Feature scaling, Feature selection methods, Dimensionality reduction (Principal Component Analysis), Class balancing, Outlier detection and removal.

UNIT II — Hours:7

Regression: Linear regression with one variable, Linear regression with multiple variables, Gradient descent, Over-fitting, Regularization, Regression evaluation metrics

UNIT III — Hours: 8

.

Classification: Decision trees, Naive Bayes classifier, Logistic regression, K-nearest neighbor classifier, Perceptron, Multilayer perceptron, Neural networks, Back-propagation algorithm, Support Vector Machine (SVM), Classification evaluation metrics.

{ SHAPE * MERGEFORMAT }

Clustering: Approaches for clustering, distance metrics, K-means clustering, hierarchical clustering.

Books Recommended:

1. Mitchell, T.M. Machine Learning, McGraw Hill Education, 2017.
2. James G., Witten D., Hastie T., Tibshirani R., An Introduction to Statistical Learning with Applications in R, Springer, 2014.
3. Alpaydin E., Introduction to Machine Learning, MIT press, 2009.
4. Flach P., Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, 2015.

Web references:

1. NPTEL Course { HYPERLINK "https://nptel.ac.in/courses/106106139" }

Course Title	**Machine Learning**			**Semester**	**VII**
Course Code	**26UCT708P**			**Course Category**	**MDM**
Teaching Scheme	**L**	**T**	**P**	**Total Credits**	**1**
	0	**0**	**2**		

S. No. Course Objective

1. To introducing the basic concepts and techniques of machine learning so that a student can apply machine learning techniques to a problem at hand.
2. To Formulate classification, regression and clustering problems as optimization problems.

Course Outcomes		**BT Level**
After successful completion of course, students will be able to		
CO1	Implement data pre-processing.	**3**
CO2	Implement regression algorithms.	**3**
CO3	Implement classification algorithms.	**3**
CO4	Implement and analyze clustering algorithms.	**4**

Course Contents

The experiments will be based on the following topics:

1) To implement feature scaling techniques.
2) To implement feature selection techniques.
3) To implement simple linear regression.
4) To implement multiple linear regression.
5) To implement gradient descent algorithm.
6) To analyze overfitting and apply regularization.
7) To evaluate regression model performance.
8) To implement Decision Tree classification.
9) To implement Gaussian Naïve Bayes classifier.
10) To implement Logistic Regression for binary classification.
11) To implement KNN classifier and analyze effect of K value.
12) To implement SVM with linear and RBF kernel.
13) To implement K-means clustering and use Elbow method.
14) To perform Agglomerative clustering and plot dendrogram.
15) To compare K-Means and Hierarchical clustering.

Department of Electronics and Telecommunication Engineering

Course Title: Research Methodology **Semester: VII**
Course Code: 26UET702T **Course Category: RM**
Teaching Scheme: L – T – P **Total Credits: 02**
2 – 0– 0

Course Objectives:

After completing this course, students will be able to:

1. Understand the fundamentals of research methodology, develop the ability to conduct systematic literature review, and identify research problems in the field of Electronics & Communication Engineering.
2. Apply appropriate research design methods and basic statistical tools for data collection, analysis,and interpretation.
3. Acquire technical writing skills to prepare research papers, reports, and project documentation in IEEE format.
4. Understand and practice research ethics, intellectual property rights (IPR), and patent filing procedures relevant to engineering research.

Course outcomes:
At the end of this course students will demonstrate the ability to

CO1: Analyze research literature systematically and formulate relevant research problems in the Electronics Engineering domain.
CO2: Apply statistical tools for research data analysis.
CO3: Realize how to prepare technical reports and research papers.
CO4: Evaluate Intellectual Property Rights (IPR) and ethical considerations in research activities.

Course Content:

{ SHAPE * MERGEFORMAT }

[08 Hours]

Introduction to Research Methodology
Types of Research and Their Purposes, Research process and steps in research,Identifying research problems in Electronics & Communication, Defining research objectives and hypotheses, Characteristics of good research Need for literature review, steps in conducting literature review,Review techniques and literature review matrix,Research gap identification,Research design: Experimental, analytical, simulation-based resear

UNIT II

[08 Hours]

Data Analysis & Interpretation
Data collection, analysis, Result interpretation, Validation and error analysis,Statistical tools in research such as (MATLAB, LTspice,Python, Multisim, etc.), Hardware implementation and testing methods, Measurement techniques and instrumentation

UNIT III

[08Hours]

Technical Writing & Documentation
Structure of research paper.Writing abstract, keywords, references,Citation styles,,Journal selection (SCI, Scopus, WoS etc.),.Journal publication process, Impact factor, indexing, conferences,Plagiarism and similarity index,tools to avoid plagarism

UNIT IV

[06 Hours]

Intellectual Property Rights & Research Ethics

IPR: Patents, Copyrights, Trademarks,Patent filing procedure (Indian Patent Office),Intellectual property rights (IPR)-copyright laws,Patent rights, Ethical issues in research

Textbooks:

1. C. R. Kothari, Research methodology: Methods and Techniques, 3rd Edn., New age International 2014.
2. R. Kumar, Research methodology a step-by-step guide for beginners, Sage Publications, London, 2011.

Reference books:

1.Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students’”
2.Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”
3.Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd ,2007.
4.Mayall, “Industrial Design”, McGraw Hill, 1992.
5.Asimov, “Introduction to Design”, Prentice Hall, 1962.
6.Robert P. Merges, Peter S. Menell, Mark A. Lemley, “ Intellectual Property in New Technological Age”, 2016.
7. C.G. Thomas, Research methodology and scientific writing, Ane books, Delhi, 2015
8.10- T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008

Department of Electronics and Telecommunication Engineering

Course Title: Mobile Communication
Course Code: 26UET704T
Teaching Scheme: L – T – P
3 – 0 – 0

Semester: V
Course Category: MDM-V
Total Credits: 03

Prerequisites:--------

Course Objectives:

The objective of this course is to provide students with understanding of

1. To understand the fundamental concept of mobile communication system.
2. To understand the idea about the cellular communication theory & technology.
3. To understand the various technquies used in mobile communication.
4. To introduce various multiple access techniques involved in mobile communication.
5. To study Global system for Mobile Communication

Course Outcomes:

Upon completion of this course, students will demonstrate the ability to:

1: Describe the evolution of mobile Communication.
2: Design a model of cellular communication system, analyze their operation & performance.
3: Quantify the causes & effects of path loss & signal fading on the received signal characteristics
4: Demonstrate the different signal processing techniques to improve the signal quality.
5: Demonstrate the different multiple access techniques.
6: Design and analyze the GSM system.

Course Content:

{ SHAPE * MERGEFORMAT }

[07 Hours]

Introduction:

Evolution of Mobile Communication,Mobile radio systems around the world,Examples of mobile radio systems,paging system, Cordless Telephone System A market for mobile communications. A simplified reference model for mobile communications,

UNIT II

[08 Hours]

The Cellular Concept:

Cellular telephone system, frequency reuse, channel assignment and handoff strategies, Types of interference,trunking and grade of service,

UNIT III

The Mobile Radio Enviornment : **[07 Hours]**

Causes of propagation path loss, causes of fading-long and short term, definition of , level crossing rate and average duration of fade, delay spread, coherence bandwidth, inter-symbol interference.

UNIT IV

[07 Hours]

Equalization, Diversity & Channel Coding:

Fundamentals of equalization,Concept of Diversity, space diversity,frequency and time diversity, fundamentals of channel coding.

UNIT V

Introduction to Multiple Access Techniques: [08 Hours]

Introduction To Multiple Access, FDMA, TDMA, Code Division Multiple Access(CDMA),Space Division Multiple Access(SDMA).

UNIT VI

[08 Hours]

GSM:

Global system for mobile: services and features, GSM system architecture, GSM radio subsystem, GSM channel type, GSM frame structure, signal processing in GSM,

Textbooks:

1. Wireless Communications, Principles,Practise-Theodore S. Rappaport, PHI, 2nd Edition
2. Wireless Communications & Networking, William Stallings PHI-2003.
3. Mobile Communication,Jochen Schiller, Pearson Publication, 2004.

Reference books:

1. Wireless Digital Communication,Kamilo Feher PHI,1999
2. Mobile Cellular TeleCommunication- C.Y.Lee, 2nd Edition, Mc Graw Hill Publication

Department of Electronics and Telecommunication Engineering

Course Title: MDM-VI:PCB Design & Fabrication **Semester: VIII**
Course Code: 246UET705T **Course Category:PCC**
Teaching Scheme: L – T – P **Total Credits: 02**
2 – 0 – 0

Prerequisites: Basic knowledge of electronic components

Course Objectives:

The objective of this course is to provide students with understanding of

1) To understand the fundamentals of printed circuit boards, their evolution, classification, standards, and commonly used electronic components.
2) To develop the ability to plan and design PCB layouts by applying electrical, mechanical, and fabrication constraints.
3) To gain proficiency in PCB design processes using CAD tools, including component placement, routing, and design verification.
4) To learn PCB fabrication, assembly, and testing techniques with emphasis on quality assurance and reliability.

Course Outcomes:

Upon completion of this course, students will demonstrate the ability to:

1. Describe the fundamentals of PCBs, including their evolution, classification, and industry standards.
2. Plan and design PCB layouts by applying electrical, mechanical, and fabrication design constraints for analog and digital circuits.
3. Apply PCB design processes using CAD tools, including library management, component placement, routing, and design verification.
4. Describe PCB fabrication, assembly, and testing techniques with emphasis on quality assurance and reliability.

Course Content:

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[09 Hours]

Introduction to PCB Technology and Electronic Components

Evolution of PCB, PCB Advantages, components of a PCB, Classification of PCB: single, double, multilayer, and flexible boards, PCB standards, Electronic components: basics of electronic components, resistors, variable resistors or potentiometer, LDR, capacitors, inductors, diode, transistors, Integrated circuits, surface mount device, heat sink, transformer, relays and microcontroller.

UNIT II

[07 Hours]

Layout Planning and Design

Reading, drawing and diagrams, General PCB design consideration, electrical design consideration, conductor patterns, component placement rules, fabrication and assembly considerations, layout design, layout design checklist, design rules for analog circuits, design rules for digital circuits.

UNIT III

[07Hours]

PCB Design Process

Computer Aided Design (CAD), Basics CAD operation: layout procedure, library manager, component placement, conductor routing, checking. Manual vs automation in PCB design, photoplotter, PCB design checklist, anatomy of laminates, properties and types of laminates

UNIT IV

[07 Hours]

PCB Fabrication, Assembly and Testing

Etching solutions and chemistry, equipment and techniques: immersion, bubble, splash & spray, cutting methods: shearing, sawing, blanking of PCBs, milling & routing of PCBs, hole punching, drilling, soldering variables, soldering material & soldering tools. Quality assurance and Testing of PCBs.

Textbooks:

1. Printed circuit board design , fabrication assembly and testing By R. S. Khandpur, Tata Mc Graw Hill 2006
2. Printed circuit Board Design and technology, Walter C. Bosshart

Reference Books:

1. Printed circuits design featuring computer aided technologies by Gerald L.Ginsberg, McGraw-Hill Inc.
2. EMC and Printed circuit board ,Design theory and layout, Mark I Montrose IEEE compatibility society
3. Flexible Printed circuit board Design and manufacturing ,By Roberttorzwell
4. Printed Circuits Handbook, Sixth Edition, by Clyde F. Coombs, Jr.
5. Printed Circuit Board Designer's Reference: Basics, Christopher T. Robertson Prentice Hall Professional,2004