



Lokmanya Tilak Jankalyan Shikshan Sanstha's
PRIYADARSHINI COLLEGE OF ENGINEERING, NAGPUR
(An Autonomous Institute affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)
Electronics and Communication Engineering



Fifth Semester

Course Title: Microcontrollers and Interfacing	
Course Code: 25UEC501T	Course Category: PCC
Teaching Scheme: L – T – P	Total Credits: 04
3 – 1 – 0	Semester: V
Scheme of Examination: ESE: 60 Mks, CE: 40 Mks	
Prerequisites: Basic Microprocessor and Digital Circuits	

Course Objectives:	
1.	To understand the basics of microcontrollers and their applications.
2.	To understand programming of basic and advanced Microcontrollers.
3.	To understand and apply the knowledge for developing applications using basic and advanced microcontrollers.

Course Outcomes:	
At the end of this course, students will have an ability to:	
CO1	Articulate basic components of 8051 microcontroller.
CO2	Apply an assembly language program concepts of 8051 for writing a program.
CO3	Articulate interfacing of various hardware with 8051 microcontroller.
CO4	Compare architecture and features of various AVR microcontrollers.
CO5	Implement an AVR microcontroller programming concepts for various applications.
CO6	Execute hardware interfacing using AVR microcontrollers.

Course Contents:	
UNIT I	[07 Hours]
INTRODUCTION TO MICROCONTROLLERS: Overview of Hexadecimal number system, Overview of MC-51 family, Architecture and Programming Model of 8051, Memory Organization, SFRs , Stack, Interrupts , Timers , Serial Communication.	
UNIT II	[08 Hours]
ASSEMBLY LANGUAGE PROGRAMMING:	



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Addressing Modes, 8051 instruction set, Simple Assembly Language Programming , 8051 Programming using Timers/Counters, Delays generation, Serial Communication Programming, Interrupt Programming.

UNIT III **[08 Hours]**

MICROCONTROLLER INTERFACING:

Interfacing to External Memory, Interfacing with LED, Seven Segment Display and LCD, Sensor interfacing, 8051 Interfacing and applications using Stepper motor, DC motor and Servo motor.

UNIT IV **[07 Hours]**

INTRODUCTION TO AVR FAMILY MICROCONTROLLERS:

Introduction to AVR Family, AVR Architecture, General Purpose Registers, Data Memory, Status Register, Addressing Modes in AVR, Pin descriptions of ATMEGA16, ATMEGA32 , ATMEGA328 and ATMEGA328P and their comparison.

UNIT V **[08 Hours]**

PPROGRAMMING OF AVR MICROCONTROLLERS:

Assembly language/Embedded C programming for ATMEGA 16/32 microcontrollers, Look up Tables and Table Processing, Timer Programming, AVR programming in C-I/O programming, Data Conversion , SPI and I2C programming.

UNIT VI **[07 Hours]**

HARDWARE INTERFACING OF AVR MICROCONTROLLERS :

Display, Sensor Interfacing, Keyboard interfacing, Stepper motor interfacing, ADC-DAC interfacing, Relay interfacing, Waveform generation using Timer, DC motor control using PWM. MSP 430 Microcontroller and its features , Watchdog Timer concept.

Suggested Self Readings:

Text Books

1. 8051 Microcontroller and Embedded systems, Muhammad Ali Mazidi & Genice Gillispie Mazidi, Prentice Hall
2. AVR Microcontroller and Embedded Systems (Using Assembly & C), Muhammad Ali Mazidi & Naimi, Prentice Hall

Reference Books

1. MSP Microcontroller Basics, John Davies, First Edition, Elsevier, ISBN-13 978-9380501857
2. Microcontrollers: Fundamentals and Applications with PIC; Fernando E. Valdes-Perez, Ramon Pallas-Areny; CRC Press, Taylor & Francis Group.
3. The 8051 and MSP430 Microcontrollers: Architecture, Programming and Applications; K Uma Rao & Andhe Pallavi; Wiley; ISBN: 9788126577545



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Fifth Semester

Course Title: Microcontrollers and Interfacing Lab	
Course Code: 25UEC501P	Course Category: PCC
Teaching Scheme: L – T – P	Total Credits: 01
0 – 0 – 2	Semester: V
Scheme of Examination: ESE: 25 Mks, CE: 25 Mks	

Course Objectives:

1.	Programming model of 8051 and Assembly language Programming.
2.	Interfacing 8051 with various hardware like displays, Sensors and motors.
3.	Programming AVR timer and AVR interfacing with Hardware.
4.	Programming and interfacing with MSP430 microcontroller.

Course Outcomes:

At the end of this course, students will have an ability to:

CO1	Write and execute an assembly language program for 8051.
CO2	Interface various peripherals with 8051 microcontrollers.
CO3	Interface various peripherals with AVR microcontroller.

Course Contents:

Sr. No.	List of Experiments
	Minimum 8 experiments based on topics listed below with one mini project/Innovative experiment using any one of the microcontrollers(8051, ATMEGA16/32, MSP430)
1.	8051 based assembly language programming including Timer, Interrupt programming.
2.	Interfacing 8051 with Displays, Sensors, Motors etc.
3.	ATMEGA microcontroller interfacing with various hardware including sensors, Displays, and Stepper motors.
4.	Waveform generation using AVR microcontroller.
5.	DC motor control using PWM with AVR microcontroller.



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6.	MSP 430 microcontroller sensor interfacing.
7.	Mini Project/Innovative Experiment



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Fifth Semester

Course Title: Electromagnetic Waves	
Course Code: 25UEC502T	Course Category: PCC
Teaching Scheme: L – T – P	Total Credits: 04
3 – 1 – 0	Semester: V
Scheme of Examination: ESE: 60 Mks, CE: 40 Mks	

Course Objectives:	
1.	To study Co-ordinate Systems and Vector Theory.
2.	To study Electric Field.
3.	To Magnetic Field.
4.	To study different principles of wave propagation theory.

Course Outcomes:	
At the end of this course, students will have an ability to:	
CO1	Discuss the different coordinate systems.
CO2	Demonstrate theorems of electric Field.
CO3	Discuss magnetic fields and apply the Maxwell's equations to solve problems in electromagnetic field theory.
CO4	Analyze the propagation of wave in different transmission media.
CO5	Discuss and demonstrate various parameters and characteristics of the rectangular waveguide.
CO6	Discuss the principle of radiation and radiation characteristics of an antenna.

Course Contents:	
UNIT I	[08 Hours]
Co-ordinate Systems Basics of Vectors, Coordinate system- Cartesian Coordinate System, Cylindrical Coordinate system and spherical coordinate system concepts of differential surface and differential volume, Gradient.	
UNIT II	[08 Hours]



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Electric Field

Basics of Coulombs Law, Electric field intensity due to system of charges, Electric field intensity due to system of charges - Continuously distributed, Electric field intensity due to Infinite uniform line charge, surface charge. Gauss Law, Divergence Theorem.

UNIT III

[07 Hours]

Energy and Potential

Concept of energy & work done in moving a point charge: linear and circular path, Electric scalar Potential: Absolute Potential and potential difference, Conservative property of Potential field, Potential field of a system of charges: circular ring and disk Dipole moment, electric field at a distant point due to electric dipole, Electrostatic energy density. Poisson's and Laplace's equation and its examples of solutions, Uniqueness of electrostatic solution

UNIT IV

[08 Hours]

Magnetic Field

Basics of Magnetic Field, Biot-Savart's Law, Magnetic field intensity due to an infinite filament carrying current I in it, Amperes Circuital Law, Stokes Theorem.

UNIT V

[08 Hours]

Maxwell's equations

Physical equations for Time constant fields Continuity equation and Time-Varying fields. Maxwell's equation in point form and integral form Significance of Gradient Divergence and Curl, Boundary Conditions. Maxwell's

UNIT VI

[06Hours]

UNIT- VI: Electromagnetic Waves

Maxwell's equations in Phaser Form, wave equation in general conducting and perfect Dielectric medium, Solution of wave equation in general conducting medium, general Expression s for α & β , Wave propagation in free space or perfect dielectric and perfect conductor, Skin effect, Poynting vector and Poynting theorem.

Suggested Self Readings:

Text Books

1. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, 2005
2. E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India.
3. Narayana Rao, N: Engineering Electromagnetics, 3rd ed., Prentice Hall, 1997.

Reference Books

1. David Cheng, Electromagnetics, Prentice Hall.



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2.	William H. Hayt Jr.& John A. Buck, Engineering Electromagnetics, McGraw-Hill.
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Fifth Semester

Course Title: PCB Design & Prototyping	
Course Code: 25UEC503P	Course Category: PCC
Teaching Scheme: L – T – P	Total Credits: 01
0 – 0 – 2	Semester: V
Scheme of Examination: ESE: 25 Mks, CE: 25 Mks	
Prerequisites: Basic Electronics Workshop	

Course Objectives:

1.	Identify different rules of artwork and prepare PCB accordingly.
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Course Outcomes:

At the end of this course, students will have an ability to:

CO1	List different types of electronic drawings
CO2	Demonstrate the steps involved in manufacturing of a PCB
CO3	Design layout by different techniques for single sided PCB

Course Contents:

Sr. No.	List of Experiments
1.	Different types of Electronics drawings & tools
2.	Steps involved in manufacturing of a PCB
3.	Techniques for a designing layout for single sided PCB
4.	Design of PCB layout/artwork for simple circuit by manual method
5.	Design of PCB layout/artwork for simple circuit by using software
6.	Mini Project based on PCB layout/artwork designed in expt.4 or 5



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Fifth Semester

Course Title: Measurement and Instrumentation	
Course Code: 25UEC521T	Course Category: PEC-I
Teaching Scheme: L – T – P	Total Credits: 02
2 – 0 – 0	Semester: V
Scheme of Examination: ESE: 30 Mks, CE: 20 Mks	

Course Objectives:	
1.	Necessary foundation of electronic measurement techniques and its use for voltage, current, power, energy, frequency & time measurement
2.	Working principle and use of moving coil instruments for measurements of voltage, current, power, energy etc.
3.	Understanding application of bridges in resistance, capacitance and Inductance measurement and their use in real life industrial applications.
4.	Knowledge of working principle of various instruments like CRO, DSO, LCR, and Spectrum Analyzer for testing and measurement.

Course Outcomes:	
At the end of this course, students will have an ability to:	
CO1	Identify and analyse the factors affecting performance of measuring system
CO2	Choose appropriate instruments for the measurement of voltage, current in ac and dc measurements
CO3	Describe the operating principle of DC and AC bridges, transducers based systems.
CO4	Discuss the operating principles of basic building blocks of digital systems, recording and display units

Course Contents:	
UNIT I	[08 Hours]
Measurement standards–Errors-Types of Errors- Statistics of errors, Need for calibration. Classification of instruments, secondary instruments–indicating, integrating and recording operating forces - essentials of indicating instruments - deflecting, damping, controlling torques. Ammeters and	



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voltmeters - moving coil, moving iron, constructional details and operation, principles shunts and multipliers – extension of range.

UNIT II **[07 Hours]**

Measurement of power:

Dynamometer type wattmeter –Construction and working - 3- phase power measurement-Low Powerfactor wattmeters. Measurement of energy: Induction type watt-hour meters- Single phase energy meter – construction and working, two element three phase energy meters, Digital Energy meters -Time of Day(TOD) and Smart metering (description only). Current transformers and potential transformers – principle of working -ratio and phase angle errors.

UNIT III **[08 Hours]**

Classification, measurement of low, medium and high resistance- Ammeter voltmeter method(for low and medium resistance measurements)-Kelvin's double bridge Wheatstones bridge- loss of charge method, measurement of earth resistance. Measurement of self-inductance - Maxwell's Inductance bridge, Measurement of capacitance –Schering's, Measurement of frequency-Wien's bridge. Calibration of Ammeter, Voltmeter and Wattmeter using DC potentiometers. High voltage and high current in DC measurements- voltmeters, Sphere gaps, DC Hall effect sensors

UNIT IV **[07 Hours]**

Transducers - Definition and classification. LVDT, Electromagnetic and Ultrasonic flow meters, Piezoelectric transducers-modes of operation-force transducer, Load cell, Strain gauge. Oscilloscopes-Principal of operation of general purpose CRO-basics of vertical and horizontal deflection system, sweep generator etc. DSO-Characteristics-Probes and Probing techniques. Digital voltmeters and frequency meters using electronic counters, DMM, Clamp on meters.

Suggested Self Readings:

Text Books

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| 1. | Sawhney A.K., A course in Electrical and Electronic Measurements & instrumentation, DhanpatRai. |
| 2. | J. B. Gupta, A course in Electrical & Electronic Measurement & Instrumentation., S K Kataria& Sons |
| 3. | Kalsi H. S., Electronic Instrumentation, 3/e, Tata McGraw Hill, New Delhi, 2012 |
| 4. | S Tumanski, Principles of electrical measurement, Taylor & Francis. |

Reference Books

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|----|---|
| 1. | Golding E.W., Electrical Measurements & Measuring Instruments, Wheeler Pub. |
| 2. | Cooper W.D., Modern Electronics Instrumentation, Prentice Hall of India |
| 3. | Stout M.B., Basic Electrical Measurements, Prentice Hall |



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Fifth Semester

Course Title: Information Theory and Coding	
Course Code: 25UEC522T	Course Category: PEC-I
Teaching Scheme: L – T – P	Total Credits: 02
2 – 0 – 0	Semester: V
Scheme of Examination: ESE: 30 Mks, CE: 20 Mks	
Prerequisites: Digital Communication	

Course Objectives:	
1.	To learn Information Theory, Entropy and Mutual Information
2.	To verify and apply the Channel Models and channel capacity of various channels
3.	To study error correcting codes
4.	To study Hamming Codes, LDPC Codes, Introduction to Cyclic Codes.

Course Outcomes:	
At the end of this course, students will have an ability to:	
CO1	Explain basic terminologies of information theory and source coding.
CO2	Identify channel models and channel capacity.
CO3	Apply various error control encoding and decoding techniques
CO4	Compute Linear Block coding and apply it in real world scenario.
CO5	Estimate the performance of Convolutional Coding and Decoding.
CO6	Illustrate Reed Solomon Codes, BCH Codes and ARQ schemes.

Course Contents:	
UNIT I	[08 Hours]
INFORMATION THEORY: Entropy, Mutual Information, Conditional and Joint Entropy, Relative Entropy, Variable Length Codes, Source Coding Theorem, Various source coding techniques: Shannon-Fano, Huffman coding, Lempel Ziv Coding. Channel Capacity Theorem.	



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UNIT II	[07 Hours]
ERROR CONTROL CODING: Introduction to Galois Field, Generator Matrix and Parity Check Matrix, Systematic Codes, Error Detection and Correction, Erasure and Errors, Standard Array and Syndrome Decoding, Probability of Error, Coding Gain and Hamming Bound.	
UNIT III	[08 Hours]
CHANNEL CODING TECHNIQUES-I: Convolutional Codes, Trellis Codes: Generator Polynomial Matrix and Encoding using Trellis, Distance Properties of Convolutional Codes. Fano Decoding, Viterbi Decoding.	
UNIT IV	[07 Hours]
CHANNEL CODING TECHNIQUES-II Reed Solomon (RS) encoding and decoding, BCH encoding and decoding, Generator Polynomials, Automatic Repeat Request Strategies, Selective Repeat ARQ System, Hybrid ARQ Schemes.	

Suggested Self Readings:	
Text Books	
1.	K. Sam Shanmugam , "Digital and analog communication systems", John Wiley, 1996.
2.	Simon Haykin , "Digital communication" , John Wiley, 2003.
3.	Shu Lin, Daniel Costello, Jr, "Error Control Coding- Fundamentals and Applications" – Pearson, Inc. Second Edition, ISBN: 978-81-317-3440-7.
4.	Error Correcting Coding Theory-Man Young Rhee- 1989, McGraw-Hill Publishing
5.	T.M. Cover and J. A. Thomas, Elements of information theory, John Wiley & Sons, 2012
6.	Information theory, coding and cryptography, Ranjan Bose, McGraw Hill, 3 rd Edition, 2016.
Reference Books	
1.	Digital Communications-Fundamental and Application - Bernard Sklar, PE.
2.	Digital Communications- John G. Proakis, 5th ed., 2008, TMH
3.	Error Correction Coding – Mathematical Methods and Algorithms – Todd K. Moon, 2006, Wiley



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Fifth Semester

Course Title: Computer Architecture	
Course Code: 25UEC523T	Course Category: PEC-I
Teaching Scheme: L – T – P	Total Credits: 02
2 – 0 – 0	Semester: V
Scheme of Examination: ESE: 30 Mks, CE: 20 Mks	

Course Objectives:	
1.	Discuss the basic concepts and structure of computers.
2.	Understand the concept of memory management and virtual memory.
3.	To identify and compare different methods for computer I/O.
4.	Learn about Parallel Organizations

Course Outcomes:	
At the end of this course, students will have an ability to:	
CO1	Explain computer architecture concepts.
CO2	Explain and apply algorithms used for various arithmetic operations performed in computer.
CO3	Distinguish the organization of various parts of a system memory hierarchy
CO4	Describe fundamentals concepts of pipeline and vector processing.

Course Contents:	
UNIT I	[08 Hours]
BASIC STRUCTURE OF COMPUTER: Functional units, Basic operational concepts, Bus architecture, Instruction formats, Instruction set properties, RISC vs CISC, instruction types, Addressing modes, Execution of a Complete Instruction, Subroutine Call and Return, parameter passing, Types of Interrupts. Central processing unit: major component and organization, ALU and Bit slice concept. Control unit- Role, types and block diagram, Hardwired control unit, Microprogrammed Control unit: Control Word, Microprogram, Control Memory, Control Address Register, Sequencer, Sequencing of control signals, microinstruction format.	
UNIT II	[07 Hours]
COMPUTER ARITHMETIC:	



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Number representations, Fixed Point representation, Floating Point Representation, Representing Negative Numbers, Arithmetic with Complements, Overflow, Detecting Overflow, Signed multiplication, Booth's Algorithm, bit-pair recoding, Integer Division-Restoring and Non-Restoring algorithm.

UNIT III

[08 Hours]

MEMORY AND IO SYSTEM:

Various technologies used in memory design, multi-module memories and interleaving, Associative Memory, Cache memory, Virtual Memory.

I/O mapped I/O and memory mapped I/O, interrupts and interrupts handling mechanisms, vectored interrupts, synchronous vs. asynchronous data transfer, Direct Memory Access

UNIT IV

[07 Hours]

PIPELINING AND PARALLEL PROCESSING:

Pipelining: Concept and Demonstration with Example, Instruction Level Pipelining, Instruction Cycle, Three & Four-Segment Instruction Pipeline. Parallel Processing, Multiple Functional Units, Flynn's Classification, Vector Processing, Applications, Vector Operations, Matrix Multiplication.

Suggested Self Readings:

Text Books

1. Computer Organization by V. C. Hamacher, Z. G. Vranesic and S. G. Zaky, McGraw Hill, 5th ed, 2002.
2. Stallings, "Computer Organization & Architecture", Pearson Education
3. Computer architecture and organization by Carl Hamacher- McGraw Hill Higher Education 4th Edition
4. Computer architecture and parallel processing by Kai Hwang - New York McGraw Hill publication.

Reference Books

1. Computer Architecture & Organization III Ed- J.P.Hayes.
2. Structured Computer Organization by A.S.Tanenbaum, 4th Edition, Pearson Education
3. Computer Organization and Architecture: Designing for Performance by William Stallings, 10th Edition Pearson Education.



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Fifth Semester

Course Title: Introduction to Emerging Technologies	
Course Code: 25UEC524T	Course Category: PEC-I
Teaching Scheme: L – T – P	Total Credits: 02
2 – 0 – 0	Semester: V
Scheme of Examination: ESE: 30 Mks, CE: 20 Mks	
Prerequisites: Basic familiarity with data structures and algorithms.	

Course Objectives:	
1.	To introduce the fundamental concepts, history, and societal impact of Artificial Intelligence (AI).
2.	To enable logical reasoning and problem-solving using AI techniques.
3.	To provide knowledge of Machine Learning paradigms and neural networks.
4.	To familiarize students with AI/ML tools and real-world applications

Course Outcomes:	
At the end of this course, students will have an ability to:	
CO1	Explain the core concepts of Artificial Intelligence and its components.
CO2	Apply logical reasoning and problem-solving techniques in AI systems.
CO3	Analyze and implement various Machine Learning paradigms and neural network models.
CO4	Utilize AI/ML tools, frameworks, and languages to address real-world applications effectively.

Course Contents:	
UNIT I	[07 Hours]
Introduction to AI: History, evolution, and applications, AI and Society: Impacts on technology and humanity, Agents and Knowledge-Based Systems: Definition, types, and components. Problem-Solving Techniques: Search strategies, games, and AI-based decision-making.	
UNIT II	[07 Hours]
Propositional Logic:	



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Syntax, semantics, and inference techniques, First Order Logic: Structure and limitations. Handling Uncertainty in AI: Probability models and reasoning approaches.

UNIT III

[08 Hours]

Advanced Problem Solving: Search and optimization methods.

Machine Learning Paradigms: Supervised Learning: Regression, decision trees, and classification, Unsupervised Learning: Clustering and dimensionality reduction, Reinforcement Learning: Model-based approaches, Artificial Neural Networks:

Introduction to neural networks: Biological vs. artificial, Hopfield Network, Backpropagation, and Support Vector Machines (SVM).

UNIT IV

[08 Hours]

Deep Learning Basics:

Overview and Applications, AI/ML Tools and Frameworks:

Software: TensorFlow, PyTorch, Scikit Learn, and IBM Watson, Real-World Applications: AIML in healthcare, finance, education, and transportation, Ethical considerations and societal challenges in AIML, Future trends and innovations in AI and ML.

Suggested Self Readings:

Text Books

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|----|--|
| 1. | Wolfgang Ertel, Introduction to Artificial Intelligence, 2nd Edition, UTICS, Springer. |
| 2. | Ethem Alpaydın, Introduction to Machine Learning, 3rd Edition, The MIT Press. |

Reference Books

- | | |
|----|---|
| 1. | John Paul Mueller, Luca Massaron, Artificial Intelligence for Dummies, 1st Edition, 2018. |
| 2. | Steven W. Knox, <i>Machine Learning: A Concise Introduction</i> , 1st Edition, Wiley, 2018. |



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Fifth Semester

Course Title: Computer Networks	
Course Code: 25UCT504T	Course Category: MDM-III
Teaching Scheme: L – T – P	Total Credits: 03
3 – 0 – 0	Semester: V
Scheme of Examination: ESE: 60 Mks, CE: 40 Mks	

Course Objectives:	
1.	Build an understanding of the fundamental concepts of computer networking and its topologies.
2.	Learn about the transmission media used for wired and wireless network and learn the concept of switching techniques.
3.	Learn the concept of network services and various protocols of Data Link Layer and MAC sub-layer.
4.	Introduce the concept Network Layer and IP Addressing techniques.
5.	Introduce transport layer services and its protocol Headers.
6.	Introduce the function of Application Layer and Presentation layer paradigm and protocols

Course Outcomes:	
At the end of this course, students will have an ability to:	
CO1	Describe the basics of Computer Network, Data Communication, Network topologies
CO2	Describe the transport layer, transmission media and switching techniques.
CO3	Analyze the services and features of various protocols of Data Link Layer and MAC sub-layer.
CO4	Apply the concept of IP Addressing techniques and its various protocols of Network Layer.
CO5	Describe the transport layer, Application Layer services and its protocol Headers and Analyze the congestion control protocols.
CO6	Explain the function of Application Layer and Presentation layer paradigm and protocols.

Course Contents:	
UNIT I	[07 Hours]
UNIT I: Computer Networks Overview	



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Introduction to Networks, Network Topology, Types of communication: -simplex, half duplex, full duplex, Network classification: - LAN, MAN, WAN, Network Architecture, Protocols, Services and primitives, OSI Reference Model, TCP/IP Reference Model.

UNIT II **[07 Hours]**

UNIT II: Physical Layer

Data and Signals, Digital Transmission, Analog Transmission, Bandwidth Utilization: Multiplexing and Spreading, Transmission Media: -Guided Media, Unguided, Structure of Switch, types of switches, Switching Techniques: -Circuit-switching, Message switching, packet switching,

UNIT III **[08 Hours]**

UNIT III: Data Link Layer

Design Issues, framing methods, Flow Control and Error Control, Stop-and-wait flow control, Sliding-window flow control, Stop-and-wait ARQ, Go-back-N ARQ, Selective-repeat ARQ, HDLC, MAC sub layer: ALOHA, CSMA-CD.

UNIT IV **[08 Hours]**

UNIT IV: Network Layer:

Network layer duties, Routers, IP addressing and its classification, IPv4 address, IPv6 address, Mask and Subnet, Routing algorithms like shortest path routing, Dijkstra's algorithm, Bellman Ford Algorithm, Distance Vector Routing, Dynamic Routing

UNIT V **[08 Hours]**

UNIT V: Transport Layer:

Transport layer services, Connection oriented & Connectionless, Three-way handshaking, UDP model, TCP: - TCP header format, comparison between UDP and TCP, Need of Congestion control, Principal of congestion, Quality of Service (QoS), Token bucket and leaky bucket algorithm.

UNIT VI **[07 Hours]**

UNIT VI: Application Layer

Application Layer: DNS, Electronic Mail, File Transfer (FTP), WWW, HTTP, SNMP, SMTP. Introduction to Cryptography, Secret key algorithm, public key algorithm, Digital Signature, Basics of Attacks and security.

Suggested Self Readings:

Text Books

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| 1. | Data Communications and Networking, Fourth Edition by Behrouza A. Forouzan, TMH. |
| 2. | Computer Networks, A.S. Tanenbaum, 4th Edition, Pearson education. |



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Reference Books

1.	Data and Computer Communications, tenth Edition by William Stallings, Pearson Educations.
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Fifth Semester

Course Title: computer Network Lab	
Course Code: 25UCT504P	Course Category: MDM-III
Teaching Scheme: L – T – P	Total Credits: 01
0 – 0 – 2	Semester: V
Scheme of Examination: ESE: 25 Mks, CE: 25 Mks	

Course Objectives:

1.	To understand the working principle of various communication protocols.
2.	To analyse the various routing algorithms.
3.	To know the concept of data transfer between nodes

Course Outcomes:

At the end of this course, students will have an ability to:	
CO1	Explain different hardware components in computer communication network
CO2	Demonstrate different communication protocols for computer networks
CO3	Design different networks using NS-2

Course Contents:

Sr. No.	List of Experiments
1.	To study Network Hardware components – Cables, NIC, Repeaters, Hubs, Bridges, Switches and Routers.
2.	To demonstrate the formation of Local Area Network
3.	To demonstrate data transmission using Ping protocol, tracer and IP configuration.
4.	To study Network Simulator “ns-2”.
5.	To perform the simulation of 2 Nodes in ns-2.
6.	To create a Simple Network Topology in ns-2.
7.	To perform simulation using TCP protocol using ns-2
8.	To perform simulation using UDP protocol using ns-2.



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9.	To perform PC to PC communication using RS-232 port.
10.	To configure Router.
11.	To understand IP address of the system and Network Address Translation.
12.	To study the Domain Name Server (DNS)

Fifth Semester

Course Title: Biomedical Engineering	
Course Code: 25UOE538T	Course Category: OE-III
Teaching Scheme: L – T – P	Total Credits: 02
2 – 0 – 0	Semester: V
Scheme of Examination: ESE: 30 Mks, CE: 20 Mks	

Course Objectives:	
1.	To understand the biomedical signal acquisition & medical informatics.
2.	To understand x-ray, MRI, CT, VR technologies and infra-red imaging,
3.	To understand the biomedical sensors.
4.	To have thorough understanding of medical instruments & devices.

Course Outcomes:	
At the end of this course, students will have an ability to:	
CO1	Describe biomedical signal acquisition system & medical informatics
CO2	Describe x-ray, MRI, CT, VR technologies and infra-red imaging.
CO3	Explain Biomedical sensors & measurements.
CO4	Describe different medical instruments & their applications.

Course Contents:	
UNIT I	[08 Hours]
Introduction to Biomedical Engineering: Introduction to biomedical engineering, scope of electronics in biomedical engineering, block diagram of bio medical Electronics, block diagram of bio medical Instrumentation, Hospital information system: function and state, Computer based patient records. Medical instruments and Devices Used in home	



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UNIT II	[08Hours]
Imaging: X-Ray, Computed Tomography, Magnetic Resonance Imaging, Ultrasound, Magnetic Resonance Microscopy, Electrical Impedance Tomography, Medical Applications of Virtual Reality Technology, Infrared Imaging: Advances in Medical Infrared Imaging.	
UNIT III	[07 Hours]
Biomedical Sensors: Biomedical Sensors, Physical Measurements, Biopotential Electrodes, Electrochemical Sensors, Optical Sensors, Bioanalytic Sensors, Biological Sensors for Diagnostics.	
UNIT IV	[07 Hours]
Bio-potential Amplifiers: Bio-potential Amplifiers, Bioelectric Impedance Measurements, Implantable Cardiac Pacemakers, Non-invasive Blood Pressure Measurement, Cardiac Output Measurement, Implantable Stimulators for Neuromuscular Control, Blood Glucose Monitoring,	

Suggested Self Readings:	
Text Books	
1.	R.S.Khandpur, 'Hand Book of Bio-Medical instrumentation', Tata McGraw Hill Publishing Co Ltd., 2003
2.	"Medical Devices and Systems", 3rd Edition, Joseph D. Bronzino Trinity College Hartford, Connecticut, United
3.	Biomedical States Engineering of America from theory to applications, Reza Fazel-Rezai, University of North Dakota,
4.	Medical Instrumentation: Application and Design Fifth Edition by John G. Webster (Editor), Amit J. Nimunkar



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Fifth Semester

Course Title: Soft Computing	
Course Code: 25UOE539T	Course Category: OE-III
Teaching Scheme: L – T – P	Total Credits: 02
2 – 0 – 0	Semester: V
Scheme of Examination: ESE: 30 Mks, CE: 20 Mks	

Course Objectives:	
1.	Introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience.
2.	To familiarize with genetic algorithms.
3.	To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inferencing systems.

Course Outcomes:	
At the end of this course, students will have an ability to:	
CO1	Determine the feasibility of applying a soft computing methodology for a particular problem.
CO2	Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
CO3	Apply genetic algorithms to combinatorial optimization problems.
CO4	Apply neural networks to pattern classification and regression problems.

Course Contents:	
UNIT I	[07 Hours]
Fuzzy Logic:	



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Fuzzy Set Theory: Basic Definition and Terminology, Set Theoretic Operations, MF Formulation and Parameterization, MF of two dimensions, Fuzzy Union, Intersection and Complement.

UNIT II

[08Hours]

Fuzzy Rules and Fuzzy Reasoning:

Extension Principles and Fuzzy Relations, Fuzzy IF THEN Rules, Fuzzy Reasoning. Fuzzy Inference System Introduction, Mamdani Fuzzy models, Other Variants, Sugeno Fuzzy Models, Tekamoto Fuzzy Models.

UNIT III

[07 Hours]

Genetic Algorithms:

Fundamentals of Genetic Algorithms: Basic Concepts Creation, Offspring's Encoding, Fitness functions, Reproduction, Genetic Modelling: Inheritance Operators, Cross over, Inversion and detection, Mutation operator, Bitwise operators.

UNIT IV

[08 Hours]

Artificial Neural Networks:

Introduction, Architecture, Back Propagation and feed Forward Networks, Offline Learning, Online Learning.

Supervised Learning of Neural Networks: Introduction, Perceptrons, Adaline Back Propagation Multilayer Perceptrons, Back Propagation Learning Rules, Methods of Speeding. Radial Basis Function Networks, Functional Expansion Networks.

Suggested Self Readings:

Text Books

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| 1. | J.S.R. Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing" PHI/Pearson Education, New Delhi 2004. |
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Reference Books

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| 1. | T. J. Ross, "Fuzzy Logic with Engineering Applications." TMH, New York, 1997. |
| 2. | D. E. Goldberg, Genetic Algorithms in Search Optimization and Machine Learning, Addison Wesley, 3rd Ed. |
| 3. | B. Kosko, Neural Network and fuzzy systems, Prentice Hall of India, 2006 |



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Fifth Semester

Course Title: Introduction to 5G Technology	
Course Code: 25UOE540T	Course Category: OE-III
Teaching Scheme: L – T – P	Total Credits: 02
2 – 0 – 0	Semester: V
Scheme of Examination: ESE: 30 Mks, CE: 20 Mks	

Course Objectives:	
1.	To understand the evolution and need for 5G technology.
2.	To explore the architecture, design principles, and key enabling technologies of 5G.
3.	To analyze 5G's capabilities in terms of speed, latency, and connectivity.
4.	To evaluate the challenges and solutions in deploying 5G systems.

Course Outcomes:	
At the end of this course, students will have an ability to:	
CO1	Explain the evolution of mobile networks from 1G to 5G and the need for 5G technology.
CO2	Describe the 5G architecture and its key components.
CO3	Identify and analyze the enabling technologies like Massive MIMO, millimeter-wave communication, and network slicing.
CO4	Discuss the challenges in 5G deployment, including spectrum management and security concerns.

Course Contents:	
UNIT I	[07 Hours]



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Introduction to 5G Technology:

Overview of mobile communication evolution: 1G to 4G. Need for 5G and its vision. Key performance indicators (KPIs) of 5G. Mobile Broadband standards (3gpp.org), ITU (International Radio Communication Union), NOMA (Non Orthogonal Multiple access) technology, Frugal 5G Technology.

UNIT II

[07 Hours]

Network Architecture:

5G NR (New Radio) and core network architecture. Comparison of 4G LTE and 5G architecture. 5G deployment modes: Standalone (SA) and Non-Standalone (NSA)

UNIT III

[08 Hours]

Key Enabling Technology:

Massive MIMO and beam forming. Millimeter-Wave (mm Wave) communication. Network slicing and virtualization (SDN/NFV). Edge computing and its role in 5G

UNIT IV

[08 Hours]

Spectrum Management and Challenges:

Spectrum allocation and frequency bands for 5G. Interference management and energy efficiency. Security challenges and solutions in 5G.

Suggested Self Readings:

Text Books

1. "Fundamentals of 5G Mobile Networks" by Jonathan Rodriguez, Wiley.
2. "5G Technology: 3GPP New Radio" by Harri Holma and Antti Toskala, Wiley.

Reference Books

1. "5G Mobile and Wireless Communications Technology" by Afif Osseiran, Jose F. Monserrat, and Patrick Marsch, Cambridge University Press.
2. "5G NR: The Next Generation Wireless Access Technology" by Erik Dahlman, Stefan Parkvall, and Johan Skold, Academic Press.
3. "5G Wireless Systems: Simulation and Evaluation Techniques" by Yang Yang, Juergen Gross, and Hsiao-Hwa Chen, Springer.



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Fifth Semester

Course Title: Embedded C Programming	
Course Code: 25UEC504P	Course Category: VSC-I
Teaching Scheme: L – T – P	Total Credits: 02
0 – 1 – 2	Semester: V
Scheme of Examination: ESE: 25 Mks, CE: 25 Mks	

Course Objectives:	
1.	To provide hands-on experience in programming 32-bit microcontroller -ARM Cortex-M0 using Embedded C
2.	To develop skills in interfacing various peripherals with ARM Cortex-M0
3.	To understand the concepts of embedded systems design and development using ARM Cortex-M0
4.	To Implement the Device drivers.

Course Outcomes:	
At the end of this course, students will have an ability to:	
CO1	Write Embedded C program for simple applications
CO2	Interface various peripherals with - ARM Cortex-M0
CO3	Write Device driver programs.

Basic Topics	
1.	C Programming and Embedded system:



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	Introduction to embedded systems. Basic structure of program, syntax and data types, Variables, operators, and control structures, Functions, various Data structures in Embedded C, Setting up the development environment (Keil, ARM Development Studio, etc.)
2.	Introduction to ARM Cortex M0 and Programming Fundamentals: Overview of ARM Cortex M0 architecture, instruction set architecture, Programming the ARM Cortex M0 processor (data processing, control flow, etc.), built-in peripherals (GPIO, UART, etc.), Interrupts and interrupt handling
3.	Interfacing Peripherals with ARM Cortex-M0: Interfacing LEDs, switches, displays, analog-to-digital converters (ADC) and digital-to-analog converters (DAC), serial communication protocols (UART, SPI, I2C, sensors and actuators with ARM Cortex-M0.
4.	Device Driver concepts: Driver concepts, Steps for device driver designing, Block & character driver distinction, Low level drivers, OS drivers etc, Writing character drivers, Device major, minor number.
List of LAB Experiments	
1.	1. Setting up the development environment (Keil/ARM/Code Composer Studio) and writing and debugging a simple Embedded C program. A. Write an Embedded C program that declares and initializes variables of different data types (e.g., int, char, float, bool). B. Write an Embedded C program that demonstrates the use of arithmetic operators (e.g., +, -, *, /, %). C. Write an Embedded C program that demonstrates the use of control structures (e.g., if-else, switch, for, while, do-while).
2.	LED and Button Interfacing: Write a program to turn on an LED after detecting a pressed button connected to a GPIO pins using ARM Cortex-M0.
3.	LCD Interfacing: Write a program to initialize an LCD display and display message on it using ARM Cortex-M0.
4.	Sensor Interfacing: Write a program to read data from a temperature sensor/ any sensor using ARM Cortex-M0.
5.	Timer and PWM Interfacing: Write a program to generate an interrupt on a timer expiration using ARM Cortex-M0. Write a program to generate a PWM signal using a timer on ARM Cortex-M0.



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6.	ADC Interfacing: Write a program to perform an analog-to-digital conversion using ARM Cortex M0. Write a program to Interface sensors for demonstrating Wireless communication (Bluetooth, RFID, ZigBee etc.) Write a program for Interfacing motors and actuators with ARM Cortex-M0
Part B	
1.	Implementation of data structure for any application Eg. Design Temperature Monitoring System: Design an application that monitors temperature readings from sensor and stores them in a database. The database is implemented using the data structures (array, linked list, stack etc)
Part C	
1.	Device driver programming – Implementation of Device Drivers:
2.	Write a UART driver to communicate with a serial device (e.g., terminal, serial monitor) using ARM Cortex-M0.
3.	Write an SPI driver to communicate with an SPI device (e.g., EEPROM, ADC) using ARM Cortex-M0.

Suggested Self Readings

Text Books	
1	ARM System Developers Guide, Designing and Optimizing System Software, by Andrew N. SLOSS, Dominic SYMES and Chris WRIGHT, ELSEVIER, 3004
Reference Books	
1	Complete Guide to C for Embedded Systems: From Code to Hardware Control: From Basics to Advanced: Mastering C Programming for Embedded Systems Development and Peripheral Control Kindle Edition by Hugo S. Dias
2	LPC2141/42/44/46/48 Single-chip 16-bit/32-bit microcontrollers; up to 512 kB flash with ISP/IAP, USB 2.0 full-speed device, 10-bit ADC and DAC (Datasheet)



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Fifth Semester

Course Title: Business Management and Entrepreneurship	
Course Code: 25UBS505T	Course Category: HSSM Entrepreneurship/Economics Management Courses
Teaching Scheme: L – T - P	Total Credits: 03
3 – 0 – 0	Semester: V
Scheme of Examination: ESE:60 Mks, CE:40 Mks.	
Prerequisite: Basic knowledge of Business and Management	

Course Objectives:	
1.	To develop knowledge and skills among the learners to operate and manage business operations.
2.	To build an understanding among the learners about business situations in which entrepreneurs act.
3.	To encourage learners to develop entrepreneurial skills that benefit society.

Course Outcomes:	
At the end of this course, students will have an ability to:	
CO1	Develop the basic concept of Business management
CO2	Describe various types of market structures and integration
CO3	Categorize the businesses into various types
CO4	Analyze the concept of E-commerce and of business strategies
CO5	Acquire basics of entrepreneurship development with special reference to women entrepreneurs
CO6	Analyze the challenges faced by small enterprises and their constructive role in economic development

Course Contents:	
UNIT I	[08 Hours]
Concept, nature and characteristics of management, Marketing management, Marketing mix, Product life cycle, Financial Management, Venture funding and Angel funding.	



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UNIT II [07 Hours]	
Market Structure: Perfect and Imperfect Market: Monopoly, Oligopoly and Monopolistic Market, Concept of top line and bottom-line growth, Break even analysis, Forward and Backward Integration, Case study.	
UNIT III [07 Hours]	
Types of Business Structure- Sole proprietorship, Partnership, Private company, Public company, Co-operative society, Features, Advantages and disadvantages.	
UNIT IV [8 Hours]	
E-commerce, Types of E-commerce- B2B, B2C. B2G, C2G, C2C, C2B, Merger and Acquisition: Concept and types, advantages of merger and acquisition, hostile takeover, Stock Market: Procedures, Importance Basic terminologies, Case study	
UNIT V [08 Hours]	
Concept of entrepreneurship, characteristics of an entrepreneur, types of Entrepreneurships, Functions of Entrepreneurs, Women Entrepreneurship in India, Problems and challenges of women entrepreneurs, Government support system to develop women entrepreneurship.	
UNIT VI [07 Hours]	
Concept of Small-Scale Industries, Types of SSI, Role of SSI in economic development, Advantages and Disadvantages of SSI, Sickness in SSI, Government initiatives of SSI, Incentives for SSI, Tax holidays.	
Suggested Self Readings:	
Reference books	
1.	Modern Business Organization and Management by S.A. Sherlekar and V.S. Sherlekar, Himalaya Publication, 2016
2.	Entrepreneurial Development By, S. S. Khanka S. Chand & Co. Ltd. New Delhi, 1999.
3.	Small- Scale Industries and Entrepreneurship in 21 st Century, by Dr. Vasant Desai, Himalaya Publication, 2023
4.	Merger & Acquisitions, The Art of Science, by Ashish Patil, Saaa Capital Pvt. Ltd, 2016
5.	Venture Capital and Angel Investing, Andrew M. Lane, NicoleP. Mifflin
6.	Industrial Economics and Entrepreneurship Development by A.M. Sheikh, Nawaz Khan and M.A. Tongo, S. Chand Publications, 2016



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Course Title: Artificial Intelligence- Knowledge Representation and Reasoning	
Course Code: 25UHSEC5T	Course Category: Honors
Teaching Scheme: L – T – P	Total Credits: 04
3 – 1 – 0	V Sem
Scheme of Examination: ESE: 60 Mks, CE: 40 Mks	
Prerequisites: Introduction to Artificial Intelligence	
Course Objectives:	
1.	Provide students with a deep understanding of various knowledge representation (KR) techniques used in Artificial Intelligence.
2.	Explore reasoning methodologies, enabling students to apply logical inference, problem-solving strategies, and decision-making techniques.
3.	Enhance the ability to model real-world problems using semantic networks, predicate logic, ontologies, and other advanced representation techniques.
4.	Foster critical thinking in understanding uncertainty, non-monotonic reasoning, and knowledge-based systems for AI applications.
5.	Prepare students to leverage KR and reasoning techniques in AI-driven systems, such as expert systems, robotics, and natural language processing.

Course Outcomes:	
At the end of this course, students will have the ability to:	
CO1	Demonstrate an understanding of different knowledge representation paradigms like logic-based, frame-based, and semantic networks.
CO2	Apply propositional and predicate logic for inference and reasoning in AI systems.
CO3	Analyse various reasoning techniques under uncertainty, including Bayesian reasoning and fuzzy logic.
CO4	Design and implement knowledge-based systems for real-world applications.
CO5	Explore non-monotonic reasoning and understand the role of ontologies in AI applications.
CO6	Evaluate AI algorithms that utilize knowledge representation and reasoning techniques for solving complex problems.

Course Contents:

UNIT I

[08 Hours]



Introduction to Knowledge Representation and Reasoning

Overview of Artificial Intelligence (AI) and the role of Knowledge Representation (KR)

Characteristics of KR systems: Expressiveness, Inferential Adequacy, and Efficiency

KR Approaches: Logic-based, Semantic Networks, Frame-based, Rule-based Systems

UNIT II

[07 Hours]

Propositional and Predicate Logic

Propositional Logic: Syntax and Semantics, Logical Connectives, Truth Tables

Predicate Logic: First-Order Predicate Logic (FOPL), Quantifiers, Unification

Resolution and Inference in Predicate Logic

UNIT III

[08 Hours]

Reasoning Under Uncertainty

Introduction to Uncertainty in AI

Bayesian Networks: Conditional Probabilities, Inference in Bayesian Networks

Fuzzy Logic: Membership Functions, Fuzzy Inference Systems, and Applications

UNIT IV

[07 Hours]

Non-Monotonic Reasoning and Default Logic

Non-monotonic Reasoning: Characteristics and Applications

Default Reasoning and Truth Maintenance Systems (TMS)

Introduction to Belief Revision and Reasoning with Incomplete Information

UNIT V

[07 Hours]

Ontologies and Knowledge Engineering

Ontologies: Definition, Role in AI, Ontology Languages (OWL, RDF)

Ontology Design and Implementation: Classes, Properties, Individuals



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Knowledge Engineering and Expert Systems: Case Studies and Applications

UNIT VI

[08 Hours]

Advanced Reasoning Techniques and Applications

Temporal and Spatial Reasoning

Knowledge Representation in Natural Language Processing (NLP) and Robotics

Knowledge Graphs and Semantic Web

AI Tools and Frameworks for KR (e.g., Prolog, OWL API)

Suggested Self Readings:

Text Books

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|----|---|
| 1. | Elaine Rich and Kevin Knight, "Artificial Intelligence," McGraw-Hill. |
| 2. | Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach," Pearson. |

Reference Books

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|----|--|
| 1. | Ronald Brachman and Hector Levesque, "Knowledge Representation and Reasoning," Morgan Kaufmann. |
| 2. | George F. Luger, "Artificial Intelligence: Structures and Strategies for Complex Problem Solving," Addison Wesley. |