Class:- **Final Year B. Tech**	Semester-VII
Course Code: **AI401**	Course Name: **Social and Ethical issues in AI**

L	T	P	Credits
2	--	--	2

Course Description:
This course examines the social and ethical implications of Artificial Intelligence (AI), focusing on issues like bias, privacy, accountability, and transparency. Students will explore the impact of AI on society, employment, and human autonomy. The course emphasizes responsible AI development, ethical decision-making, and governance to ensure AI benefits society while minimizing risks.

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

1. Comprehend the ethical and societal challenges posed by Artificial Intelligence (AI).
2. Analyze issues such as bias, fairness, privacy, and transparency in AI systems.
3. Evaluate the impact of AI on employment, human autonomy, and social structures.
4. Develop frameworks for responsible and ethical AI design and implementation.
5. Explore the role of regulations and governance in mitigating AI-related risks.

Prerequisite: Basic knowledge of Artificial Intelligence concepts, computer programming, and understanding of societal and ethical principles is recommended for this course.

Course Content

Unit No	Description	Hrs
1.	**Introduction to AI Ethics** Overview of Artificial Intelligence and its societal impact, Importance of ethics in AI development, Ethical theories and frameworks applied to AI, Introduction to bias, fairness, and accountability in AI.	04

2.	**Bias and Fairness in AI Systems** Sources of bias in AI: Data, algorithms, and human factors, Techniques to identify and mitigate bias, Fairness in decision-making AI systems, Case studies on biased AI systems and their consequences.	04
3.	**Privacy and Surveillance** Privacy concerns in AI-powered systems, Data collection, usage, and consent in AI applications, AI in surveillance: Ethical dilemmas and implications, Balancing privacy and security in AI technologies.	04
4.	**Transparency, Accountability, and Explainability** Importance of explainable AI (XAI), Challenges in achieving transparency in AI models, Accountability for AI decisions and ethical responsibility, Role of stakeholders in ensuring transparent AI practices.	04
5.	**Societal and Employment Impacts** Impact of AI on jobs, automation, and future workforce trends, Ethical considerations in replacing human labour with AI, Human-AI collaboration: Opportunities and risks, Social implications of widespread AI adoption.	04
6.	**Governance, Regulation, and Future Challenges** The role of regulations and ethical standards in AI, Global perspectives on AI governance, Emerging challenges in AI ethics (e.g., autonomous weapons, deepfakes), Building responsible AI for sustainable development.	04

References -

Text Books:

- Mark Coeckelbergh, "AI Ethics", The MIT Press.
- Virginia Dignum, "Responsible Artificial Intelligence: How to Develop and Use AI in a Responsible Way", Springer.
- Cathy O'Neil, "Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy", Crown Publishing.

Reference Books:

- Brian Christian, "The Alignment Problem: Machine Learning and Human Values", W.W. Norton & Company.
- Shalini Chhabra, "Artificial Intelligence Ethics and Governance: A Practical Guide for Responsible AI", CRC Press.

Class:- **Final Year B. Tech**	Semester-VII
Course Code: **AI403**	Course Name: **Cryptography and Network Security**

L	T	P	Credits
3	--	--	3

Course Description:
This course introduces the fundamentals of cryptography and network security, focusing on techniques to secure communication, protect sensitive data, and prevent cyber threats. It covers cryptographic algorithms, secure network protocols, authentication methods, and intrusion detection systems. Students will learn to design and implement security solutions to safeguard information systems and networks against modern cyberattacks.

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

1. Comprehend the core principles of cryptography and network security.
2. Apply cryptographic algorithms to ensure secure communication and data protection.
3. Analyze and implement secure network protocols and authentication techniques.
4. Identify and mitigate vulnerabilities using intrusion detection and prevention systems.
5. Develop robust security solutions to address modern cyber threats and safeguard networks.

Prerequisite: A basic understanding of computer networks, programming fundamentals, and mathematics (specifically number theory, probability, and linear algebra) is recommended for this course.

Course Content

Unit No	Description	Hrs
1.	**Introduction to Cryptography and Network Security** Overview of Security: Need, Goals, and Challenges, Principles of Cryptography, Types of Attacks: Passive, Active, Insider, and Outsider, Security Services and Mechanisms, Classical Cryptographic Techniques: Substitution and Transposition Ciphers, Overview of Modern Cryptography.	06
2.	**Symmetric Key Cryptography**	06

Rajarambapu Institute of Technology • CSE (AI&ML) Engg. Department 415 414 • Rajaramnagar

K.E.S. Rajarambapu Institute of Technology • Rajaramnagar Autonomous 415 414 Dist. Sangli. M.S.

	Symmetric Encryption Principles, Block Ciphers and Stream Ciphers, DES (Data Encryption Standard), AES (Advanced Encryption Standard), Modes of Operation: ECB, CBC, OFB, CFB, CTR, Strengths and Weaknesses of Symmetric Key Cryptography.	
3.	**Asymmetric Key Cryptography and Key Management** Principles of Public Key Cryptography, RSA Algorithm: Key Generation, Encryption, and Decryption, Diffie-Hellman Key Exchange, Elliptic Curve Cryptography (ECC), Key Management: Distribution and Agreement, Challenges in Key Distribution.	**06**
4.	**Hash Functions and Digital Signatures** Hash Functions: Properties and Applications, Message Authentication Codes (MACs), Cryptographic Hash Functions: MD5, SHA-1, SHA-2, Digital Signatures: Principles and Algorithms, Public Key Infrastructure (PKI) and Certificates.	**06**
5.	**Network Security Protocols** Secure Communication Protocols: SSL/TLS, HTTPS, AI-Powered Authentication & Access Control, IPSec: Authentication Header (AH) and Encapsulating Security Payload (ESP), Virtual Private Networks (VPNs), Wireless Security: WEP, WPA, WPA2, Email Security: PGP and S/MIME.	**06**
6.	**Cybersecurity and Emerging Trends** Intrusion Detection and Prevention Systems (IDPS), Network Security & AI, Firewalls and Network Address Translation (NAT), Security in IoT and Cloud Environments, Blockchain and Cryptography, Ethical and Legal Aspects of Security, AI & ML in Threat Detection.	**06**

References -

Text Books:

- Behrouz A. Forouzan, "Cryptography and Network Security", McGraw-Hill Education.
- Charles P. Pfleeger, "Security in Computing", Pearson Education.
- Atul Kahate, "Cryptography and Network Security", McGraw-Hill Education.

Reference Books:

- William Stallings, "Cryptography and Network Security: Principles and Practice", Pearson Education.
- Douglas R. Stinson, "Cryptography: Theory and Practice", Chapman & Hall/CRC Press.

Rajarambapu Institute of Technology CSE (AI&ML) Engg. Department 415 414 Rajaramnagar

K.E.S. Rajarambapu Institute of Technology Rajaramnagar Autonomous 415 414 Dist. Sangli. M.S.

Class:- **Final Year B. Tech**	Semester-**VII**
Course Code: **AI405**	Course Name: **Cloud Computing**

L	T	P	Credits
3	--	--	3

Course Description:

Over the past few years, cloud computing—a large-scale distributed computing paradigm—has emerged as a major force in information technology. Cloud computing services are being used more widely as a result of the exponential development in data size in social media and scientific simulation. The term "cloud computing," is usually used to describe data centers accessible to many different users via the Internet, refers to the on-demand availability of computer system resources, particularly data storage and computing power, without direct active management by the user. Clouds can be limited to a single organization (enterprise clouds) or can be accessible to multiple organizations (public clouds).
The course provides an overview of Cloud Computing terminologies along with the context of Virtualization. Various architectures providing the underlying bed of services are discoursed. Moreover, the industrial platforms and its associated work flows are deliberated in detail.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

1. Illustrate the working of cloud computing models.
2. Compare the architectures, service & deployment models of cloud computing.
3. Explore the context of virtualization technologies and its need.
4. Examine cloud computing platforms and its underlying security architecture.
5. Elaborate advanced applications of cloud computing in different sectors.

Prerequisite:

1. Knowledge of operating systems and computer networks
2. Basic architecture of client-server model and distributed computing

Course Content

Unit No	Description	Hrs
1.	**Basics of Cloud Computing** Introduction and Characteristics of Cloud Computing, Cloud computing reference model, Advantages and Disadvantages of cloud computing, Challenges ahead, Edge computing.	06

2.	**Models, Architecture and Storage** NIST architecture, Delivery Models: IaaS, PaaS, SaaS, MLaas Deployment models, Cloud storage, Cloud-Based AI Frameworks and Libraries, Open challenges.	**06**
3.	**Virtualization** Characteristics of virtualized environments, Taxonomy of virtualization techniques, Virtualization and cloud computing, Pros and cons of virtualization, Paravirtualization and Full virtualization.	**06**
4.	**Cloud Platforms** Amazon web services, Google AppEngine, Mirosoft Azure, Aneka platform, Edge AI & Serverless Computing.	**06**
5.	**Cloud Computing Security Architecture** Architectural Considerations, General Issues, Trusted Cloud Computing, Secure Execution environments and Communications, Identity Management and Access Control, AI driven cloud security.	**06**
6.	**Cloud Applications and Advanced Topics** Scientific applications, Business and consumer applications, Energy efficiency in clouds, Serverless Computing (FaaS), Containerization and Orchestration.	**06**

References –

Text Books:

- Rajkumar Buyya, Australia Christian Vecchiola, Australia S. Thamarai Selvi, "Mastering Cloud Computing Foundations and Applications Programming", Elsevier Inc.

Reference Books:

- Rajkumar Buyya, James Broberg, Andrzej Goscinski, "Cloud Computing: Principles and Paradigms", John Wiley & Sons, Inc.
- Judith Hurwitz, R. Bloor, M. Kanfman, F. Halper "Cloud Computing for Dummies", Wiley India Edition.
- John W. itinghouse james F. Ransome, "Cloud Computing Implementation, Management and Security", CRC Press.

Rajarambapu Institute of Technology CSE (AI&ML) Engg. Department 415 414 Rajaramnagar

K.E.S. Rajarambapu Institute of Technology Rajaramnagar Autonomous 415 414 Dist. Sangli. M.S.

Class:- **Final Year B. Tech**	Semester-VII
Course Code: **AI407**	Course Name: **(PE-III) Intelligent Transportation System**

L	T	P	Credits
3	--	--	3

Course Description:
Intelligent Transportation System is an evolving branch focuses to improve the efficiency, safety, and sustainability of transportation systems. This course explains Intelligent Transportation Systems (ITS) and how advanced technologies can make transportation faster, safer, and eco-friendlier. It focuses on using tools like the Internet of Things (IoT), Artificial Intelligence (AI), and Machine Learning (ML) to solve problems such as traffic jams, accidents, and pollution.

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

1. Comprehend fundamentals of intelligent transportation systems.
2. Apply IoT technologies to design smart transportation solutions.
3. Perform data analysis for traffic monitoring, autonomous navigation, and real-time data analytics.
4. Apply AI and Machine Learning techniques for traffic prediction and management.
5. Examine and propose solutions to technical, ethical, and societal challenges in deploying ITS.

Prerequisite: IOT

Course Content

Unit No	Description	Hrs
1.	**Introduction to Intelligent Transportation Systems** Overview of ITS and its importance, Components and infrastructure of ITS, Challenges in modern transportation systems, Role of IoT in transforming transportation. Role of AI and ML in ITS.	06
2.	**IoT Devices and Sensors for ITS** Types of IoT devices used in transportation: Sensors, cameras, RFID, Sensor integration in vehicles and infrastructure, Communication between IoT devices (Vehicle-to-Vehicle (V2V) and Vehicle-to-Infrastructure (V2I)).	06

3.	**Communication Protocols and Networks** Wireless communication technologies: ZigBee, Bluetooth, Wi-Fi, and LoRaWAN, Cellular networks for IoT: 4G, 5G, and NB-IoT, IoT protocols: MQTT, CoAP, and HTTP/REST.	**06**
4.	**Data Management and Analytics in IoT** Data collection from IoT devices. Cloud platforms for IoT: AWS IoT, Azure IoT Hub, and Google Cloud IoT. Real-time analytics and decision-making using IoT data.	**06**
5.	**Traffic Prediction and Management** Basics of traffic flow and congestion, Simple ML models for traffic prediction- linear regression, AI for managing traffic lights and reducing congestion, AI in maps and navigation systems-route optimization, Introduction to self-driving cars.	**06**
6.	**Challenges and Security in IoT-based ITS** Cybersecurity challenges in IoT-enabled transportation systems. Privacy concerns with IoT data. IoT system reliability and scalability.	**06**

References -

Text Books:

- Rajkumar Buyya, Amir Vahid Dastjerdi, "Internet of Things: Principles and Paradigms", Morgan Kaufmann.
- Asier Perallos, Unai Hernandez-Jayo, Enrique Onieva, Ignacio Julio Garcia-Zubia, "Intelligent Transportation Systems: Smart and Green Infrastructure Design", CRC Press.

Reference Books:

- Hussein T. Mouftah, Melike Erol-Kantarci, "Connected and Autonomous Vehicles in Smart Cities", Taylor & Francis (CRC Press).
- Olivier Hersent, "Internet of Things (IoT): Key Applications and Protocols", Wiley.

Rajarambapu Institute of Technology CSE (AI&ML) Engg Department 415 414 Rajaramnagar

Rajarambapu Institute of Technology Rajaramnagar Autonomous 415 414 Dist. Sangli. M.S.

Class:- **Final Year B. Tech**	Semester-**VII**
Course Code: **AI409**	Course Name: **(PE-III) Pattern Recognition**

L	T	P	Credits
3	--	--	3

Course Description:
Pattern Recognition is a foundational course in Artificial Intelligence and Machine Learning that explores techniques for recognizing patterns and structures in data. This course focuses on the theoretical principles and practical methodologies for designing systems that can classify, cluster, and interpret complex datasets. Students will learn about supervised and unsupervised learning methods, feature extraction, and dimensionality reduction, along with advanced tools such as neural networks for pattern recognition. The course also emphasizes hands-on implementation using modern programming libraries and applies pattern recognition techniques to real-world applications like image processing, speech recognition, and data analytics.

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

1. Comprehend and apply fundamental concepts of pattern recognition.
2. Apply Bayes decision theory and statistical methods to design optimal classifiers for both continuous and discrete data distributions.
3. Analyze various pattern recognition techniques for real-world AI tasks.
4. Evaluate and optimize pattern recognition models for real-world applications.

Prerequisite: Fundamentals of Machine Learning, Basic Knowledge of Algorithms, Programming Skills, Mathematics for Machine Learning

Course Content

Unit No	Description	Hrs
1.	**Introduction to Pattern Recognition** Definitions and Applications of Pattern Recognition in AI & Machine Learning, Key Components of an AI-Based Pattern Recognition System, Design Cycle: Learning, Training, and Testing, Review of Probability and Statistics, Bayes Decision Theory: Minimum Error and Risk Classifiers.	06
2.	**Bayes Decision Theory and Parameter Methods**	06

Rajarambapu Institute of Technology CSE (AI&ML) Engg. Department 415 414

K.E.S. Rajarambapu Institute of Technology Rajarambapu Autonomous 415 414 Dist. Sangli. M.S.

	Discriminant functions, Decision surfaces, Normal density and discriminant functions, discrete features Maximum-Likelihood estimation: Gaussian case; Maximum a Posteriori estimation; Bayesian estimation: Gaussian case	
3.	**Unsupervised Learning** Clustering, Vector Quantization, Kohonen Map, EM Algorithm; Advanced Clustering in AI, Dimensionality Reduction Techniques: PCA, LDA, t-SNE., Applications of Unsupervised Learning in AI, Anomaly Detection, and Data Preprocessing	**06**
4.	**Sequential Pattern Recognition** Hidden Markov Models (HMMs); Discrete HMMs; Continuous HMMs Sequence Learning Techniques, Multimodal sequence processing	**06**
5.	**Graph-Based Pattern Recognition** Graph Theory Basics for ML,Graph Neural Networks (GNNs), GATs, GCNs,Pattern Mining in Social, Biological, and Knowledge Graphs, Structure-Preserving Embeddings.	**06**
6.	**Generative Modeling in Pattern Recognition** Energy-Based Models (EBMs), GAN Advances: StyleGAN, Big GAN, Cycle GAN, Variational Inference & VAEs, Diffusion Models: Denoising Diffusion Probabilistic Models (DDPMs), Fairness & Bias in Recognition Models, Data-Centric AI and Ethical Considerations.	**06**

References -

Text Books:

- Bishop, Christopher M., "Pattern Recognition and Machine Learning", Springer.
- Duda, Richard O., Peter E. Hart, and David G. Stork, "Pattern Classification", Wiley.

Reference Books:

- Hastie, Trevor, Robert Tibshirani, and Jerome Friedman, "The Elements of Statistical Learning", Springer.
- William L. Hamilton "Graph Representation Learning", Morgan & Claypool Publishers.
- Earl Gose: Richard Johnsonbaugh, Steve Jost, "Pattern Recognition and Image Analysis", ePub eBook.

Rajarambapu Institute of Technology CSE (AI&ML) Engg. Department 415 414 Rajaramnagar

K.E.S. Rajarambapu Institute of Technology Rajaramnagar Autonomous 415 414 Dist. Sangli. M.S.

Class:- **Final Year B. Tech**	Semester-VII
Course Code: **AI411**	Course Name: **(PE – III) Next-Generation IP Networks**

L	T	P	Credits
3	--	--	3

Course Description:
This course provides an in-depth exploration of Next-Generation IP Networks with a focus on supporting AI & ML applications. Students will learn the key principles, technologies, and protocols behind modern IP networks, including 5G, SDN, NFV, and network slicing. Emphasis is placed on the challenges of ensuring scalability, low latency, and security for AI and ML systems over distributed networks. The course will involve both theoretical foundations and practical case studies to prepare students for future network design and management.

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

1. Comprehend the architecture and evolution of Next-Generation IP Networks.
2. Gain expertise in 5G networks and their integration with AI and ML applications.
3. Analyze and design scalable and efficient network protocols for AI workloads.
4. Explore the role of SDN (Software-Defined Networking) and NFV (Network Functions Virtualization) in AI network optimization.
5. Implement security strategies to protect AI & ML data over IP networks.
6. Evaluate network performance for latency and bandwidth in AI and ML environments.

Prerequisite: Basics of computer networks and communication protocols.

Course Content

Unit No	Description	Hrs
1.	**Introduction to Next-Generation IP Networks** Overview of IP Networks, Key Features of Next-Generation Networks, 5G Networks, SDN and NFV in Next-Generation Networks, Network Automation.	06

2.	**5G Networks and AI Integration** 5G Architecture and Components, 5G Core Network, AI Integration in 5G Networks, AI-Driven Network Slicing, Low-Latency and High-Throughput Applications.	**06**
3.	**Software-Defined Networking (SDN)** SDN Concepts and Architecture, SDN Protocols, AI and SDN for Network Optimization, SDN for AI Networks, Use Cases.	**06**
4.	**Network Functions Virtualization (NFV)** NFV Fundamentals, Virtual Network Functions (VNFs), Orchestration and Management, AI-Driven NFV, NFV Use Cases in AI/ML.	**06**
5.	**Security in AI & ML Networks** Security Challenges in AI/ML Networks, Encryption and Authentication, Threat Detection Using AI, AI & ML for Network Security, Case Studies in Security.	**06**
6.	**Performance Evaluation and Network Optimization** Network Performance Metric, Measurement Techniques, AI-Based Network Optimization, Load Balancing and Traffic Management, Quality of Service (QoS) for AI Traffic.	**06**

References -

Text Books:

- Erik Dahlman, Stefan Parkvall, and Johan Skold, "5G NR: The Next Generation Wireless Access Technology", Academic Press - 2018.
- Patricia A. Morreale and James M. Anderson, "Software-Defined Networking: Design and Deployment", CRC Press - 2014.

Reference Books:

- Rajendra Chayapathi and Kiran K. S. Soni, "Network Functions Virtualization: Deployment and Operation", Wiley - 2017.
- S. S. Gaurav, "Artificial Intelligence for Networks", Springer, 2020.

Rajarambapu Institute of Technology CSE (AI&ML) Engg. Department 415 414 Rajaramnagar

K.E.S. Rajarambapu Institute of Technology Rajaramnagar Autonomous 415 414 Dist. Sangli. M.S.

Class:- **Final Year B. Tech**	Semester-VII
Course Code: **AI413**	Course Name: **(PE-III) Chatbot**

L	T	P	Credits
3	--	--	3

Course Description:
This course focuses on the development of intelligent chatbots using Natural Language Processing (NLP) and Machine Learning techniques. Students will learn to design, implement, and deploy conversational agents for various real-world applications. The course also covers advanced topics like deep learning models, chatbot evaluation, and integration with messaging platforms.

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

1. Comprehend the different types of chatbots and their architectures.
2. Apply natural language processing techniques to develop chatbots.
3. Design and implement conversational agents with effective dialogue management.
4. Use machine learning algorithms to classify user intents and generate responses.
5. Build advanced chatbots using deep learning models like RNNs and Transformers.
6. Deploy chatbots on platforms and evaluate their performance for improvements.

Prerequisite: Basic proficiency in Python programming.
Fundamental understanding of machine learning concepts and algorithms.

Course Content

Unit No	Description	Hrs
1.	**Introduction to Chatbots and Conversational AI** Types of chatbots: Rule-based, AI-based, Chatbot system architecture, Use cases in industries, Evolution of chatbot technology, Ethical considerations in chatbots.	06
2.	**Natural Language Processing (NLP) for Chatbots** Text Preprocessing: Tokenization, Lemmatization, Feature extraction: Bag-of-Words, TF-IDF, Named Entity Recognition (NER), Part-of-speech tagging, Sentiment analysis and emotion detection.	06

3.	**Designing Conversational Agents** Intent recognition and classifiers, Slot filling and entity extraction, Multi-turn conversation management, Designing conversation flows.	06
4.	**Machine Learning for Chatbots** Supervised learning for classification, Unsupervised learning for clustering, Sequence-to-sequence models, Pretrained models: BERT, GPT, Transfer learning in chatbots.	06
5.	**Advanced Chatbot Models** Long Short-Term Memory (LSTM), Attention mechanisms and Transformers, Fine-tuning pretrained models, Generative models for response generation.	06
6.	**Deployment and Evaluation Recurrent Neural Networks (RNNs)** Integrating chatbots with platforms, Voice-based chatbot development, Performance metrics evaluation, A/B testing and improvement, Handling privacy and security.	06

References -

Text Books:

- Sumit Raj, "Building Chatbots with Python: Using Natural Language Processing and Machine Learning".
- Steven Bird, Ewan Klein, and Edward Loper "Natural Language Processing with Python", published by O'Reilly 2016.

Reference Books:

- James H. Martin, Daniel Jurafsky "Speech and Language Processing" Published by Pearson.
- Chris Manning, Hinrich Schütze, "Foundations of Statistical Natural Language Processing" MIT Press. Cambridge.
- Natural Language Processing in Action: Understanding, analyzing, and generating text with Python by Hobson Lane, Hannes Hapke, Cole Howard.

Rajarambapu Institute of Technology CSE (AI&ML) Engg. Department 415 414

K.E.S. Rajarambapu Institute of Technology Rajaramnagar Autonomous 415 414 Dist. Sangli. M.S.

Class:- **Final Year B. Tech**	Semester-VII
Course Code: **AI415**	Course Name: **(PE-IV) Robotics**

L	T	P	Credits
3	--	--	3

Course Description:
This course provides an introduction to the multidisciplinary field of robotics, focusing on its foundational principles and integration with artificial intelligence. Students will explore the fundamentals of robotic systems, including kinematics, dynamics, perception, path planning, and learning algorithms. The course emphasizes practical applications in manufacturing, healthcare, space, and human-robot interaction, preparing students for the evolving landscape of robotics in real-world contexts.

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

1. Comprehend the fundamental concepts, types, and applications of robotics across various industries.
2. Demonstrate mathematical models for robotic kinematics and dynamics, including optimization and trajectory planning.
3. Apply foundational concepts of supervised learning, reinforcement learning, and transfer learning to robotic tasks.
4. Examine AI techniques for robotic perception and decision-making.
5. Analyze and design frameworks for effective human-robot interaction and collaborative robotics.

Prerequisite: Machine learning.

Course Content

Unit No	Description	Hrs
1.	**Introduction to Robotics** Basic concepts and types of robots: industrial, mobile, and service, Applications in manufacturing, healthcare, and space, Overview of robotic components: actuators, sensors, controllers.	06
2.	**Robot Kinematics and Dynamics**	06

	Basic forward and inverse kinematics, Dynamic models of robotic arms and simple control methods, Introduction to optimization and trajectory planning using AI.	
3.	**Perception in Robotics** Introduction to computer vision and image processing, Basics of LiDAR and depth sensors for navigation, Simple SLAM techniques using AI tools.	**06**
4.	**Path Planning and Decision-Making** Basic path planning algorithms like A* and RRT, Introduction to decision-making in robots using AI, Ethical considerations in autonomous systems.	**06**
5.	**Learning in Robotics** Introduction to robot learning: Supervised and reinforcement learning basics, Introduction to Q-Learning and Deep Q-Networks, Basic concepts of transfer learning.	**06**
6.	**Human-Robot Interaction (HRI) and Collaboration** Basics of Human-Robot Interaction (HRI), Emotion recognition and natural language processing for robots, Collaborative robots (cobots): AI/ML in ensuring safety and efficiency.	**06**

References -

Text Books:

- John J. Craig, "Introduction to Robotics: Mechanics and Control", Pearson Education.
- Francis X. Govers," Artificial Intelligence for Robotics", Packt Publishing.
- Peter Corke,"Robotics, Vision, and Control: Fundamental Algorithms in MATLAB", Springer.

Reference Books:

- Cameron Hughes and Tracey Hughes, "Robot Programming: A Guide to Controlling Autonomous Robots", Pearson Education.
- Howie Choset, Kevin M. Lynch, Seth Hutchinson, "Principles of Robot Motion: Theory, Algorithms, and Implementations", MIT Press.

Rajarambapu Institute of Technology CSE (AI&ML) Engg. Department 415 414 Rajaramnagar

K.E.S. Rajarambapu Institute of Technology Rajaramnagar Autonomous 415 414 Dist. Sangli. M.S.

Class:- **Final Year B. Tech**	Semester-VII
Course Code: **AI417**	Course Name: **(PE-IV) Game Designing**

L	T	P	Credits
3	-	-	3

Course Description:
This course offers an in-depth exploration into the world of game designing, specifically tailored for students specializing in Artificial Intelligence and Machine Learning (AIML). The curriculum covers essential aspects of game design, from conceptualization to final implementation, providing students with both theoretical knowledge and practical skills.
Throughout the course, students will engage in hands-on projects and lab sessions, where they will create game prototypes, develop AI-driven game mechanics, and work collaboratively on a capstone project. By the end of the course, students will have a comprehensive understanding of game design and development, equipped with the skills to create innovative and engaging games.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Comprehend the fundamental concepts and theories behind game design and development
2. Apply game mechanics, dynamics, aesthetics, and story elements in designing games.
3. Analyze player psychology, engagement, and game balancing techniques.
4. Evaluate AI techniques used in modern games, including decision trees, FSMs, ML.
5. Create a prototype of a simple AI-enabled game using industry-standard tools.

Prerequisite: Basic Knowledge of Programming, OOP, AI, Computer Graphics, Game Development Fundamentals.

Course Content

Unit No	Description	Hrs
1.	**Introduction to Game Design & Development** History and evolution of games, Genres and platforms, Game design process, Elements of game design: rules, play, culture, and fun, Game loops and feedback systems, Role of AI in modern game design.	06
2.	**Game Mechanics, Dynamics, and Aesthetics (MDA Framework)** Game mechanics (rules, controls, actions), Dynamics (run-time behavior, player interactions), Aesthetics (emotions, narrative), Game	06

Rajarambapu Institute of Technology CSE (AI&ML) Engg. Department 415 414
K.E.S's Rajarambapu Institute of Technology Rajaramnagar Autonomous 415 414 Dist. Sangli M.S.

	balancing, progression systems, Player types and engagement models (Bartle taxonomy).	
3.	**Game Narrative and World Design** Types of storytelling in games, Worldbuilding and immersion, Character design and role-playing elements, Interactive narrative techniques (branching, emergent), Dialogue systems, Procedural storytelling and AI-driven plot generation.	**06**
4.	**Game Development Tools and Engines** Overview of Unity, Unreal Engine, Scripting basics (C#, Blueprints), Asset pipelines: art, animation, sound, Prototyping and iteration, Introduction to physics and UI, Integration of AI modules in Unity (e.g., NavMesh, ML Agents).	**06**
5.	**AI & ML in Game Design** Game AI vs traditional AI, Finite State Machines (FSMs), Behavior Trees, Pathfinding: A*, NavMesh, Decision-making: Utility systems, Minimax Machine Learning in games: adaptive difficulty, player modeling, NPC behavior learning.	**06**
6.	**Game Testing, Monetization, and Ethics** Playtesting, QA cycles, user feedback, Monetization models (freemium, ads, DLCs), Analytics in games: retention, churn prediction, Legal and ethical concerns: addiction, data privacy, Careers and trends in Game Design & AI.	**06**

References -

Text Books:

- Raph Koster, "A Theory of Fun for Game Design".
- Tracy Fullerton, "Game Design Workshop: A Playcentric Approach to Creating Innovative Games".
- Georgios N. Yannakakis and Julian Togelius, "Artificial Intelligence and Games".

Reference Books:

- Sanjay MadhavAshok N. Kamthane, "Game Programming Algorithms and Techniques".
- Will McGugan, "Beginning Game Development with Python and Pygame".
- David H. Eberly, "3D Game Engine Design".

Class:- **Final Year B. Tech**	Semester-**VII**
Course Code: **AI419**	Course Name: **(PE-IV) Wireless Sensor Network**

L	T	P	Credits
3	--	--	3

Course Description:
This course introduces students to the fundamentals of wireless communication and sensor networks. It covers key concepts such as radio propagation, wireless channels, modulation, and multiple access techniques. The course also delves into wireless LANs, PANs, WANs, and MANs, along with wireless internet technologies. A significant portion is devoted to ad-hoc and sensor networks, highlighting the unique challenges and applications. Topics like MAC, routing protocols, QoS, energy management, and sensor network platforms are explored in detail, offering practical insights into real-world wireless communication systems.

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

1. Comprehend the fundamentals of wireless communication technologies and the electromagnetic spectrum.
2. Examine the design, constraints, and challenges of ad-hoc and sensor networks.
3. Develop an understanding of MAC and routing protocols for ad-hoc and sensor networks.
4. Implement energy management and QoS strategies in wireless networks, with a focus on sensor networks.
5. Analyze sensor network platforms, tools and AI-based simulation environments.

Prerequisite: Computer Networks, Data structures and algorithms.

Course Content

Unit No	Description	Hrs
1.	**Introduction** Fundamentals of wireless communication technology, electromagnetic spectrum radio propagation, characteristics of wireless channels, modulation techniques, multiple access techniques, wireless networking technologies, AI-powered wireless communication.	06

2.	**AI-Driven Adhoc and Sensor Networks** Fundamentals of adhoc and sensor networks, unique constraints, challenges, advantages of adhoc and sensor networks, applications in smart cities, healthcare, agriculture, ML-based traffic prediction and anomaly detection in WSN, Sensor network architecture, data dissemination, and gathering, Deep learning models for sensor data fusion and anomaly detection.	**06**
3.	**MAC Protocols** Issues in designing MAC protocols for adhoc wireless networks, design goals, classification of MAC protocols, MAC protocols for sensor network, location discovery, quality, other issues, S-MAC, IEEE 802.15.4, Federated Learning for Edge AI in WSN.	**06**
4.	**Smart Routing Protocols** Issues in designing a routing protocol, classification: table-driven, on-demand, hybrid, flooding, hierarchical, and power aware routing protocols, ML-based dynamic routing for energy efficiency, Reinforcement Learning (RL)-based adaptive routing for WSN.	**06**
5.	**AI-Enabled QoS and Energy Management** Challenges in providing QoS in WSN, ML-driven solutions for latency, jitter, and throughput optimization, AI-based energy management: Predictive analysis for power conservation, Battery optimization strategies using AI models.	**06**
6.	**Sensor Network Platforms and Tools** Sensor Node Hardware: Berkeley Motes, Programming Challenges, Node-level software platforms-TinyOS, nesC, CONTIKIOS, Node-level Simulators-NS2, COOJA, TOSSIM, AI-driven network simulations, State-centric AI Programming.	**06**

References –

Text Books:

- C. Siva Ram Murthy, and B. S. Manoj, "AdHoc Wireless networks", Pearson Education - 2008.
- Theodore S. Rappaport, "Wireless Communications: Principles and Practice" Prentice Hall - 2002.

Reference Books:

- Feng Zhao and Leonides Guibas, "Wireless sensor networks ", Elsevier publication.
- Jochen Schiller, "Mobile Communications", Pearson Education.
- William Stallings, "Wireless Communications and Networks ", Pearson Education.

Class:- **Final Year B. Tech**	Semester-**VII**
Course Code: **AI421**	Course Name: **(PE-IV) Natural Language Processing**

L	T	P	Credits
3	--	--	3

Course Description:
This course provides an in-depth exploration of Natural Language Processing (NLP), focusing on key techniques and challenges in text processing, parsing, semantics, and machine learning-based approaches. Students will gain practical experience with NLP tasks such as text classification, sentiment analysis, machine translation, and word sense disambiguation. The course also covers advanced topics such as part-of-speech tagging, morphological analysis, and coreference resolution.

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

1. Identify key NLP applications such as text classification, sentiment analysis, and machine translation.
2. Analyze text processing challenges like tokenization, sentence segmentation, and part-of-speech tagging.
3. Use of finite state automata (FSA) and finite state transducers (FST) for morphological analysis.
4. Compare rule-based and probabilistic approaches for part-of-speech tagging and evaluate their performance.
5. Assess different parsing techniques, including CFG, LFG, and PCFG, for syntactic analysis.
6. Develop and implement algorithms for word sense disambiguation and coreference resolution using NLP techniques.

Prerequisite: Programming Skills, Basic Machine Learning Knowledge

Course Content

Unit No	Description	Hrs
1.	**Introduction to NLP**	06

	Introduction to NLP, NLP applications: Speech to Text (STT), Text to Speech (TTS), Story Understanding, NL Generation, QA system, Machine Translation, Text Summarization, Text Classification, Sentiment Analysis, Grammer/Spell Checker, challenges, NLP abstraction levels, Natural Language (NL) Characteristics and NL computing techniques and steps, NL tasks: Segmentation, Chunking, tagging, NER, Parsing, Word Sense Disambiguation, NL Generation.	
2.	**Text Processing Challenges** Text Processing Challenges, Overview of Language Scripts and their representation on Machines using Character Sets, Language, Corpus and Application Dependence issue, Segmentation: word level (Tokenization), Sentence level	**06**
3.	**Morphology in NLP** Regular Expression and Automata Morphology, Types, Survey of English and Indian Languages Morphology, Morphological parsing FSA and FST, Porter stemmer, Rule based and Paradigm based Morphology, Human Morphological Processing, Machine Learning approaches.	**06**
4.	**Part-of-Speech Tagging** World Classes ad Part-of-Speech tagging (POS), survey of POS tagsets, Rule based approaches (ENGTOWL), Stochastic approaches (Probabilistic, N-gram and HMM), TBL morphology, unknown word handling, evaluation metrics: Precision/Recall/F-measure, error analysis.	**06**
5.	**NLP Parsing Techniques** NL parsing basics, approaches: TopDown, BottomUp, Overview of Grammar Formalisms: constituency and dependency school, Grammer notations CFG, LFG, PCFG, LTAG, Feature- Unification, overview of English CFG, Indian Language Parsing in Paninian Karaka Theory, CFG parsing using Earley's and CYK algorithms.	**06**
6.	**Semantic Analysis in NLP** Concepts and issues in NL, Theories and approaches for Semantic Analysis, Meaning Representation, Word similarity, Lexical Semantics, Word senses and relationships, WordNet, Word Sense Disambiguation:	**06**

	Lesk Algorithm Walker's algorithm, Coreferences Resolution: Anaphora, Cataphora.	

References -

Text Books:

- Steven Bird, Ewan Klein, and Edward Loper "Natural Language Processing with Python", published by O'Reilly.
- Nitin Indurkhya, Fred J. Damerau "Handbook of Natural Language Processing", CRC press taylor and francis group.

Reference Books:

- James H. Martin, Daniel Jurafsky "Speech and Language Processing" Published by Pearson.
- Chris Manning, Hinrich Schütze, "Foundations of Statistical Natural Language Processing" MIT Press. Cambridge.

Rajarambapu Institute of Technology CSE (AI&ML) Engg. Department 415 414 Rajarammagar

K.E.S. Rajarambapu Institute of Technology Rajarammagar Autonomous 415 414 Dist. Sangli M.S.

Class:- **Final Year B. Tech**	Semester-**VII**
Course Code: **AI427**	Course Name: **(PELab - I) Robotics Lab**

L	T	P	Credits
-	-	2	1

Course Description:
This course introduces students to the fundamentals of robotics, focusing on the integration of mechanical, electrical, and computational systems. It provides an overview of robotic systems, including their hardware and software components, and explores key topics such as kinematics, dynamics, perception, path planning, decision-making, and learning. Students will also study human-robot interaction and ethical considerations in robotics. With practical exposure to AI and ML techniques, this course equips students with the skills to design, analyze, and implement robotic systems for diverse applications, including manufacturing, healthcare, and space exploration.

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

1. Comprehend the fundamental concepts, types of robots, and identify their applications in real-world scenarios.
2. Apply forward and inverse kinematics, and implement basic trajectory planning for robotic manipulators using AI techniques.
3. Utilize vision systems, depth sensors, and SLAM algorithms for robotic mapping and navigation.
4. Develop and implement path planning algorithms and decision-making frameworks while considering ethical aspects.
5. Use of supervised, unsupervised, and reinforcement learning techniques for robot adaptation and performance improvement

Prerequisite: Basic knowledge of C Programming

Course Content

Experiment No	Description	Hrs
1.	**Introduction to robotics**	02
2.	**Sensor Integration in Robotics**	02

Rajarambapu Institute of Technology CSE (AI&ML) Engg. Department 415 414 Rajarammagar
K.E. Society's Rajarambapu Institute of Technology Rajarammagar Autonomous 415 414 Dist. Sangli. M.S

	Interface and test various sensors (e.g., proximity, IR, and ultrasonic) for data acquisition.	
3.	**Robot Kinematics and Dynamics** Implement forward and inverse kinematics for a 2-DOF robotic arm using a simulation tool	**04**
4.	**Image Processing for Object Detection** Perform basic object detection using OpenCV.	**02**
5.	**Trajectory Planning for a Robotic Arm** Design and simulate a simple trajectory for a robotic arm using AI-based optimization.	**02**
6.	**SLAM Implementation** Implement a simple SLAM algorithm using a pre-built dataset and a simulation tool.	**02**
7.	**Path Planning and Decision-Making** Implement the A* algorithm for navigating a robot in a grid-based environment.	**02**
8.	**Decision-Making in Robots** Create a basic decision-making framework using a behavior tree or rule-based logic for a simulated robot.	**02**
9.	**Reinforcement Learning for Robot Control** Implementation of Q-Learning to train a simulated robot to navigate a maze.	**02**
10.	**Emotion Recognition Using AI** Implement a basic emotion recognition system using a pre-trained AI model and simulate a robot's response.	**04**

References -

Text Books:

- Bruno Siciliano, Lorenzo Sciavicco, Luigi Villani, Giuseppe Oriolo, "Robotics: Modelling, Planning and Control", Springer (2010).
- Francis X. Govers, "Artificial Intelligence for Robotics", Packt Publishing (2018).

Reference Books:

- Lentin Joseph "Learning Robotics using Python", Packt Publishing.
- Francis X. Govers, "Deep Learning for Robotics", Apress.
- Danica Kragic, Markus Vincze "Vision for Robotics", Now Publishers.

Rajarambapu Institute of Technology CSE (AI&ML) Engg. Department 415 414 Rajarammagar

K.E.S. Rajarambapu Institute of Technology Rajarammagar Autonomous 415 414 Dist. Sangli. M.S.

Class:- **Final Year B. Tech**	Semester-**VII**
Course Code: **AI429**	Course Name: **(PELab -I) Game Designing Lab**

L	T	P	Credits
	-	2	1

Course Description:
This practical course provides hands-on experience in the design and development of interactive games using modern engines and AI techniques. Students will explore the core aspects of game prototyping, environment building, UI/UX design, and player behavior scripting. Through structured experiments, students will implement AI concepts such as pathfinding, finite state machines, and machine learning-based NPC behaviors. Emphasis is placed on iterative development, playtesting, and real-world application of game AI. The course culminates in a mini-project where students build a functional AI-enabled game.

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

1. Comprehend the fundamentals of game development tools and workflows.
2. Apply scripting and asset integration to build interactive game environments.
3. Implement AI techniques like FSM, pathfinding, and basic ML for game entities.
4. Analyze and improve user interaction, difficulty tuning, and game balance through testing.
5. Create a complete playable game prototype with AI components and present it effectively.

Prerequisite: Basic Knowledge of Programming, OOP, AI, Computer Graphics, Game Development Fundamentals.

Course Content

Exp No	Description	Hrs
1.	Installation of a game engine-Unity, familiarization of the GUI.	02
2.	Installation of a game engine-Conceptualize the theme for a 2D game.	02
3.	Implementation of Character design & sprites, movement and character control.	02
4.	Implementation of movement and character control.	02

5.	Implementation of Level design: design of the world in form of tiles along with interactive and collectible objects.	**02**
6.	Implementation & Design of interaction between the player and the world, optionally using the physics engine.	**04**
7.	Implementation of Design of menus and user interaction in mobile platform.	**02**
8.	Implementation of Inserting audio.	**02**
9.	Implementation of 2D Game.	**02**
10.	Design and Develop a Simple AI-Enabled Game Prototype with Playtesting.	**04**

References -

Text Books:

- Raph Koster "A Theory of Fun for Game Design".
- Tracy Fullerton, "Game Design Workshop: A Playcentric Approach to Creating Innovative Games".
- Georgios N. Yannakakis and Julian Togelius, "Artificial Intelligence and Games".

Reference Books:

- Sanjay MadhavAshok N. Kamthane, "Game Programming Algorithms and Techniques".
- Will McGugan, "Beginning Game Development with Python and Pygame".
- David H. Eberly, "3D Game Engine Design".
- Jung Hyun Han, "3D Graphics for Game Programming".

Rajarambapu Institute of Technology • Rajarampagar • CSE (AI&ML) Engg. Department 415 414

K.E. Society's Rajarambapu Institute of Technology • Rajarampagar Autonomous 415 414 Dist. Sangli. M.S.

Class:- **Final Year B. Tech**	Semester-VII
Course Code: **AI431**	Course Name: **(PELab-I) Wireless Sensor Network Lab**

L	T	P	Credits
-	-	2	1

Course Description:
This course provides a comprehensive introduction to wireless sensor networks (WSNs), exploring their unique constraints, challenges, and applications. Topics covered include wireless communication fundamentals, sensor network architectures, MAC and routing protocols, quality of service (QoS), energy management strategies, and sensor network platforms. The course emphasizes hands-on learning with simulation tools and programming environments, preparing students for practical deployment and research in wireless sensor technologies.

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

1. Demonstrate an understanding of fundamental principles of wireless sensor networks, including architecture, communication, and deployment strategies.
2. Implement and evaluate various MAC and routing protocols in simulated and real-world scenarios.
3. Analyze network performance parameters such as energy consumption, QoS, and throughput.
4. Develop and deploy software for sensor nodes using tools like TinyOS, nesC, or Contiki.
5. Apply advanced concepts like localization and data aggregation to optimize sensor network performance.

Prerequisite: Basic knowledge of C Programming

Course Content

Experiment No	Description	Hrs
1.	**AI-Based Node Deployment Strategies** Implement uniform, random, and ML-optimized node deployment strategies in a wireless sensor network.	04
2.	**Energy Consumption Analysis**	02

	Simulate and evaluate the energy consumption of sensor nodes under different MAC protocols.	
3.	**Performance of Modulation Techniques** Compare the performance of various modulation techniques in wireless communication under different noise levels.	**02**
4.	**Routing Protocol Simulation** Implement table-driven and on-demand routing protocols, analyzing latency, throughput, and packet delivery ratio.	**02**
5.	**QoS Analysis in Wireless Sensor Networks** Analyze the quality of service (QoS) parameters such as latency, jitter, and throughput under varying traffic loads.	**02**
6.	**Energy-Efficient Routing** Design and evaluate a power-aware routing protocol to extend the network lifetime.	**02**
7.	**Data Aggregation Techniques** Implement different data aggregation techniques for reducing redundant data in the network.	**02**
8.	**Localization in WSN** Develop a localization algorithm to estimate the positions of unknown nodes based on anchor nodes.	**02**
9.	**TinyOS Programming for Sensor Nodes** Deploy program in TinyOS for basic sensing and communication tasks.	**02**
10.	**Simulation of Sensor Networks Using any Simulator** Use any AI driven simulator to model and analyze a wireless sensor network's performance.	**04**

References -

Text Books:

- Nirupama Bulusu and Sanjay Jha, "Wireless Sensor Networks: A Systems Perspective", Wiley-Interscience - 2007.
- William Stallings, "Wireless Communications & Networks", Pearson Education - 2004.

Reference Books:

- Carlos Cordeiro and Dharma P. Agrawal, "Ad Hoc and Sensor Networks: Theory and Applications", World Scientific - 2011.
- Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons - 2005.

Rajarambapu Institute of Technology
CSE (AI&ML) Engg. Department
415 414

K.E.S. Rajarambapu Institute of Technology
Rajaramnagar Autonomous 415 414 Dist. Sangli M.S.

Class:- **Final Year B. Tech**	Semester-VII
Course Code: **AI433**	Course Name: **(PELab-I) Natural Language Processing Lab**

L	T	P	Credits
-	-	2	1

Course Description:
The course aims to equip students with essential Natural Language Processing (NLP) techniques such as text preprocessing, morphological analysis, and part-of-speech tagging. Students will learn to develop and implement NLP models, including n-grams and named entity recognition, to solve real-world problems. By the end of the course, students will be able to create NLP applications and evaluate their performance effectively.

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

1. Comprehend and apply text preprocessing techniques such as tokenization, stop word removal, and stemming.
2. Analyze the structure of words using morphological analysis, including roots, prefixes, and suffixes.
3. Create and implement n-gram models (unigrams, bigrams, trigrams) for text representation and prediction.
4. Identify and apply parts of speech (noun, verb, adjective, etc.) in sentences through tagging techniques.
5. Develop and evaluate an NLP application to address a real-world problem, such as sentiment analysis or chatbot development.

Prerequisite: Proficiency in Python, Basic Machine Learning Knowledge

Course Content

Experiment No	Description	Hrs
1.	Implementation tokenization, filtration, script validation, stop word removal, and stemming.	04
2.	Analyze the structure of words and their components.	02
3.	Examine n-grams (unigrams, bigrams, trigrams) can be used for text representation and prediction.	02

Rajarambapu Institute of Technology CSE (AI&ML) Engg. Department 415 414 Rajarammagar
K.E.S. Rajarambapu Institute of Technology Rajaramnagar Autonomous 415 414 Dist. Sangli M.S.

4.	Tagging each word in a sentence with its appropriate part of speech (noun, verb, etc.).	**02**
5.	Identifying and extracting meaningful word groups (chunks) from text using chunking techniques.	**04**
6.	Identifying and classifying named entities (like people, locations, organizations) in text.	**02**
7.	Experiment on creating and manipulating words, perhaps using a language model or word generator tool.	**04**
8.	Develop a small-scale project applying NLP techniques to solve a real-world problem (e.g., sentiment analysis, chatbot, etc.).	**04**

References -

Text Books:

- Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta, Harshit Surana, "Practical Natural Language Processing: A Comprehensive Guide to Building Real-World NLP Systems" Kindle Edition
- Delip Rao, Brian McMahan, "Natural Language Processing with PyTorch: Build Intelligent Language Applications Using Deep Learning".

Reference Books:

- Hobson Lane, Hannes Hapke, Cole Howard "Natural Language Processing in Action: Understanding, analyzing, and generating text with Python".

Rajarambapu Institute of Technology CSE (AI&ML) Engg. Department 415 414 Rajarammagar

K.E.S. Rajarambapu Institute of Technology Rajarammagar Autonomous 415 414 Dist. Sangli M.S.

Class:- **Final Year B. Tech**	Semester-**VII**
Course Code: **AI423**	Course Name: **Cloud Computing Lab**

L	T	P	Credits
-	-	2	1

Course Description:
Cloud computing, a large-scale distributed computing paradigm, has become a significant influence in information technology in recent years. The exponential growth in data size in scientific simulation and social media has led to a greater use of cloud computing services. The phrase "cloud computing," which is typically used to refer to data centers that are reachable by a wide range of users through the Internet, describes the on-demand availability of computer system resources, specifically data storage and processing capacity, without the need for direct user administration. Enterprise clouds are exclusive to a single organization, while public clouds are available to numerous organizations.
This lab course will assist to create and deploy cloud-based applications. It will support to formulate and execute Grid-based applications while utilizing the cloud and grid toolkits.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Configure various virtualization tools such as Virtual Box, VMware workstation
2. Design and deploy a web application in a PaaS environment
3. Acquire how to simulate a cloud environment to implement new schedulers
4. Install and use a generic cloud environment that can be used as a private cloud
5. Manipulate large data sets in a parallel environment

Prerequisite:
1. Knowledge of operating systems and computer networks
2. Basic architecture of client-server model and distributed computing

Course Content

Experiment No	Description	Hrs
1.	Install Virtualbox/VMware Workstation with different flavours of OS on top of Linux/windows.	04
2.	Install a C compiler in the virtual machine created using virtual box and execute Simple Programs.	02
3.	Install Google App Engine. Create hello world app and other simple web applications using python/java.	04
4.	Write a Google app engine program to generate n even numbers or multiply two matrices and deploy it to google cloud.	02

Rajarambapu Institute of Technology CSE (AI&ML) Engg. Department 415 414 Rajaramnagar
K.E.S. Rajarambapu Institute of Technology Rajaramnagar Autonomous 415 414 Dist. Sangli M.S

5.	Cloud-Based Image Recognition using AI for object detection and classification.	**02**
6.	Simulate a cloud scenario using CloudSim and run a scheduling algorithm.	**04**
7.	Find a procedure to transfer the files from one virtual machine to another virtual machine.	**02**
8.	Implement AI-based auto-scaling using and ML-based predictions.	**02**
9.	Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version).	**04**

References -

Text Books:

- Derrick Rountree and Ileana Castrillo, "The Basics of Cloud Computing: Understanding the Fundamentals of Cloud Computing in Theory and Practice" Syngress.
- Arshdeep Bahga and Vijay Madisetti, "Cloud Computing: A Hands-On Approach".

Reference Books:

- Judith Hurwitz, R. Bloor, M. Kanfman, F. Halper "Cloud Computing for Dummies", Wiley India Edition
- John W. itinghouse james F. Ransome, "Cloud Computing Implementation, Management and Security", CRC Press
- Todd Koff, "Explain the Cloud Like I'm 10: Learn the secrets of AWS, AZURE, GCP, and K8S".

Rajarambapu Institute of Technology CSE (AI&ML) Engg. Department 415 414 Rajaramnagar

K.I.T. Rajarambapu Institute of Technology Rajaramnagar Autonomous 415 414 Dist. Sangli. M.S.

Class: - **Final Year B. Tech**	Semester-VII
Course Code: **AI425**	Course Name: **Blockchain Technologies Lab**

L	T	P	Credits
--	--	2	1

Course Description:
This course provides hands-on experience in blockchain development, covering key concepts like smart contracts, decentralized applications (dApps), and distributed ledgers. Students will work with platforms such as Ethereum and Hyperledger to design, build, and test real-world blockchain solutions. By the end of the course, participants will be equipped to develop secure and innovative blockchain applications for industries like finance, healthcare, and supply chain.

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

1. Articulate the principles of blockchain technology, including decentralized systems, cryptography, and consensus mechanisms.
2. Develop and deploy secure smart contracts on platforms like Ethereum using Solidity.
3. Design and develop decentralized applications (dApps) that interact with blockchain networks.
4. Apply Blockchain Solutions to Real-World Problems.
5. Utilize Blockchain Development tools like Hyperledger, Ganache, and Truffle.
6. Identify security vulnerabilities in blockchain applications and ensure adherence to ethical and legal standards.

Prerequisite:
Students are expected to have a foundational understanding of programming concepts, with proficiency in languages such as JavaScript, Python, or C++. Prior knowledge of web development and basic cryptography is recommended. Familiarity with blockchain concepts is beneficial but not mandatory, as core concepts will be introduced during the course.

Course Content		
Experiment No	**Description**	**Hrs**

1.	Implementation of a Simple Blockchain Structure	02
2.	Hashing Data using SHA-256 for Data Integrity	02
3.	Simulation of Proof-of-Work (PoW) and Proof-of-Stake (PoS) Algorithms	02
4.	Development and Deployment of a Smart Contract using Solidity	02
5.	Creation and Deployment of an ERC-20 Token on Ethereum Testnet	02
6.	Building a Decentralized Application (dApp) with Web3.js or Ethers.js	02
7.	Security Analysis of Smart Contracts (Detecting and Preventing Reentrancy Attacks)	02
8.	Development of a Blockchain-Based Supply Chain Traceability System	04
9.	Setup and Configuration of a Private Blockchain Network using Hyperledger Fabric	04
10.	Implementation of a Decentralized Voting System on Blockchain	02

References -

Text Books:

- Imran Bashir, "Mastering Blockchain".
- Daniel Drescher, "Blockchain Basics: A Non-Technical Introduction in 25 Steps".

Reference Books:

- Elad Elrom , "The Blockchain Developer".
- Melanie Swan, "Blockchain: Blueprint for a New Economy".
- Arshdeep Bahga and Vijay Madisetti, "Blockchain Applications: A Hands-On Approach".
- Imran Bashir, "Advanced Blockchain Development".

Rajarambapu Institute of Technology CSE (AI&ML) Engg. Department 415 414 Rajaramnagar

K.I.T. Rajarambapu Institute of Technology Rajaramnagar Autonomous 415 414 Dist. Sangli. M.S.

Class:- **Final Year B. Tech**	Semester-VII
Course Code: **AI435**	Course Name: **Capstone Project Phase-II**

L	T	P	Credits
--	--	6	3

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

1. Apply AI/ML knowledge and principle to develop innovative products and services.
2. Identify engineering problems and propose AI/ML-based solutions effectively.
3. Design efficient algorithms to improve product/service performance.
4. Develop projects using modern tools, techniques, and technologies.
5. Adopt industry practices for efficient project development and execution.
6. Enhance teamwork, project management, and communication skills in projects.

General guidelines:
The capstone project phase-II of this semester carries 4 credits. The majority of project work shall be in VII semester. The project group from project phase-I will continue to work on the project selected during VI semester and submit the completed project work to department by the prescribed date usually two weeks before the end of VII semester as mentioned below:

1. Executed project
2. Project report

The capstone project phase-II report should be prepared using Latex Software and it is as per the format provided. Students should maintain a project diary, regularly write progress and get the approval from both project guide and industry mentor assigned at least twice in a month either by physically reporting or through email communication.

Project evaluation:
The students shall be evaluated individually and groupwise for his/her project through the quality of work carried out, the novelty of the concept, the report submitted and presentation etc.
The ISE evaluation of capstone project phase- II will be carried out for 50%. The assessments are carried out as per the rubrics given to the guides.
The ESE evaluation will be done as per schedule given by COE for 50%, where students have to present their entire project work carried out throughout the Sem-VI and Sem-VII. The evaluation will be done by panel of examiner containing guide and a faculty appointed by DPC.

Rajarambapu Institute of Technology CSE (AI&ML) Engg. Department 415 414 Rajaramnagar

K.E.S. Rajarambapu Institute of Technology Rajaramnagar Autonomous 415 414 Dist. Sangli. M.S.

Class:- **Final Year B. Tech**	Semester-**VIII**
Course Code: **OE4382**	Course Name: **Finance for Engineers (Online Course)**

L	T	P	Credits
2	-	--	2

Course Description:
In today's workplace, it is nearly impossible for an engineer to perform without considering the financial impact of every action on the organization's bottom line. Engineers need to be aware of issues such as cost reduction and capital investment and how their decisions can affect the financial statements. This course introduces basic financial management to engineers and technical personnel who need this knowledge to manage a profit center effectively. The course aims at providing students with an in-depth coverage of the various aspects of financial management.
It covers the assessing the financial health of the organization through ratio and cash flow analysis, sources of long term as well as short term finance. Decisions concern with financing, working capital and long term investment. Class will focus on both the academic theories underlying the management of funds and the practical aspects of financial management.

Course Learning Outcomes:
After successful completion of this course, students will be able to,
1. Discuss the fundamental aspects of accounting and finance.
2. Apply theoretical knowledge and information for preparing various financial statements.
3. Analyze the financial information for solving managerial problems.
4. Evaluate financial performance of the organization for effective decision making.

Prerequisite:
Basics of Mathematics

Course Contents

Unit No	Description	Hrs
1.	**Finance Terminologies & Financial Statement** Key terms of Accounting and Finance, Accounting Principles underlying Preparation of Financial Statements.	4
2.	**Analyzing Health of a Firm** Techniques of Analyzing Health of a Firm, Classification of Ratios – Liquidity, Leverage, Activity, Profitability, Analysis of Cash Flows.	4

3.	**The Management of Working Capital** Need of Working Capital, Operating Cycle of Working Capital, Determinants of Working Capital, Preparation of Working capital statement.	4
4.	**Investment Decision Rules** Investment Decision Rules, Evaluation Criteria for Investment Decision: Payback, ARR, NPV, PI & IRR, Decision Tree Analysis.	4
5.	**Long Term Financing** Long Term Financing: Shares, Debentures, Loan capital, foreign capital, FDI, Euro issues & external borrowings, Venture capital financing.	4
6.	**Financing Decisions and Cost of Capital** Risk & Return, Cost of Capital, Cost of Equity, Cost of Debt, Weighted Average Cost of Capital.	4

References –

Reference Books:

- Paul Kimmel, J. Weygandt, D. Kieso, Financial Accounting
- S.N. Maheshwari & S.K. Maheshwari, Problems & Solutions in Advanced Accountancy, Vikas Publishing House Pvt. Ltd., New Delhi
- M.C. Shukla, T.C. Grewal & S. C. Gupta, Advanced Accounts, S. Chand
- M. Y. Khan & P. K. Jain, Financial Management, Tata McGraw-Hill Publishing Company Limited, New Delhi
- Prasanna Chandra, Financial Management, Tata McGraw-Hill Publishing Company Limited.

Note: - Being online course, lecture videos of each unit will be made available through college platform to the students. For each unit there will be separate assignment. Students need to submit all assignments within specified time.
Weightage: 25% weightage for unit wise assignments + 75% weightage for final exam.
Final exam will be held at college campus.

Rajarambapu Institute of Technology • Rajarammagar CSE (AI&ML) Engg. Department 415 414

K.E.S. Rajarambapu Institute of Technology • Rajarammagar Autonomous 415 414 Dist. Sangli. M.S.

Class:-**Final Year B. Tech.**	Semester- **VIII**
Course Code: **OE4362**	Course Name: **Engineering Management & Economics**

L	T	P	Credits
2	-	-	2

Course Description:
Engineering management is the integration of management principles with engineering practices. It is a specialized field that focuses on effectively leading engineering teams and managing technical projects. This course is structured into two key modules: Engineering Management and Engineering Economics. The first module is centered on building the managerial skills necessary to guide, mentor, and inspire technical professionals in their engineering roles. The second module delves into engineering economics, a vital area for engineering firms to maintain their competitive advantage and market presence, focusing on economic decision-making.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Develop administrative, organizational, and planning skills to effectively manage and execute engineering projects.
2. Create bar charts and milestone charts to track and manage project progress.
3. Analyze profit and cost data, conducting economic evaluations to make informed, optimal decisions.
4. Calculate depreciation using various methods.

Prerequisite: Basics of Mathematics

Course Content

Unit No	Description	Hrs
1	**Managerial skills** Theories of Management Principles of Management (by Henry Fayol), Functions of Management, Planning, Organizing, Staffing, Directing, Co-Ordination, Communication, Motivation and Controlling	04
2	**Organizational skills** Levels of management, Organizations-elements, types and characteristics of organization, Management by Objectives (MBO)	04
3	**Planning Tools**	04

	Methods of scientific management- Critical Path Method (CPM), Programme Evaluation & Review Techniques (PERT), Network Crashing, Bar Chart, Mile-Stone chart, Gant Chart	
4	**Methods of Economic Analysis** Economic equivalence, Methods of comparison of alternatives- Present Worth Method, Rate of Return method, Benefit-Cost ratio method	**04**
5	**Make or Buy Decision** Approaches of make or buy decision-Simple cost analysis, Economic analysis, break-even analysis, Payback analysis	**04**
6	**Depreciation** Methods of Depreciation- Straight line method, Declining balance depreciation, Sum of years digits method, sinking fund method, service output method	**04**

References –

Text Books:

- Gilbert Daniel R, Freeman R. Edward and Stoner James A. F, "Management" Pearson Education.
- Harold Kerzner, "Project Management- A system approach to planning, scheduling and controlling", John Wiley & Sons Inc.
- Punmia B. C. and Khandelwal K. K, "Project Planning, Scheduling and controlling with PERT and CPM", Laxmi Publications Pvt. Ltd.
- Paneerselvam R, "Engineering Economics", Prentice Hall India Learning Private Limited.

Reference Books:

- Cannice Mark V, Koontz Harold and Weihrich Heinz, "Management", McGraw Hill Education (I) Pvt. Ltd.
- Blank Leland and Tarquin Anthony, "Basics of Engineering Economy", Tata McGraw-Hill.
- Mithani D. M, "Managerial Economics- Theory & Applications", Himalaya Publishing House-New Delhi.

Note:- Being online course, lecture videos of each unit will be made available through college platform to the students. For each unit there will be separate assignment. Students need to submit all assignments as per schedule.

Weightage: 25% weightage for unit wise assignments + 75% weightage for final examination.

Class:- **Final Year B. Tech**	Semester-**VIII**
Course Code: **IP4024**	Course Name: **Industry Internship & Project**

L	T	P	Credits
-	-	--	12

Course Description:

Internship is designed to expand the depth and breadth of academic learning of students in their particular areas of study. It is an opportunity for students to receive experience in applying theories learned from the classroom to specific experiences with the community and work world. An internship can also heighten awareness of community issues, motivate students to create opportunities, embrace new ideas, and give direction to positive change. A successful internship can give valuable information in making decisions about the direction of future studies or employment. An internship is an opportunity not only to use and develop industry-related knowledge and skills, but also to enhance some of the skills that are transferable to any professional work setting. Students from Final year B.Tech are eligible to do this internship. Selected candidates by college will be permitted for internship of minimum 20 weeks in 8th semester. During this Internship, it is expected that students should identify the problems arising in the industry related to Engineering, and they have to give the solution to the company.

Course Learning Outcomes:

1. **Internship**

After the successful completion of the IIP- II the student should be able to

1. Examine the functioning of the company on the terms of inputs, transformation process and the outputs (products and services)
2. Develop an attitude to adjust with the company culture, work norms, code of conduct.
3. Recognize and follow the safety norms, Code of conduct.
4. Demonstrate the ability to observe, analyse and document the details as per the industry practices.
5. Interpret the processes, systems and procedures and to relate to the theoretical concepts- studies.
6. Develop the leadership abilities, communication.
7. Demonstrate project management and finance sense

2. **Project**

After the successful completion of the project, the student should be able to;

1. Identify the project/problem in the domain of a program relevant for the company.
2. Compile the information to the pertaining to the problem identified.
3. Analyze the information using the statistical tools/ techniques.
4. develop the feasible solution for given problem.
5. Analyze the impact of the project on the performance of company/department.

Course Content

I. Internship:

During Internship, Students should follow guidelines given below.

1. After joining the industry students should learn all the departments and their workings. Furthermore, student should understand how each department of industry is interlinked with one another.
2. Student should correlate the theoretical aspects learned in academics with industry practices.
3. Students should gain a knowledge of new technologies which industry follows.
4. Students should follow the professional codes and ethics.
5. Students should follow all rules and regulations of industry. Special care should be taken regarding safety.

- **Work Diary:**

  Work Diary will be provided to each student, which contains details regarding internship, do's and don'ts and evaluation scheme. Student is required to write the Diary regularly and get it signed by the industry guide periodically. During the visit of Mentor, assigned to the student should be able to go through the Diary to access the work done and write the remarks/ instruction. At the end of internship, student should submit the duly completed diary to the department.

- **Duration:**

  The internship duration is of one complete semester (approximately 20 weeks) between 1st January to 30th May of the respective academic year. Biometric attendance on working days is compulsory.

II. Project:

Students should select technical problems occurring within the industry as a project in consult with industry & Institute mentors.

- **Evaluation**

Faculty Mentor will be assigned to each student by the Institute who will monitor the progress of internship and project and help the student to sort-out any issues/ problems arising. Mentor of student from college will visit the industry as per the schedule given below.

Sr.No.	Evaluation	Period
1.	At the beginning of the program for orienting Students to the company and finalize the project	During 2nd Week
2.	Review-I (ISE-1)	During10thweek
3.	Review-II (ISE-2)	During15thweek
4.	Review-III (ESE)	During20thweek

*Review-III is end semester examination (ESE), which will be conducted at institute.
*During ESE, students should submit, Project & internship report, Work diary, Internship & project completion certificate issued by industry etc. to respective departments.

Class:- **Final Year B. Tech**	Semester-VIII
Course Code: **OE4382**	Course Name: **Finance for Engineers (Online Course)**

L	T	P	Credits
2	-	--	2

Course Description:
In today's workplace, it is nearly impossible for an engineer to perform without considering the financial impact of every action on the organization's bottom line. Engineers need to be aware of issues such as cost reduction and capital investment and how their decisions can affect the financial statements. This course introduces basic financial management to engineers and technical personnel who need this knowledge to manage a profit center effectively. The course aims at providing students with an in-depth coverage of the various aspects of financial management.
It covers the assessing the financial health of the organization through ratio and cash flow analysis, sources of long term as well as short term finance. Decisions concern with financing, working capital and long term investment. Class will focus on both the academic theories underlying the management of funds and the practical aspects of financial management.

Course Learning Outcomes:
After successful completion of this course, students will be able to,
1. Discuss the fundamental aspects of accounting and finance.
2. Apply theoretical knowledge and information for preparing various financial statements.
3. Analyze the financial information for solving managerial problems.
4. Evaluate financial performance of the organization for effective decision making.

Prerequisite:
Basics of Mathematics

Course Contents

Unit No	Description	Hrs
1.	**Finance Terminologies & Financial Statement** Key terms of Accounting and Finance, Accounting Principles underlying Preparation of Financial Statements	04
2.	**Analyzing Health of a Firm** Techniques of Analyzing Health of a Firm, Classification of Ratios – Liquidity, Leverage, Activity, Profitability, Analysis of Cash Flows	04

3.	**The Management of Working Capital** Need of Working Capital, Operating Cycle of Working Capital, Determinants of Working Capital, Preparation of Working capital statement	**04**
4.	**Investment Decision Rules** Investment Decision Rules, Evaluation Criteria for Investment Decision: Payback, ARR, NPV, PI & IRR, Decision Tree Analysis	**04**
5.	**Long Term Financing** Long Term Financing: Shares, Debentures, Loan capital, foreign capital, FDI, Euro issues & external borrowings, Venture capital financing.	**04**
6.	**Financing Decisions and Cost of Capital** Risk & Return, Cost of Capital, Cost of Equity, Cost of Debt, Weighted Average Cost of Capital	**04**

References –

Reference Books:

- Paul Kimmel, J. Weygandt, D. Kieso, Financial Accounting.
- S.N. Maheshwari & S.K. Maheshwari, Problems & Solutions in Advanced Accountancy, Vikas Publishing House Pvt. Ltd., New Delhi.
- M.C. Shukla, T.C. Grewal & S. C. Gupta, Advanced Accounts, S. Chand.
- M. Y. Khan & P. K. Jain, Financial Management, Tata McGraw-Hill Publishing Company Limited, New Delhi.
- Prasanna Chandra, Financial Management, Tata McGraw-Hill Publishing Company Limited.

Note: - Being online course, lecture videos of each unit will be made available through college platform to the students. For each unit there will be separate assignment. Students need to submit all assignments within specified time.
Weightage: 25% weightage for unit wise assignments + 75% weightage for final exam.
Final exam will be held at college campus.

Rajarambapu Institute of Technology • Rajaramnagar • CSE (AI&ML) Engg. Department 415 414

K.E. Rajarambapu Institute of Technology • Rajaramnagar Autonomous 415 414 Dist. Sangli. M.S.

Class:-**Final Year B. Tech.**	Semester- **VIII**
Course Code: **OE4362**	Course Name: **Engineering Management & Economics**

L	T	P	Credits
2	-	-	2

Course Description:
Engineering management is the integration of management principles with engineering practices. It is a specialized field that focuses on effectively leading engineering teams and managing technical projects. This course is structured into two key modules: Engineering Management and Engineering Economics. The first module is centered on building the managerial skills necessary to guide, mentor, and inspire technical professionals in their engineering roles. The second module delves into engineering economics, a vital area for engineering firms to maintain their competitive advantage and market presence, focusing on economic decision-making.

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

1. Develop administrative, organizational, and planning skills to effectively manage and execute engineering projects.
2. Create bar charts and milestone charts to track and manage project progress.
3. Analyze profit and cost data, conducting economic evaluations to make informed, optimal decisions.
4. Calculate depreciation using various methods.

Prerequisite: Basics of Mathematics

Course Content

Unit No	Description	Hrs
1	**Managerial skills** Theories of Management Principles of Management (by Henry Fayol), Functions of Management, Planning, Organizing, Staffing, Directing, Co-Ordination, Communication, Motivation and Controlling	04
2	**Organizational skills** Levels of management, Organizations-elements, types and characteristics of organization, Management by Objectives (MBO)	04
3	**Planning Tools**	04

Rajarambapu Institute of Technology • Rajaramnagar • CSE (AI&ML) Engg. Department 415 414
K.E. Rajarambapu Institute of Technology * Rajaramnagar Autonomous 415 414 Dist. Sangli. M.S.

	Methods of scientific management- Critical Path Method (CPM), Programme Evaluation & Review Techniques (PERT), Network Crashing, Bar Chart, Mile-Stone chart, Gant Chart	
4	**Methods of Economic Analysis** Economic equivalence, Methods of comparison of alternatives- Present Worth Method, Rate of Return method, Benefit-Cost ratio method	**04**
5	**Make or Buy Decision** Approaches of make or buy decision-Simple cost analysis, Economic analysis, break-even analysis, Payback analysis	**04**
6	**Depreciation** Methods of Depreciation- Straight line method, Declining balance depreciation, Sum of years digits method, sinking fund method, service output method	**04**

References –

Text Books:

- Gilbert Daniel R, Freeman R. Edward and Stoner James A. F, "Management" Pearson Education.
- Harold Kerzner, "Project Management- A system approach to planning, scheduling and controlling", John Wiley & Sons Inc.
- Punmia B. C. and Khandelwal K. K, "Project Planning, Scheduling and controlling with PERT and CPM", Laxmi Publications Pvt. Ltd.
- Paneerselvam R, "Engineering Economics", Prentice Hall India Learning Private Limited.

Reference Books:

- Cannice Mark V, Koontz Harold and Weihrich Heinz, "Management", McGraw Hill Education (I) Pvt. Ltd.
- Blank Leland and Tarquin Anthony, "Basics of Engineering Economy", Tata McGraw-Hill.
- Mithani D. M, "Managerial Economics- Theory & Applications", Himalaya Publishing House-New Delhi.

Note:- Being online course, lecture videos of each unit will be made available through college platform to the students. For each unit there will be separate assignment. Students need to submit all assignments as per schedule.

Weightage: 25% weightage for unit wise assignments + 75% weightage for final examination.

Class:- **Final Year B. Tech**	Semester-**VIII**
Course Code: **RE4044**	Course Name: **Research Internship**

L	T	P	Credits
-	-	-	12

Course Description:
Research experience for undergraduates is important not only for conducting research on a topic that has an impact on a current research activity, but also as a tool to enhance undergraduate education. For the engineering technology students, research experiences allow them to carry out in-depth study of engineering concepts, while emphasizing hands-on experiences and practical applications. Participating in research projects strengthens the student's resume, and fulfills the requirements of present day employers, who demand sound engineering skills in their employees.

Course Learning Outcomes:
After completion of this course, the student will be able to,

1. Investigate the technical literature.
2. Recognize and evaluate theories, practices, and/or research on a chosen topic by conducting a thorough literature review and submitting a written integrative, critical summary of the current literature.
3. Design a research problem and develop a methodology.
4. Develop and implement an advanced original research or creative project.
5. Develop the ability to explain the conceptual viability of the project and describe the major components involved.
6. Develop advanced discipline-relevant skills and competencies.
7. Write a research report and paper.

Course Content
Students should carefully discuss with their research advisor about time expectations to complete the research project.
Degree to which students meet expectations: The following is a minimum set of expectations for every student enrolled for this course for credit:
i) perform a background literature search and review,
ii.) Develop a project plan,
iii.) Perform experimental work or applied experimental work,
iv.) Write and present a research report.
iv) Write and submit research paper to any reputed journal/international conference.

- **To submit or publish the research paper in any reputed journal/international conference is a necessary criteria to become eligible for End semester Examination (ESE).**

Quality of the final report and oral presentation: The research advisor will provide clear expectations of the desired format, content, and deadlines of the final report. The research advisors will grade the final report.

Attendance: In order to provide the measure of performance, the research advisor is expected to complete a two mid-term evaluation with the student, accompanied by recommendations for improvement for the remainder of the term. The mid-term evaluation with the student should be accompanied by a one-on-one meeting between the research advisor and the student.

Absences and Make-up Work: Requirements for attendance is as per RR of the Institute

- **Evaluation**

Faculty guide will be assigned to each student by the Institute who will monitor the progress of research project and help the student to sort-out any issues/ problems arising. Schedule of evaluation will be as given below.

Sr.No.	Evaluation	Period
5.	Review-I (ISE-1)	During10thweek
6.	Review-II (ISE-2)	During15thweek
7.	Review-III (ESE)	During20thweek

*Review-III is end semester examination (ESE).
*During ESE, students should submit research Project report, proof of submission of research paper to reputed journal/international conference to respective departments.
*If student is doing research project in outside organization (Research Lab/ institutes), he/she should submit project completion certificate given by outside organization.

Class:- **Final Year B. Tech**	Semester-**VIII**
Course Code: **ED4104**	Course Name: **Project Management**

L	T	P	Credits
2	-	--	2

Course Description:
To improve and update knowledge of new entrepreneurs in the areas of project preparation & appraisal techniques; decision-making process in the sector of industrial, infrastructure & sustainable opportunities that would lead to improved viability, returns and effective investment decisions. Writing a business plan which can gain interest of the fund providers like venture capitalists and other sources of funding.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Develop a Comprehensive Business Plan for selected business
2. Evaluate Project Viability Through Financial Appraisal
3. Analyze the Environmental and Technical Aspects of a Project
4. Apply Project Management Techniques
5. Assess the Commercial Feasibility of a Business Opportunity

Prerequisite:
General knowledge of economics & clear concept about own business model.

Course Content

Unit No	Description	Hrs
1.	**Project appraisal** -Project Development Cycle, Preparation of feasibility studies, project formulation, screening for pre-feasibility studies, stages of feasibility report preparation, Project Analysis including Market Analysis, Technical Analysis & Financial Analysis, Various analytical techniques and integrating the data gathered into a full-fledged business plan.	04
2.	**Project Analysis**-Environmental Analysis, Risk Analysis, Infrastructure Development & Financing, Risk Management, Risk identification, Qualitative risk analysis, Quantitative risk analysis, Risk planning and control, National Cost-Benefit Analysis, Financing Sustainable Opportunities. Sustainability and Green Business Practices	04
3.	**Business Plan:** What is business plan, Entrepreneurial opportunities and Business Plan. Preparing business plan. (Practical Exercises on preparation of business plan) Components of Business Plan, Executive summary, other components. Project report contents.	04

4.	**Commercial Appraisal:** Economic feasibility and commercial viability, market analysis, Market Research, Industry Analysis, Competitor analysis, defining the target market, market segmentation, market positioning, building a marketing plan, market strategy.	04
5.	**Technical Appraisal:** Operation and Production Plan: Types of production systems, Product design and analysis, New product development, location and layout decisions, project layout, plant and technology choices, product specification and customer needs, production planning and control, Commercializing Technologies	04
6.	**Financial Appraisal:** pro forma income statements, financial projections, working capital requirement, funds flow and Cash flow statements; Ratio Analysis. **Project Management Techniques**: Identifying organizational structures Estimating costs and budgeting Using critical path project management tools (WBS, Gantt chart, Project Network Diagram) Establishing the critical path Tracking project milestones Using the program evaluation and review technique (PERT tool) Using process improvement tools (Fishbone, SIPOC) Managing time Controlling quality	04

References -

Text Books:

- Dwivedi, A.K.: Industrial Project and Entrepreneurship Development, Vikas Publishing House.

Reference Books:

- Bangs Jr., D.H., *The Business Planning Guide,* Dearborn Publishing Co.
- Katz, J.A. and Green, R.P., Entrepreneurial Small Business, McGraw Hill
- Mullins, J. and Komisar R., Getting to Plan B, Harvard Business Press
- O'Donnell, M., The Business Plan: Step by Step, UND Center for Innovation.
- Scarborough, N.M. and Zimmerer, T.W., Effective Small Business Management, Pearson
- Pickle, H.B.and Abrahamson, R.L., Small Business Management, Wiley
- Desai, V., Dynamics of Entrepreneurial Development & Management, Himalaya Publishing
- Kao, J., Creativity & Entrepreneurship, Prentice Hall
- Singh, Narendra, Project Management & Control, Himalaya Publications.

Rajarambapu Institute of Technology Rajaramnagar CSE (AI&ML) Engg. Department 415 414

Rajarambapu Institute of Technology Rajaramnagar Autonomous 415 414 Dist. Sangli. M.S. K.E.S.

Class:- **Final Year B. Tech**	Semester-VIII		L	T	P	Credits
Course Code: **ED4044**	Course Name: **Commercial Aspects of the Project**		2	-	--	2

Course Description:
To familiarize students with accounting, mechanics of preparation of financial statements, understanding corporate financial statements, their analysis and interpretation.
The objectives of the course are to build the skills, frameworks and knowledge in entrepreneurial finance. Students will study the financing of small and medium sized businesses & Financial management from the perspective of both the entrepreneur and investors.
This course will also give overall understanding of marketing management which will help them in developing their own marketing decisions & in understanding the importance of market survey techniques. It will help them in conducting suitable market survey for their own selected products.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Interpret basic Accounting and Financial Terminologies.
2. Prepare & analyze financial statements.
3. Apply basic principles of marketing.
4. Apply knowledge of marketing mix for any organization.

Prerequisite:
General knowledge of economics & clear concept about own business model

Course Content

Unit No	Description	Hrs
1.	**Accounting Terminologies** Meaning, nature, functions, types of accounting; generally accepted accounting concepts, principles and conventions; double entry system. Accounting Records: Fundamentals of record keeping, the accounting process, Computer-based accounting systems. Accounting cycle.	04
2.	**Financial Management**	04

Rajarambapu Institute of Technology Rajarammagar CSE (AI&ML) Engg. Department 415 414
K.E.S. Rajarambapu Institute of Technology Rajarammagar Autonomous 415 414 Dist. Sangli M.S.

	Definition, nature, objectives, functions and scope of financial management, Preparation of financial plan – its objectives, essential features, consideration in formulating financial plan	
3.	**Financial Statements** Balance sheet: assets, liabilities. Income statement: concept of income, concept of expenses, concept of gain and losses. Components of the income statement. Cash flow statements: purpose, components, concept, Process.	**04**
4.	**Nature & Scope of Marketing** Evolution, core marketing concepts, selling concept, marketing concept, Holistic marketing concept, portfolio approach-BCG matrix. Marketing Research- Concept & practice, Steps in Marketing Research.	**04**
5.	**Marketing Environment and STP** Demographic, economic, political, legal, socio cultural, technological environment (Indian context); environmental scanning to discover marketing opportunities, Segmentation, Targeting and Positioning, difference between segmentation, targeting and positioning.	**04**
6.	**Marketing Mix: Product, Price, Promotion and Place.** **Product Decisions:** Concept of Product, Levels of Product, Product Mix Decisions, Product Line Decisions, Individual Product Decisions, Branding, Product Life-cycle - Stages. **Pricing Decisions:** Meaning, Factors influencing Pricing Decisions, Methods of Pricing **Place Decisions:** Meaning, Channels of Distribution **Promotion Decisions:** Elements of Promotion Mix, Advertising, Publicity, Sales Promotion, Personal Selling, Direct Marketing and Public Relations,	**04**

References -

Text Books:

- Maheshwari, S.N. and Maheshwari, S.K., Financial Accounting, Vikas Publishing House
- Leach C.J. and Melicher, R.W. Entrepreneurial Finance, Thomson.
- For B2C = Kotler, P., Keller, K.L., Koshy, A. and Jha, M.: Marketing Management,

Rajarambapu Institute of Technology CSE (AI&ML) Engg. Department 415 414 Rajarammagar
Rajarambapu Institute of Technology Rajarammagar Autonomous 415 414 Dist. Sangli. M.S.

Pearson
- For B2B = Sarin, S. Strategic Brand Management for B2B Markets, Sage

Reference Books:
- Ghosh, T.P., Financial Accounting for Managers, Tax-mann Allied Services
- Gupta, A., Financial Accounting for Management, Prentice Hall
- Jain, S.P. and Narang, K.L., Advanced Accountancy, Kalyani Publishers.
- Smith, J.K., Smith, R.L. and Bliss, R.T., Entrepreneurial Finance, Stanford University Press
- Smith, J.K. and Smith, R.L., Entrepreneurial Finance, Wiley.
- Rogers, S., Entrepreneurial Finance, McGraw Hill.
- Chandra, P., Financial Management, McGraw Hill.
- Kotler P. & Armstrong, G., Principles of Marketing, Pearson

Note:

- Lectures of this theory course will be conducted through online mode.
- Recorded videos will be made available to students on MOODLE platform.
- Faculty will upload three lectures per week and links will be shared on every Monday.
- Students need to appear in Unit Test-1, Unit Test-2 and ESE in college campus as per the regular practice.
- Faculty of concerned course will take the decision regarding modes of In-Semester Evaluation (ISE).

Class:- **Final Year B. Tech**	Semester-**VIII**
Course Code: **ED4064**	Course Name: **Entrepreneurship Development Program (EDP)**

L	T	P	Credits
-	-	--	1

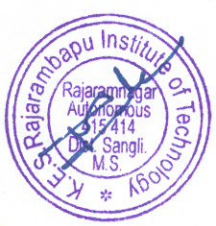
Course Description:
Student will attend short term intensive EDP program organized either in house or by any authorized agency approved by CIIED.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Apply knowledge of engineering, economics, marketing and finance for formulation of business plan, starting & managing new business.

Prerequisite: General knowledge of business & clear concept about

Course Content:
1 Student will undergo training programs organized by CIIED.
Programs on marketing, Finance management, project report preparation by professional agencies. Students are required to apply this knowledge for preparing final project report.
2. Student will complete online certification course- **Entrepreneurial & Employability Skill Development Program** by Singapore polytechnic in association with Jugad Funda & Shivaji University, Kolhapur or any other approved agencies.

Evaluation- ISE **50** marks by mentor for-
1. Completion of online certification course- **Entrepreneurial & Employability Skill Development Program** by Singapore polytechnic in association with Jugad Funda & Shivaji University, Kolhapur or any approved agencies.
2. Active participation in programs by completing various activities/assignments in program.



Class:- **Final Year B. Tech**	Semester-VIII
Course Code: **ED4084**	Course Name: **Entrepreneurial Internship**

L	T	P	Credits
-	-	-	11

Course Description:
Student will prepare technically feasible and economically viable detailed project report including market survey.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Apply knowledge of engineering, economics, marketing and finance for preparation of project report.
2. Make commercial, technical and financial appraisal of project.

Course Content
Student will start working on collection of data required for business plan. During semester he may require to visit various support organizations, similar industries , suppliers of raw materials, machinery, special service providers. He has to conduct market survey. For this student can go out of campus with prior permission of mentor. Mentor should maintain this record. Students are required to work independently by taking guidance from mentor/Head CIIED/faculty on expert panel of CIIED.
Product prototype & execution of business operation is must & it should be validated by Departmental ED committee.
Continuous efforts taken by student should be observed by mentor for ISE evaluation. At the end of semester detailed project report will be presented before Expert committee for ISE evaluation of 100 marks.
Then student will appear for ESE. Project report evaluation &assessment will be done by a panel of experts appointed by COE.

Evaluation	Weightage	Particulars	converted Marks
ISE	10%	Preliminary project report	10
	20%	Market Survey	20
	20%	Completion of Legal Aspects	20
	50%	Final Report	50
ESE	100%	ESE -Final Report	100

Class:- **Final Year B. Tech.**	Semester- **VII**
Course Code: **REH401**	Course Name: **Intellectual Property Rights**

L	T	P	Credits
-	-	-	2

Course Description:
This course provides a comprehensive introduction to the principles and practices of Intellectual Property Rights (IPR) with a focus on their application in the fields of science, technology, and engineering. Students will explore the various forms of intellectual property, including patents, copyrights, trademarks, trade secrets, and industrial designs, and understand their legal, economic, and ethical implications. The course covers the process of securing and enforcing IP rights, the role of international agreements and organizations, and the challenges posed by emerging technologies. Through case studies, practical exercises, and discussions, students will gain the knowledge and skills necessary to protect and manage intellectual property in a globalized and innovation-driven world.

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

1. Explain the basic concepts and importance of Intellectual Property Rights.
2. Identify different types of intellectual property and their relevance in the technology sector.
3. Analyze the legal aspects of IPR and its implications for innovation and business.
4. Apply IPR principles to protect inventions, designs, and creative works.
5. Evaluate the ethical and societal impact of IPR in a global context.

Prerequisite:
Write prerequisite required to study this course.

Course Content

Unit No	Description	Hrs
1	**Introduction to Intellectual Property Rights** Definition and importance of Intellectual Property (IP); Historical evolution of IPR; Types of Intellectual Property: Patents, Copyrights, Trademarks, Trade Secrets, Industrial Designs, Geographical Indications; Role of IPR in innovation and economic development; Overview of global IPR systems (WIPO, WTO, TRIPS Agreement)	

2	**Patents** Concept of patents and patentability criteria (novelty, inventive step, industrial applicability); Types of patents: Utility, Design, and Plant Patents; Patent application process: Filing, examination, and grant; Patent infringement and enforcement; Case studies on patent disputes in technology sectors; Introduction to Patent Cooperation Treaty (PCT) and international patent filing	
3	**Copyrights and Related Rights** Concept of copyright and its scope; Subject matter of copyright: Literary, artistic, musical, and software works; Rights of copyright holders and limitations (fair use, public domain); Copyright registration and enforcement; Digital rights management and challenges in the digital era; Case studies on copyright infringement in software and media	
4	**Trademarks and Industrial Designs** Concept of trademarks and their importance in branding; Types of trademarks: Word marks, logos, service marks, collective marks; Trademark registration process and infringement; Concept of industrial designs and their protection; Design registration and enforcement; Case studies on trademark and design disputes	
5	**Trade Secrets and Geographical Indications** Concept of trade secrets and their protection; Legal framework for trade secrets (e.g., NDAs, confidentiality agreements); Geographical Indications (GIs): Concept and significance; Protection of GIs and their role in promoting local products; Case studies on trade secret theft and GI disputes	
6	**IPR Management, Ethics, and Global Perspectives** IPR management in technology transfer and commercialization; Licensing and assignment of IP rights; IPR in open innovation and collaborative research; Ethical issues in IPR: Biopiracy, patenting life forms, and access to medicines; Global IPR trends and challenges: Counterfeiting, piracy, and cross-border enforcement; Role of IPR in startups and entrepreneurship; Future of IPR in emerging technologies (AI, blockchain, biotechnology)	

Rajarambapu Institute of Technology, Rajarammagar - CSE (AI&ML) Engg. Department 415 414

K.E.S. Rajarambapu Institute of Technology, Rajarammagar, Autonomous 415 414 Dist. Sangli M.S.

References –

Text Books:

- Roger E. Schechter, John R. Thomas, "Intellectual Property: The Law of Copyrights, Patents, and Trademarks", West Academic Publishing
- David Bainbridge, "Introduction to Intellectual Property", Oxford University Press

Reference Books:

- Robert Merges, John Duffy, "Patent Law and Policy: Cases and Materials", LexisNexis
- David Wright, "Intellectual Property Rights: A Practical Guide for Engineers", Wiley

Note: - Being online course, lecture videos of each unit will be made available through college platform to the students. For each unit there will be separate assignment. Students need to submit all assignments as per schedule.

Class:- **Final Year B. Tech.**	Semester- **VII**
Course Code: **REH402**	Course Name: **Research Project Phase 2**

L	T	P	Credits
-	-	-	11

Course Description:

This course is designed to guide B. Tech. students through the execution and reporting phase of their research project, building on the foundation laid in Phase 1. Students will implement the research plan outlined in their synopsis, focusing on data collection, experimentation, analysis, and interpretation. The course emphasizes the application of research methodologies, tools, and techniques to address the research problem effectively. Through regular mentoring sessions, students will refine their research approach, troubleshoot challenges, and ensure adherence to ethical guidelines. The course also focuses on the preparation of a detailed research report and the presentation of findings.

The evaluation process is designed to assess students' ability to execute their research plan and communicate their results effectively. It includes In-Semester Evaluation (ISE - 50%) and End-Semester Evaluation (ESE - 50%), comprising progress reviews, report submissions, and final presentations.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

1. Apply appropriate analytical tools and techniques to process and interpret research.
2. Identify and address challenges encountered during the research process.
3. Prepare a comprehensive research report detailing the objectives, methodology, findings, and conclusions.
4. Communicate research outcomes effectively through written and oral presentations.
5. Demonstrate ethical guidelines and standards throughout the research process.

Rajarambapu Institute of Technology CSE (AI&ML) Engg Department 415 414 Rajaramnagar

K.E.S. Rajarambapu Institute of Technology Rajaramnagar Autonomous 415 414 Dist. Sangli. M.S.

Class:- **Final Year B. Tech.**	Semester- **VII**
Course Code: **REH403**	Course Name: **Research Project (Synopsis) Phase 1**

L	T	P	Credits
-	-	-	2

Course Description:

This course is designed to guide B. Tech. students through the initial phase of their research project, focusing on the development of a comprehensive research synopsis. Students will be introduced to the fundamentals of research methodology, including problem identification, literature review, research design, and ethical considerations. The course emphasizes the formulation of clear research questions, the selection of appropriate methodologies, and the preparation of a well-structured research proposal. Through mentoring sessions, students will learn to conduct systematic literature reviews, design research frameworks, and present their synopsis/proposal effectively. The course aims to equip students with the skills necessary to plan, propose, and defend their research projects, setting a strong foundation for the successful execution of their research in Phase 2.

The evaluation process is designed to assess students' understanding and application of research concepts. It includes in Semester Evaluation (ISE - 50%) and End-Semester Evaluation (ESE - 50%) comprises presentation sessions.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

1. Demonstrate an understanding of research methodology and project planning.
2. Identify a research problem with clear objectives and questions.
3. Conduct a systematic literature review using appropriate sources and tools.
4. Develop a research synopsis with a well-defined methodology and expected outcomes.
5. Present research synopsis/proposal effectively.

Rajarambapu Institute of Technology, Rajaramnagar
CSE (AI&ML) Engg. Department
415 414

Rajarambapu Institute of Technology
Rajaramnagar Autonomous
415 414
Dist. Sangli M.S.

Class:- **Final Year B. Tech.**	Semester- **VII**
Course Code: **REH405**	Course Name: **Research-Specific Core Course-1 (Online NPTEL Course)**

L	T	P	Credits
-	-	-	3

Course Description:

Student can opt for online certification course and produce certificate.

- The student should select the course in consultation with mentor on NPTEL platform related to project area.
- The course should be minimum 25 hours' duration and should have certification facility.

Student should complete course and get certificate. The certificate copy should be submitted to mentor. The evaluation process is designed to assess students' understanding of core concepts related to project area. It includes in Semester Evaluation (ISE - 50%) and End-Semester Evaluation (ESE - 50%) comprises presentation sessions.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

1. Explain the key concepts and insights gained from the NPTEL course
2. Apply concepts, tools, and methodologies learned from the NPTEL course into their ongoing research project
3. Analyze research-specific problems using the knowledge acquired from the online course.
4. Identify the real life applications and practices of courses studied

Rajarambapu Institute of Technology CSE (AI&ML) Engg. Department 415 414 Rajaramnagar

Rajarambapu Institute of Technology Rajaramnagar Autonomous 415 414 Dist. Sangli. M.S.