K.E. Society's
Rajarambapu Institute of Technology, Sakharale
(An Autonomous Institute, affiliated to Shivaji University, Kolhapur)
Final Year B. Tech. Syllabus
To be implemented for 2022-26 Batch
Department of Computer Science and Engineering

Class:- **Final Year B. Tech**	Semester-**VII**
Course Code: CS421	Course Name: Cloud Computing

L	T	P	Credits
02	--	02	03

Course Description:
Cloud Computing is a large-scale distributed computing paradigm that has become a driving force for information technology. The exponential growth of data in scientific instrumentation, simulation, and social media has triggered the wider adoption of cloud computing services. This course explores solutions and design principles for building large network-based systems supporting both compute and data-intensive applications across geographically distributed infrastructures.

Course Learning Outcomes:

At the end of the course the student should be able to:

1. Describe fundamental cloud computing concepts, including service models, deployment models, and the evolution of cloud computing.
2. Demonstrate the ability to implement virtualization techniques and resource management strategies in cloud environments.
3. Evaluate cloud security challenges, including identity and access management, compliance issues, and data encryption techniques.
4. Develop cloud-based applications using major cloud service providers like AWS, Microsoft Azure, and Google Cloud.

Prerequisites: Basic knowledge of operating systems, networking, and distributed computing.

Course Content		
Unit No	**Description**	**Hrs**
1	**Introduction to Cloud Computing** Basics of cloud computing, Evolution of cloud computing, Key characteristics and benefits, Cloud computing use cases and real-world applications	**04**
2	**Cloud Architecture and Models** Cloud computing service models (IaaS, PaaS, SaaS), Deployment models (Public, Private, Hybrid, Community), Comparative analysis of cloud service providers	**04**
3	**Virtualization in Cloud Computing** Types of virtualization, Hypervisors, Virtual machines, Resource allocation and management, Performance optimization through virtualization	**04**
4	**Cloud Security and Privacy** Security issues in cloud computing, Identity and access management, Compliance and legal issues, Encryption techniques for cloud data security	**04**
5	**Cloud Storage and Databases** Cloud storage architectures, Database services in cloud, Big data management in cloud, Data replication and consistency models	**04**
6	**Cloud Computing Platforms and Applications** Overview of AWS, Google Cloud, Microsoft Azure, Cloud-based application development, Serverless computing, Edge computing and its impact on cloud services	**04**

It should consist of minimum 10 experiments based on the syllabus and experiment list mentioned below.

Course Content		
Exp No.	**Description**	**Hrs**
1.	Install Oracle Virtual box and create two VMs on your laptop	**04**
2.	Install Turbo C in guest OS and execute C program.	**02**
3.	Test ping command to test the communication between the guest OS and Host OS.	**02**
4.	Install Hadoop single node setup.	**02**
5.	Develop a simple Hadoop application called Word Count. It counts the number of occurrences of each word in a given input set.	**02**

6.	Develop Hadoop application to count no of characters, no of words and each character frequency.	**02**
7.	Develop Hadoop application to process given data and produce results such as finding the year of maximum usage, year of minimum usage.	**02**
8.	Design a protocol and use Simple Queue Service (SQS)to implement the barrier synchronization after the first phase.	**02**
9.	Develop a Guestbook Application using Google App Engine.	**02**
10.	Develop a Windows Azure Hello World application using.	**02**

References –

Text Books

- Rajkumar Buyya, James Broberg, Andrzej Goscinski, "Cloud Computing: Principles and Paradigms", Wiley, 2024 Edition.
- Kai Hwang, Geoffrey C. Fox, Jack J. Dongarra, "Distributed and Cloud Computing", Elsevier, 2024 Edition.
- Dan Marinescu, "Cloud Computing: Theory and Practice", Elsevier, 2024 Edition.

References

- Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", Tata McGraw Hill, 2024 Edition.
- Gautam Shroff, "Enterprise Cloud Computing", Cambridge University Press, 2024 Edition.

E-Textbooks:

- http://www.pds.ewi.tudelft.nl/
- http://csrc.nist.gov/publications/nistpubs

MOOC Courses:

- http://www.edx.org/course/introduction-cloud-computing-ieeex-cloudintro-x-1
- http://www.coursera.org/specialization/cloud-computing

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Class:- **Final Year B. Tech**	Semester-**VII**
Course Code: CS423	Course Name: Software Testing Quality Assurance

L	T	P	Credits
3	--	--	03

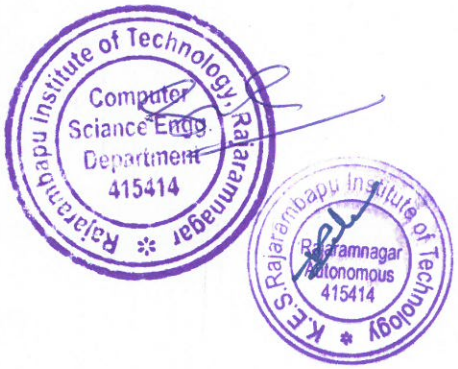
Course Description:
This course provides an in-depth understanding of software testing methodologies and quality assurance practices essential for delivering robust and reliable software products. Students will learn the principles of software testing, explore manual and automated testing techniques, and understand the role of quality assurance in the software development lifecycle. The curriculum emphasizes practical skills through test case design, defect tracking, and test management, while also addressing advanced topics such as performance, security, and mobile testing. In the quality assurance segment, students will study industry standards, process improvement models, and risk management strategies, gaining insights into maintaining and enhancing software quality. The course also highlights emerging trends, such as Agile, DevOps, and Test-Driven Development, preparing students for dynamic roles in modern software development environments.

Course Learning Outcomes:
At the end of the course the student should be able to:

1. Explain the objectives and importance of different testing techniques and their role in the software development lifecycle.
2. Design and execute test cases for a given software module using systematic approaches such as equivalence partitioning and boundary value analysis.
3. Analyze software testing outcomes to identify defects and categorize them based on severity and priority.
4. Assess the quality of a software product using defined metrics and industry-standard models, such as ISO 9001 or CMMI.
5. Develop a detailed test strategy and quality assurance plan for a complex software application, incorporating emerging trends like Agile or CI/CD pipelines.
6. Design a custom automated testing framework for a web application using tools like Selenium or JUnit.

Prerequisites: Software Engineering concepts

Course Content		
Unit No	**Description**	**Hrs**
1	**Introduction to Software Testing** Definition and significance of software testing, Common causes and costs of software defects, Role and responsibilities of a software tester, Overview of software development life cycles (e.g., Waterfall, Agile) and their relation to testing	**06**
2	**Testing Techniques and Strategies** Static Testing: Reviews, walkthroughs, and inspections, Dynamic Testing: Black-box and white-box testing techniques, Test Case Design: Equivalence partitioning, boundary value analysis, decision table testing, Levels of Testing: Unit, integration, system, and acceptance testing	**06**
3	**Test Management and Documentation** Test Planning: Objectives, strategies, resource estimation, and scheduling, Test Case Development: Writing effective test cases and test scripts, Defect Management: Bug life cycle, defect tracking systems (e.g., JIRA), Test Metrics and Reporting: Measuring test effectiveness and efficiency	**06**
4	**Advanced Testing Topics** Automated Testing: Introduction to tools (e.g., Selenium) and scripting, Performance Testing: Load, stress, and scalability testing, Security Testing: Identifying vulnerabilities and threats, Mobile and Web Application Testing: Specific challenges and strategies	**06**
5	**Software Quality Assurance (SQA)** Quality Concepts: Definitions, importance, and cost of quality, SQA Activities: Process monitoring, product evaluation, and audits, Standards and Models: ISO 9000 series, Capability Maturity Model Integration (CMMI), Risk Management: Identifying, analyzing, and mitigating risks	**06**
6	**Emerging Trends and Best Practices in SQA** Agile and DevOps: Impact on testing and quality assurance, Test-Driven Development (TDD) and Behavior-Driven Development (BDD),Continuous Integration and Continuous Deployment (CI/CD) pipelines, Ethical and Legal Considerations in Software Testing	**06**



References –

Text Books

- Naresh Chauhan, "Software Testing: Principles and Practices", Second Edition, Oxford University Press, ISBN 978-0198061847.
- Dorothy Graham, Rex Black, Erik van Veenendaal, "Foundations of Software Testing", Second Edition, Cengage Learning, ISBN 978-1844809899.

References

- William E. Lewis, "Software Testing and Continuous Quality Improvement", Third Edition, Auerbach Publications, ISBN 978-1439834369.
- Paul Ammann, Jeff Offutt, "Introduction to Software Testing", Second Edition, Cambridge University Press, ISBN 978-1107172012.

Class:- **Final Year B. Tech**	Semester-**VII**
Course Code: CS425	Course Name: Program Elective-III -Digital Forensic

L	T	P	Credits
3	--	--	03

Course Description:
This course offers a detailed exploration of the field of digital forensics and cybercrime investigation. Students will gain practical skills in conducting forensic examinations of various digital devices and network environments. The curriculum covers core concepts such as data acquisition and preservation, forensic analysis techniques, network intrusion analysis, mobile device forensics, email forensics, and legal and ethical considerations. Emphasis is placed on hands-on experience using industry-standard forensic tools and methodologies. Students will also learn to prepare comprehensive forensic reports and present findings effectively.

Course Learning Outcomes:
At the end of the course the student should be able to:

1. Understand the principles and practices of digital forensics and cybercrime investigation.
2. Apply methodologies for acquiring, preserving, and analyzing digital evidence.
3. Utilize forensic tools and techniques to investigate cyber incidents.
4. Analyze digital evidence from diverse sources to identify malicious activity.
5. Apply legal and ethical principles and best practices in digital forensics investigations.
6. Communicate forensic findings through clear reports and presentations.

Prerequisites: Networking, Fundamental Cybersecurity Knowledge, Operating System Internals, CLI Skills, Basic Legal Concepts, Analytical and Problem-Solving Skills

Course Content		
Unit No	**Description**	**Hrs**
1	**Foundations of Digital Forensics and Cybercrime Investigation:** Basic computer organization, File system, Memory organization concept, Data storage concepts **Digital Forensics Science:** Overview of forensic science, including computer forensics and digital forensics principles, Role of digital forensics in incident response and cybersecurity, Understanding the chain of custody for digital evidence. **Computer Crime:** Criminalistics and its application to the investigative process, Analysis of the cyber-criminalistics domain, Techniques for profiling cybercriminals and understanding their behavior, Adopting a holistic approach to cyber-forensics, Collaboration between law enforcement, cybersecurity professionals, and legal entities	**04**
2	**Cyber Crime Scene Analysis and Evidence Management:** **Cyber Crime Scene Analysis:** Overview of legal frameworks and court orders relevant to cybercrime investigations, Roles of computer security incident response team, Methods for the search and seizure of electronic evidence in compliance with legal procedures, Techniques for handling retrieved and unretrieved electronic communications (emails, chat logs, etc.), Importance of maintaining the chain of custody for electronic evidence, Preparation of court documents required for criminal investigations, including warrants and subpoenas. **Evidence Management:** Best practices for preserving evidence integrity during analysis and investigation, Role of forensic tools in collecting and analyzing digital evidence, Challenges and solutions in handling encrypted and volatile data.	**04**
3	**Data Acquisition and Evidence Gathering:** Overview of Data Acquisition, Roles of peoples involved in data collection (First Respondent, Investigators, crimes scene technician), Data Acquisition from Live Systems, Data Acquisition from Shutdown and Remote Systems, Data Acquisition from Servers, Email Investigations, Password Cracking, Data Acquisition from Mobile Devices, Seizing and Preserving Mobile Devices, Data Acquisition from social media, Acquiring Data from Encrypted Systems, Challenges and Issues in Cybercrime Investigations	**06**
4	**Analysis of Digital Evidences:** Forensic Analysis Preparation, Restoring and preparing forensic duplicates for analysis, recovering deleted files, unallocated space, and generating file lists, Windows and UNIX/Linux System Investigation, reviewing logs, performing keyword searches, identifying unauthorized accounts and processes, and checking for rogue files and access points, and detecting Trojan modules. Hacker Tools Investigation, analysing hacker tools, understanding file compilation, and	**08**

	performing static and dynamic analysis of malicious tools.	
5	**Network Forensics and E-Mail Forensics:** Overview of IDS, including types (network-based, host-based, signature-based, anomaly-based), advantages, and disadvantages.Network Intrusions and Attacks: Identifying attack types (direct, distributed, automated), recognizing pre-intrusion activities (port scans, address spoofing), and dealing with attacks involving Trojans, viruses, and worms. Collecting network evidence using monitoring systems, tcpdump, log files, and analysing network protocols like TCP/IP. Password Cracking & Social Engineering: Techniques like brute force and password interception, with preventive measures. **E-Mail Forensics**: Understanding e-mail as evidence, client protocols, SMTP headers, and e-mail fraud prevention (spoofing, spamming, phishing). Overview of forensic tools such as Mail Tracker Pro, Email Tracer, Aid4Mail Forensic, and EnCase Forensic for e-mail analysis.	**08**
6	**Mobile Phone Forensics:** Mobile Hacking Techniques: SMS and call spoofing/forging, Bluesnarfing. Role of mobile phones in crime, evidence types Forensic Procedures: Data from SIM cards, memory cards, and operator networks. Overview of tools such as iPhone Backup Analyzer, WhatsApp Xtract, and Skype Xtractor. Procedures for handling Android devices, including data acquisition and analysis. Report Writing: Goals of Report, Layout of an Investigative Report, Guidelines for Writing a Report	**06**

References –

Text Books

- Padmavathi Ganapathi, "Digital Forensics and Investigation Methods", First Edition, Notion Press.
- Dr. Nilakshi Jain and Dr. Dhananjay R. Kalbande, "Digital Forensic: The Fascinating World of Digital Evidences", Wiley.
- Vacca J., "Computer Forensics, Computer Crime Scene Investigation", Charles River Media, 1-58450-389.
- Amelia Phillips and Christopher Steuart, "Guide to Computer Forensics and Investigation", 3rd or 4th Edition, Nelson.

References

- Andre Arnes, "Digital Forensics", Wiley.
- Chuck Easttom, "An In-depth Guide to Mobile Device Forensics", First Edition, CRC Press.

Class:- **Final Year B. Tech**	Semester-**VII**
Course Code: CS427	Course Name: Program Elective-III GPU Computing

L	T	P	Credits
03	--	--	03

Course Description:
This course provides an elementary introduction about development of parallel programming applications using GPUs. This course introduces many-core programming approaches like CUDA C/C++ as programming languages to implement different algorithms and applications. This course focuses on learning and implementation of different application to harness the power of CPU and GPU due to the advancement of technologies. This course teaches you how to organize the computations so that the required computations performed efficiently, making good use of the available hardware resources.

Course Learning Outcomes:
At the end of the course the student should be able to:

1. Explain the architecture of GPUs and how they differ from CPUs in terms of parallel processing capabilities.
2. Describe the CUDA programming model and its components.
3. Develop efficient parallel algorithms using CUDA C/C++ and CUDA Python libraries that exploit the GPU's computational power.
4. Apply the techniques for memory optimization.
5. Implement GPU-accelerated solutions to real-world problems such as image processing, machine learning, and simulations.

Prerequisites:
- Preliminary knowledge of Microprocessor Architecture and Fundamentals of Computer
- Preliminary knowledge of C/C++ and Python programming
- Preliminary knowledge of Data structure and Design of Algorithms.

Course Content		
Unit No	**Description**	**Hrs**
1	**Introduction to GPU Computing and CUDA** History, GPU Architecture, Clock speeds, CPU / GPU comparisons, Heterogeneity, Accelerators, Parallel Programming, CUDA Data Parallelism Model, CUDA Program Structure, Device Memories and Data Transfer, Kernel Functions and Threading.	**06**
2	**CUDA Threads:** CUDA Thread Organization, Using blockIdx and threadIdx, Synchronization and Transparent Scalability, Thread Assignment, Thread Scheduling and Latency Tolerance.	**06**
3	**CUDA Memories and Data Locality:** Importance of Memory Access Efficiency, Memory Types, Reducing Global Memory Traffic, Boundary Checks, Memory as a Limiting Factor to Parallelism Examples.	**06**
4	**CUDA Performance Considerations:** More on Thread Execution, Global Memory Bandwidth, Dynamic Partitioning of SM Resources, Instruction Mix, Thread Granularity, Measured Performance and Summary.	**06**
5	**CUDA Streams, and Events:** Asynchronous processing, tasks, Task-dependence, Overlapped data transfers, Default Stream, Synchronization with streams. Events, Event-based-Synchronization - Overlapping data transfer and kernel execution, pitfalls.	**06**
6	**Introduction to CUDA Python with Numba:** Numba to compile CUDA kernels from NumPy universal functions, Numba to create and launch custom CUDA kernels, Key GPU memory management techniques	**06**

References –

Text Books

- David Kirk and Wen-mei Hwu, Programming Massively Parallel Processors: A Hands-On Approach, 2nd Edition, Publisher: Morgan Kaufman, 2012, ISBN: 9780124159921.

References

- Shane Cook, CUDA Programming: A Developer's Guide to Parallel Computing with GPUs, Morgan Kaufman; 2012 (ISBN: 978-0124159334)

Class:- **Final Year B. Tech**	Semester-**VII**
Course Code: CS429	Course Name: Program Elective-III -Optimization Techniques

L	T	P	Credits
03	--	--	03

Course Description:
Various problems that exist in the engineering and scientific domain (e.g., machine learning, finance, scheduling, etc.) involve minimizing (or maximizing) a cost (or reward) function. To solve such problems analytically or using traditional techniques is challenging. This course introduces students to the basics and classification of optimization problems, formulation of optimization problems. The course provides a forum in which the students obtain information about recent advances in optimization sciences and successful applications of optimization methods. It tries to minimize the gap between optimization theory and practice. It also highlights successful applications of optimization techniques in various domains.

Course Learning Outcomes:
At the end of the course the student should be able to:

1. Illustrate the concepts of optimization and its terminologies.
2. Explore optimization problems from various domains and formulate the mathematical models.
3. Explore different operators of evolutionary algorithms.
4. Analyze the performance of different swarm algorithms.
5. Evaluate the efficiency of incremental optimization algorithms for complex problem-solving.

Prerequisites: Basic knowledge of operating systems, networking, and distributed computing.

Course Content		
Unit No	**Description**	**Hrs**
1	**Introduction to Optimization** Engineering application of Optimization, Statement of Optimization problem, Optimal problem formulation, Classification of the Optimization problem. Optimum design concepts: Definition of Global and Local optima, Optimality criteria, Review of basic calculus concepts, Global optimality.	**06**
2	**Mathematical and Engineering Optimization Problems** Single Objective optimization problems, Multi-Objective optimization problems, Pareto optimal solution, Components of a mathematical model, Nonmathematical problem and its modeling, Example.	**06**
3	**Evolutionary Algorithms** Introduction to traditional optimization techniques and Evolutionary Algorithms, Genetic Algorithms, A Simple Genetic Algorithm, Operators of Genetic Algorithms, Analysis of Genetic Algorithms, Types of Genetic Algorithms, Applications.	**06**
4	**Swarm intelligence** Introduction to Swarm-based techniques, Examples, Particle swarm optimization, Algorithm and working of Particle swarm optimization, Operators, Analysis of Particle swarm optimization, Types of Particle swarm optimization, Applications.	**06**
5	**Advanced Optimization Techniques** Introduction to algorithm-specific parameter-free algorithms, Teaching-Learning based optimization, Variations of Teaching-Learning based optimization, Jaya algorithm, Variations of Jaya algorithm, Applications.	**06**
6	**Engineering and Real-world Applications** Benchmark Functions for single and multi-objective optimization problems, Engineering and real-world problems - Crop planning, Power generation planning, Water supply management, Supply chain, Problems from Machine learning, Finance, Transportation and Logistics, Scheduling, Routing, etc.	**06**

References –

Text Books

- S.S. Rao, "Optimization: Theory and Practice", Wiley Eastern Ltd.
- Richard Bronson, "Operations Research", Schaum's Outline Series..

References

- Bo Xing and Wen-Jing Gao, Innovative Computational Intelligence: A Rough Guide to 134 Clever Algorithms, Springer, Cham, 2014
- Ruhul Amin Sarker and Charles S. Newton, Optimization Modelling - A Practical Approach, 1st Edition, CRC Press, 2007.
- Kalyanmoy Deb, "Optimization for Engineering Design: Algorithms and Examples", PHI Learning.

MOOC Courses:

- https://www.coursera.org/specialization/optimization
- https://www.edx.org/course/optimization-methods

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Class:- **Final Year B. Tech**	Semester-**VII**
Course Code: CS431	Course Name: Program Elective-III -Innovation and Entrepreneurship

L	T	P	Credits
03	--	--	03

Course Description:
This course introduces students to the fundamentals of innovation and entrepreneurship. It covers entrepreneurial personality traits, business opportunities, decision-making processes, business model development, lean start-up methodologies, and organizational structures. The course also includes financial aspects of startups and institutional support for entrepreneurs.

Course Learning Outcomes:
At the end of the course the student should be able to:

1. Understand the characteristics, challenges, and behavioral aspects of entrepreneurship.
2. Identify and evaluate entrepreneurial opportunities and develop business models.
3. Apply decision-making techniques in entrepreneurial processes and negotiations.
4. Analyze financial and institutional aspects for organizing and sustaining business ventures.

Prerequisites: Basic knowledge of business and management principles.

Course Content

Unit No	Description	Hrs
1	**Introduction to Entrepreneurship** Entrepreneurial traits, Entrepreneurial personality and intentions, Entrepreneurial challenges, Case studies of successful entrepreneurs	06
2	**Entrepreneurial Opportunities** Opportunity discovery and creation, Pattern identification and recognition for venture creation, Prototype and exemplar model, Reverse engineering	06
3	**Entrepreneurial Process & Decision Making** Entrepreneurial ecosystem, Ideation, Opportunity development and exploitation, Negotiation techniques, Decision-making approaches, Effectuation and causation	06
4	**Business Models & Lean Start-ups** Business models and their importance, Value proposition creation, Customer-focused innovation, Business model canvas, Introduction to lean startups, Business pitching	06

5	**Organizing Business & Finance** Forms of business organizations, Organizational structures, Evolution of organizations, Venture finance sources, Selection of financial models, Institutional support	**06**
6	**Case Studies & Applications** Real-world examples of entrepreneurship, Startup ecosystem analysis, Role of government policies, Ethical considerations in entrepreneurship	**06**

References –

Text Books

- Eric Ries, "The Lean Startup: How Constant Innovation Creates Radically Successful Businesses", Penguin Books Limited, 2011.
- Steve Blank, "The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company", K&S Ranch, 2013.

References

- T.H. Byers, R.C. Dorf, A. Nelson, "Technology Ventures: From Idea to Enterprise", McGraw Hill, 2013.
- Upendra Kachru, "India Land of a Billion Entrepreneurs", Pearson.

MOOC Courses:

- https://www.udacity.com/course/how-to-build-a-startup--ep245
- https://www.futurelearn.com/courses/innovation-management

Class:- **Final Year B. Tech**	Semester-**VII**
Course Code: CS433	Course Name: Program Elective-III -Advanced Database System

L	T	P	Credits
3	--	--	03

Course Description:
The Advanced Database Systems course provides in-depth knowledge and hands-on experience with modern database management systems (DBMSs). The course focuses on advanced topics in database theory, system architectures, and cutting-edge techniques for managing large-scale, distributed, and complex data environments. Students will explore the principles, algorithms, and technologies behind DBMSs used in industry, including distributed databases, NoSQL databases, cloud-based data management, and big data systems. By the end of the course, students will have the skills to design, implement, and optimize advanced database systems, addressing both theoretical and practical challenges that arise in today's data-driven world.

Course Learning Outcomes:
At the end of the course, the student should be able to:

1. Introduce different database systems like distributed and parallel databases
2. Illustrate data mining & warehousing with Olap implementations
3. Explore and design the object-oriented database.
4. Acquaint with distributed query processing and its phases including query optimization
5. Demonstrate big data with Hadoop & its components

Prerequisites: Database System

Course Content		
Unit No	**Description**	**Hrs**
1	**Chapter No. 1 - Database System architectures** Centralized & C/S architectures, Server systems, Distributed systems, Distributed databases – homogeneous & heterogeneous databases, Distributed data storage, Distributed transactions, Commit protocols, Concurrency control in distributed databases, Availability, Distributed query processing, Heterogeneous distributed databases	06
2	**Chapter No. 2 - Parallel Databases** Introduction, I/O parallelism, Inter-query parallelism, Intra-query parallelism, Intra-operation parallelism, Inter-operation parallelism	06
3	**Chapter No. 3 - Data Analysis and Mining** Introduction to decision support, OLAP: Multidimensional Data Model, Multidimensional Aggregation Queries, Window Queries in SQL: 1999,Implementation Techniques for OLAP, Data Warehousing, Introduction to datamining, The knowledge Discovery Process, Counting co-occurrences, Mining for rules, Clustering, Similarity search over sequences.	06
4	**Chapter No. 4 - Object Based Databases** Overview, Complex Data Types, Structured Types and Inheritance in SQL, Table Inheritance, Array and Multisets Types in SQL, Object Identity and Reference Types in SQL, Object Oriented DBMS versus Object Relational DBMS.	06
5	**Chapter No. 5 - Query Processing and Optimization** Overview of query processing, Measure of query cost, Selection Operation, Sorting, Join Operation, Evaluation of expressions, Overview of Optimizations, Transformation of Relational Expressions, Estimating Statistics of Expression Results, Choice of Evaluations plans.	06
6	**Chapter No. 6 - BIG Data and Hadoop** Big data, Characteristics of Big data, Introduction to Hadoop, High level architecture of Hadoop, HDFS file system architecture and special features of Hadoop, Hadoop commands, MAP reduce and Elastic search concept	06

References –

Text Books

- Silberschatz, Korth, Sudarshan , Database System Concepts , 6, MGH International Edition
- Ramez Elmasri, Shamkant and B. Navathe, Fundamentals of Database Systems, 7

References

- Raghu Ramkrishnan, Johannes Gehrke,, Database Management System , 3, MGH International Edition
- G.K.Gupta , Database Management Systems, 1
- C.J. Date, Longman, Introduction to Database Systems , Pearson Education
- Peter Rob and Coronel , Database Systems, Design, Implementation and Management , Thomson

Class:- **Final Year B. Tech**	Semester-**VII**
Course Code: CS435	Course Name: Program Elective-IV- System Security planning & IT Audit

L	T	P	Credits
03	--	--	03

Course Description:
This course provides an in-depth understanding of system security planning and IT audit principles, techniques, and practices. It focuses on identifying and mitigating security risks, compliance requirements, and the implementation of effective IT governance strategies. Students will gain hands-on experience with security frameworks, auditing tools, and methodologies to assess and enhance organizational security and compliance.

Course Learning Outcomes:
At the end of the course the student should be able to:

1. Develop and implement security plans aligned with organizational policies.
2. Conduct IT audits to ensure compliance with legal, regulatory, and business requirements.
3. Analyze and mitigate security risks using industry-standard frameworks.
4. Evaluate and design security controls for IT systems and networks.
5. Utilize auditing tools and techniques for vulnerability assessment and compliance verification.
6. Integrate security and auditing practices into IT governance for continuous improvement.

Prerequisites: Computer Networks, Information Security Principles, Basic Programming Skills (e.g., Python, Shell Scripting), Awareness of Cybersecurity Threats, Risk Management Concepts

Course Content		
Unit No	**Description**	**Hrs**
1	**Introduction to System Security Planning** Importance of system security planning, Security policies, procedures, and standards, Role of security in IT governance, Components of a security plan: risk assessment, controls, and monitoring, Case studies on organizational security planning	**06**
2	**IT Audit Fundamentals** Introduction to IT audit: purpose, scope, and objectives, Types of IT audits: compliance, operational, and technical, Audit planning and risk assessment, Role of auditors in IT governance, Standards and frameworks (e.g., COBIT, ISO 27001)	**06**
3	**Risk Management and Security Controls** Risk management process: identification, assessment, and mitigation, Security controls: preventive, detective, and corrective, Tools for risk analysis and control testing, Business impact analysis and continuity planning, Emerging risks and challenges	**06**
4	**IT Audit Tools and Techniques** Tools for system auditing (e.g., Nessus, Wireshark), Techniques: sampling, evidence collection, and documentation, Vulnerability assessment and penetration testing, Automated auditing solutions, Reporting and recommendations	**08**
5	**Legal, Regulatory, and Ethical Aspects** Data protection laws and compliance requirements, Industry regulations (e.g., GDPR, HIPAA), Ethical hacking and ethical considerations in IT auditing, Cybersecurity frameworks and legal aspects, Case studies: regulatory compliance failures and lessons learned	**04**
6	**Integrated Security and Audit Frameworks** Security Information and Event Management (SIEM), Incident response planning and auditing, Integration of IT security with enterprise governance, Performance metrics for auditing and security, Future trends in system security and IT auditing	**06**

References –

Text Books

- Robert E. Davis, "IT Auditing Using a Controls Approach", 2nd Edition, CRC Press, ISBN: 978-1439812958
- Michael Whitman, Herbert Mattord, "Principles of Information Security", 6th Edition, Cengage Learning, ISBN: 978-1337102063
- Chris Jackson, "Network Security Auditing", 1st Edition, Cisco Press, ISBN: 978-1587056417
- Thomas R. Peltier, "Information Security Policies, Procedures, and Standards", 2nd Edition, Auerbach Publications, ISBN: 978-1439851650

References

- William Stallings, "Network Security Essentials: Applications and Standards", 6th Edition, Pearson Education, ISBN: 978-0134527338
- James J. F. Forest, "Cybersecurity: Public Sector Threats and Responses", 1st Edition, Routledge, ISBN: 978-0415953211

Class:- **Final Year B. Tech**	Semester-**VII**
Course Code: CS437	Course Name: Program Elective-IV- AR and VR

L	T	P	Credits
03	--	--	03

Course Description:
This course provides an introduction to the fundamental concepts of Augmented Reality (AR) and Virtual Reality (VR). It covers the principles of computer graphics, transformations, viewing pipelines, AR/VR technologies, and their applications in various domains, including the metaverse. Students will explore real-world applications and gain hands-on experience with AR/VR technologies.

Course Learning Outcomes:

At the end of the course the student should be able to:

1. Understand the basic principles of computer graphics and their applications in AR/VR.
2. Analyze different transformation techniques used in 2D and 3D visualization.
3. Evaluate various AR/VR technologies and their impact on modern computing.
4. Develop simple AR/VR applications and understand their real-world applications.

Prerequisites: Basic knowledge of C programming and computer graphics concepts.

Course Content

Unit No	Description	Hrs
1	**Basics of Computer Graphics** Introduction to computer graphics, Applications of computer graphics, Points, Lines, Circles and ellipses, Scan conversion algorithms, Inside-Outside test	06
2	**2D and 3D Transformations** 2D transformations (translation, rotation, scaling), Homogeneous coordinates, Composite transformations, Reflection, Shearing, 3D transformations	06
3	**Viewing and Clipping** Viewing pipeline, Window-to-viewport transformation, Clipping algorithms (Cohen-Sutherland, Liang-Barsky, NLN), Color models (RGB, CMY, YIQ, XYZ)	06
4	**AR/VR and Metaverse Fundamentals** Concept and components of VR, Technology and features of AR, Differences	08

	between AR and VR, Overview of Mixed Reality, Introduction to the Metaverse	
5	**Animation Techniques** Introduction to animation, Morphing animation, Rendered animation, Character animation, Facial animation, Applications in AR/VR	**06**
6	**Applications of AR/VR** Case studies on AR/VR applications, Game development, Healthcare applications, Architectural visualization, Educational applications, Future trends	**06**

References –

Text Books

- D. Hearn and P. Baker, "Computer Graphics: C Version", Pearson Education.
- Burdea, G. C., and P. Coffet, "Virtual Reality Technology", Wiley-IEEE Press, 2003/2006.
- Alan B. Craig, "Understanding Augmented Reality: Concepts and Applications", Morgan Kaufmann, 2013.

References

- Leigh P. K., and Kiran Thakrar, "Multimedia Systems and Design", PHI.
- Mitra Sramana, "Entrepreneur Journeys (Volume 1)", Booksurge Publishing.

MOOC Courses:

- https://www.udacity.com/course/introduction-to-virtual-reality--ud1012
- https://www.futurelearn.com/courses/augmented-reality

Class:- **Final Year B. Tech**	Semester-**VII**
Course Code: CS439	Course Name: Program Elective-IV- Deep Learning

L	T	P	Credits
03	--	-	03

Course Description:

This **Deep Learning** course provides a comprehensive introduction to the core principles, methods, and applications of deep learning techniques. Students will learn the fundamental concepts of neural networks and how they are employed to solve complex problems in fields such as computer vision, natural language processing, and time-series forecasting. The course covers essential topics such as the architecture and working of feedforward neural networks, convolutional neural networks (CNNs), recurrent neural networks (RNNs), and advanced models like autoencoders and generative adversarial networks (GANs). Students will also explore optimization techniques, loss functions, and regularization strategies that are vital for training efficient deep learning models.

Course Learning Outcomes:

At the end of the course the student should be able to:

1. Explain the core components of deep learning models such as feedforward neural networks, CNNs, and RNNs, and their application in different domains.
2. Apply deep learning techniques to solve real-world problems like image classification, time-series forecasting, and text generation.
3. Analyze the architecture and performance of different deep learning models, including CNNs, RNNs, and GANs, to identify suitable approaches for specific tasks.
4. Evaluate and compare different deep learning algorithms and architectures, assessing their suitability, accuracy, and efficiency in various problem domains such as computer vision and natural language processing.
5. Design and develop deep learning models using appropriate techniques (e.g., transfer learning, fine-tuning, and regularization) for solving complex real-world problems, considering model optimization and ethical implications.

Prerequisites: Machine Learning

Course Content		
Unit No	**Description**	**Hrs**
1	**Introduction to Deep Learning and Neural Networks** Introduction to deep learning and its importance, Overview of machine learning vs deep learning, Basic concepts of neural networks, Perceptrons and multi-layer perceptrons, Activation functions (ReLU, Sigmoid, Tanh), Gradient descent and backpropagation.	**06**
2	**Feedforward Neural Networks and Optimization** Architecture of deep neural networks (DNN), Feedforward networks vs recurrent networks, Loss functions: Mean Squared Error, Cross-Entropy, Optimization algorithms: Gradient Descent, Adam, SGD, Regularization techniques: L1, L2, Dropout, Overfitting and underfitting in deep learning models	**06**
3	**Convolutional Neural Networks (CNNs)** Introduction to CNNs and their architecture, Convolutional layers, pooling layers, and fully connected layers, Understanding kernel filters and feature maps, Applications of CNNs in image processing (object detection, image classification).	**06**
4	**Recurrent Neural Networks (RNNs) and LSTMs** Introduction to sequence data and RNNs, Vanilla RNN vs. Long Short-Term Memory (LSTM) networks, Understanding the vanishing gradient problem, Applications of RNNs in time series analysis, Bidirectional RNNs and GRUs (Gated Recurrent Units).	**06**
5	**Advanced Deep Learning Techniques** Autoencoders: Types (Vanilla, Denoising, Variational) and applications in data compression and anomaly detection, Generative Adversarial Networks (GANs), Architecture of GANs: Generator and Discriminator, Training and challenges of GANs, Deep reinforcement learning: Introduction and key concepts, Attention Mechanisms and Transformer models.	**06**
6	**Deep Learning for Real-World Applications** Overview of applications in computer vision, Natural Language Processing, and speech recognition, Transfer learning and fine-tuning models for specific tasks, Ethical considerations in AI and deep learning, Future directions in deep learning: AI in healthcare, autonomous systems, etc.	**06**

References –

Text Book

- Ia G. Deep learning, Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press, 2016.

References

- Aggarwal, Charu C. Neural networks and deep learning. Vol. 10. No. 978. Cham: springer, 2018.
- Shanmugamani, Rajalingappaa. Deep Learning for Computer Vision: Expert techniques to train advanced neural networks using TensorFlow and Keras. Packt Publishing Ltd, 2018.
- https://github.com/topics/deep-learning

Class:- **Final Year B. Tech**	Semester-**VII**
Course Code: CS441	Course Name: Program Elective-IV- Blockchain and smart contracts for Digital Supply Chains

L	T	P	Credits
03	--	--	03

Course Description:

This course explores the transformative potential of blockchain technology and smart contracts within digital supply chains. The course covers fundamental concepts of blockchain, including its architecture, key characteristics, and various consensus mechanisms. Students will gain hands-on experience in developing smart contracts using Ethereum, learning programming languages such as Solidity. Through real-world case studies, participants will analyze the impact of blockchain on supply chain efficiency, transparency, and traceability. The course will also address the challenges and ethical considerations associated with implementing these technologies. By the end of the course, students will be equipped to design innovative blockchain-based solutions tailored to improve supply chain operations, preparing them for future advancements in this rapidly evolving field.

Course Learning Outcomes:

At the end of the course the student should be able to:

1. Describe the fundamental concepts of blockchain technology and its significance in digital supply chains.
2. Explain the mechanisms of blockchain, including data structures, cryptographic principles, and consensus algorithms.
3. Demonstrate the ability to create simple smart contracts using programming languages such as Solidity on the Ethereum platform.
4. Analyze real-world case studies to identify how blockchain and smart contracts improve efficiency and transparency in supply chain management.
5. Evaluate the benefits and limitations of implementing blockchain technology and smart contracts in various supply chain scenarios.
6. Design innovative solutions that leverage blockchain technology to address specific challenges in digital supply chains, considering future trends and ethical implications.

Prerequisites: Cryptography Basics, Database concepts ,Data Structures

Course Content		
Unit No	**Description**	**Hrs**
1	**Introduction to Blockchain** Overview of blockchain technology, History and evolution of blockchain, Key characteristics: decentralization, transparency, immutability, Importance of blockchain in digital transactions, Applications in various industries, with a focus on supply chains, Introduction to key terms and concepts (nodes, miners, ledgers)	**06**
2	**Blockchain Fundamentals** Detailed exploration of how blockchain works, Data structures: blocks, chains, and Merkle trees, Cryptographic principles: hashing, public/private keys, Consensus mechanisms: Proof of Work, Proof of Stake, and others, Types of blockchains: public, private, and consortium, Security features and vulnerabilities in blockchain systems	**06**
3	**Smart Contracts** Definition and functionality of smart contracts, How smart contracts differ from traditional contracts, Use cases in various sectors (finance, real estate, etc.), Programming languages for smart contracts (Solidity overview), Benefits of using smart contracts in supply chains (efficiency, cost reduction), Limitations and challenges of smart contracts.	**06**
4	**Ethereum and Smart Contracts** Introduction to Ethereum as a blockchain platform, Architecture of Ethereum: nodes, EVM, and gas mechanism, Writing and deploying smart contracts on Ethereum, Tools for development: Remix IDE, Truffle Suite, Security best practices for smart contracts (audits, testing), Case studies of successful Ethereum-based applications in supply chains.	**06**
5	**Applications in Supply Chains** Overview of digital supply chain management challenges, How blockchain enhances traceability and transparency, Real-world case studies: IBM Food Trust, VeChain, and others, Integration with IoT devices for real-time tracking, Role of tokenization in supply chains (asset tracking), Future potential applications and innovations.	**06**
6	**Future Trends and Challenges** Emerging trends in blockchain technology (Layer 2 solutions, cross-chain interoperability), Regulatory landscape and compliance issues, Ethical considerations: privacy concerns and data ownership, Challenges to adoption: scalability, energy consumption, user education, Predictions for the future of blockchain in supply chains.	**06**

References –

Text Books

- Harpreet Singh Kshetri "Blockchain and Supply Chain Management",Elsevier Publisher,1st Edition (2021),ISBN: 978-0-323-89934-5

References

- Nick Vyas,"Blockchain and the Supply Chain: Concepts, Strategies and Practical Applications", Kogan Page publication, ISBN: 9781398605213
- Mathiyazhagan, Taghipour, Agarwal Blockchain Technology in Supply Chain Management for Society 5.0, Routledge Publication, ISBN: 9781032011653

Class:- **Final Year B. Tech**	Semester-**VII**
Course Code: CS443	Course Name: Programme Elective IV - Data Analytics

L	T	P	Credits
03	--	--	03

Course Description:
This course introduces the fundamentals of data analytics, covering descriptive statistics, data preprocessing, clustering, frequent pattern mining, regression, and classification. Students will learn to analyze and visualize data, address data quality issues, and apply statistical and machine learning techniques to uncover insights and make predictions. Through practical examples and methodologies like CRISP-DM, the course provides a strong foundation for understanding and working with data.

Course Learning Outcomes:

At the end of the course the student should be able to:

1. Define Big Data, data analytics, and methodologies like CRISP-DM and KDD.
2. Describe data patterns using univariate and bivariate techniques.
3. Illustrate multivariate data using visualization and statistical tools.
4. Identify data quality issues and apply preprocessing techniques.
5. Apply clustering methods and analyze frequent patterns in data.
6. Demonstrate regression and classification techniques for predictions.

Prerequisites: Basic knowledge of statistics, programming, and linear algebra.

Course Content

Unit No	Description	Hrs
1	**Introduction**: What Can We Do With Data? Big Data and Data Science Big Data Architectures, Small Data, What is Data?, A Short Taxonomy of Data Analytics, Examples of Data Use, A Project on Data Analytics, A Little History on Methodologies for Data Analytics, The KDD Process, The CRISPDM Methodology	06
2	**Descriptive Statistics:** Scale Types, Descriptive Univariate Analysis, Descriptive Bivariate Analysis	06
3	**Descriptive Multivariate Analysis:** Multivariate Frequencies, Multivariate Data Visualization, Multivariate Statistics, Infographics and Word Clouds	06

4	**Data Quality and Preprocessing:** Data Quality, Converting to a Different Scale Type, Converting to a Different Scale, Data Transformation, Dimensionality Reduction	**06**
5	**Clustering:** Distance Measures, Clustering Validation, Clustering Techniques **Frequent Pattern Mining:** Frequent Itemsets, Association Rules, Behind Support and Confidence, Other Types of Pattern	**06**
6	**Regression-** Predictive Performance Estimation, Finding the Parameters of the Model, Technique and Model Selection **Classification-** Binary Classification, Predictive Performance Measures for Classification, Distancebased Learning Algorithms, Probabilistic Classification Algorithms	**06**

References –

Text Books

- Moreira, J., Carvalho, A.C.P. de L.F. and Horváth, T. (2019) *A general introduction to data analytics*. Hoboken, NJ: John Wiley & Sons, Inc.

References

- Emc Education Services. *Data Science & Big Data Analytics Discovering, Analyzing, Visualizing and Presenting Data*. Indianapolis, In, Usa John Wiley & Sons, Inc, 2015.

Class:- **Final Year B. Tech**	Semester-**VII**
Course Code: CS445	Course Name: Mobile Application Development II

L	T	P	Credits
02	--	02	03

Course Description:
This course provides an in-depth introduction to iOS app development using Swift, Interface Builder, and Firebase. It is designed for students who wish to learn the fundamentals of building user-friendly mobile applications for iPhones and iPads, while exploring modern development practices and tools such as SwiftUI, UIKit, and Firebase services. Throughout the course, students will gain hands-on experience by implementing basic and custom user interfaces, connecting UI elements to code, and developing interactive mobile applications. They will learn to create dynamic user interfaces using both Storyboard and SwiftUI, leveraging the power of Auto Layout, stack views, and data-binding techniques. The course also covers Firebase integration, including real-time data storage and retrieval using Firebase Realtime Database and Firestore, alongside best practices for secure app development.

Course Learning Outcomes:
At the end of the course the student should be able to:

1. Implement a Basic User Interface Using Interface Builder.
2. Create UI elements like buttons, text fields, and lists using SwiftUI components
3. Analyze user input and application behavior to identify common UI/UX issues and implement solutions.
4. Develop a custom user interface component or module using SwiftUI or UIKit to meet specific user needs.
5. Publish an app to the App Store or distribute it via TestFlight, including all necessary metadata, screenshots, and descriptions.

Prerequisites: Familiarity with Object-Oriented Programming (OOP), Basic understanding of mobile development concepts.

Course Content		
Unit No	**Description**	**Hrs**
1	**Introduction to iOS Development & Xcode Environment** Overview of iOS architecture and frameworks, Installing and setting up Xcode, Introduction to Storyboard and Interface Builder, Overview of Model-View-Controller (MVC) design pattern, Swift basics: Variables, data types, functions, control flow.	**04**
2	**Designing User Interfaces with Storyboards** View Controllers and the View hierarchy, Adding UI components: Labels, Buttons, TextFields, Images. Using Auto Layout and constraints for responsive design, Outlets and Actions: Connecting UI to Swift code, Stack Views for dynamic layouts. Implementing Segues for screen transitions, Navigation Controllers and Tab Bar Controllers, Passing data between View Controllers, Modals and custom transitions, Handling Lifecycle Methods of View Controllers.	**08**
3	**Introduction to UIKit and SwiftUI** Introduction to Interface Builder (Storyboard and XIB), Building views using UIKit (UILabel, UIButton, UITextField, UIImageView), Introduction to SwiftUI for declarative UI design, Layout techniques with StackViews, ScrollViews, and Auto Layout.	**04**
4	**Handling User Interaction** Connecting UI elements to code using IBOutlets and IBActions, Managing touch events and gestures, Custom UI Components, Building custom UI components like custom buttons and views.	**04**
5	**Firebase Realtime Database and Firestore Integration** Introduction to Firebase Realtime Database and Firestore. Storing, retrieving, updating, and deleting data with Firestore and Realtime Database. Firebase security rules for secure data storage. Structuring data in Firebase: Collections, Documents, and Nodes.	**02**
6	**Final Project and App Deployment** Building and debugging a complete iOS app from start to finish. Testing the app (unit tests, UI tests, debugging). Preparing the app for submission to the App Store. App Store guidelines, certificates, provisioning profiles, and App Store connect.	**02**

References –

Text Book

- "iOS Programming: The Big Nerd Ranch Guide" (7th Edition) by Christian Keur and Aaron Hillegass

References

- **Apple Developer Documentation**
  Official documentation from Apple, which includes detailed information about iOS frameworks, APIs, and best practices for building iOS applications.
  Link: https://developer.apple.com/documentation/

- **"Firebase iOS SDK Documentation":** Official documentation for Firebase's iOS SDK, including detailed guides on integrating Firebase services like Firestore, Realtime Database, Authentication, and more into iOS apps.

Class:- **Final Year B. Tech**	Semester-**VII**
Course Code: CS447	Course Name: DevOps Lab

L	T	P	Credits
--	--	02	01

Course Description:

This course provides an in-depth exploration of DevOps, a culture and set of practices designed to bridge the gap between software development and IT operations. The focus is on automating processes, enhancing collaboration, and improving the delivery pipeline for faster, more reliable software deployment.

Through practical, hands-on learning, students will explore the key principles of DevOps including continuous integration (CI), continuous delivery (CD), infrastructure as code (IaC), monitoring, and containerization. The course covers the tools, techniques, and workflows commonly used in modern DevOps environments, such as Docker, Jenkins, Kubernetes, Git, Ansible, and Terraform.

Course Learning Outcomes:

1. Identify the Key Benefits of DevOps and Its Connection to Cloud Platforms and Version Control Systems.
2. Demonstrate Proficiency in Version Control Using Git, GitHub, GitLab, and Bitbucket for Collaborative Development.
3. Apply CI/CD Principles to Web Development Projects Using Jenkins, Git, and Local HTTP Servers for Automation.
4. Explore Containerization Concepts and Deploy Applications Using Docker, Integrating CI/CD Practices.
5. Execute the Maven Build Lifecycle and Manage Container Orchestration Using Kubernetes for Scalable Application Deployment.

Prerequisites: Expertise with Programming Languages.

It should consist of minimum 10 experiments based on the syllabus and experiment list mentioned below.

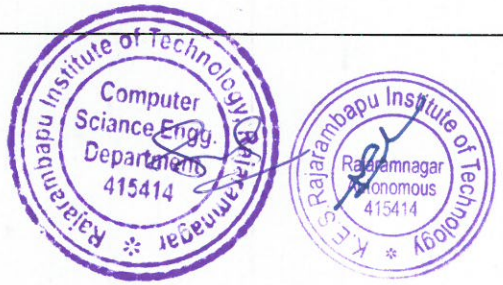
Course Content		
Experiment no.	**Description**	**Hrs**
1.	Introduction to DevOps: Understanding the DevOps culture, principles, and its benefits for development teams and organizations.	**04**
2.	Version Control with Git and GitHub	**02**
3.	Implement GitHub Operations	**02**
4.	Implement GitLab Operations	**02**
5.	Implement BitBucket Operations	**02**
6.	Applying CI/CD Principles to Web Development Using Jenkins, Git, and Local HTTP Server	**02**
7.	Exploring Containerization and Application Deployment with Docker	**02**
8.	Applying CI/CD Principles to Web Development Using Jenkins, Git, using Docker Containers	**02**
9.	Demonstrate Maven Build Life Cycle	**02**
10.	Demonstrate Container Orchestration using Kubernetes.	**02**

Text Books:

- B. Thangaraju, "Real-World DevOps Practices" Wiley.
- Gene Kim , Jez Humble , Patrick Debois, John Willis "The Devops Handbook: How to Create World-Class Agility, Reliability, & Security in Technology Organizations" It Revolution Press; 2nd ed. edition

Reference Books:

- Soumiyajit Das Chowdhury, "Mastering DevOps in Kubernetes Paperback" BPB Publications
- Sumit Kapoor, "AWS Devops Engineer Professional Certification Guide: Hands-On Guide to Understand, Analyze, and Solve 150 Scenario-Based Questions" BPB Publications.



Class:- **Final Year B. Tech**	Semester-**VII**
Course Code: CS449	Course Name: Program Elective Lab-I System Security Planning & IT Audit Lab

L	T	P	Credits
--	--	02	01

Course Description:
The System Security Planning & IT Audit course provides practical and theoretical knowledge to secure IT infrastructure and perform systematic audits. Students will develop skills in risk assessment, vulnerability scanning, network analysis, access control, encryption, and compliance auditing. Using tools like Nessus, Wireshark, and Splunk, they will gain hands-on experience in crafting security policies, managing incidents, and aligning with global standards. This course prepares learners to address cybersecurity challenges and enhance organizational resilience.

Course Learning Outcomes:

1. Develop and implement foundational security policies, procedures, and plans to address organizational security requirements.
2. Perform risk assessments and vulnerability analyses using standard frameworks and tools to identify and mitigate security threats.
3. Analyze network traffic to detect anomalies and understand penetration testing methodologies to evaluate system vulnerabilities.
4. Implement security mechanisms such as role-based access control (RBAC) and data encryption to enhance data protection.
5. Conduct IT compliance audits and develop actionable reports based on regulatory frameworks like ISO 27001.
6. Utilize advanced tools such as SIEM platforms to monitor and analyze system logs for proactive incident response and continuous security improvement.

Prerequisites: Networking, Cybersecurity Tools

It should consist of minimum 10 experiments based on the syllabus and experiment list mentioned below.

Course Content		
Exp No	**Description**	**Hrs**
1.	Developing a Security Policy	**02**
2.	Performing a Risk Assessment	**02**
3.	Conducting a Vulnerability Scan	**02**
4.	Network Traffic Analysis	**02**
5.	Penetration Testing Basics	**02**
6.	Implementing Access Control Mechanisms	**02**
7.	Compliance Audit Simulation	**02**
8.	Incident Response Plan Development	**02**
9.	Data Encryption and Decryption	**02**
10.	Security Information and Event Management (SIEM)	**02**

References -

Text Books

- Robert E. Davis, "IT Auditing Using a Controls Approach", 2nd Edition, CRC Press, ISBN: 978-1439812958
- Michael Whitman, Herbert Mattord, "Principles of Information Security", 6th Edition, Cengage Learning, ISBN: 978-1337102063
- Chris Jackson, "Network Security Auditing", 1st Edition, Cisco Press, ISBN: 978-1587056417
- Thomas R. Peltier, "Information Security Policies, Procedures, and Standards", 2nd Edition, Auerbach Publications, ISBN: 978-1439851650

References

- William Stallings, "Network Security Essentials: Applications and Standards", 6th Edition, Pearson Education, ISBN: 978-0134527338
- James J. F. Forest, "Cybersecurity: Public Sector Threats and Responses", 1st Edition, Routledge, ISBN: 978-0415953211

Class:- **Final Year B. Tech**	Semester-**VII**
Course Code: CS451	Course Name: Program Elective Lab-I AR and VR lab

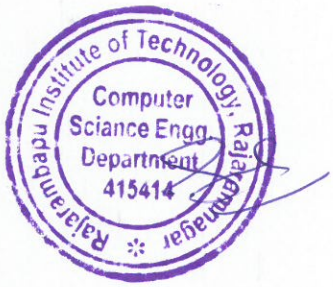
L	T	P	Credits
--	--	02	01

Course Description:
The AR and VR lab aims to provide hands-on experience with various concepts and techniques used in augmented and virtual reality applications. Students will implement basic computer graphics algorithms, apply 2D and 3D transformations, and develop AR/VR applications using relevant tools and technologies. The lab will focus on practical exposure to rendering techniques, animation, and real-world AR and VR case studies.

Course Learning Outcomes:

1. Implement basic graphics commands and algorithms in C for rendering primitives.
2. Develop transformation techniques for 2D and 3D graphics and apply them to graphical objects.
3. Execute line clipping and polygon filling algorithms for different graphical applications.
4. Create basic animations and interactive AR/VR applications using programming techniques.
5. Demonstrate the implementation of AR/VR principles through case studies and projects.

Prerequisites: Expertise with Programming Languages.



It should consist of minimum 10 experiments based on the syllabus and experiment list mentioned below.

Course Content		
Experiment no.	**Description**	**Hrs**
1.	Develop the DDA Line drawing algorithm using C language.	**04**
2.	Develop the Bresenham's Line drawing algorithm using C language	**02**
3.	Develop the mid-point Circle drawing algorithm using C language	**02**
4.	Develop the 8-connected and 4-connected boundary fill algorithm using C language	**02**
5.	Perform the following 2D Transformation operation - Translation, Rotation and Scaling	**02**
6.	Perform the Cohen-Sutherland Line Clipping Algorithm. 9 Perform the Liang-Barsky Line Clipping Algorithm	**02**
7.	Perform the simple Animation of Moving car and bouncing ball.	**02**
8.	Perform the following Animation methods. a. Morphing Animation b. Rendered Animation	**02**
9.	Perform the following Animation methods. a. Character Animation b. Facial Animation	**02**
10.	Case study on developing architecture of a house using Virtual Reality.	**02**

References -

Text Books:

- Computer Graphics, D.Hearn And P.Baker - Pearson Eduction - C Version, Latest edition
- Multimedia Systems and Design, And leigh , P. K and Kiran Thakrar. PHI

Reference Books:

- Principles of Three dimensional Computer Animations by Michael O'Rourke, W W Norton & Company.
- Burdea, G. C. and P. Coffet. Virtual Reality Technology, Second Edition. Wiley-IEEE Press, 2003/2006. Publications.

Class:- **Final Year B. Tech**	Semester-**VII**
Course Code: CS453	Course Name: Program Elective Lab-I Deep Learning Lab

L	T	P	Credits
	--	02	01

Course Description:

This course provides a comprehensive introduction to deep learning, focusing on the development, implementation, and deployment of neural networks for solving real-world problems. Students will learn how to build and train various deep learning models, including Perceptrons, Multi-Layer Perceptrons (MLP), Convolutional Neural Networks (CNN), and Recurrent Neural Networks (RNN) for tasks such as classification, regression, and sequence prediction. The course also covers advanced topics such as regularization techniques, transfer learning, autoencoders, and Generative Adversarial Networks (GANs). In addition to theoretical knowledge, students will gain hands-on experience by implementing and experimenting with deep learning models on real datasets.

Course Learning Outcomes:

1. Apply basic and advanced neural network models such as Perceptrons, Multi-Layer Perceptrons (MLP), Convolutional Neural Networks (CNN), and Recurrent Neural Networks (RNN for various classification, regression, and sequence prediction tasks.
2. Analyze the performance of deep learning models, including the identification of overfitting or underfitting through evaluation metrics such as accuracy and loss.
3. Assess the performance of advanced deep learning models (autoencoders, GANs) through metrics such as reconstruction error and generated image quality.
4. Design and deploy a deep learning model for a custom application, such as a sentiment analysis or image classification tasks.

Prerequisites: Machine Learning, Python

It should consist of minimum 10 experiments based on the syllabus and experiment list mentioned below.

Course Content		
Exp No	**Description**	**Hrs**
1.	Implement a simple perceptron model.	**02**
2.	Train a multi-layer perceptron (MLP) on a toy dataset (e.g., XOR problem).	**02**
3.	Implement and visualize gradient descent and backpropagation for training a neural network.	**02**
4.	Build a feedforward neural network (FNN) and train it on a classification dataset (e.g., MNIST).	**02**
5.	Experiment with different optimization algorithms (Gradient Descent, Adam, SGD) and compare their performance.	**02**
6.	Apply regularization techniques (L1, L2, Dropout) to improve model generalization.	**02**
7.	Build a simple CNN for image classification using the CIFAR-10 dataset.	**02**
8.	Implement a vanilla RNN for a simple sequence prediction task (e.g., stock price prediction).	**02**
9.	Implement a basic autoencoder for image denoising and anomaly detection.	**02**
10.	Build a Generative Adversarial Network (GAN) and train it on a dataset (e.g., MNIST).	**02**
11.	Implement transfer learning for a custom task in computer vision or NLP.	**02**
12.	Mini Project : Code implementation and documentation. Final report with results and analysis. Working model API or web interface.	Through out Semester

References -

Text Books:

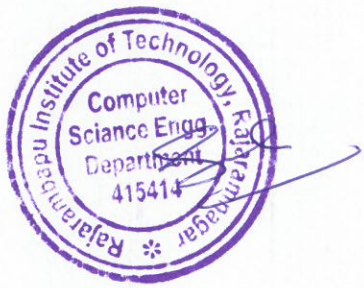
- Géron, Aurélien. *Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow*. " O'Reilly Media, Inc.", 2022.

Reference Books:

- Chollet, Francois, and François Chollet. Deep learning with Python. simon and schuster, 2021.

Web Links for Practical Deep Learning

- https://course.fast.ai/Lessons/lesson1.html
- https://machinelearningmastery.com/tutorial-first-neural-network-python-keras/



Class:- **Final Year B. Tech**	Semester-**VII**
Course Code: CS455	Course Name: Simulation and digital twin Lab

L	T	P	Credits
	--	2	1

Course Description:
This hands-on course provides an in-depth exploration of simulation techniques and the innovative concept of digital twins, focusing on their applications across various industries. Students will engage in a series of experiments that cover the fundamental principles of digital twin technology, from creating basic models to integrating real-time data for performance analysis. Through practical exercises, participants will learn to apply simulation software, analyze system behaviors, and develop predictive maintenance strategies based on insights gained from digital twins. By the end of the course, students will have a solid understanding of how digital twins can enhance decision-making and optimize operations in fields such as manufacturing, healthcare, urban planning, and energy management. This course is designed for those interested in harnessing the power of digital transformation and simulation technologies to drive innovation and efficiency.

Course Learning Outcomes:
1. Understand the Fundamentals of Digital Twins
2. Apply Simulation Techniques to Create Digital Twin Models
3. Analyze System Performance Using Data from Digital Twins
4. Create Predictive Maintenance Strategies Based on Digital Twin Insights

Prerequisites: F with a programming language such as Python or C++

It should consist of minimum 08 experiments based on the syllabus and experiment list mentioned below.

Course Content		
Experiment no.	**Description**	**Hrs**
1.	To Understand the fundamental concepts of digital twins.	**04**
2.	Develop a basic digital twin model using simulation software.	**04**
3.	To Learn how to integrate sensor data into a digital twin.	**02**
4.	To Analyze the performance of a digital twin under various conditions.	**02**
5.	To Explore predictive maintenance using digital twins.	**02**
6.	To Test different design scenarios virtually.	**02**
7.	Simulate the effects of temperature or humidity changes on the performance of a digital twin representing an electronic device.	**04**
8.	Create visual dashboards that display real-time data from the digital twin, highlighting key performance indicators.	**04**

Text Books:

- Simulation Techniques of Digital Twin in Real-Time Applications, R. K. Ganguli, Wiley
- Digital Twin: A Dynamic System and Computing Perspective, R. K. Ganguli, Routledge

Reference Books:

- The Digital Twin at the Center of R&D, Mevea
- 5 Steps to Get Started with Digital Twins E-book, NVIDIA, NVIDIA

Class:- **Final Year B. Tech**	Semester-**VII**
Course Code: CS457	Course Name: Programme Elective Lab-I - Data Analytics lab

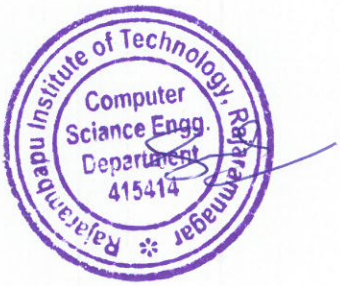
L	T	P	Credits
--	--	02	01

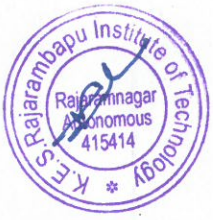
Course Description:
The Data Analytics Lab provides hands-on experience with essential data analysis techniques using real-world datasets. This course equips students with practical skills to perform data exploration, transformation, and visualization using tools like Python, R, and Orange Data Mining. The lab focuses on techniques such as descriptive statistics, clustering, regression, and classification analysis, giving students the opportunity to apply machine learning algorithms and assess model performance. Additionally, students will work on text mining techniques, including generating word clouds and creating informative infographics. By the end of this lab, students will gain a comprehensive understanding of how to manipulate and analyze data to derive meaningful insights across a range of domains.

Course Learning Outcomes:
At the end of the course the student should be able to:

1. Define and describe key concepts in data analytics, including methodologies and statistical techniques.
2. Apply preprocessing and data transformation methods to enhance data quality.
3. Analyze and visualize data using clustering, frequent pattern mining, and multivariate analysis.
4. Build predictive models using regression and classification techniques and evaluate their performance..

Prerequisites: Basic knowledge of statistics, programming, and linear algebra.





Course Content		
Exp No	**Description**	**Hrs**
11.	**Exploring and Describing Datasets** Load a dataset and perform univariate and bivariate descriptive statistics.	**02**
12.	**Data Visualization** Create data visualizations like histograms, scatter plots, and boxplots for multivariate analysis.	**02**
13.	**Data Quality Assessment** Identify and handle missing, inconsistent, or outlier data in a dataset.	**02**
14.	**Data Transformation** Perform scaling, normalization, and dimensionality reduction (e.g., PCA) on a dataset.	**02**
15.	**Clustering Analysis** Apply K-means clustering and visualize the clusters in 2D space	**02**
16.	**Frequent Pattern Mining** Discover frequent itemsets and association rules using the Apriori algorithm. Tool: Orange Data Mining, Python (MLxtend)	**02**
17.	**Regression Analysis** Implement linear regression to predict target values and evaluate model performance.	**02**
18.	**Classification Analysis** Perform binary classification using logistic regression and calculate performance metrics.	**02**
19.	**Distance-Based Learning** Implement a K-nearest neighbors (KNN) algorithm for classification.	**02**
20.	**Word Cloud and Infographics** Generate word clouds and create infographics for a textual dataset.	**02**

References –

Text Books

- Moreira, J., Carvalho, A.C.P. de L.F. and Horváth, T. (2019) *A general introduction to data analytics*. Hoboken, NJ: John Wiley & Sons, Inc.

References

- Emc Education Services. *Data Science & Big Data Analytics Discovering, Analyzing, Visualizing and Presenting Data*. Indianapolis, In, Usa John Wiley & Sons, Inc, 2015.

Class:- **Final Year B. Tech**	Semester-VII
Course Code: CS4354	Course Name: Capstone Project Phase-II

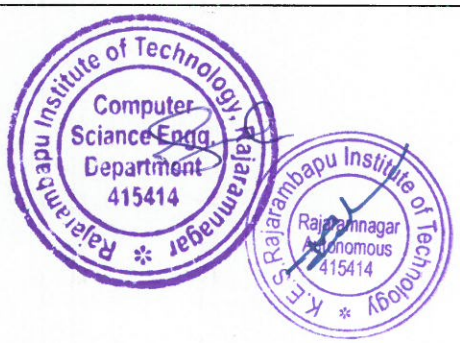
L	T	P	Credits
--	--	6	3

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

1. Apply Computer Engineering knowledge and principle to develop innovative products and services.
2. Identify engineering problems and propose Computer Engineering -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.



Model I: Industry Internship (II)

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

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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.

K.E. Society's
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(An Autonomous Institute, affiliated to Shivaji University, Kolhapur)
Final Year B. Tech. Syllabus
To be implemented for 2022-26 Batch
Department of Computer Science and Engineering

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** Methods of scientific management- Critical Path Method (CPM), Programme Evaluation & Review Techniques (PERT), Network Crashing, Bar Chart, Mile-Stone chart, Gant Chart	04
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.

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Computer Sciance Engg. Department
415414

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Class:- **Final Year B. Tech**	Semester-**VIII**	**L**	**T**	**P**	**Credits**
Course Code : IP4024	Course Name : Industry Internship & Project	-	-	--	**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. Analyse the information using the statistical tools/ techniques.

3. Analyse the information using the statistical tools/ techniques.
4. develop the feasible solution for given problem.
5. Analyse 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.

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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.

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Computer Sciance Engg. Department
415414

K.E.S. Rajarambapu Institute of Technology
Rajaramnagar Autonomous
415414

Model II: Research Internship (RI)

Course Code : OE4382	Course Name : Finance for Engineers (Online Course)	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.

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** Methods of scientific management- Critical Path Method (CPM), Programme Evaluation & Review Techniques (PERT), Network Crashing, Bar Chart, Mile-Stone chart, Gant Chart	04
4	**Methods of Economic Analysis** Economic equivalence, Methods of comparison of alternatives- Present Worth Method, Rate of Return method, Benefit-Cost ratio method	04

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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
1.	Review-I (ISE-1)	During10thweek
2.	Review-II (ISE-2)	During15thweek
3.	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.

Model III: Entrepreneurial Internship (EI)

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(An Autonomous Institute, affiliated to Shivaji University, Kolhapur)
Final Year B. Tech. Syllabus
To be implemented for 2022-26 Batch
Department of Computer Science and Engineering

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

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

L	T	P	Credits
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 –** Definition, nature, objectives, functions and scope of financial management, Preparation of financial plan – its objectives, essential features, consideration in formulating financial plan	04
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, 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 the formulation of business plan, starting & managing new business.

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

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.

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Final Year B. Tech. Syllabus
To be implemented for 2022-26 Batch
Department of Computer Science and Engineering

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

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B. Tech in Computer Science & Engineering - Honors with Research and Multidisciplinary Minor

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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**	

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)	

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.

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.

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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

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