MOOGAMBIGAI CHARITABLE AND EDUCATIONAL TRUST

Rajarajeswari College of Engineering

(An Autonomous Institution under Visvesvaraya Technological University, Belagavi)
#14, Ramohalli Cross, Kumbalagodu, Mysore Road, Bengaluru–560074

Master of Computer Applications

III & IV Semester Scheme and Syllabus

(2024 Scheme)

VISION

To empower young minds through technology, research and innovation, to produce technically competent and socially responsible professionals in higher education.

MISSION

1. To deliver excellence in education through innovative teaching, impactful research, and continuous skill development, preparing students to meet global challenges with technical expertise and ethical responsibility.
2. To foster a transformative learning environment that integrates technology, research and practical experience, empowering students to become skilled professionals and socially conscious leaders.
3. To cultivate a culture of lifelong learning and professional excellence by encouraging creativity, research, and community engagement, equipping students with the skills to thrive in a dynamic world.
4. To provide a holistic educational experience that combines advanced technology, hands-on research, and community-focused learning, shaping students into competent, ethical professionals who contribute positively to society.

QUALITY POLICY

Rajarajeswari College of Engineering is committed to imparting quality technical education that nurtures competent, ethical professionals with global relevance. We ensure academic excellence through a dynamic, outcome-based curriculum, experienced faculty, and cutting-edge infrastructure. Continuous improvement is driven by innovation, research and strong industry collaboration. We foster holistic development and a progressive environment that supports lifelong learning, teamwork, and professional growth.

CORE VALUES

Academic Excellence, Integrity, Innovation, Global Competence, Continuous Improvement.

Master of Computer Applications

DEPARTMENT VISION

To be a department of excellence in technical education, widely known for the development of application developers, IT professionals, entrepreneurs, researches creates benefit all of humanity.

DEPARTMENT MISSION

1. To ensure diverse knowledge integration with industry for creative learning and application.
2. To nuture talent in usage of application of Digital Intelligence and use of Power of technology.
3. To create entrepreneurs thro incubating technology businesses and committee to create and sustaining to be societal relevant education
4. To ensure the student connect at personal level and focus on to holistic development with Intellectual, Emotional, Spiritual and Behavioral traits.

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MOOGAMBIGAI CHARITABLE AND EDUCATIONAL TRUST

Rajarajeswari College of Engineering

(An Autonomous Institution under Visvesvaraya Technological University, Belagavi)

Master of Computer Applications

Scheme of Teaching and Examinations – 2024

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the Academic Year 2025-26)

III Semester

S. No	Course Category and Course Code		Course Title	TD / PSB	Teaching Hours / Week			Examination				
					Lecture	Practical / Seminar	Tutorial / SDA	Duration in Hours	CIE Marks	SEE Marks	Total Marks	Credits
					L	P	T/S					
1	PEC	**P24MCAX31Y**	Specializations	MCA	**3**	**0**	**0**	**3**	**50**	**50**	**100**	**3**
2	PEC	**P24MCAX31Y**	Specializations	MCA	**3**	**0**	**0**	**3**	**50**	**50**	**100**	**3**
3	PEC	**P24MCAX31Y**	Specializations	MCA	**3**	**0**	**0**	**3**	**50**	**50**	**100**	**3**
4	PROJ	**P24MCAP304**	Project Work	MCA	**25-30 Hours per week**			**3**	**50**	**50**	**100**	**15**
5	AEC	**P24MCA305**	Research Methodology & IPR	MCA	**NPTEL Certification**							**PP**
								TOTAL	**200**	**200**	**400**	**24**

Project work is a significant component aimed at fostering research, practical application of knowledge, and innovation.

Evaluation Process:

- Internal Evaluation: Faculty members from the department review the project report and presentation for content quality, innovation, and depth of research.
- External Evaluation: An external examiner, often an industry expert or academician from another institution, reviews the project.
- Viva Voce Examination: The student defends their project work before a panel comprising internal and external examiners. This assesses their understanding, analytical ability, a application of the project work.

P24MCA305- Research Methodology and IPR- Non- Credit Mandatory Course (NCMC) if students have not studied this course in their undergraduate program then he /she has to take thi course and complete the certification before the minimum duration of the program (Two years), however, this course will not be considered for vertical progression. This course will b evaluated in III semester.

X-D/A/N/I/S/W Y: 1,2,3,4,5,6

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The students can opt for any three courses from any one specialization:

Data Science and Analytics		**AI and ML**	
Course Code	**Course Name**	**Course code**	**Course Name**
P24MCAD311	Data Mining and Visualization	**P24MCAA311**	Introduction to Generative AI
P24MCAD312	Big Data Analytics	**P24MCAA312**	Artificial Neural Networks
P24MCAD313	Business Data Analytics	**P24MCAA313**	Natural Language Processing
P24MCAD314	Enterprise Resource Planning	**P24MCAA314**	Deep Learning Fundamentals
P24MCAD315	Exploratory Data Analysis	**P24MCAA315**	Introduction to Machine Learning
P24MCAD316	Social Media Analytics	**P24MCAA316**	Computer Vision
Network and System Administration		**IOT**	
Course Code	**Course Name**	**Course Code**	**Course Name**
P24MCAN311	Computer Networks	**P24MCAI311**	Data Management for IoT
P24MCAN312	Network and Linux Administration	**P24MCAI312**	Networked Embedded Applications
P24MCAN313	TCP/IP	**P24MCAI313**	Cross Platform Application Development
P24MCAN314	Unix Shell Programming	**P24MCAI314**	IoT Technology and Applications
P24MCAN315	Cloud Essentials	**P24MCAI315**	Communication and Networking Technologies in IoT
P24MCAN316	Introduction to ERP and SAP Basis Administration	**P24MCAI316**	Software and Programming in IoT
Security			**Web Application Development**
Course Code	**Course Name**	**Course Code**	**Course Name**
P24MCAS311	Ethical Hacking	**P24MCAW311**	WEB Development using Full Stack Open
P24MCAS312	Cyber Security	**P24MCAW312**	Rich Internet Application Development
P24MCAS313	Cryptography and Network Security	**P24MCAW313**	Web Development using PHP and MySQL
P24MCAS314	Blockchain Technologies	**P24MCAW314**	Enterprise Application programming
P24MCAS315	Database & Web Application Security	**P24MCAW315**	Advances in Web Technologies
P24MCAS316	Mobile and Wireless Security	**P24MCAW316**	Web Programming using Java

Dean-Academics **Principal**

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Master of Computer Applications

Scheme of Teaching and Examinations – 2024

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the Academic Year 2025-26)

IV Semester

S. No	Course Category and Course Code		Course Title	TD / PSB	Teaching Hours / Week			Examination				
					Lecture	Practical / Seminar	Tutorial / SDA	Duration in Hours	CIE Marks	SEE Marks	Total Marks	Credits
					L	P	T/S					
1	PEC/MDC	**P24MCA401**	Online course (NPTEL)	MCA	**3**	**0**	**0**		**100**	**-**	**100**	**3**
2	TS	**P24MCAS402**	Technical Seminar	MCA	**0**	**4**	**0**	**3**	**100**	**-**	**100**	**2**
3	INT	**P24MCAI403**	Research Internship / Industry Internship / Startup Internship	MCA	**13 weeks**			**3**	**50**	**50**	**100**	**1**
								TOTAL	**250**	**50**	**300**	**1**

TS: Technical Seminar: Students can present the seminar based on the new technologies in the seminar by all postgraduate students of the program shall mandatory. The CIE marks awarded for the Seminar shall be based on the evaluation of the Report, Presentation skill, and performance in the Question a Answer session.

Industry/ Research Internship leading to the project work /startup.

Industry Internship: The main objective of the industry internship is to ensure that the intern is exposed to a real-world environment and gain practic experience. Often, it may be a practical exposure to the theory that has been learned during the academic period. The industry internship helps studer understand of analytical concepts and tools, hone their skills in real-life situations, and build confidence in applying the skills learned.

Research Internship: A research internship is an opportunity for students or early career professionals to gain hands-on experience in conducting resear under the guidance of a mentor or within a research team. These internships can take place in academic institutions, research organizations, governme agencies, or private companies.

Dean-Academics **Principal**

3rd Semester Syllabus
Data Science and Analytics

SEMESTER-III					
DATA MINING AND VISUALIZATION **Category: PEC**					
Course Code	:	P24MCAD311	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	Understand foundational concepts of data mining, including data preprocessing, pattern discovery, and classification techniques.
2.	Apply data mining algorithms to extract useful patterns, trends, and insights from large datasets..
3.	Analyze and interpret mined data using appropriate visualization techniques and tools.
4.	Develop skills to evaluate the performance of various data mining models and choose suitable techniques based on problem context.
5.	Use data visualization tools and libraries to present complex data and mining results in an intuitive and meaningful way.

Module – 1	**No. of Hours**
Foundations of Data Mining and Data Preprocessing Introduction to Data Mining & Preprocessing Techniques: Introduction to data mining: Motivation, architecture, KDD process. Types of data: Structured, semi-structured, unstructured. Data preprocessing: Cleaning, integration, reduction, transformation, Missing Values and Noisy Data. Data summarization and visualization techniques for preprocessing analysis. Implementation using Python: Pandas, NumPy for basic preprocessing.	9
Module – 2	**No. of Hours**
Data Mining Techniques and Algorithms Mining Techniques: Classification, Clustering & Association: Classification: Decision Trees, k-NN, Naive Bayes – concepts and implementation. Clustering: k-Means, Hierarchical clustering. Association rule mining: Market basket analysis, Apriori algorithm, FP-Growth. Evaluation methods: Confusion matrix, precision, recall, ROC.	9
Module – 3	**No. of Hours**
Data Visualization Techniques Static and Interactive Data Visualization with Python: Principles of effective data visualization. Visualization tools and libraries: Matplotlib, Seaborn, Plotly, Bokeh. Histograms, bar charts, scatter plots, heatmaps, and pair plots. Dashboard creation using Jupyter notebooks and interactive widgets. Case studies and real-world examples using multi dimensional data.	9
Module – 4	**No. of Hours**
Visualizing Streaming and Real-Time Data Real-Time Analytics and Streaming Data Visualization Overview of streaming data: Sources, characteristics, and tools. Real-time processing with Apache Kafka, PySpark Streaming (introductory overview). Visualization strategies for streaming data. Tools: Dash by Plotly, Streamlit, Grafana. Case studies: Sensor data, web server logs.	9
Module – 5	**No. of Hours**
Advanced Data Mining Applications and Trends Emerging Trends and Applications in Data Mining social media and text data. Sentiment analysis and NLP basics using Python. Time series analysis and visualization. Anomaly detection and predictive analytics. Ethical issues and future trends in data mining.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand foundational concepts of data mining and apply preprocessing techniques using Python.
CO2	Implement key data mining techniques such as classification, clustering, and association rule mining.
CO3	Design and develop effective static and interactive data visualizations using Python libraries.
CO4	Apply real-time visualization strategies for streaming data using tools like Dash, Streamlit, and Grafana.
CO5	Analyze advanced data mining applications including sentiment analysis, time series, and anomaly detection.

Text Books	
1.	Jiawei Han, Micheline Kamber, Jian Pei, Data Mining Concepts and Techniques, Morgan Kaufmann.
2.	Wes McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Python, O'Reilly Media.
3.	Tim Grobmann, Mario Dobler, Data Visualization with Python, O'Reilly Media.

Web links and Video lectures (e-Resources)

NPTEL – Data Mining by IIT Kharagpur (Prof. Pabitra Mitra) https://nptel.ac.in/courses/106105174

- Data Mining Full Course by Great Learning (YouTube) https://www.youtube.com/watch?v=RlD5q_pIWkM
- Data Visualization using Python (Edureka) https://www.youtube.com/watch?v=UB3DE5Bgfx4
- Harvard Data Science: Visualization (edX) https://cs50.harvard.edu/
- Tableau for Data Visualization (Simplilearn) https://www.youtube.com/watch?v=IFM03Nis2dg

ASSESSMENT DETAILS (BOTH CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 50% of the maximum marks and Minimum passing marks for the SEE is 40% of the maximum marks of SEE. The minimum passing marks in SEE is 50% i.e. sum of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

The maximum CIE marks are 50. A student candidate shall obtain not less than 50% of the maximum CIE marks. CIE Assessment shall be based on:

- Descriptive Tests conducted for 50 marks and scaled down to 30 Marks.
- Assignments, presentations, Quiz, Simulation, Experimentation, Mini project, oral examination, field work and class participation etc., (for 20 Marks) conducted in the respective course. Course instructors are given autonomy in choosing a few of the above based on the subject relevance and should maintain necessary supporting documents for same.

SEMESTER END EXAMINATION

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have Part–A and Part-B.
- Part–A consists of 12 full questions (Need to write 6 questions) carrying14marks. Part–B consists of one compulsory question carrying 16 marks.
- Each full question of 14 marks will have 2 sub questions A & B Carrying 4 & 10 marks.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	-	-	-	-	-	-	-	-
CO2	3	3	2	2	1	-	-	-	-	-	-
CO3	2	2	3	2	1	-	1	-	-	-	-
CO4	2	3	3	3	2	-	-	-	-	-	-
CO5	3	2	3	3	2	1	-	-	-	-	-

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-III					
BIG DATA ANALYTICS **Category: PEC**					
Course Code	:	P24MCAD312	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	Understand Big Data Concepts – Gain a comprehensive understanding of Big Data, its characteristics, and its significance in modern computing.
2.	Explore Big Data Technologies – Learn about various Big Data tools and frameworks such as Hadoop, Spark, and NoSQL databases.
3.	Perform Data Processing & Analysis – Develop skills in processing, storing, and analyzing large-scale data using distributed computing techniques.

Module – 1	**No. of Hours**
Big Data Fundamentals and Ecosystem Overview Introduction to Big Data: Concepts and Ecosystem: Definition and Evolution of Big Data. Characteristics of Big Data (Volume, Velocity, Variety, Veracity, Value). Traditional v/s Big Data Systems, Introduction to Hadoop Ecosystem: HDFS, YARN, MapReduce. Architecture and components of Hadoop. Limitations of Hadoop and the shift to Spark.	9
Module – 2	**No. of Hours**
Hadoop Architecture and MapReduce Programming Distributed Data Processing using Hadoop: Hadoop Distributed File System (HDFS): Design and operations. Hadoop MapReduce: Programming model, job execution flow. Writing MapReduce programs (Word Count, Sorting, Joins). Advanced Hadoop: Combiners, Partitioners, and Counters. Hadoop Streaming and integration with Python.	9
Module – 3	**No. of Hours**
Apache Spark for Big Data Analytics In-Memory Big Data Processing with Spark: Spark architecture and components: RDDs, DAG, Executors. Transformations and Actions on RDDs. Introduction to Data Frames and Spark SQL. Introduction to Spark MLlib for machine learning. PySpark: Setting up and running Spark jobs using Python.	9
Module – 4	**No. of Hours**
NoSQL and Big Data Storage Systems Scalable Data Storage with NoSQL Databases: Need for NoSQL: Limitations of RDBMS in Big Data. Types of NoSQL Databases: Key-Value, Document, Column, Graph. Introduction to HBase: Architecture and CRUD operations. Working with Cassandra and MongoDB. Data modelling for scalability and performance.	9
Module – 5	**No. of Hours**
Big Data Tools and Industry Applications Real-World Big Data Applications and Tools: Overview of Big Data Tools: Hive, Pig, Sqoop, Flume, Oozie. Data ingestion with Flume and Sqoop. Use cases in healthcare, finance, e-commerce, IoT, social media. Real-time analytics introduction using Kafka and Spark Streaming. Ethics and challenges in Big Data (privacy, bias, governance).	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the fundamental concepts, evolution, and architecture of Big Data, including the Hadoop ecosystem.
CO2	Develop and execute distributed data processing tasks using HDFS and MapReduce programming techniques.
CO3	Analyze and implement in-memory data processing using Apache Spark and perform machine learning tasks with Spark MLlib.
CO4	Compare and evaluate NoSQL data models (Key-Value, Document, Column, Graph) and perform operations on HBase, MongoDB, and Cassandra.
CO5	Apply big data tools (Hive, Pig, Sqoop, Flume, Kafka) in real-world domains and understand ethical issues related to Big Data analytics.
Text Books	
1.	Tom White – Hadoop: The Definitive Guide, O'Reilly Media.
2.	Vignesh Prajapati – Big Data Analytics with R and Hadoop, Packt Publishing.
3.	Jure Leskovec, Anand Rajaraman, Jeff Ullman – Mining of Massive Datasets, Cambridge University Press.
4.	Venkat Ankam – Big Data Analytics with Spark, Packt Publishing.

Web links and Video lectures (e-Resources)
NPTEL Big Data Analytics Course – https://nptel.ac.in/courses/106/104/106104189/ • Simplilearn Big Data Tutorial (YouTube) – https://www.youtube.com/watch?v=-FrXAKGthF8 • Detailed explanation of Big Data concepts and tools. • Big Data Analytics Using Python (YouTube - Great Learning) – https://www.youtube.com/watch?v=ZkZclIFmgVY

ASSESSMENT DETAILS (BOTH CIE AND SEE)

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CO-PO Mapping

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CO2	1	2	3	-	-	-	-	-	-	-	-
CO3	-	2	3	-	3	-	-	3	-	-	-
CO4	2	2	-	-	-	-	-	3	-	-	-
CO5	-	2	3	3	-	-	3	-	-	-	-

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-III					
BUSINESS DATA ANALYTICS **Category: PEC**					
Course Code	:	P24MCAD313	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	Understand the Fundamentals of Business Analytics – Learn the core concepts, tools, and techniques used in data-driven decision-making for businesses.
2.	Data Collection and Processing – Gain knowledge of data acquisition, cleaning, transformation, and management techniques for business applications.
3.	Exploratory Data Analysis & Visualization – Develop skills to analyze and visualize business data using statistical and graphical methods.
4.	Predictive Analytics & Machine Learning – Apply statistical models and machine learning techniques to predict business trends and customer behavior.

Module – 1	**No. of Hours**
Foundations of Business Data Analytics Introduction to Business Analytics and Data-Driven Decision Making: Introduction to Business Analytics: Scope, Types (Descriptive, Predictive, Prescriptive). Data in Business: Structured v/s Unstructured, Sources of Data. Business Intelligence v/s Business Analytics. Analytics Life Cycle: CRISP-DM methodology. Role of Business Analyst: Tools, Skills, and Case Examples.	9
Module – 2	**No. of Hours**
Data Preprocessing and Exploratory Analysis Data Wrangling, Cleaning, and Exploration for Business Insights: Data Preparation: Cleaning, Integration, Transformation. Handling Missing Data, Outliers, and Noise. Descriptive Statistics: Mean, Median, Mode, Variance, Skewness. Correlation and Covariance. Visualization for Exploration: Histograms, Boxplots, Heatmaps. Business Case: Customer Segmentation and Sales Data Analysis.	9
Module – 3	**No. of Hours**
Predictive Analytics in Business Forecasting and Predictive Modelling for Business Decision Making: Introduction to Regression: Simple & Multiple Linear Regression. Logistic Regression: Applications in classification. Time Series Analysis and Forecasting Techniques. Model Evaluation: RMSE, MAE, Accuracy, Precision, Recall. Business Applications: Sales Forecasting, Customer Churn Prediction.	9
Module – 4	**No. of Hours**
Prescriptive Analytics and Optimization Optimization and Decision-Making Techniques: Introduction to Prescriptive Analytics. Linear Programming and Solver in Excel. Optimization Models: Objective functions, Constraints. Sensitivity and Scenario Analysis. Decision Trees and Business Rules. Case Study: Resource Allocation, Pricing Models, Supply Chain Optimization	9
Module – 5	**No. of Hours**
Data Visualization and Business Intelligence Tools Storytelling and Visualization for Business Insights Principles of Data Visualization and Dashboards. BI Tools: Introduction to Power BI, Tableau. Designing Interactive Dashboards. KPI Definition and Visualization. Business Reporting and Data-Driven Story telling. Final Capstone: Complete Business Analytics Solution	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the foundational concepts of business analytics, types of analytics, and the data analytics lifecycle.
CO2	Apply data preprocessing techniques and perform exploratory data analysis to extract meaningful business insights.
CO3	Develop and evaluate predictive models using regression and time series forecasting for business decision making.
CO4	Implement prescriptive analytics using optimization techniques to support data-driven decisions in a business context.
CO5	Design interactive dashboards using BI tools and present data-driven stories for effective communication of business insights.

Text Books	
1.	Abdulhamit Subasi, Practical Machine Learning for Data Analysis Using Python, Academic Press.
2.	U. Dinesh Kumar, Business Analytics: The Science of Data-Driven Decision Making, Wiley.
3.	Wes McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, O'Reilly.
4.	Wayne Winston, Microsoft Excel Data Analysis and Business Modeling, Microsoft Press.

Web links and Video lectures (e-Resources)
Introduction to Business Analytics – NPTEL Course • Harvard Data Science and Business Analytics Lectures – YouTube Playlist • Coursera: Business Analytics by Wharton – Coursera

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CO2	-	2	-	2	2	-	-	-	-	-	-
CO3	-	2	3	-	-	-	-	2	-	-	-
CO4	-	-	3	3	-	-	-	-	-	-	-
CO5	-	2	-	3	-	-	-	-	-	-	-

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-III					
ENTERPRISE RESOURCE PLANNING **Category: PEC**					
Course Code	:	P24MCAD314	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	Understand ERP Concepts – Explain the fundamentals of ERP, its evolution, and its significance in modern businesses.
2.	Analyze ERP Modules – Explore core ERP modules like Finance, HR, Supply Chain, and Customer Relationship Management (CRM).
3.	ERP Implementation Strategies – Understand the phases of ERP implementation, challenges, and best practices
4.	ERP Technologies & Trends – Examine emerging trends in ERP, such as cloud-based solutions, AI integration, and analytics
5.	Real-world Applications – Analyze case studies of ERP implementations in various industries to understand its impact on business efficiency.

Module – 1	**No. of Hours**
ERP Systems and Business Process Integration Fundamentals of ERP and Business Process Mapping Evolution of ERP – MRP, MRP II to ERP. Business Functions and Business Processes. Need for Integration and ERP as an Integrator, Benefits, Risks, and Misconceptions of ERP. Overview of Functional Modules: Finance, HR, Production, Sales. Case Example: Business Process before and after ERP	09
Module – 2	**No. of Hours**
ERP Architecture and Technologies ERP System Architecture and Technological Infrastructure Client/Server Architecture, Service-Oriented Architecture (SOA), Cloud-based ERP vs On-Premise ERP, ERP Platforms and Databases, ERP and Web Integration, Security, Customization, and Interoperability in ERP Systems. Overview of leading ERP systems: SAP, Oracle, Microsoft Dynamics, Odoo	09
Module – 3	**No. of Hours**
ERP Modules and Functional Features Core ERP Modules and Organizational Applications Finance and Accounting Module, Manufacturing and Production Planning, Sales and Distribution, Human Resource Management (HRM). Supply Chain Management (SCM), CRM and Business Intelligence Features, Industry Examples: ERP use in Retail, Healthcare, Logistics.	09
Module – 4	**No. of Hours**
ERP Implementation and Project Management ERP Life Cycle and Implementation Strategies Phases of ERP Implementation Life Cycle, Business Process Reengineering (BPR) and Change Management, Implementation Methodologies (ASAP, AIM), ERP Project Planning, Testing, Training, Go-Live & Support, Cost-Benefit Analysis, Vendor Selection, Risk Management, Failure Cases and Lessons Learned.	09
Module – 5	**No. of Hours**
Emerging Trends in ERP and Industry Practices Future Directions and ERP in the Digital Era ERP with AI, ML, IoT, and Blockchain, ERP and Digital Transformation, Mobile ERP and UX Design, ERP in SMEs and Cloud ERPs. ERP Data Analytics and Reporting, Future Trends: Low-Code ERP, Industry 4.0 Integration, Capstone: Evaluation of ERP for a case enterprise.	09

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the fundamentals of ERP systems, their evolution, business processes, and the need for integration
CO2	Analyze ERP architectures, technologies, and distinguish between various deployment models and ERP solutions...
CO3	Examine ERP functional modules and their applications across different business domains.
CO4	Apply ERP implementation strategies, project management techniques, and evaluate risk and success factors..
CO5	Explore and assess emerging trends in ERP such as AI, IoT, Blockchain, and digital transformation practices.

Text Books	
1.	Alexis Leon, Enterprise Resource Planning, McGraw Hill Education.
2.	Mary Sumner, Enterprise Resource Planning, Pearson Education.
3.	Mahadeo Jaiswal & Ganesh Vanapalli, Enterprise Resource Planning, Macmillan India.
4.	Ellen Monk, Bret Wagner, Concepts in Enterprise Resource Planning, Cengage Learning.

Web links and Video lectures (e-Resources)
https://www.youtube.com/watch?v=qgHlU_ll6mk https://www.youtube.com/watch?v=pSttK5Op1rI&utm_source=chatgpt.com https://www.youtube.com/watch?v=JnSrp4k1gJw&utm_source=chatgpt.com https://www.youtube.com/watch?v=ppfBvofxCM0&utm_source=chatgpt.com https://www.youtube.com/watch?v=cblNqNEThcE&utm_source=chatgpt.com

ASSESSMENT DETAILS (BOTH CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 50% of the maximum marks and Minimum passing marks for the SEE is 40% of the maximum marks of SEE. The minimum passing marks in SEE is 50% i.e. sum of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

The maximum CIE marks are 50. A student candidate shall obtain not less than 50% of the maximum CIE marks. CIE Assessment shall be based on:

- Descriptive Tests conducted for 50 marks and scaled down to 30 Marks.
- Assignments, presentations, Quiz, Simulation, Experimentation, Mini project, oral examination, field work and class participation etc., (for 20 Marks) conducted in the respective course. Course instructors are given autonomy in choosing a few of the above based on the subject relevance and should maintain necessary supporting documents for same.

SEMESTER END EXAMINATION

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have Part–A and Part-B.
- Part–A consists of 12 full questions (Need to write 6 questions) carrying14marks. Part–B consists of one compulsory question carrying 16 marks.
- Each full question of 14 marks will have 2 sub questions A & B Carrying 4 & 10 marks.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	2	-	-	-	-	-	-	-	-	-
CO2	1	2	-	-	1	-	-	-	-	-	-
CO3	-	2	3	-	3	-	-	-	-	-	-
CO4	-	-	3	-	-	3	-	-	-	-	-
CO5	-	-	-	-	3	-	3	2	-	-	-

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-III					
EXPLORATORY DATA ANALYSIS **Category: PEC**					
Course Code	:	P24MCAD315	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	To introduce the fundamental concepts and principles of exploratory data analysis.
2.	To equip students with skills to summarize and visualize both univariate and multivariate data effectively.
3.	To develop the ability to clean, pre-process, and transform raw data for analysis
4.	To expose learners to current trends and tools used in the field of EDA.

Module – 1	**No. of Hours**
Introduction to Exploratory Data Analysis: Historical background and role of EDA in data science, Philosophy and goals of EDA, Comparison with classical statistical methods, Types of data and scales of measurement, Importance of visual summaries before formal modelling.	9
Module – 2	**No. of Hours**
Univariate Data Exploration: Distribution shape: symmetry, skewness, kurtosis Summary statistics: mean, median, mode, variance, standard deviation, range, IQR Graphical techniques: histograms, dot plots, stem-and-leaf plots, boxplots, Identifying outliers and anomalies.	9
Module – 3	**No. of Hours**
Bivariate and Multivariate Data Exploration: Scatter plots, trend analysis, Correlation vs. causation,Crosstabs and pivot tables, Pair plots and heatmaps, Data smoothing (moving averages, LOESS).	9
Module – 4	**No. of Hours**
Data Transformation and Cleaning: Motivation for data transformation (e.g., to achieve normality or reduce skew) Log, square root, and other transformations, Handling missing values and duplicates, Introduction to resistant statistics (median, trimmed mean).	9
Module – 5	**No. of Hours**
Emerging Trends and case studies: EDA as a storytelling tool, AI-powered visualizations, integration with big data platforms.Case studies: EDA on real-world datasets (Titanic, Iris, planet), pitfalls in EDA.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the role and importance of Exploratory Data Analysis in the data science pipeline..
CO2	Analyze univariate and bivariate datasets using appropriate summary statistics and visualization techniques.
CO3	Apply data analysis techniques to explore relationships between multiple variables and derive insights using Python.
CO4	Apply data transformation and cleaning methods to prepare raw data for further analysis.
CO5	Interpret insights from real-world datasets and communicate findings through visual storytelling and reporting.

Text Books	
1.	Exploratory Data Analysis by John W. Tukey.
2.	An Introduction to Statistical Learning by Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani.
3.	Think Stats: Exploratory Data Analysis in Python by Allen B. Downey

Web links and Video lectures (e-Resources)

- https://youtu.be/fHFOANOHwh8?si=MFGfiOEvPQSF-g2H
- https://youtu.be/w2QVZHcJapU?si=xfacUu80VK8J4fzc
- https://youtu.be/clblk_NwEU8?si=e4O8qLB6TnuaejdQ

ASSESSMENT DETAILS (BOTH CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 50% of the maximum marks and Minimum passing marks for the SEE is 40% of the maximum marks of SEE. The minimum passing marks in SEE is 50% i.e. sum of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

The maximum CIE marks are 50. A student candidate shall obtain not less than 50% of the maximum CIE marks. CIE Assessment shall be based on:

- Descriptive Tests conducted for 50 marks and scaled down to 30 Marks.
- Assignments, presentations, Quiz, Simulation, Experimentation, Mini project, oral examination, field work and class participation etc., (for 20 Marks) conducted in the respective course. Course instructors are given autonomy in choosing a few of the above based on the subject relevance and should maintain necessary supporting documents for same.

SEMESTER END EXAMINATION

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have Part–A and Part-B.
- Part–A consists of 12 full questions (Need to write 6 questions) carrying14marks. Part–B consists of one compulsory question carrying 16 marks.
- Each full question of 14 marks will have 2 sub questions A & B Carrying 4 & 10 marks.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	-	-	-	-	-	-	-	-	-	-
CO2	1	2	-	-	-	-	-	-	-	-	-
CO3	-	2	-	-	3	-	-	-	-	-	-
CO4	1	-	-	3	-	-	-	3	-	-	-
CO5	1	2	-	-	-	-	-	-	-	-	-

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-III					
SOCIAL MEDIA ANALYTICS **Category: PEC**					
Course Code	:	P24MCAD316	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	Understand the fundamentals and evolution of social media platforms.
2.	Explore key concepts and techniques in social media data collection and analysis.
3.	Apply analytics tools to extract insights from social media data.
4.	Develop skills in sentiment analysis, trend prediction, and influence measurement.
5.	Design data-driven strategies for business and marketing using social media insights.

Module – 1	**No. of Hours**
Introduction to Social Media Analytics Foundations of Social Media Data Analysis Introduction to Social Media Analytics: Definition, Applications, and Importance, Overview of Popular Social Media Platforms: Facebook, Twitter, Instagram, LinkedIn, YouTube Social Media Data Types: Structured vs. Unstructured Dat, Social Media Metrics and KPIs: Engagement, Reach, Impressions, Sentiment Score, Data Collection Techniques: Web Scraping, APIs (Twitter, Facebook, YouTube), Streaming Data	9
Module – 2	**No. of Hours**
Sentiment Analysis and Text Mining Natural Language Processing for Social Media Data Fundamentals of Sentiment Analysis: Positive, Negative, Neutral Sentiments, Text Preprocessing: Tokenization, Stopword Removal, Stemming, Lemmatization Machine Learning Approaches for Sentiment Classification: Naïve Bayes, SVM, LSTM, Word Embeddings and Sentiment Scoring: TF-IDF, Word2Vec, BERT.	9
Module – 3	**No. of Hours**
Social Network Analysis and Trend Detection Graph-based Social Media Analytics Basics of Social Network Analysis (SNA) Key Metrics: Centrality, Clustering Coefficients, Community Detection, Influencer Identification and User Engagement Analytic Hashtag Analysis and Topic Modelling using LDA, Trend Detection on Social Media: Time Series Analysis, Virality Prediction.	9
Module – 4	**No. of Hours**
Visualizing and Interpreting Social Media Insights Data Visualization and Interpretation for Social Media Analytics Importance of Data Visualization in Social Media Analytic. Visualization Techniques: Word Clouds, Heatmaps, Network Graphs Sentiment Heatmaps and Hashtag Trends Visualization, Dashboard Creation using Tableau and Power BI.	9
Module – 5	**No. of Hours**
Applications of Social Media Analytics in Business and Research Business and Industry Applications of Social Media Analytics Social Media Analytics in Digital Marketing: Ad Performance and Customer Engagement, Social Media in Business Intelligence: Brand Monitoring and Crisis Management, Ethical Considerations in Social Media Analytics: Privacy, Bias, and Data Protection. Future Trends in Social Media Analytics: AI-Driven Social Insights, Capstone Project: Analyzing Real-World Social Media Data for Business Insights.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the fundamentals of social media analytics, data types, key metrics, and data collection techniques.
CO2	Apply sentiment analysis and text mining techniques to analyze social media data using NLP and ML models.
CO3	Analyze social network structures and trends using graph-based analytics, hashtag modeling, and virality detection.
CO4	Visualize and interpret social media insights using tools like Tableau and Power BI to support decision-making.
CO5	Evaluate real-world applications of social media analytics in business, digital marketing, brand monitoring, and ethical considerations.

Text Books	
1.	Matthew A. Russell, Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Instagram, GitHub, and More, O'Reilly Media
2.	Wasim Ahmed, Social Media Analytics: Techniques and Insights for Extracting Business Value Out of Social Media, Wiley i
3.	Reza Zafarani, Mohammad Ali Abbasi, Huan Liu, Social Media Mining: An Introduction, Cambridge University Press
4.	Piyushimita Thakuriah, Nebiyou Tilahun, Moira Zellner, Seeing Cities Through Big Data: Research, Methods and Applications in Urban Informatics, Springer.

Web links and Video lectures (e-Resources)
NPTEL Course on Social Media Analytics – nptel.ac.in • IBM Social Media Analytics Tutorials – ibm.com • YouTube Channel: Analytics Vidhya – youtube.com/analyticsvidhya

ASSESSMENT DETAILS (BOTH CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 50% of the maximum marks and Minimum passing marks for the SEE is 40% of the maximum marks of SEE. The minimum passing marks in SEE is 50% i.e. sum of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

The maximum CIE marks are 50. A student candidate shall obtain not less than 50% of the maximum CIE marks. CIE Assessment shall be based on:

- Descriptive Tests conducted for 50 marks and scaled down to 30 Marks.
- Assignments, presentations, Quiz, Simulation, Experimentation, Mini project, oral examination, field work and class participation etc., (for 20 Marks) conducted in the respective course. Course instructors are given autonomy in choosing a few of the above based on the subject relevance and should maintain necessary supporting documents for same.

SEMESTER END EXAMINATION

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have Part–A and Part-B.
- Part–A consists of 12 full questions (Need to write 6 questions) carrying14marks. Part–B consists of one compulsory question carrying 16 marks.
- Each full question of 14 marks will have 2 sub questions A & B Carrying 4 & 10 marks.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	2	-	-	-	-	-	-	-	-	-
CO2	-	2	2	-	3	-	-	-	-	-	-
CO3	-	2	-	3	3	-	-	-	-	-	-
CO4	-	-	2	-	3	-	-	3	-	-	-
CO5	-	-	-	-	-	3	3	-	-	-	-

Level 3 - High, Level 2 - Moderate, Level 1 - Low

AI & ML

SEMESTER-III INTRODUCTION TO GENERATIVE AI Category: PEC					
Course Code	:	P24MCAA311	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	Understand the Fundamentals of Generative AI.
2.	Master in Core Generative AI Models: GANs, VAEs, and Diffusion Models.
3.	Develop Practical Skills in Generative AI Using Popular Frameworks.
4.	Explore the Ethical Implications and Social Impact of Generative AI.
5.	Apply Generative AI to Real-World Applications.

Module – 1	No. of Hours
Introduction to AI and Machine Learning-Types of Generative Models (e.g., LLM,SLM,GANs, VAEs, Autoregressive Models)- Neural Networks: Basic Architecture, Backpropagation, Activation Functions-Deep Learning Basics and its Applications-Unsupervised vs. Supervised Learning	9
Module – 2	**No. of Hours**
Introduction to Generative Adversarial Networks (GANs) and Variational Autoencoders (VAEs)-Understanding the Generator-Discriminator Architecture in GANs-Latent Space Representation and Loss Functions-Training Strategies, Optimization, and Hyperparameter Tuning-Applications and Case Studies in Image, Video, and Text Generation-Diffusion Models and their Use in Modern AI Art Generation	9
Module – 3	**No. of Hours**
Introduction to TensorFlow and PyTorch for Generative AI Building GANs and VAEs from Scratch Hands-on Projects: Generating Images, Music, and Text - Model Evaluation Techniques (FID Score, Inception Score, BLEU Score) - Fine-tuning Pretrained Models for Specialized Applications	9
Module – 4	**No. of Hours**
Ethical Challenges in AI: Bias, Fairness, and Accountability- Deepfakes and Synthetic Media: Risks and Regulations - AI in Content Creation: Copyright, Ownership, and Creativity - Data Privacy in Generative AI Systems - Bias and Fairness in Training Data: Identifying and Mitigating	9
Module – 5	**No. of Hours**
AI in Digital Art and Content Creation - Music Generation Using Neural Networks - Healthcare Applications: Drug Discovery and Medical Imaging - Natural Language Generation (NLG) and Chatbots - Case Studies: Generative AI in Gaming, Fashion, and Virtual Reality	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the Fundamentals concepts of Generative AI
CO2	Identify the performance of generative models using metrics
CO3	Analyze the ethical implications of generative AI
CO4	CO4 Apply algorithms to build and train generative models using frameworks
CO5	Compare the performance of various generative AI architectures

Text Books	
1.	Gohil, P. (2019). Machine learning with Tensor Flow. BPB Publications.
2.	Akerkar, R. (2020). Deep learning: A practitioner's approach. Springer.
3.	Arora, R. (2021). Artificial intelligence: A guide for thinking humans. Wiley India Pvt. Ltd.
4.	Schwab, K. (2017). The fourth industrial revolution (Indian edition). Penguin Random House India.

Web links and Video lectures (e-Resources)

- https://www.youtube.com/watch?v=rwF-X5STYks
- https://www.youtube.com/watch?v=6aZiboOfYRA
- https://www.youtube.com/shorts/W5nwke7iw8c

- https://www.youtube.com/watch?v=t64TZ5S-IeY
- https://www.youtube.com/watch?v=Hv4oyBthaqs

ASSESSMENT DETAILS (BOTH CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 50% of the maximum marks and Minimum passing marks for the SEE is 40% of the maximum marks of SEE. The minimum passing marks in SEE is 50% i.e. sum of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

The maximum CIE marks are 50. A student candidate shall obtain not less than 50% of the maximum CIE marks. CIE Assessment shall be based on:

- Descriptive Tests conducted for 50 marks and scaled down to 30 Marks.
- Assignments, presentations, Quiz, Simulation, Experimentation, Mini project, oral examination, field work and class participation etc., (for 20 Marks) conducted in the respective course. Course instructors are given autonomy in choosing a few of the above based on the subject relevance and should maintain necessary supporting documents for same.

SEMESTER END EXAMINATION

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have Part–A and Part-B.
- Part–A consists of 12 full questions (Need to write 6 questions) carrying14marks. Part–B consists of one compulsory question carrying 16 marks.
- Each full question of 14 marks will have 2 sub questions A & B Carrying 4 & 10 marks.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	-	-	-	-	-	-	-	-	-
CO2	-	2	-	-	1	-	-	1	-	-	-
CO3	3	-	-	-	2	-	-	-	-	-	-
CO4	-	-	-	-	-	2	1	-	-	-	-

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-III					
ARTIFICIAL NEURAL NETWORKS **Category: PEC**					
Course Code	:	P24MCAA312	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	Understand the Fundamentals of Artificial Neural Networks
2.	Learn the Training Process of Neural Networks
3.	Explore Different Neural Network Architectures
4.	Implement Neural Networks Using Frameworks
5.	Understand Practical Applications and Limitations of Neural Networks

Module – 1	**No. of Hours**
Overview of Artificial Intelligence and Machine Learning - What are Neural Networks? Introduction to Neurons and Perceptrons - Structure of an ANN: Layers (Input, Hidden, Output)- Activation Functions: Sigmoid, ReLU, Tanh - Introduction to Feedforward Networks	9
Module – 2	**No. of Hours**
Forward Propagation and Loss Functions - Introduction to Gradient Descent and Backpropagation Learning Rate and Optimization Algorithms (e.g., Stochastic Gradient Descent, Adam) - Overfitting and Regularization Techniques (e.g., Dropout, L2 regularization) - Introduction to Epochs and Batch Processing	9
Module – 3	**No. of Hours**
Single-Layer vs. Multi-Layer Perceptrons (MLPs) - Convolutional Neural Networks (CNNs) for image processing - Recurrent Neural Networks (RNNs) for sequence data - Autoencoders and their applications - Introduction to Transfer Learning	9
Module – 4	**No. of Hours**
Introduction to TensorFlow and PyTorch- Implementing a Simple Neural Network with PyTorch/TensorFlow - Data Preprocessing and Loading Datasets - Training, Testing, and Evaluating Models - Hyperparameter Tuning and Model Optimization	9
Module – 5	**No. of Hours**
Applications of Neural Networks in Image Recognition, Natural Language Processing, and Time Series Prediction-Neural Networks for Classification vs. Regression-Common Pitfalls in Neural Network Training-Ethical Considerations and Model Interpretability-Future Trends in Neural Networks and Deep Learning.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the principles of Neural Networks
CO2	Analyze the feed-forward neural networks
CO3	Identify different types of models of neural networks
CO4	Implement ANN using frameworks
CO5	Compare different applications of artificial neural networks

Text Books	
1.	Deepa, S. N. (2020). Artificial Neural Networks: A Practical Approach. Wiley India Pvt. Ltd.
2.	Patel, M., & Patel, A. (2019). Artificial Neural Networks: Applications and Implementations. BPB Publications
3.	Gupta, S. K. (2017). Introduction to Neural Networks using MATLAB 6.0. Tata McGraw-Hill Education.

Web Resources

- https://www.youtube.com/watch?v=jmmW0F0biz0
- https://www.youtube.com/watch?v=mlk0rddP3L4
- https://www.youtube.com/watch?v=oJNHXPs0XDk

ASSESSMENT DETAILS (BOTH CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 50% of the maximum marks and Minimum passing marks for the SEE is 40% of the maximum marks of SEE. The minimum passing marks in SEE is 50% i.e. sum of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

The maximum CIE marks are 50. A student candidate shall obtain not less than 50% of the maximum CIE marks. CIE Assessment shall be based on:

- Descriptive Tests conducted for 50 marks and scaled down to 30 Marks.
- Assignments, presentations, Quiz, Simulation, Experimentation, Mini project, oral examination, field work and class participation etc., (for 20 Marks) conducted in the respective course. Course instructors are given autonomy in choosing a few of the above based on the subject relevance and should maintain necessary supporting documents for same.

SEMESTER END EXAMINATION

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have Part–A and Part-B.
- Part–A consists of 12 full questions (Need to write 6 questions) carrying14marks. Part–B consists of one compulsory question carrying 16 marks.
- Each full question of 14 marks will have 2 sub questions A & B Carrying 4 & 10 marks.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	2	-	-	-	-	-	-
CO3	-	2	-	-	-	-	-	-	-	-	-
CO4	-	2	-	-	-	-	-	-	-	-	-
CO5	-	2	-	-	-	2	2	-	-	-	-

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-III					
NATURAL LANGUAGE PROCESSING **Category: PEC**					
Course Code	:	P24MCAA313	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	Understand the Fundamentals of Natural Language Processing.
2.	Learn Text Pre-processing Techniques.
3.	Implement Basic NLP Models.
4.	Explore Word Embeddings and Advanced NLP Models.
5.	Understand NLP Applications and Real-World Use Cases.

Module – 1	**No. of Hours**
Introduction to NLP: Definition and scope - Basic Linguistic Concepts: Syntax, Semantics, and Pragmatics - Language Models: Unigram, Bigram, and N-grams - Overview of NLP Tasks: Text classification, Named Entity Recognition (NER), Sentiment Analysis, etc. - Key Applications of NLP: Machine Translation, Speech Recognition, Chatbots	09
Module – 2	**No. of Hours**
Text Cleaning: Removing special characters, punctuation, stop words, and irrelevant data Tokenization: Word-level and sentence-level tokenization - Stemming and Lemmatization: Understanding and applying common text normalization techniques - Text Vectorization: Bag-of Words (BoW), TF-IDF, Word Embeddings (Word2Vec, GloVe) - Part-of-Speech (POS) Tagging: Introduction to syntactic categories	09
Module – 3	**No. of Hours**
Introduction to Machine Learning for NLP: Supervised vs. Unsupervised Learning - Building a Text Classification Model: Naive Bayes, Logistic Regression, and SVM for text classification - Sentiment Analysis: Using basic machine learning models for sentiment classification - Introduction to Deep Learning for NLP: Feedforward Neural Networks for text - Evaluating NLP Models: Accuracy, Precision, Recall, and F1-score.	09
Module – 4	**No. of Hours**
Word Embeddings: Introduction to Word2Vec and GloVe - Semantic Analysis: Understanding word similarity, cosine similarity, and vector-based word representations - Neural Networks for NLP: Simple architectures like RNNs and LSTMs -Introduction to Transformer Models: Basic understanding of BERT and GPT - Language Representation Models and Fine-tuning	09
Module – 5	**No. of Hours**
Named Entity Recognition (NER): Techniques for identifying entities in text-Text Summarization: Extractive vs. Abstractive Summarization-Machine Translation: Introduction to rule-based, statistical, and neural machine translation systems-Chatbots and Conversational AI: Building simple conversational agents using NLP-Ethical Considerations: Bias in NLP models and ethical implications of NLP applications	09

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the basic concepts of Natural Language Processing
CO2	Apply text pre-processing techniques
CO3	Apply Machine Learning Algorithms to NLP Tasks
CO4	Implement and train word embedding models (Word2Vec, GloVe) on text corpora
CO5	Analyze the ethical considerations in NLP applications

Text Books	
1.	Kumar, V., & Dey, L. (2019). Introduction to Natural Language Processing. Wiley India Pvt. Ltd.
2.	Sahani, M., & Dey, L. (2021). Natural Language Processing: Techniques and Applications. McGraw-Hill Education.
3.	Rai, M. (2019). Foundations of Natural Language Processing. Oxford University Press.

Reference books	
1.	Prasad, R., & Rani, N. (2020). Natural Language Processing with Python: A Practical Guide. BPB Publications.

Web links and Video lectures (e-Resources)
• https://www.youtube.com/watch?v=aeOLjFe256E&list=PLD392E2ACAEF0C689 • https://www.youtube.com/watch?v=zG8AJhVy5NY&list=PLD392E2ACAEF0C689&index=2 • https://www.youtube.com/watch?v=dBEpW4h2Gig&list=PLD392E2ACAEF0C689&index=6 • https://www.youtube.com/watch?v=kfssS6bD5FQ&list=PLD392E2ACAEF0C689&index=7 • https://www.youtube.com/watch?v=iWbkjwe-xag&list=PLD392E2ACAEF0C689&index=12

ASSESSMENT DETAILS (BOTH CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 50% of the maximum marks and Minimum passing marks for the SEE is 40% of the maximum marks of SEE. The minimum passing marks in SEE is 50% i.e. sum of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

The maximum CIE marks are 50. A student candidate shall obtain not less than 50% of the maximum CIE marks. CIE Assessment shall be based on:

- Descriptive Tests conducted for 50 marks and scaled down to 30 Marks.
- Assignments, presentations, Quiz, Simulation, Experimentation, Mini project, oral examination, field work and class participation etc., (for 20 Marks) conducted in the respective course. Course instructors are given autonomy in choosing a few of the above based on the subject relevance and should maintain necessary supporting documents for same.

SEMESTER END EXAMINATION

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have Part–A and Part-B.
- Part–A consists of 12 full questions (Need to write 6 questions) carrying14marks. Part–B consists of one compulsory question carrying 16 marks.
- Each full question of 14 marks will have 2 sub questions A & B Carrying 4 & 10 marks.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO2	2	-	2	-	2	-	-	-	-	-	-	-
CO3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	2	-	-	-	1	-	-	-	-	-	-	-
CO5	1	1	-	-	-	-	-	2	-	-	-	-

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-III					
DEEP LEARNING FUNDAMENTALS **Category: PEC**					
Course Code	:	P24MCAA314	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	Understand the fundamentals of deep learning
2.	Understanding the working of Convolutional Neural Networks and RNN in decision making.
3.	Illustrate the strength and weaknesses of many popular deep learning approaches..
4.	Introduce major deep learning algorithms, the problem settings, and their applications to solve real world problems

Module – 1	**No. of Hours**
Introduction: What is a Neural Network? The Human Brain, Models of a Neuron, Neural Networks Viewed As Directed Graphs, Feedback, Network Architectures Rosenblatt's Perceptron: Introduction, Perceptron, The Perceptron Convergence Theorem, Relation Between the Perceptron and Bayes Classifier for a Gaussian Environment.	9
Module – 2	**No. of Hours**
Multilayer Perceptrons: Introduction, Some Preliminaries, Batch Learning and On-Line Learning, The Back Propagation Algorithm, XOR Problem, Heuristics for Making the Back- Propagation Algorithm Perform Better, Computer Experiment: Pattern Classification, Back Propagation and Differentiation.	9
Module – 3	**No. of Hours**
Regularization for Deep Learning: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under Constrained Problem, Dataset Augmentation, Semi-Supervised Learning. Optimization for Training Deep Models: How Learning Differs from pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rate.	9
Module – 4	**No. of Hours**
Convolution Networks: The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, The Neuroscientific Basic for Convolutional Network, Convolutional Networks and the History of Deep Learning.	9
Module – 5	**No. of Hours**
Sequence Modeling: Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to- Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, The Long Short-Term Memory and Other Gated RNNs.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understanding Deep Learning Fundamentals.
CO2	Design and Implementation of Neural Networks
CO3	Optimization and Performance Tuning
CO4	Application of Advanced Deep Learning Architectures

Text Books	
1.	Simon Haykin, Neural networks and Learning Machines, 3rd Edition, Pearson, 2016
2.	An Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016.

Reference Books	
1.	Bengio, Yoshua. "Learning deep architectures for AI." Foundations and trends in Machine Learning, 2009
2.	N.D. Lewis, "Deep Learning Made Easy with R: A Gentle Introduction for Data Science", January 2016
3.	Nikhil Buduma, "Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms", O'Reilly publications

Web links and Video lectures (e-Resources)
https://www.deeplearningbook.org/lecture_slides.html https://www.youtube.com/watch?v=VyWAvY2CF9c https://www.youtube.com/watch?v=7sB052Pz0sQ https://www.youtube.com/watch?v=Mubj_fqiAv8 https://www.coursera.org/learn/neural-networks-deep-learning https://onlinecourses.nptel.ac.in/noc20_cs62/preview

ASSESSMENT DETAILS (BOTH CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 50% of the maximum marks and Minimum passing marks for the SEE is 40% of the maximum marks of SEE. The minimum passing marks in SEE is 50% i.e. sum of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

The maximum CIE marks are 50. A student candidate shall obtain not less than 50% of the maximum CIE marks. CIE Assessment shall be based on:

- Descriptive Tests conducted for 50 marks and scaled down to 30 Marks.
- Assignments, presentations, Quiz, Simulation, Experimentation, Mini project, oral examination, field work and class participation etc., (for 20 Marks) conducted in the respective course. Course instructors are given autonomy in choosing a few of the above based on the subject relevance and should maintain necessary supporting documents for same.

SEMESTER END EXAMINATION

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have Part–A and Part-B.
- Part–A consists of 12 full questions (Need to write 6 questions) carrying14marks. Part–B consists of one compulsory question carrying 16 marks.
- Each full question of 14 marks will have 2 sub questions A & B Carrying 4 & 10 marks.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	-	-	-	-	-	-	-	-	-	-
CO2	-	2	-	2	-	-	-	-	-	-	-
CO3	-	2	-	-	-	2	-	-	-	-	-
CO4	-	-	1,2	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	3	-	-	-	-	-

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-III					
INTRODUCTION TO MACHINE LEARNING **Category: PEC**					
Course Code	:	P24MCAA315	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	To understand the basic theory underlying machine learning, types, and the process.
2.	To become familiar with data and visualize univariate, bivariate, and multivariate data using statistical techniques and dimensionality reduction.
3.	To understand various machine learning algorithms such as similarity-based learning, regression, decision trees.
4.	To familiarize with learning theories, probability-based models, and reinforcement learning, developing the skills required for decision-making in dynamic environments.

Module – 1	**No. of Hours**
Introduction to Machine Learning: Need for Machine Learning, Machine Learning Explained, Machine Learning in Relation to Other Fields, Types of Machine Learning, Challenges of Machine Learning, Machine Learning Process, Machine Learning Application. **Understanding Data**: Introduction, Big Data Analytics and Types of Analytics, Big Data Analysis Framework, Descriptive Statistics, Univariate Data Analysis and Visualization, Bivariate Data and Multivariate Data.	09
Module – 2	**No. of Hours**
Understanding Data: Multivariate Statistics, Essential Mathematics for Multivariate Data, Overview of Hypothesis, Feature Engineering and Dimensionality Reduction Techniques. **Basics of Learning Theory**: Introduction to Learning and its Types, Introduction to Computation Learning Theory, Design of a Learning System, Introduction to Concept Learning, Induction Biases, Modelling in Machine Learning.	09
Module – 3	**No. of Hours**
Similarity-based Learning: Introduction to Similarity or Instance-based Learning, Nearest-Neighbor Learning,Weighted K-Nearest-Neighbor Algorithm, Nearest Centroid Classifier, Locally Weighted Regression (LWR). **Regression Analysis**: Introduction to Regression, Introduction to Linearity, Correlation, and Causation, Introduction toLinear Regression, Validation of Regression Methods, Multiple Linear Regression, Polynomial Regression, Logistic Regression	09
Module – 4	**No. of Hours**
Decision Trees Learning: Introduction to Decision Tree Learning model, Decision Tree Induction Algorithms, Validating and Pruning of Decision Trees. **Bayesian Learning**: Introduction to Probability-based Learning, Fundamentals of Bayes Theorem, Classification Using Bayes Model.	09
Module – 5	**No. of Hours**
Artificial Neural Networks: Introduction, Biological Neurons, Artificial Neurons, Perceptron and Learning Theory, Types of Artificial Neural Network. **Reinforcement Learning**: Overview and Scope of Reinforcement Learning, Components of Reinforcement Learning, Q-Learning.	09

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understanding ML Fundamentals
CO2	Applying ML Algorithms
CO3	Model Evaluation and Optimization
CO4	Practical Implementation and Problem-Solving

Text Books	
1.	S Sridhar and M Vijayalakshmi, “Machine Learning”, Oxford University Press, 2021.
2.	M N Murty and Ananthanarayana V S, “Machine Learning: Theory and Practice”, Universities Press (India) Pv t.Limited, 2024.

Reference Text Books	
1.	Tom M. Mitchell, "Machine Learning," McGraw-Hill Education, 2013.
2.	Miroslav Kubat, "An Introduction to Machine Learning," Springer, 2017

Web links and Video lectures (e-Resources)
• Web links and Video Lectures (e-Resources):
• https://www.universitiespress.com/resources?id=9789393330697
• https://onlinecourses.nptel.ac.in/noc23_cs18/preview
• https://www.geeksforgeeks.org/machine-learning/
• https://www.w3schools.com/python/python_ml_getting_started.asp
• https://www.tutorialspoint.com/machine_learning/index.html

ASSESSMENT DETAILS (BOTH CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 50% of the maximum marks and Minimum passing marks for the SEE is 40% of the maximum marks of SEE. The minimum passing marks in SEE is 50% i.e. sum of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

The maximum CIE marks are 50. A student candidate shall obtain not less than 50% of the maximum CIE marks. CIE Assessment shall be based on:

- Descriptive Tests conducted for 50 marks and scaled down to 30 Marks.
- Assignments, presentations, Quiz, Simulation, Experimentation, Mini project, oral examination, field work and class participation etc., (for 20 Marks) conducted in the respective course. Course instructors are given autonomy in choosing a few of the above based on the subject relevance and should maintain necessary supporting documents for same.

SEMESTER END EXAMINATION

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have Part–A and Part-B.
- Part–A consists of 12 full questions (Need to write 6 questions) carrying14marks. Part–B consists of one compulsory question carrying 16 marks.
- Each full question of 14 marks will have 2 sub questions A & B Carrying 4 & 10 marks.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	-	-	-	-	-	-	-	-	-	-
CO2	-	2	-	3	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	2	-	-	-	-	2	-	-	-

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-III					
COMPUTER VISION **Category: PEC**					
Course Code	:	P24MCAA316	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	Understand the Fundamentals of Computer Vision
2.	Implement Feature Extraction and Object Recognition
3	Analyze Motion and Video Processing Techniques and Apply Deep Learning in Computer Vision

Module – 1	**No. of Hours**
Introduction to Computer Vision and Image Representation: Basics of Computer Vision and its applications, Digital images: Pixels, resolution, and color models, Image formation and perception Visualizing pixel intensity distributions, Working with pixel-based operations, Introduction to video processing.	09
Module – 2	**No. of Hours**
Feature Detection and Image Processing Techniques: Edge detection techniques (Sobel, Canny) Line and corner detection, Gaussian kernels and filters, Delaunay mesh segmentation, Voro noimesh applications in vision	09
Module – 3	**No. of Hours**
Shape and Object Recognition: Contour detection and shape analysis, Feature extraction methods Maximal nucleus clusters and Lowe keypoints, Image segmentation techniques, Introduction to object tracking in videos	09
Module – 4	**No. of Hours**
Computational Geometry and Machine Vision: Concepts of computational topology in vision Linear filtering and transformations, Spatial relationships and image transformations, Use of graphs and meshes in object representation, Real-time and offline video analysis	09
Module – 5	**No. of Hours**
Advanced Topics and Applications: Deep learning for computer vision (basics), Convolutional Neural Networks (CNNs) overview, Applications in biometrics, medical imaging, and robotics. Future trends in computer vision , Case studies and project discussions	09

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understanding Image Processing Fundamentals
CO2	Apply Feature Extraction and Object Recognition techniques
CO3	Understand Motion Analysis and Video Processing methods
CO4	Utilize deep learning models like CNNs for image classification and segmentation.
CO5	Evaluate the performance of different computer vision techniques for practical applications.

Text Books	
1.	Peters, J. F. (2017). Foundations of computer vision: Computational geometry, visual image structures, and object shape detection. Springer International Publishing
2.	Szeliski, R. (2022). Computer vision: Algorithms and applications (2nd ed.). Springer.
3.	Forsyth, D. A., & Ponce, J. (2011). Computer vision: A modern approach (2nd ed.). Pearson.

Web links and Video lectures (e-Resources)
• . https://www.youtube.com/channel/UCf0WB91t8Ky6AuYcQV0CcLw
• https://www.youtube.com/watch?v=2w8XIskzdFw
• https://16385.courses.cs.cmu.edu/spring2021/lectures
• https://github.com/kuzand/Computer-Vision-Video-Lectures

ASSESSMENT DETAILS (BOTH CIE AND SEE)

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CONTINUOUS INTERNAL EVALUATION (CIE)

The maximum CIE marks are 50. A student candidate shall obtain not less than 50% of the maximum CIE marks. CIE Assessment shall be based on:

- Descriptive Tests conducted for 50 marks and scaled down to 30 Marks.
- Assignments, presentations, Quiz, Simulation, Experimentation, Mini project, oral examination, field work and class participation etc., (for 20 Marks) conducted in the respective course. Course instructors are given autonomy in choosing a few of the above based on the subject relevance and should maintain necessary supporting documents for same.

SEMESTER END EXAMINATION

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have Part–A and Part-B.
- Part–A consists of 12 full questions (Need to write 6 questions) carrying14marks. Part–B consists of one compulsory question carrying 16 marks.
- Each full question of 14 marks will have 2 sub questions A & B Carrying 4 & 10 marks.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-
CO3	2	-	-	-	-	-	-	-	-	-	-
CO4	2	-	-	-	-	-	-	-	-	-	-
CO5	-	2	-	-	-	-	-	-	-	-	-

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Network and System Administration

SEMESTER-III					
COMPUTER NETWORKS **Category: PEC**					
Course Code	:	P24MCAN311	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	At the end of the course, the student will be able to Familiarize the basic terminologies used for computer networking.
2.	Implement the computer networks concepts like TCP/IP, IPC and Congestion avoidance techniques.
3.	Simulate the working of wired networks and analyze its performance.

Module – 1	**No. of Hours**
Introduction: Data Communications, Networks, The Internet, Broadcast and Point-To Point Networks; Connectionless and Connection-Oriented Services; Network Devices; Network Topologies; Types of Network: LAN, MAN, WAN,PAN; Server Based LANs and Peer-to-Peer LANs; Transmission Types; Modes of Communication;	9
Module – 2	**No. of Hours**
Network Models: Design Issues of the Layer, Protocol Hierarchy, ISO-OSI Reference Model: Functions of each Layer; Various Terminology used in Computer Network; Connection-Oriented and Connectionless Services, Internet (TCP/IP) Reference Model, Comparison of ISO OSI and TCP/IP Model.	9
Module – 3	**No. of Hours**
Transmission Media: Transmission Medium, Guided Media: Coaxial Cable, Twisted Pair, Fiber Optics Cable; Unguided Media: Radio Waves, Infrared, Micro-wave, Satellite communication, Laser. Switching Techniques.	9
Module – 4	**No. of Hours**
Data Link layer: Data link layer design issues, Error Detection and Correction Codes, Data Link Protocols (Simplex Stop-and-wait protocol for Error free and noisy channel) and Sliding window protocols. **Network Layer**: Network Layer Design issues, Routing algorithms, Congestion Control Algorithms, Quality of Service, Internetworking and The Network Layer in the Internet.	9
Module – 5	**No. of Hours**
The Transport Layer: The Transport Service, Elements of Transport Protocols, Congestion Control, The Internet Transport Protocol: UDP, The Internet Transport Protocols – TCP. **The application Layer**: DNS: Domain Name Space, Domain Resource Records, Domain Name Servers. Electronic mail: SMTP, The World Wide Web: Static and dynamic web pages, web applications, HTTP, mobile web. Streaming audio and Video: Digital audio and video, streaming stored and live media, Content delivery: Content and internet traffic, content delivery networks, peer-to-peer networks.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Apply the basic concepts of networks like protocol, internet and OSI layers
CO2	Analyze the working of Physical Layer.
CO3	Demonstrate the various Switching networks

Text Books	
1.	Behrouz A. Forouzan,: Data Communication and Networking, 4th Edition Tata McGraw-Hill, 2006.
2.	Alberto Leon-Garcia and Indra Widjaja: Communication Networks - Fundamental Concepts and Key architectures, 2nd Edition Tata McGraw-Hill, 2004
3.	William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.

Web links and Video lectures (e-Resources)
https://www.binghamton.edu/watson/continuing-education/data-science/intro-to-computer-networks.html https://elearn.daffodilvarsity.edu.bd/course/view.php?id=5457 https://onlinecourses.nptel.ac.in/noc21_cs18/preview

ASSESSMENT DETAILS (BOTH CIE AND SEE)

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CONTINUOUS INTERNAL EVALUATION (CIE)

The maximum CIE marks are 50. A student candidate shall obtain not less than 50% of the maximum CIE marks. CIE Assessment shall be based on:

- Descriptive Tests conducted for 50 marks and scaled down to 30 Marks.
- Assignments, presentations, Quiz, Simulation, Experimentation, Mini project, oral examination, field work and class participation etc., (for 20 Marks) conducted in the respective course. Course instructors are given autonomy in choosing a few of the above based on the subject relevance and should maintain necessary supporting documents for same.

SEMESTER END EXAMINATION

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have Part–A and Part-B.
- Part–A consists of 12 full questions (Need to write 6 questions) carrying14marks. Part–B consists of one compulsory question carrying 16 marks.
- Each full question of 14 marks will have 2 sub questions A & B Carrying 4 & 10 marks.

CO-PO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	1							
CO2		**2**					1	
CO3		**2**	**3**					

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-III					
NETWORK AND LINUX ADMINISTRATION **Category: PEC**					
Course Code	:	P24MCAN312	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	Set up and manage network interfaces, IP addresses, and network services.
2.	Configuration of firewalls using ip tables, NAT, and secure Linux networks.
3.	To Manage Network Services – Work with DNS, DHCP, remote login, and web server configurations.
4.	To Diagnose network issues and optimize performance using Linux tools.

Module – 1	**No. of Hours**
Introduction to Networking :History and evolution of computer networking Basic network components and models **TCP/IP Networks** :Layers of the TCP/IP model Understanding IP addresses, subnetting, and classes The Internet Control Message Protocol (ICMP) **Linux Networking Basics :**Maintaining your Linux system for networking networking interfaces and configuration in Linux Overview of the /proc file system.	9
Module – 2	**No. of Hours**
Configuring Serial Hardware : Communications software for modem links Accessing and managing serial devices Configuration utilities for serial communication **TCP/IP Configuration :** Understanding /proc for network-related data Configuring Linux-based TCP/IP networking **Name Services and DNS :**Resolver library overview How DNS works and alternatives to BIND.	9
Module – 3	**No. of Hours**
Point-to-Point Protocol in Linux Running pppd and using options files, Automating dialing with chat ,IP configuration and link control options Security considerations and authentication in PPP **Advanced PPP Configurations :** Debugging PPP setups, PPPoE options in Linux, **Networking Security & Firewalls :** Understanding network security threats, Firewall concepts and IP filtering basics.	9
Module – 4	**No. of Hours**
TCP/IP Firewalls : Methods of attack and security considerations, Netfilter and iptables basics, Setting up and managing Linux firewalls, **IP Masquerade & Network Address Translation:** Configuring the kernel for IP Masquerade, Handling NAT and DNS lookups **IP Accounting & Network Monitoring :** Configuring IP accounting Collecting and analyzing network data.	9
Module – 5	**No. of Hours**
Network Services and Remote Access : Understanding inetd, tcpd, and xinetd, Remote Procedure Call (RPC) configuration,Remote login and execution services **IPv6 & Web Server Configuration :**IPv4 limitations and introduction to IPv6, Configuring IPv6 networks in Linux, Apache Web Server setup and configuration. **Wireless Networking:** History and standards of wireless networking, Security concerns in 802.11b networks.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Learn about network setup, IP addresses, and how computers communicate.
CO2	Configure internet connections, share files, and manage network settings
CO3	Protect a system from hackers by setting up firewall rules and security measures.

Text Books	
1.	"Computer Networking: A Top-Down Approach" – James F. Kurose & Keith W. Ross A great introduction to networking concepts, covering application-layer protocols, TCP/IP, and security.
2.	Linux Firewalls: Enhancing Security with nftables and Beyond" – Steve Suehring A comprehensive guide on firewall security, iptables, and nftables in Linux.
3.	Mastering Linux Network Administration" – Jay LaCroix Covers advanced Linux networking topics, including system administration and server configuration.

Web links and Video lectures (e-Resources)
Computer Networking Full Course (Beginner-Friendly) https://www.youtube.com/watch?v=qiQR5rTSshw (NetworkChuck – Cisco Basics & TCP/IP) **Linux Networking & Firewall Setup** https://www.youtube.com/watch?v=zA42YPS52Xo (TechWorld with Nana – Linux Networking Guide) https://youtu.be/_eY4IfpbRDs?si=vHeCLsgFewCGJw3t

ASSESSMENT DETAILS (BOTH CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 50% of the maximum marks and Minimum passing marks for the SEE is 40% of the maximum marks of SEE. The minimum passing marks in SEE is 50% i.e. sum of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

The maximum CIE marks are 50. A student candidate shall obtain not less than 50% of the maximum CIE marks. CIE Assessment shall be based on:

- Descriptive Tests conducted for 50 marks and scaled down to 30 Marks.
- Assignments, presentations, Quiz, Simulation, Experimentation, Mini project, oral examination, field work and class participation etc., (for 20 Marks) conducted in the respective course. Course instructors are given autonomy in choosing a few of the above based on the subject relevance and should maintain necessary supporting documents for same.

SEMESTER END EXAMINATION

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have Part–A and Part-B.
- Part–A consists of 12 full questions (Need to write 6 questions) carrying14marks. Part–B consists of one compulsory question carrying 16 marks.
- Each full question of 14 marks will have 2 sub questions A & B Carrying 4 & 10 marks.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	1	2						
CO2		2		3				
CO3	1	2			3			3

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-III					
TCP/IP **Category: PEC**					
Course Code	:	P24MCAN313	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	This course provides a solid foundation for understanding the communication process of the Internet.
2.	The student will understand the fundamental concepts of computer networking in the context of the TCP/IP model and protocols.
3.	To study classful and classless addressing, IPV4, IPv6, UDP, TCP, congestion control and flow control.

Module – 1	**No. of Hours**
TCP/IP Protocol Suite - Protocol Layers, The TCP/IP Protocol suite and Addressing.IPV4 Addresses- Introduction, Classful and Classless Addressing, Internet Protocol Version4 (IPv4) – Datagram's, Fragmentation, Options, Checksum, Security, IP Package.	9
Module – 2	**No. of Hours**
Introduction to the Transport Layer: Transport Layer Services and Protocols. User Datagram Protocol (UDP): Introduction, User Datagram, UDP Services and Applications, UDP Package.	9
Module – 3	**No. of Hours**
Transmission Control Protocol – I: TCP Services: Process-to-Process Communication, Full-Duplex Communication, Multiplexing and De-multiplexing, Reliable Service, Connection-Oriented Service Features, Segment, TCP Connection, Windows in TCP.	9
Module – 4	**No. of Hours**
Transmission Control Protocol – II: Flow Control, Error Control, Congestion Control, TCP Timers, Options and TCP Package.	9
Module – 5	**No. of Hours**
IPv6 Addressing – Introduction, Address Space Allocation, Global Unicast Addresses, Auto configuration and Renumbering. IPv6 Protocol - Introduction, Packet Format, Transition from IPv4 to IPv6. ICMPv6 - Introduction, Error Messages, Informational Messages, Neighbor- Discovery Messages, Group Membership Messages.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understanding of TCP/IP Architecture
CO2	Identify and assign **IPv4 & IPv6 addresses** effectively.
CO3	TCP & UDP Transmission Mechanisms

Text Books	
1.	TCP/IP Protocol Suite, Behrouz A. Forouzan, 4th Edition, Tata McGraw-Hill Edition.
2.	Data communication and Networking with TCP/IP Protocol Suite, Behrouz A. Forouzan, 6th Edition, Tata McGraw-Hill Edition.
3.	The TCP/IP Tutorial and Technical Overview Adolfo Rodriguez, John Gatrell, John Karas, Roland Peschke

Web links and Video lectures (e-Resources)
https://www.youtube.com/watch?v=TBHHCd_9tz8 https://www.youtube.com/watch?v=7GnSWC7ClNs

ASSESSMENT DETAILS (BOTH CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 50% of the maximum marks and Minimum passing marks for the SEE is 40% of the maximum marks of SEE. The minimum passing marks in SEE is 50% i.e. sum of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

The maximum CIE marks are 50. A student candidate shall obtain not less than 50% of the maximum CIE marks. CIE Assessment shall be based on:

- Descriptive Tests conducted for 50 marks and scaled down to 30 Marks.
- Assignments, presentations, Quiz, Simulation, Experimentation, Mini project, oral examination, field work and class participation etc., (for 20 Marks) conducted in the respective course. Course instructors are given autonomy in choosing a few of the above based on the subject relevance and should maintain necessary supporting documents for same.

SEMESTER END EXAMINATION

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have Part–A and Part-B.
- Part–A consists of 12 full questions (Need to write 6 questions) carrying14marks. Part–B consists of one compulsory question carrying 16 marks.
- Each full question of 14 marks will have 2 sub questions A & B Carrying 4 & 10 marks.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	**1**		**2**					
CO2		**2**		**3**				
CO3	**1**		**3**			**3**		

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-III					
UNIX SHELL PROGRAMMING **Category: PEC**					
Course Code	:	P24MCAN314	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	To help the students to understand effective use of Unix concepts, commands and terminology. Identify, access, and evaluate UNIX file system
2.	Explain the fundamental design of the Unix operating system
3.	Familiarize with the systems calls provided in the Unix environment.
4.	Design and build an application/service over the Unix operating system

Module – 1	**No. of Hours**
Introduction: Unix Components/Architecture. Features of Unix. The UNIX Environment and UNIX Structure, Posix and Single Unix specification. General features of Unix commands/ command structure. Command arguments and options. Basic Unix commands such as echo, print f, ls, who, date, passwd, cal, Combining commands. Meaning of Internal and external commands. The type command: knowing the type of a command and locating it. The root login. Becoming the super user: su command. Unix files: Naming files. Basic file types/categories. Organization of files. Hidden files. Standard directories. Parent-child relationship. The home directory and the HOME variable. Reaching required files- the PATH variable, manipulating the PATH, Relative and absolute pathnames. Directory commands – pwd, cd, mkdir, rmdir commands. The dot (.) and double dots (..) notations to represent present and parent directories and their usage in relative path names. File related commands – cat, mv, rm, cp, wc and od commands.	9
Module – 2	**No. of Hours**
File attributes and permissions: The ls command with options. Changing file permissions: the relative and absolute permissions changing methods. Recursively changing file permissions. Directory permissions. The shells interpretive cycle: Wild cards. Removing the special meanings of wild cards. Three standard files and redirection. Connecting commands: Pipe. Basic and Extended regular expressions. The grep, egrep. Typical examples involving different regular expressions. Shell programming: Ordinary and environment variables. The profile Read and read-only commands. Command line arguments. exit and exit status of a command. Logical operators for conditional execution. The test command and its shortcut. The if, while, for and case control statements. The set and shift commands and handling positional parameters.	9
Module – 3	**No. of Hours**
Unix Standardization and Implementations: Introduction, Unix Standardization, UNIX System Implementation. File I/O: Introduction, File Description, open, create, read, write, close, fcntl functions. Files and Dictionaries: mkdir and rmdir functions, reading dictionaries, chdir, fchdir and getcwd functions. Device Special files. The Environment of a UNIX Process: Introduction, main function, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, Shared Libraries, Memory Allocation, Environment Variables, setjmp and longjmp Functions, getrlimit, setrlimit Functions.	9
Module – 4	**No. of Hours**
Process Control: Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, wait3, wait4 Functions, Race Conditions, exec Functions. Overview of IPC Methods, Pipes, popen, pclose Functions, Coprocesses, FIFOs, System V IPC, Message Queues, Semaphores. Shared Memory, Client-Server Properties, Passing File Descriptors, An Open Server-Version 1.	9
Module – 5	**No. of Hours**
Signals and Daemon Processes: Introduction, Signal Concepts, Signal Functions, SIGCLD Semantics, Kill and Raise functions, Alarm and Pause Functions, Signal Sets, sigprocmask Function, sigpending function, sigaction function, sigsetjmp and siglongjmp functions, sigsuspend function, abort function, system function, sleep, nanosleep and clock_nanosleep functions, sigqueue functions, job-control signals, signal names and numbers. Daemon Processes: Introduction, Daemon Characteristics, Coding Rules, Error Logging, Client-Server Model.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand UNIX basics, navigate files and directories and use command-line interfaces.
CO2	Manage user accounts, permissions, and system resources, create and edit files.
CO3	Apply advanced UNIX concepts, including shell scripting, troubleshooting, and networking/security features.

Text Books	
1.	Sumitabha Das., Unix Concepts and Applications., 4th Edition., Tata McGraw Hill
2.	W. Richard Stevens: Advanced Programming in the UNIX Environment, 2nd Edition, Pearson Education, 2005
3.	Unix System Programming Using C++ - Terrence Chan, PHI, 1999.
4.	M.G. Venkatesh Murthy: UNIX & Shell Programming, Pearson Education.

Web links and Video lectures (e-Resources)
https://www.youtube.com/watch?v=ffYUfAqEamY https://www.youtube.com/watch?v=Q05NZiYFcD0 https://www.youtube.com/watch?v=8GdT53KDIyY https://www.youtube.com/watch?app=desktop&v=3Pga3y7rCgo

ASSESSMENT DETAILS (BOTH CIE AND SEE)

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CONTINUOUS INTERNAL EVALUATION (CIE)

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SEMESTER END EXAMINATION

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have Part–A and Part-B.
- Part–A consists of 12 full questions (Need to write 6 questions) carrying14marks. Part–B consists of one compulsory question carrying 16 marks.
- Each full question of 14 marks will have 2 sub questions A & B Carrying 4 & 10 marks.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	**1**			**2**				
CO2		**2**			**3**			
CO3	**1**		**3**				**3**	

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-III					
CLOUD ESSENTIALS **Category: PEC**					
Course Code	:	P24MCAN315	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	Explain the fundamentals of cloud
2.	Analyze Business Benefits and Risks of Cloud Computing.
3.	Evaluate Emerging Trends in Cloud Computing

Module – 1	**No. of Hours**
Introduction to Cloud: Defining a cloud, Characteristics of Cloud Computing, Cloud computing reference model, Architectures for parallel and distributed computing, Elements of parallel computing and Elements of distributed computing. Cloud Service Models: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Function as a Service (FaaS), Blockchain-as-a-Service (BaaS) and use cases, Cloud Deployment Models: Public Cloud, Private Cloud, Hybrid and Multi-Cloud, Community Cloud.	9
Module – 2	**No. of Hours**
Core Components of Cloud Architecture: Compute Services, Storage Services, Networking Services, Virtualization, Types of Virtualization, Containers vs. Virtual Machines (VMs), Load Balancing in Cloud, Auto-Scaling & Fault Tolerance, Content Delivery Networks(CDN), Bare Metal Cloud ,Cloud Orchestration and Automation.	9
Module – 3	**No. of Hours**
Cloud Automation, DevOps, and Future Innovations: Cloud Automation and Infrastructure as Code (IaC), DevOps and Continuous Integration/Continuous Deployment (CI/CD), Multi-Cloud and Hybrid Cloud Strategies, Sustainability and Green Cloud Computing, Cloud Innovations- AI-powered cloud automation-5G and its impact on cloud computing.	9
Module – 4	**No. of Hours**
Cloud Security & Risk Management: Cloud Adoption, Advantages and Challenges of Cloud Adoption, Security Risks in Cloud- Data Breaches, Identity Theft, Network Security in Cloud. Security Solutions in Cloud: Identity and Access Management (IAM), Data Encryption Techniques, Firewalls & Intrusion Detection Systems: Compliance & Regulatory Frameworks, Disaster Recovery and Business Continuity Planning in Cloud.	9
Module – 5	**No. of Hours**
Emerging Trends and case study: AI, Edge Computing, Quantum Cloud, Event-driven architecture in cloud, Cloud-based AI services -AWS SageMaker, Google Vertex AI, Azure ML. Case Study: Netflix's Cloud Migration, Zoom's Cloud Scalability.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Demonstrate the fundamental concepts of cloud computing.
CO2	Understand Cloud Security Challenges.
CO3	Understand and Explain Cloud Compute Services and Analyze Cloud Networking Services.
CO4	Compare different deployment and service models of cloud to develop different variety of applications with securities.

Text Books	
1.	CompTIA Cloud Essentials+ Study Guide: Exam CLO-002 [2nd ed.]
2.	Rajkumar Buyya, Christian Vecchiola, and Thamrai Selvi Mastering Cloud Computing McGraw Hill Education.
3.	Handbook of Cloud Computing, Borko Furht- Armando Escalante.
4.	Cloud Essentials: CompTIA Authorized Courseware for Exam CLO-001.

Web links and Video lectures (e-Resources)
. https://youtu.be/dUpwh5Xg xsA?si=pF4mgT2n5W 7nyQFc https://www.youtube.com/watch?v=1N3oqYhzHv4 https://www.youtube.com/watch?v=RWgW-CgdIk0

ASSESSMENT DETAILS (BOTH CIE AND SEE)

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CONTINUOUS INTERNAL EVALUATION (CIE)

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SEMESTER END EXAMINATION

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CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	**2**							
CO2	**2**	**2**			**2**			
CO3	**2**	**2**			**3**			
CO4	**2**	**3**		**3**				**3**

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-III					
INTRODUCTION TO ERP AND SAP BASIS ADMINISTRATION **Category: PEC**					
Course Code	:	P24MCAN316	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:2:0	SEE	:	50 Marks
Total Hours	:	45 L	Total	:	100 Marks
Credits		3	SEE Duration	:	3 Hrs

Course Objectives	
1.	Explain the objectives, importance, and decision phases of supply chain management.
2.	Evaluate ERP Implementation Processes
3.	Analyze the ERP Market and Leading Vendors
4.	Explain SAP system architecture, installation, and administration processes.

Module – 1	**No. of Hours**
Introduction to Supply Chain Management: Supply chain – objectives – importance – decision phases – process view – competitive and supply chain strategies – achieving strategic fit – supply chain drivers – obstacles – framework – facilities – inventory – transportation – information – sourcing – pricing.	9
Module – 2	**No. of Hours**
ERP Implementation: Implementation of Life Cycle, Implementation Methodology, Hidden Costs, Organizing Implementation, Vendors, Consultants and Users, Contracts, Project Management and Monitoring	9
Module – 3	**No. of Hours**
ERP Market: ERP Market Place, SAP AG, People Soft, Baan Company, JD Edwards World Solutions Company, Oracle Corporation, QAD, System Software Associates.	9
Module – 4	**No. of Hours**
Introduction to SAP Basis: System architecture, Installation/administration. User and role management, Transport Management System (TMS), Job\spool management, and database administration. System monitoring, troubleshooting, performance optimization, focusing on work processes, buffer tuning and memory management.	9
Module – 5	**No. of Hours**
Advanced SAP Basis & HANA: SAP patch management, system upgrades, security, audit logs, user access monitoring, backup and disaster recovery strategies. A brief introduction to SAP HANA: architecture, basic administration and case studies.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Analyze the essentials of supply chain management in ERP.
CO2	Analyze the implementation of ERP in the context of business of the different organization
CO3	Analyze the given case study of ERP marketing.

Text Books	
1.	"Supply Chain Management: Strategy, Planning, and Operation" – *Sunil Chopra, Peter Meindl*
2.	"Enterprise Resource Planning: Fundamentals of Design and Implementation" – *K. Ganesh, Sanjay Mohapatra*
3.	"SAP Basis Administration Handbook, NetWeaver Edition" – *Ranjit Mereddy*
4.	"SAP HANA Administration" – *Richard Bremer, Lars Breddemann*

Web links and Video lectures (e-Resources)
https://training.sap.com/content/sap-logistic-supply-chain https://www.sap.com/products/erp/what-is-erp.html. https://youtu.be/uuF746PiZ9k

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CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1		1	2					
CO2		2	1	3				
CO3			2		3			

Level 3 - High, Level 2 - Moderate, Level 1 - Low

IoT

SEMESTER-III					
DATA MANAGEMENT FOR IOT **Category: PEC**					
Course Code	:	P2AMCAI311	CIE	:	50Marks
Teaching Hours L:T:P	:	3:0:0	SEE	:	50Marks
Total Hours	:	45(T)	Total	:	100Marks
Credits	:	03	SEE Duration	:	3Hrs

Course Objectives	
1.	Explain the fundamental concepts, architecture, and communication protocols of IoT, including smart devices, RFID, and wireless sensor networks.
2.	Analyze IoT network connectivity, data exchange formats, and web integration techniques for efficient IoT communication.
3.	Apply data acquisition, storage, cloud computing, and analytics techniques to manage IoT data effectively.
4.	Evaluate IoT security challenges, privacy concerns, and identity management strategies to ensure data protection.
5.	Develop IoT prototypes, integrate IoT gateways, and analyze business models for real-world applications and Industry 4.0.

Module–1	**No. of Hours**
Introduction to IoT and System Architecture: Vision and Definitions of IoT, Smart Hyper connected Devices and IoT Applications, IoT Conceptual Frame work and Architectural Views, IoT Communication Protocols: MQTT, CoAP, XMPP, Sources of IoT Data: RFID, Wireless Sensor Networks, Wearable Technologies, Smart Homes, Smart Cities	9
Module–2	**No. of Hours**
IoT Connectivity, Communication, and Web Integration: IoT Network and Connectivity Principles: IPv4, IPv6, 6LoWPAN, TCP/IP, IP Addressing, MAC Addressing, IETF Six-Layer Design for IoT, Communication Protocols: HTTP, HTTPS, FTP, Telnet, Web Connectivity & Data Exchange: JSON, MIME, TLV Data Formats, REST, SOAP, Web Sockets, MQTT.	9
Module–3	**No. of Hours**
IoT Data Management and Analytics: Data Acquisition and Storage: Data Validation, Events Assembly, Data Store Processes, SQL v/s No SQL Databases, Spatial & Time-Series Databases, Cloud Data Processing for IoT: SaaS, IaaS, PaaS, DaaS, XaaS Models, Cloud Platforms (AWS IoT, TCS Connected Universe), Cloud-Based Data Storage & Computing, IoT Data Analytics: Descriptive, Real-time, Predictive Analytics, Business Intelligence & Big Data for IoT.	9
Module–4	**No. of Hours**
IoT Security, Privacy, and Threat Management: IoT Security Challenges: Vulnerabilities & Threat Analysis, Identity Establishment & Access Control, IoT Security Architecture: Layered Attacker Models, IoT Security Tomography, Data Privacy Considerations: Use Cases and Misuse Cases, lockchain for IoT Security.	9
Module–5	**No. of Hours**
IoT Prototyping, Applications, and Business Models : Prototyping IoT Devices and Embedded Systems: Arduino, Intel Galileo, RaspberryPi, BeagleBone, mBed, IoT Gateway Development & API Integration, IoT in Industrial Applications (Industry4.0): Connected Vehicles (TeslaExample), Smart Cities, Smart Agriculture, Smart Production, Business Models & IoT Innovation: Value Creation using IoT, IoT driven Business Strategies	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Explain the fundamental concepts, architectures, communication protocols, and data sources of IoT, including smart devices, RFID, and wireless sensor networks.
CO2	Analyze IoT network architectures, communication protocols, data exchange formats, and web integration techniques for seamless IoT connectivity..

CO3	Apply data acquisition, storage, cloud computing, and analytics techniques to process and manage IoT data effectively.
CO4	Evaluate IoT security challenges, privacy concerns, identity management, and emerging security frameworks for safeguarding IoT data.
CO5	Develop IoT prototypes, integrate IoT gateways and APIs, and analyze real-world applications and business models for IoT innovation.

Text Books	
1.	"**Internet of Things: Principles and Paradigms**" – Rajkumar Buyya & Amir Vahid Dastjerdi Covers IoT architecture, communication protocols, cloud integration, and security concepts.
2.	"**Internet of Things: A Hands-on Approach**" –Arshdeep Bahga & Vijay Madisetti Practical guide with IoT prototyping using Raspberry Pi, Arduino, and cloud platforms
3.	"**Building the Internet of Things**: Implement New Business Models, Disrupt Competitors, and Transform Your Industry"–Maciej Kranz

Web links and Video lectures (e-Resources)

- IoT Security & Privacy–https://csrc.nist.gov/publications/detail/sp/800-183/final
- IoT Security IoT Basics & Applications–https://www.coursera.org/learn/internet-of-things
- IoT Data Management & Cloud Computing–AWS IoT Core Tutorials
- IoT Security & Privacy–Stanford Cybersecurity & Internet of Things`

ASSESSMENT DETAILS (BOTH CIE AND SEE)

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CONTINUOUS INTERNAL EVALUATION (CIE)

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SEMESTER END EXAMINATION

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CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	-	2	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	3	3	-	2	-	-	-	-
CO4	3	3	-	-	-	-	2	-	-	-	-
CO5	-	3	-	-	-	3	-	-	-	-	-

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-III					
NETWORKED EMBEDDED APPLICATION **Category: PEC**					
Course Code	:	P2AMCAI312	CIE	:	50Marks
Teaching Hours L:T:P	:	3:0:0	SEE	:	50Marks
Total Hours	:	45(T)	Total	:	100Marks
Credits	:	3	SEE Duration	:	3Hrs

Course Objectives	
1.	To expose the students to the fundamentals of wired embedded networking techniques.
2.	To introduce the concepts of embedded ethernet.
3.	To expose the students to the fundamentals of wireless embedded networking.
4.	To discuss the fundamental building blocks of digital instrumentation.
5.	To introduce design of Programmable measurement & control of electrical Device.

Module–1	**No. of Hours**
NETWORK EMBEDDED SYSTEMS: AN INTRODUCTION Networked Embedded Systems: Networking of Embedded Systems-Automotive Networked Embedded Systems Networks-Embedded Systems in Industrial Automation- Wireless Sensor Networks- Networked Embedded Systems in Building Automation–Middleware Design and Implementation for Networked Embedded Systems-Introduction- Middleware Solution Space ORB Middleware for Networked Embedded Systems.	9
Module–2	**No. of Hours**
WIRELESS SENSOR NETWORKS: Introduction To WSNS- Architecture for WSNS-Localization & Synchronization for WSN-Time Sync Issues & Resource Aware Localization.	9
Module–3	**No. of Hours**
ENERGY-EFFICIENT MACPROTOCOLS FOR WSN Design Issues for MAC Protocols for WSNs, Overview on Energy-Efficient MAC Protocols for WSNs, Mobility Support in WSNs, Multi channel Protocols for WSNs, Summary and Open Issues.	9
Module–4	**No. of Hours**
AUTOMOTIVE NETWORK EDEMBEDDED SYSTEMS Trends in Automotive Communication Systems, Time–Triggered Communication, Flex Ray Communications, Lin Standards.	9
Module–5	**No. of Hours**
INDUSTRIAL AUTOMATION Introduction To Industrial Automation, Fieldbus Bus –What Is a Fieldbus, Communication Fundamental, The OSI Model Fieldbus Characteristics, Networking Networks, Interconnection in Heterogeneous Environments, Industrial Ethernet, The New Fieldbus, Real-Time Ethernet-Home Automation Home Automation-Introduction-Structure of the IEC Standardization, Real-Time Requirements, Practical Realizations.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the basics of network systems.
CO2	Discuss about the sensor network components, architecture and design principles of WSN
CO3	Explain the need MAC protocols and energy conservation.
CO4	Application of networked automotive system.
CO5	Design and development of home automation.

Text Books	
1.	R. Zurawski, Network Embedded Systems, CrcPress, 2009.
2.	G. Pottie, W.Kaiser, Principles of Embedded Networked System Design.
3.	RajKamal, Embedded Systems, Tata Mc GrawHill, NewDelhi, 2003
4.	Francine Krief, ”Communicating Embedded System” Wiley 2010.

Web links and Video lectures (e-Resources)
• https://youtu.be/aYfBTXXhK70?si=QwkwzAfzGt34ESP2

- https://youtu.be/JO4AEkOVF2M?si=625mOK9NIuaP6Gn-
- https://youtu.be/vn7aT9-cYzQ?si=eiEV3iiLAzJlIWYI
- https://youtu.be/runrFcCsC1E?si=FGDXIXMtjNd1VykP

ASSESSMENT DETAILS (BOTH CIE AND SEE)

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PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	2	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	2	-	-	-
CO3	-	-	-	-	-	2	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-
CO5	-	-	1	-	-	-	-	-	-	-	-

Level 3 – High, Level 2 – Moderate, Level 1 – Low

SEMESTER-III					
CROSS PLATFORM APPLICATION DEVELOPMENT **Category: PEC**					
Course Code	:	P2AMCAI313	CIE	:	50Marks
Teaching Hours L:T:P	:	3:0:0	SEE	:	50Marks
Total Hours	:	45L	Total	:	100Marks
Credits	:	3	SEE Duration	:	3Hrs

Course Objectives	
1.	Understand Cross-Platform Development Fundamentals.
2.	Install and configure cross-platform development environments.
3.	Implement responsive UI designs that adapt to different screen sizes and resolutions.
4.	Write code using languages like Dart (Flutter) and Implement core application functionality using reusable code components.

Module–1	**No. of Hours**
Introduction to Dart-Getting started with Dart, The evolution of Dart, How Dart works, Dart VM and JavaScript compilation, Dart development tools, Understanding why Flutter uses Dart, introducing the structure of the Dart language, Dart operators, Type checking and casting, Dart types and variables, Type inference– bringing dynamism to the show, Control flows and looping, Functions,Datastructures,collections,andgenerics,IntroductiontoOOPinDart,DartOOP features- Objects and classes, Encapsulation, Inheritance and composition, Abstraction, Polymorphism	9
Module–2	**No. of Hours**
Intermediate Dart Programming- Dart classes and constructors, Field accessors–getters and setters, Static fields and methods, Class inheritance, Interfaces, abstract classes, and mixins, Callable classes, top-level functions, and variables, Understanding Dart libraries and packages, Creating Dart libraries, Dart packages, Package structures, Stage hand–the Dart Project Generator, The pubspec file, Package dependencies–pub, Introducing a sync programming with Futures and Isolates, Introducing Unit testing with Dart	9
Module–3	**No. of Hours**
An Introduction to Flutter- Comparisons with other mobile app development frame works, Flutter compilation (Dart), Flutter rendering, Widgets introduction, Hello Flutter-Running the generated project. The Flutter User Interface–Widgets: Building Layouts in Flutter-Stateful versus stateless widgets, Built in widgets, Understanding built-in layout widgets, Creating a UI with widgets, Creating custom widgets.	9
Module–4	**No. of Hours**
Handling User Input and Gestures-Handling user gestures, Input Widgets, Validating Inputs (Forms), Custom input and Form Field. **Theming and Styling** – Theme widgets, Material Design, sing Custom Fonts, Dynamic styling with Media Query and Layout Builder	9
Module–5	**No. of Hours**
Routing: Navigating between Screens-Understanding the Navigator widget, Named routes, Screen transitions, Hero animations **Developing Fully Featured Apps**–Firebase Plug-in- Firebase Overview, Firebase authentication, NoSql Database with Cloud Firestore	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Explain the fundamental concepts, benefits, and challenges of cross-platform application development.
CO2	Compare different cross-platform frame works (Flutter, React Native, Xamarin) and select the appropriate one for a given application.
CO3	Design and implement responsive and adaptive user interfaces for cross-plat form applications.
CO4	Design and develop basic user interfaces that are responsive across multiple platforms and screensizes.

Text Books	
1.	Flutter for Beginners-Alessandro Biessek, Published by Packt Publishing Ltd. ISBN 978-1-78899-608-2

Web links and Video lectures (e-Resources)
• Official Docs:https://flutter.dev/docs • Flutter YouTube Channel: https://www.youtube.com/c/FlutterDev • Dart Programming: https://dart.dev

ASSESSMENT DETAILS (BOTH CIE AND SEE)

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CONTINUOUS INTERNAL EVALUATION (CIE)

The maximum CIE marks are 50. A student candidate shall obtain not less than 50% of the maximum CIE marks. CIE Assessment shall be based on:

- Descriptive Tests conducted for 50 marks and scaled down to 30 Marks.
- Assignments, presentations, Quiz, Simulation, Experimentation, Mini project, oral examination, field work and class participation etc., (for 20 Marks) conducted in the respective course. Course instructors are given autonomy in choosing a few of the above based on the subject relevance and should maintain necessary supporting documents for same.

SEMESTER END EXAMINATION

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have Part–A and Part-B.
- Part–A consists of 12 full questions (Need to write 6 questions) carrying14marks. Part–B consists of one compulsory question carrying 16 marks.
- Each full question of 14 marks will have 2 sub questions A & B Carrying 4 & 10 marks.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	-	-	2	-	-	-	-	-	-
CO2	2	-	2	-	2	-	-	-	-	-	-
CO3	-	-	3	-	3	-	-	3	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	2	-	2	-	-	-	-	-	-

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-III					
IOT TECHNOLOGY AND APPLICATION **Category: PEC**					
Course Code	:	P2AMCAI314	CIE	:	50Marks
Teaching Hours L:T:P	:	3:0:0	SEE	:	50Marks
Total Hours	:	45L	Total	:	100Marks
Credits	:	3	SEE Duration	:	3Hrs

Course Objectives	
1.	To understand the concepts of Internet of Things and the application of IoT.
2.	To Explore IoT Architectures and Technologies.
3.	Examine IoT Communication and Networking.
4.	Apply IoT Solutions in Real-World Scenarios.

Module–1	**No. of Hours**
What is The Internet of Things? Overview and Motivations, Examples of Applications, IPV6 Role, Areas of Development and Standardization, Scope of the Present Investigation. Internet of Things Definitions and frameworks-IoT Definitions, IoT Frameworks, Basic Nodal Capabilities. Internet of Things Application Examples-Overview, Smart Metering /Advanced Metering Infrastructure Health/Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Tracking, Over-The-Air-Passive Surveillance/Ring of Steel, Control Application Examples, Myriad Other Applications.	9
Module–2	**No. of Hours**
Fundamental IoT Mechanism and Key Technologies-Identification of IoT Object and Services, Structural Aspects of the IoT, Key IoT Technologies. Evolving IoT Standards-Overview and Approaches, IETF IPV6 Routing Protocol for RPLRoll, Constrained Application Protocol, Representational State Transfer, ETSIM2M, Third Generation Partnership Project Service Requirements for Machine-Type Communications, CENELEC, IETFIPv6 Over Low power WPAN, Zigbee IP (ZIP), IPSO.	9
Module–3	**No. of Hours**
Textbook1: 1.1 to 3.1 1 Module-3 Layer½ Connectivity: Wireless Technologies for the IoT- WPAN Technologies for IoT / M2M, Cellular and Mobile Network Technologies for IoT/M2M, Layer 3 Connectivity: IPv6 Technologies for the IoT: Overview and Motivations. Address Capabilities, IPv6 Protocol Overview, IPv6 Tunneling, IPsec in IPv6, Header Compression Schemes, Quality of Service in IPv6, Migration Strategies to IPv6...	9
Module–4	**No. of Hours**
Case Studies illustrating IoT Design-Introduction, Home Automation, Cities,Environment, Agriculture, Productivity Applications.	9
Module–5	**No. of Hours**
Data Analytics for IoT: Introduction, Apache Hadoop, Using Hadoop Map Reduce for Batch Data Analysis, Apache Oozie, ApacheSpark, ApacheStorm, Using Apache Storm for Real-time Data Analysis, Structural Health Monitoring Case Study.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Use of Devices, Gateways and Data Management in IoT.
CO2	Design IoT applications in different domain and be able to analyze their performance
CO3	Implement basic IoT applications on embedded platform.
CO4	Implement basic IoT applications for Data Analytics

Text Books	
1.	Daniel Minoli: Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications, Wiley, 2013.
2.	Arshdeep Bahga, Vijay Madisetti: Internet of Things: A Hands-on Approach, Universities Press, 2015.

Web links and Video lectures (e-Resources)
• http://download.e-bookshelf.de/download/0000/8067/18/L-G-0000806718-0002366365.pdf • https://jcer.in/jcer-docs/E-Learning/Digital%20Library%20/E-Books/Internet-of-things-a-hands on-approach-%20Arshadeep.pdf

ASSESSMENT DETAILS (BOTH CIE AND SEE)

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CONTINUOUS INTERNAL EVALUATION (CIE)

The maximum CIE marks are 50. A student candidate shall obtain not less than 50% of the maximum CIE marks. CIE Assessment shall be based on:

- Descriptive Tests conducted for 50 marks and scaled down to 30 Marks.
- Assignments, presentations, Quiz, Simulation, Experimentation, Mini project, oral examination, field work and class participation etc., (for 20 Marks) conducted in the respective course. Course instructors are given autonomy in choosing a few of the above based on the subject relevance and should maintain necessary supporting documents for same.

SEMESTER END EXAMINATION

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have Part–A and Part-B.
- Part–A consists of 12 full questions (Need to write 6 questions) carrying14marks. Part–B consists of one compulsory question carrying 16 marks.
- Each full question of 14 marks will have 2 sub questions A & B Carrying 4 & 10 marks.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
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CO2	-	-	1	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	2	-	3	-	-	-
CO4	-	3	-	-	-	-	-	-	-	-	-

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-III					
COMMUNICATION AND NETWORKING TECHNOLOGY IN IOT					
Course Code	:	P2AMCAI315	CIE	:	50Marks
Teaching Hours L:T:P	:	3:2:0	SEE	:	50Marks
Total Hours	:	45(T)	Total	:	100Marks
Credits	:	3	SEE Duration	:	3Hrs

Course Objectives	
1.	Understand fundamentals of IoT architecture outline and standards.
2.	Understand and analyze different architectural views.
3.	Understand the importance of IoT Layer Protocols.
4.	Understand the importance of architecture and Industrial Internet of Things.

Module–1	**No. of Hours**
Introduction: IoT Technology trends and future opportunities, IoT and Businesss cope Evolution, Business perspectives, Embedded systems Relationships, Challenges of IoT, Characteristics of IoT, Sensors and Actuators in IoT enabling Industrial Automation, Wireless sensor Networks in IoT, connecting all the things in Internet of things, IoT M2M, Software Define Networking. IoT System Management is Essential.	9
Module–2	**No. of Hours**
Introduction IOT life cycle, Physical Design, IOT Conceptual architecture, IOT protocols, Levels of IOT, IOT networking Protocols, Networking standards and technologies in IOT.	9
Module–3	**No. of Hours**
Introduction of 5G networks in IoT, IoT Networking consideration and Challenges, Business case for the IoT, Network optimization for IoT devices, Transport Layer protocols, Network Layer Protocols, IoT communication Challenges, Application Protocols for IoT.	9
Module–4	**No. of Hours**
Introduction, Evolution of IIOT, Advantages of IIOT, Drivers, Risk associated with IIOT, Businesses and Industries approach IIOT security, Applications of IIOT, Work flow of IIOT, Security considerations and challenges, IIOT: Use Cases.	9
Module–5	**No. of Hours**
Introduction, IIOT layered Architecture, three tiers IIOT, Security in IIOT, Service based Frameworks, Solutions against Intrusions in IIOT, Machine learning based solutions, Deep Learning based solutions.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the fundamentals of social media analytics, data types, key metrics, and data collection techniques.
CO2	Apply sentiment analysis and text mining techniques to analyze social media data using NLP and ML models.
CO3	Analyze social network structures and trends using graph-based analytics, hash tag modeling, and virality detection.
CO4	Visualize and interpret social media insights using tools like Tableau and Power BI to support decision-making.
CO5	Evaluate real-world applications of social media analytics in business, digital marketing, brand monitoring, and ethical considerations.

Text Books	
1.	Dr. Vijendra Pratap Singh, Mr. Neeraj Kumar., “IoT Communication Protocols”, ISBN: 978-81961690- 9-1, Deccan International Academic Publishers, 2023.
2.	Bernd Scholz-Reiter, Florian Michahelles, “Architecting the Internet of Things”, ISBN978-3-642- 19156-5e-ISBN978-3-642-19157-2, Springer, 2016.
3.	N. Ida, Sensors, Actuators and Their Interfaces, Scitech Publishers, 2014.

Web links and Video lectures (e-Resources)
• https://books.google.co.in/books?id=PSe0EAAAQBAJ&printsec=frontcover&source=gbs_ge_summaad=0#v=onepage&q&f=false • https://link.springer.com/book/10.1007/978-3-642-19157-2 • https://onlinecourses.nptel.ac.in/noc19_cs65/preview • https://archive.nptel.ac.in/courses/106/105/106105166/ • https://onlinecourses.nptel.ac.in/noc21_ee85/preview

ASSESSMENT DETAILS (BOTH CIE AND SEE)

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CONTINUOUS INTERNAL EVALUATION (CIE)

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SEMESTER END EXAMINATION

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have Part–A and Part-B.
- Part–A consists of 12 full questions (Need to write 6 questions) carrying14marks. Part–B consists of one compulsory question carrying 16 marks.
- Each full question of 14 marks will have 2 sub questions A & B Carrying 4 & 10 marks.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
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CO2	-	-	2	-	-	-	-	-	-	-	-
CO3	-	-	-	3	-	-	-	-	-	-	-
CO4	-	-	2	-	-	-	-	-	-	-	-

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-III					
SOFTWARE AND PROGRAMMING IN IOT					
Course Code	:	P2AMCAI316	CIE	:	50Marks
Teaching Hours L:T:P	:	3:0:0	SEE	:	50Marks
Total Hours	:	45(T)	Total	:	100Marks
Credits	:	3	SEE Duration	:	3Hrs

Course Objectives	
1.	Understand the Fundamentals of IoT Programming with Python. Develop RESTful API and Web Socket-based IoT Applications
2.	Implement MQTT-based IoT Communication
3.	Integrate IoT with Visualization and Automation Platforms.
4.	Explore the Synergies of IoT with Emerging Technologies.

Module–1	**No. of Hours**
Programming with Python-Setting Up your Development Environment, Understanding your Python installation, Getting Started with Python and IoT, Creating a bread board prototype circuit, Reading an electronics chematic diagram, Exploring two ways to flash an LED in Python, Exploring two ways to integrate a push button in Python, Creating your first IoT program	9
Module–2	**No. of Hours**
Networking with RESTful APIs and Web Sockets Using Flask, Introducing the Flask micro services framework, Creating a RESTful API service with Flask-RESTful, Creating a Web Socket service with Flask-Socket IO, Adding a Web Socket client webpage, Comparing the RESTful API and Web Socket servers.	9
Module–3	**No. of Hours**
Networking with MQTT, Python, and the Mosquitto MQTT Broker, Installing the Mosquitto MQTT broker, Learning MQTT by example, Introducing the Python Paho-MQTT client library, Controlling an LED with Python and MQTT, Building a web-based MQTT client.	9
Module–4	**No. of Hours**
IoT Visualization and Automation Platforms-Triggering an IFTTT Applet from your RaspberryPi, actioning your RaspberryPi from an IFTTT Applet, Visualizing data with the Thing Speak platform, Other IoT and automation platforms for further exploration..	9
Module–5	**No. of Hours**
Exploring Synergies with Emerging Technologies, Benefits of combining IoT and block chain, Benefits of combining IoT and generative AI, Benefits of combining IoT and LLM, Benefits of combining IoT and AI/ML, Benefits of combining IoT with immersive Technologies, Benefits of combining IoT with 3D and 4Dprinting, Benefits of combining IoT with 5G and6G, Benefits of combining IoT and cloud.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Demonstrate basic IOT programming in Python.
CO2	Develop practical applications with RESTful API, Web Sockets, MQTT, IFTTT etc.
CO3	Apply IoT techniques to solve real world problems. Tasks with Spark MLlib

Text Books	
1.	Raspberry Pi Cook book, Simon Monk, Publisher(s): O'Reilly Media,Inc.
2.	Programming the Internet of Things, by Andy King, Publisher O'Reilly Media, Inc.
3.	Internet of Things: Architecture and Design Principles, Raj Kamal, McGraw Hill Education (India) Private Limited

Web links and Video lectures (e-Resources)

- Flask Basics – https://flask.palletsprojects.com/en/latest/
- BuildingRESTfulAPIswithFlaskRESTfulhttps://flaskrestful.readthedocs.io/e//
- Flask-SocketIO for Real-time WebSockets – https://flask- socketio.readthedocs.io/en/latest/
- TriggeringIFTTTwithRaspberryPi–https://ifttt.com/

- Learning MQTT Protocol – https://www.hivemq.com/mqtt-essentials Video Lectures: https://youtu.be/E2ZBZb_WKMw
- https://youtu.be/t7vQF0ynF9g
- https://youtu.be/38PkhZBaEE4
- https://youtu.be/dPhr1YCQTU4
- https://youtu.be/gRRcFdmtjOM
- https://youtu.be/z3YMz-Gocmw

ASSESSMENT DETAILS (BOTH CIE AND SEE)

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SEMESTER END EXAMINATION

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CO-PO Mapping

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CO1	1	-	-	-	-	-	-	-	-	-	-
CO2	-	-	2	-	-	-	-	-	-	-	-
CO3	-	2	-	-	3	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Security

SEMESTER-III					
ETHICAL HACKING **Category: PEC**					
Course Code	:	P24MCAS311	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	To develop a comprehensive understanding of ethical hacking principles, methodologies, and tools, and recognize the significance of ethical and legal considerations in conducting security assessments.
2.	To acquire hands-on proficiency in executing penetration tests, vulnerability assessments ,and Ethical hacking techniques across various system components, networks, and applications
3.	To demonstrate the ability to identify, assess, and prioritize vulnerabilities in diverse computing environments using both manual and automated methods, and effectively communicate these findings to stakeholders.
4.	To develop a strategic mindset towards cyber security by acquiring knowledge of common attack Vectors, learning to simulate real-world attacks, and implementing preventive measures to secure systems, Networks and web applications.

Module – 1	**No. of Hours**
Introduction to Ethical Hacking Introduction to ethical hacking and its importance, Legal and ethical considerations in ethical hacking, Differentiating between black hat, white hat, and grey hat hacking, Basic cyber security concepts and terminology, Overview of penetration testing methodologies.	9
Module – 2	**No. of Hours**
Foot printing and Information Gathering Passive and active information gathering techniques, Who is lookup, DNS enumeration, and social engineering, Tools and methodologies for foot printing, Google hacking and OSINT (Open Source Intelligence) techniques.	9
Module – 3	**No. of Hours**
Scanning and Enumeration: Port scanning techniques: SYN, TCP, UDP scans; Service enumeration and version detection; NetBIOS, SNMP, and SMTP enumeration; Vulnerability scanning and assessment.	9
Module – 4	**No. of Hours**
System Hacking and Exploitation Password cracking techniques and tools; Privilege escalation and maintaining access; Malware Types and countermeasures; Exploiting common vulnerabilities (e.g., buffer overflow , SQL injection).	9
Module – 5	**No. of Hours**
Web Application and Network Security Common web vulnerabilities: SQL injection, XSS, CSRF; Web application penetration testing methodology; Network sniffing and spoofing; Intrusion Detection Systems (IDS) and Intrusion Prevention Systems (IPS).	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Explain the core concepts, principles and legal Considerations of ethical hacking.
CO2	Make us of different tools and techniques for information gathering, scanning and enumeration
CO3	Apply tools and techniques for exploiting vulnerabilities, Network sniffing, web application hacking, system hacking, Escalating privileges, etc.
CO4	Analyze the results of IDS/IPS, ethical hacking and penetration testing tasks

Text Books	
1.	Rafay Baloch, Ethical Hacking and Penetration Testing Guide, CRC Press, 2015, ISBN978-1 4822- 3161-8 (Paperback)
2.	Harper Allen, Gray Hat Hacking: The Ethical Hackers Hand Book, 3rd Edition, Mc Graw Hill, 2011.
3.	JayBeale, Andrew R. Baker, Joel Esler, Snort Intrusion Detection and Prevention Tool kit, Syngres Publishing, Inc, 2007, ISBN-13:978-1-59749-099-3

Web links and Video lectures (e-Resources)
Nmap-Official Documentation :https://nmap.org/book/ National Vulnerability Database(NVD):https://nvd.nist.gov/

ASSESSMENT DETAILS (BOTH CIE AND SEE)

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CONTINUOUS INTERNAL EVALUATION (CIE)

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SEMESTER END EXAMINATION

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CO2	2	-	-	-	2	3	-	-	-	-	-
CO3	3	-	-	-	2	3	-	-	-	-	-
CO4	3	-	-	-	3	2	3	-	-	-	-

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-III					
CYBER SECURITY **Category: PEC**					
Course Code	:	P24MCAS312	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	To learn cybercrime and cyber law.
2.	To understand the cyber-attacks and tools for mitigating them.
3.	To understand information gathering.
4.	To learn how to detect a cyber-attack.
5.	To learn how to prevent a cyber-attack.

Module – 1	**No. of Hours**
INTRODUCTION Cyber Security – History of Internet – Impact of Internet – CIA Triad; Reason for Cyber Crime – Need for Cyber Security – History of Cyber Crime; Cybercriminals – Classification of Cybercrimes – A Global Perspective on Cyber Crimes; Cyber Laws – The Indian IT Act – Cybercrime and Punishment.	9
Module – 2	**No. of Hours**
ATTACKS AND COUNTER MEASURES OSWAP; Malicious Attack Threats and Vulnerabilities: Scope of Cyber-Attacks – Security Breach – Types of Malicious Attacks – Malicious Software – Common Attack Vectors – Social engineering Attack – Wireless Network Attack – Web Application Attack – Attack Tools – Counter measures..	9
Module – 3	**No. of Hours**
RECONNAISSANCE Harvester – Who is – Netcraft – Host – Extracting Information from DNS – Extracting Information from E-mail Servers – Social Engineering Reconnaissance; Scanning – Port Scanning – Network Scanning and Vulnerability Scanning – Scanning Methodology – Ping Sweer Techniques – Nmap Command Switches.	9
Module – 4	**No. of Hours**
INTRUSION DETECTION Host -Based Intrusion Detection – Network -Based Intrusion Detection – Distributed or Hybrid Intrusion Detection – Intrusion Detection Exchange Format – Honeypots – Example System Snort.	9
Module – 5	**No. of Hours**
INTRUSION PREVENTION Firewalls and Intrusion Prevention Systems: Need for Firewalls – Firewall Characteristics and Access Policy – Types of Firewalls – Firewall Basing – Firewall Location and Configurations –Intrusion Prevention Systems – Example Unified Threat Management Products.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Explain the basics of cyber security, cybercrime and cyber law
CO2	Classify various types of attacks and learn the tools to launch the attacks
CO3	Apply various tools to perform information gathering tasks with Spark MLlib
CO4	Apply intrusion techniques to detect intrusion..
CO5	Apply intrusion prevention techniques to prevent intrusion

Text Books	
1.	Patrick Engebretson, ―The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made easy‖, Elsevier, 2011. (Unit-3)
2.	William Stallings, Lawrie Brown, ―Computer Security Principles and Practice‖, 3rd Edition, Pearson Education, 2015. (Unit-4 & 5)
3.	Jure Leskovec, Anand Rajaraman, Jeff Ullman – Mining of Massive Datasets, Cambridge University Press.

Reference Text Books	
1.	David Kim, Michael G. Solomon, ―Fundamentals of Information Systems Security‖, Jones & Bartlett Learning Publishers, 2013.

2.	Nina Godbole, Sunit Belapure, ―Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives‖, Wiley Publishers, 2011.

ASSESSMENT DETAILS (BOTH CIE AND SEE)

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CONTINUOUS INTERNAL EVALUATION (CIE)

The maximum CIE marks are 50. A student candidate shall obtain not less than 50% of the maximum CIE marks. CIE Assessment shall be based on:

- Descriptive Tests conducted for 50 marks and scaled down to 30 Marks.
- Assignments, presentations, Quiz, Simulation, Experimentation, Mini project, oral examination, field work and class participation etc., (for 20 Marks) conducted in the respective course. Course instructors are given autonomy in choosing a few of the above based on the subject relevance and should maintain necessary supporting documents for same.

SEMESTER END EXAMINATION

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have Part–A and Part-B.
- Part–A consists of 12 full questions (Need to write 6 questions) carrying14marks. Part–B consists of one compulsory question carrying 16 marks.
- Each full question of 14 marks will have 2 sub questions A & B Carrying 4 & 10 marks.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	1	-	-	-	-	-	-	-	-	-
CO2	-	2	-	3	-	-	-	-	-	-	-
CO3	2	2	-	-	3	-	-	-	-	-	-
CO4	2	1	-	2	3	3	-	-	-	-	-
CO5	-	2	-	-	-	-	3	-	-	-	-

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-III					
CRYPTOGRAPHY AND NETWORK SECURITY **Category: PEC**					
Course Code	:	P24MCAS313	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	To make the student learn different encryption techniques along with hash functions, MAC, digital signatures and their use in various protocols for network security and system security.

Module – 1	**No. of Hours**
INTRODUCTION: Computer Security Concepts, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security. CLASSICAL ENCRYPTION TECHNIQUES: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Steganography.	9
Module – 2	**No. of Hours**
D BLOCK CIPHERS AND THE DATA ENCRYPTION STANDARD: Block Cipher Principles, The Data Encryption Standard (DES), A DES Example, The Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles. BLOCK CIPHER OPERATION: Multiple Encryption and Triple DES, Electronic Codebook Mode, Cipher Block Chaining Mode, Cipher Feedback Mode, Output Feedback Mode, Counter Mode. STREAM CIPHERS : Stream ciphers,RC4 Ciphers, RC4.	9
Module – 3	**No. of Hours**
NUMBER THEORY-: Divisibility and the Division Algorithm, The Euclidean Algorithm, Modular Arithmetic, Prime Numbers, Fermat‟s and Euler's Theorems, Testing for Primality, The Chinese Remainder Theorem, and Discrete Logarithms. PUBLIC-KEY CRYPTOGRAPHY, RSA AND OTHER PUBLIC-KEY CRYPTOSYSTEMS: Principles of Public-Key Cryptosystems, The RSA Algorithm, DiffieHellman Key Exchange, ElGamal Cryptosystem.	9
Module – 4	**No. of Hours**
CRYPTOGRAPHIC HASH FUNCTIONS: Applications of Cryptographic Hash Function, Two Simple Hash Functions, Requirements and Security, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithm (SHA). MESSAGE AUTHENTICATION CODES: Message Authentication Requirements, Message Authentication Functions, Message Authentication Codes, Security of MACs, MACs Based on Hash Functions (HMAC).	9
Module – 5	**No. of Hours**
DIGITAL SIGNATURES- Digital Signatures, ElGamal Digital Signature Scheme, Schnorr Digital Signature Scheme, Digital Signature Standard (DSS). KEY MANAGEMENT AND ISTRIBUTION: Symmetric Key Distribution Using Symmetric Encryption, Symmetric Key Distribution Using Asymmetric Encryption, Distribution of Public Keys, X.509 Certificates, Public Key Infrastructure.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Analyze and design classical encryption techniques and block
CO2	Understand and analyze data encryption standard
CO3	Understand and analyze public-key cryptography, RSA and other public key cryptosystems
CO4	Understand key management and distribution schemes and design User Authentication, such as Diffie-Hellman Key Exchange, ElGamal Cryptosystem, etc
CO5	Apply intrusion prevention techniques to prevent intrusion

Text Books	
1.	William Stallings: Cryptography and Network Security- Principles And Practice, 5th Edition, Pearson/PHI, 2011.

Reference books:	
1.	William Stallings, ―Network Security Essentials (Applications and Standards)‖, 4th Edition, Pearson Education. , 2012
2.	Charlie Kaufman, Radia Perlman and Mike Speciner: ―Network Security – Private Communication in a

	Public World‖, 2nd Edition, Pearson/PHI, 2002.
3.	Eric Maiwald: —Fundamentals of Network Security‖, 1st Edition, Dreamtech Press, 2003.
4.	Whitman: —Principles of Information Security‖, 3rd Edition, Thomson, 2009.

Web links and Video lectures (e-Resources)
http://www.nptel.iitm.ac.in/courses/106105031/.
• https://www.youtube.com/playlist?list=PLBlnK6fEyqRgJU3EsOYDTW7m6SUmW6kII&utm _source=chatgpt.com
• https://www.youtube.com/playlist?list=PL71FE85723FD414D7
• https://www.youtube.com/playlist?list=PL_LGG4Jw4MdFPrMZg-otwrRPPAoXT-vgO
• https://onlinecourses.nptel.ac.in/noc20_cs21/preview?utm_source=chatgpt.com

ASSESSMENT DETAILS (BOTH CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 50% of the maximum marks and Minimum passing marks for the SEE is 40% of the maximum marks of SEE. The minimum passing marks in SEE is 50% i.e. sum of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

The maximum CIE marks are 50. A student candidate shall obtain not less than 50% of the maximum CIE marks. CIE Assessment shall be based on:

- Descriptive Tests conducted for 50 marks and scaled down to 30 Marks.
- Assignments, presentations, Quiz, Simulation, Experimentation, Mini project, oral examination, field work and class participation etc., (for 20 Marks) conducted in the respective course. Course instructors are given autonomy in choosing a few of the above based on the subject relevance and should maintain necessary supporting documents for same.

SEMESTER END EXAMINATION

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have Part–A and Part-B.
- Part–A consists of 12 full questions (Need to write 6 questions) carrying14marks. Part–B consists of one compulsory question carrying 16 marks.
- Each full question of 14 marks will have 2 sub questions A & B Carrying 4 & 10 marks.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO2	2	-	-	-	1	-	-	-	-	-	-	-
CO3	-	2	-	-	-	3	-	-	-	-	-	-
CO4	1	-	2	-	-	-	-	-	-	-	-	-
CO5	-	1	-	2	-	-	-	-	-	-	-	-

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-III					
BLOCKCHAIN TECHNOLOGIES **Category: PEC**					
Course Code	:	P24MCAS314	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	Demonstrate the basics of Block chain concepts using modern tools/technologies.
2.	Illustrate the role of block chain applications in different domains including cyber security
3.	EvaluatetheusageofBlockchainimplementation/featuresforthegivenproblem.
4.	Exemplify the usage of bit coins and its impact on the economy
5.	Analyzetheapplicationofspecificblockchainarchitectureforagivenproblem

Module – 1	**No. of Hours**
Introduction to Blockchain, How Blockchain works, Blockchain v/s Bitcoin, Practical applications, public and Private key basics, pros and cons of Blockchain, Myths about Bitcoin.	9
Module – 2	**No. of Hours**
Block chain: Architecture, versions, variants, use cases, Life use cases of block chain, Block chain v/s shared Database, Introduction to crypto currencies, Types, Applications. Ciphers, RC4.	9
Module – 3	**No. of Hours**
Concept of Double Spending, Hashing, Mining, Proof of work. Introduction to Merkel tree, Privacy ,payment verification , Resolving Conflicts , Creation of Blocks	9
Module – 4	**No. of Hours**
Introduction to Bitcoin, key concepts of Bitcoin, Merits and De Merits Fork and Segwits, Sending and Receiving bitcoins, choosing bitcoin wallet, Converting Bitcoins to Fiat Currency.	9
Module – 5	**No. of Hours**
Introduction to Ethereum, Advantages and Disadvantages, Ethereum v/s Bitcoin, Introduction to Smart contracts, usage, application, working principle, Law and Regulations. Case Study.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Demonstrate the basics of Block chain concepts using modern tools/technologies.
CO2	Analyze the role of block chain applications in different domains including cyber security
CO3	Evaluate the usage of Block chain implementation/features for the given problem
CO4	A CO4 Exemplify the usage of bitcoins and its impact on the economy
CO5	Analyze the application of specific block chain architecture for a given problem

Text Books	
1.	Beginning Block chain: A Beginner's Guide to Building Blockchain Solutions by ArshdeepBikramaditya Signal,Gautam Dhameja (Priyansu Sekhar Panda., A Press.) 2018
2.	Block chain Applications: A Hands-On Approach by Bahga, Vijay Madisetti , 2017.
3.	Block chain by Melanie Swan, O Reilly 2015

Web links and Video lectures (e-Resources)
• https://youtu.be/mzPoUjQC4WU

ASSESSMENT DETAILS (BOTH CIE AND SEE)

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CONTINUOUS INTERNAL EVALUATION (CIE)

The maximum CIE marks are 50. A student candidate shall obtain not less than 50% of the maximum CIE marks. CIE Assessment shall be based on:

- Descriptive Tests conducted for 50 marks and scaled down to 30 Marks.
- Assignments, presentations, Quiz, Simulation, Experimentation, Mini project, oral examination, field work and class participation etc., (for 20 Marks) conducted in the respective course. Course instructors are given autonomy in choosing a few of the above based on the subject relevance and should maintain necessary supporting documents for same.

SEMESTER END EXAMINATION

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have Part–A and Part-B.
- Part–A consists of 12 full questions (Need to write 6 questions) carrying14marks. Part–B consists of one compulsory question carrying 16 marks.
- Each full question of 14 marks will have 2 sub questions A & B Carrying 4 & 10 marks.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
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CO2	1	-	2	-	1	-	-	-	-	-	-
CO3	-	2	-	-	-	2	-	-	-	-	-
CO4	-	-	-	2	3	-	-	-	-	-	-
CO5	-	-	3	-	-	3	-	-	-	-	-

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-III					
DATABASE & WEB APPLICATION SECURITY **Category: PEC**					
Course Code	:	P24MCAS315	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	To understand the fundamentals of database security concepts, Identify key security threats and vulnerabilities.
2.	To examine security mechanisms and best practices for database protection Design and implement security solutions.
3.	To identify and analyze vulnerabilities in web applications and databases
4.	To design secure web applications
5.	To evaluate tools and techniques for detecting and mitigating security breaches

Module – 1	**No. of Hours**
SUPPORTING TECHNOLOGIES FOR DATABASE AND APPLICATIONS SECURITY: Data Management Technologies, Information Security, Information Management Technologies...	9
Module – 2	**No. of Hours**
DISCRETIONARY SECURITY FOR DATABASE SYSTEMS: Security Policies, Policy Enforcement and Related Issues..	9
Module – 3	**No. of Hours**
MANDATORY SECURITY FOR DATABASE SYSTEMS: Historical Developments, Design Principles.	9
Module – 4	**No. of Hours**
MULTILEVEL SECURE RELATIONAL DATABASE SYSTEMS: Multilevel Relational Data Models, Security Impact on Database Functions, Prototypes and Products.	9
Module – 5	**No. of Hours**
THE INFERENCE PROBLEM: A Perspective of the Inference Problem, Security-Constraint Processing for Inference Control, Conceptual Structures for Inference Control	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Describe core concepts of database and web application security, including data confidentiality, integrity, and access control.
CO2	Identify and explain common vulnerabilities in web applications and databases.
CO3	Apply appropriate security mechanisms (encryption, authentication, access control) to protect databases and web applications
CO4	Develop secure web applications using industry best practices and secure coding techniques
CO5	Use tools and techniques to analyze, test, and mitigate real-world security threats and attacks.

Text Books	
1.	BhavaniThuraisingham, ―Database and Applications Security‖, Integrating Information Security and Data Management, Auerbach Publications, 2005.

Reference Text Books	
1.	Michael Gertz and SushilJajodia, ―Handbook of Database Security— Applications and Trends‖, Springer, 2008.
2.	Bryan and Vincent, ―Web Application Security, A Beginners Guide‖, McGraw-Hill, 2011
3.	Alfred Basta, Melissa Zgola, ―Database Security‖, Course Technology, 2012.

Web links and Video lectures (e-Resources)
• https://www.scribd.com/document/450222788/1-2012-Web-Application-Security-a-Beginer-Guide

ASSESSMENT DETAILS (BOTH CIE AND SEE)

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CONTINUOUS INTERNAL EVALUATION (CIE)

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SEMESTER END EXAMINATION

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- The question paper will have Part–A and Part-B.
- Part–A consists of 12 full questions (Need to write 6 questions) carrying14marks. Part–B consists of one compulsory question carrying 16 marks.
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CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	-	-	-	-	-	-	-	-	-	-
CO2	-	2	-	-	-	-	-	3	-	-	-
CO3	-	-	-	-	-	3	-	-	-	-	-
CO4	-	-	-	2	-	-	-	-	-	-	-
CO5	-	-	3	-	-	-	-	-	-	-	-

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-III					
MOBILE AND WIRELESS SECURITY **Category: PEC**					
Course Code	:	P24MCAS316	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:2:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	Understand mobile and wireless communication fundamentals.
2.	Identify key security threats and vulnerabilities.
3.	Analyze security mechanisms in mobile and wireless systems
4.	Design and implement security solutions.
5.	Explore emerging trends and research areas.

Module – 1	**No. of Hours**
Security Issues in Mobile Communication: Mobile Communication History, Security – Wired Vs Wireless, Security Issues in Wireless and Mobile Communications, Security Requirements in Wireless and Mobile Communications, Security for Mobile Applications, Advantages and Disadvantages of Application – level Security.	9
Module – 2	**No. of Hours**
Security of Device, Network, and Server Levels: Mobile Devices Security Requirements, Mobile Wireless network level Security, Server Level Security. Application-Level Security in Wireless Networks: Application of WLANs, Wireless Threats, Some Vulnerabilities and Attach Methods over WLANs, Security for 1G Wi-Fi Applications, Security for 2G Wi-Fi Applications, Recent Security Schemes for Wi-Fi Applications	9
Module – 3	**No. of Hours**
Application-Level Security in Cellular Networks: Generations of Cellular Networks, Security Issues and attacks in cellular networks, GSM Security for applications, GPRS Security for applications, UMTS security for applications, 3G security for applications, Some of Security and authentication Solutions.	9
Module – 4	**No. of Hours**
Application-Level Security in MANETs: MANETs, Some applications of MANETs, MANET Features, Security Challenges in MANETs, Security Attacks on MANETs, External Threats for MANET applications, Internal threats for MANET Applications, Some of the Security Solutions. Ubiquitous Computing, Need for Novel Security Schemes for UC, Security Challenges for UC, and Security Attacks on UC networks, Some of the security solutions for UC.	9
Module – 5	**No. of Hours**
Security for Mobile Commerce Application: M-commerce Initiatives, Security Challenges in Mobile E-commerce, Types of Attacks on Mobile E-commerce, A Secure M-commerce Model Based on Wireless Local Area Network, Some of M-Commerce Security Solutions	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Familiarize with the issues and technologies involved in designing a wireless and mobile system that is robust against various attacks.
CO2	Gain knowledge and understanding of the various ways in which wireless networks can be attacked and trade-offs in protecting networks.
CO3	Have a broad knowledge of the state-of-the-art and open problems in wireless and mobile security, thus enhancing their potential to do research or pursue a career in this rapidly developing area
CO4	Learn various security issues involved in cloud computing.
CO5	Learn various security issues related to GPRS and 3G.

Text Books	
1.	Pallapa Venkataram, Satish Babu: ―Wireless and Mobile Network Security‖, 1st Edition, Tata McGraw Hill, 2010.
2.	Frank Adelstein, K.S.Gupta : ―Fundamentals of Mobile and Pervasive Computing‖, 1st Edition, Tata McGraw Hill 2005

Reference Text Books	
1.	Randall k. Nichols, Panos C. Lekkas: ―Wireless Security Models, Threats and Solutions‖, 1st Edition, Tata McGraw Hill, 2006.
2.	Bruce Potter and Bob Fleck: ―802.11 Security,‖ 1st Edition, SPD O'REILLY 2005.
3.	James Kempf: ―Guide to Wireless Network Security, Springer. Wireless Internet Security – Architecture and Protocols‖, 1st Edition, Cambridge University Press, 2008

Web links and Video lectures (e-Resources)
• https://dokumen.pub/qdownload/wireless-and-mobile-network-security-9780070700246-0070700249.html

ASSESSMENT DETAILS (BOTH CIE AND SEE)

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CONTINUOUS INTERNAL EVALUATION (CIE)

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SEMESTER END EXAMINATION

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
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CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	-	-	-	-	-	-	-	-	-	-
CO2	-	2	-	-	-	-	-	3	-	-	-
CO3	-	-	-	-	-	3	-	-	-	-	-
CO4	-	-	-	2	-	-	-	-	-	-	-
CO5	-	-	3	-	-	-	-	-	-	-	-

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Web Application Development

SEMESTER-III					
WEB DEVELOPMENT USING FULL STACK OPEN **Category: PEC**					
Course Code	:	P24MCAW311	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

	Course Objectives
1.	Understand the structure and styling of web pages.
2.	Develop interactive web applications using React.
3.	Integrate databases for dynamic content.
4.	Integrate front-end and back-end components.
5.	Deploy full-stack applications on cloud services.

Module – 1	**No. of Hours**
Basics of Web Technologies: Overview of HTML: structure, elements, and semantics, CSS basics: styling, layouts, and responsiveness, avaScript fundamentals: variables, functions, and DOM manipulation, Integrating HTML, CSS, and JavaScript for a basic web page.	9
Module – 2	**No. of Hours**
Front-End Development with React: Introduction to React: Why use React?, JSX and how it differs from HTML, Components: functional vs. class components, Creating dynamic user interfaces with conditional rendering, Handling user events and form submission, React Hooks: useState, useEffect, useContext, and custom hooks, Introduction to Redux: Setting up a Redux store, actions, reducers.	9
Module – 3	**No. of Hours**
Back-End Development with Node.js: Introduction to Node.js: Features and Architecture, Working with npm and package management, Building a basic server using Express, Middleware functions: Logging, authentication, and error handling, Introduction to MongoDB: NoSQL database concepts, CRUD Operations: Creating, reading, updating, and deleting data, Querying and filtering data using Mongoose, Handling database errors.	9
Module – 4	**No. of Hours**
Full-Stack Integration: concept of full-stack applications, RESTful APIs: Principles and best practices, Data exchange using JSON: Serialization and parsing, Co nnecting React front-end to Node.js back-end, Introduction to authentication and authorization concepts, Implementing user authentication using JWT (JSON Web Token),, Managing user sessions and tokens.	9
Module – 5	**No. of Hours**
Deployment and Maintenance: Setting up Continuous Integration and Continuous Deployment (CI/CD) pipelines, Automating tests and builds using Jenkins, GitHub Actions, or similar tools, Deploying back-end services using AWS EC2, Heroku, and Docker, Deploying back-end services.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the fundamentals of web development using modern technologies.
CO2	Develop full-stack web applications using JavaScript,
CO3	Develop full-stack web applications using React, Node.js
CO4	Develop full-stack web applications using and MongoDB.
CO5	Analyze and solve real-world problems by building scalable web applications.

Text Books	
1.	Full Stack Open 2023 by University of Helsinki (Online Course Material)
2.	Akerkar, R. (2020). Deep learning: A practitioner's approach. Springer.
3.	MongoDB: The Definitive Guide by Shannon Bradshaw, Eoin Brazil, and Kristina Chodorow
4.	Node.js Design Patterns by Mario Casciaro and Luciano Mammino

Web links and Video lectures (e-Resources)
• https://youtu.be/Vi9bxu -M-ag?si=OK1-w5YqlKJ5oYh7

- https://youtu.be/nu_pCVPKzTk?si=DOAiec3IorQtKmjA
- https://youtu.be/4EjKroJCpFA?si=gR3jzPn3rgvYwHsl

ASSESSMENT DETAILS (BOTH CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 50% of the maximum marks and Minimum passing marks for the SEE is 40% of the maximum marks of SEE. The minimum passing marks in SEE is 50% i.e. sum of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

The maximum CIE marks are 50. A student candidate shall obtain not less than 50% of the maximum CIE marks. CIE Assessment shall be based on:

- Descriptive Tests conducted for 50 marks and scaled down to 30 Marks.
- Assignments, presentations, Quiz, Simulation, Experimentation, Mini project, oral examination, field work and class participation etc., (for 20 Marks) conducted in the respective course. Course instructors are given autonomy in choosing a few of the above based on the subject relevance and should maintain necessary supporting documents for same.

SEMESTER END EXAMINATION

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
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CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	2	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-
CO5	3	3	-	3	2	2	-	-	-	-	-

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-III					
RICH INTERNET APPLICATION DEVELOPMENT **Category: PEC**					
Course Code	:	P24MCAW312	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	To provide knowledge of rich internet technologies using modern frameworks.
2.	To understand and apply client-side scripting, AJAX, and advanced UI/UX.
3.	To develop responsive, dynamic, and interactive web applications using frameworks like Angular or React
4.	To learn how to integrate backend services with frontend interfaces.
5.	Understand Practical Applications and Limitations of Neural Networks

Module – 1	**No. of Hours**
Introduction to Rich Internet Applications (RIA) and JavaScript Enhancements: Definition, Evolution, Architecture, RIA v/s Traditional Web Applications. Modern JavaScript (ES6+): Let/Const, Arrow functions, Classes, Modules, Promises	9
Module – 2	**No. of Hours**
Client-Side Frameworks and Single Page Applications (SPA): Introduction to SPA – Concepts, Routing, Lifecycle. React.js Basics – Components, Props, State, JSX, Event Handling.	9
Module – 3	**No. of Hours**
AJAX, REST APIs and Asynchronous Communication: AJAX & Fetch API – XMLHttpRequest,Fetch, Axios, Error Handling. Interfacing with REST APIs – JSON, HTTP methods, Postman Testing.	9
Module – 4	**No. of Hours**
Advanced UI Development & State Management: React Advanced – Hooks (useState, useEffect), Context API.UI/UX Libraries – Material UI / Bootstrap, Responsive Design Techniques.	9
Module – 5	**No. of Hours**
Deployment, Security and Testing of Web Applications: Deployment – Hosting on Firebase/Vercel, Build & Environment Configuration. Web Application Security & Testing – XSS, CSRF, Linting, Unit Testing with Jest.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the architecture and role of Rich Internet Applications in modern web systems.
CO2	Develop single-page applications using frameworks like React.
CO3	Implement AJAX and RESTful services for interactive client-server communication.
CO4	Design responsive, user-friendly interfaces with advanced UI/UX techniques.
CO5	Secure, test, and deploy scalable rich internet applications on modern platforms

Text Books	
1.	Learning React: Modern Patterns for Developing React Apps,Authors: Alex Banks & Eve Porcello Publisher: O'Reilly Media Edition: 2nd Edition, 2020
2.	Rich Internet Applications with Ajax Author: Harwani, B.M. Publisher: Dreamtech Press
3.	Modern Full-Stack Development: Using TypeScript, React, Node.js, Webpack, and Docker Author: Frank Zammetti Publisher: Apress

Web Resources
• https://youtu.be/BrjWObZ13AU?si=CUlH3FUfU2F2ujbt • https://youtu.be/-ZO3QVgs-sk?si=wpOnaHacgL1SxOtF

ASSESSMENT DETAILS (BOTH CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 50% of the maximum marks and Minimum passing marks for the SEE is 40% of the maximum marks of SEE. The minimum passing marks in SEE is 50% i.e. sum of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

The maximum CIE marks are 50. A student candidate shall obtain not less than 50% of the maximum CIE marks. CIE Assessment shall be based on:

- Descriptive Tests conducted for 50 marks and scaled down to 30 Marks.
- Assignments, presentations, Quiz, Simulation, Experimentation, Mini project, oral examination, field work and class participation etc., (for 20 Marks) conducted in the respective course. Course instructors are given autonomy in choosing a few of the above based on the subject relevance and should maintain necessary supporting documents for same.

SEMESTER END EXAMINATION

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have Part–A and Part-B.
- Part–A consists of 12 full questions (Need to write 6 questions) carrying14marks. Part–B consists of one compulsory question carrying 16 marks.
- Each full question of 14 marks will have 2 sub questions A & B Carrying 4 & 10 marks.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	-	-	-	-	-	-	-	-
CO2	2	-	3	-	-	-	-	-	-	-	-
CO3	2	-	3	2	3	-	-	-	-	-	-
CO4	1	2	3	-	3	-	-	-	-	-	-
CO5	2	2	2	2	3	2	-	1	-	-	-

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-III					
WEB DEVELOPMENT USING PHP AND MYSQL **Category: PEC**					
Course Code	:	P24MCAW313	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	Understand the fundamentals of web technologies.
2.	Develop dynamic web pages using HTML, CSS, JavaScript.
3.	Work with MySQL for database-driven applications
4.	Apply security and validation in web forms.
5.	Deploy basic web applications

Module – 1	**No. of Hours**
Introduction to Web Technologies: Internet and WWW, Basics of JavaScript and client-side scripting, HTTP, Web Servers, Client-Server Architecture,HTML5 and CSS3 – Forms, Tables, Layout, and Responsive Design.	9
Module – 2	**No. of Hours**
PHP Basics: PHP syntax and variables, Control structures, Functions and Arrays, File Handling, Sessions, and Cookies, Error handling, Introduction to OOP in PHP, Working with Forms.	9
Module – 3	**No. of Hours**
JavaScript for Web Interactivity: JavaScript Basics – Variables, Operators, Functions, DOM, Events, Form Validation, and Integration with HTML/CSS.	9
Module – 4	**No. of Hours**
My SQL and PHP Integration: Introduction to My SQL, Database Concepts, SQL Queries (CRUD), Table Design, Connecting PHP to My SQL, Prepared statements and data handling.	9
Module – 5	**No. of Hours**
Web Application Features: Form validation (Client-side and Server-side),User authentication and session management, File uploads and downloads, Security practices (SQL Injection, XSS, CSRF),Hosting and deployment basics.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Describe the structure and components of web technologies.
CO2	Develop web pages using HTML, CSS, and JavaScript.
CO3	Design and interact with MySQL databases from PHP.
CO4	Implement form validation and apply security measures in web apps.
CO5	Deploy a basic PHP-MySQL-based web application.

Text Books	
1.	Luke Welling and Laura Thomson, PHP and MySQL Web Development, 5th Edition, AddisonWesley, 2016.
2.	"PHP & MySQL: Novice to Ninja" (6th Edition) Author: Tom Butler and Kevin Yank Publisher: SitePoint, 2022
3.	"Learning PHP, MySQL & JavaScript: With jQuery, CSS & HTML5" (5th Edition) Author: Robin Nixon Publisher: O'Reilly Media, 2018

Web links and Video lectures (e-Resources)

- https://www.youtube.com/live/s-iza7kAXME?si=cIV2baX4EjkzBGel
- https://youtu.be/btoVIlr7rAQ?si=PYiphzXfd0pij0op
- https://youtu.be/cGwSm8xDSwI?si=-ZTkFmBTVlUB0eOL

ASSESSMENT DETAILS (BOTH CIE AND SEE)

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CONTINUOUS INTERNAL EVALUATION (CIE)

The maximum CIE marks are 50. A student candidate shall obtain not less than 50% of the maximum CIE marks. CIE Assessment shall be based on:

- Descriptive Tests conducted for 50 marks and scaled down to 30 Marks.
- Assignments, presentations, Quiz, Simulation, Experimentation, Mini project, oral examination, field work and class participation etc., (for 20 Marks) conducted in the respective course. Course instructors are given autonomy in choosing a few of the above based on the subject relevance and should maintain necessary supporting documents for same.

SEMESTER END EXAMINATION

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have Part–A and Part-B.
- Part–A consists of 12 full questions (Need to write 6 questions) carrying14marks. Part–B consists of one compulsory question carrying 16 marks.
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CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-
CO3	3	3	2	2	-	-	-	-	-	-	-
CO4	3	3	3	2	2	-	-	-	-	-	-
CO5	3	3	3	3	3	2	-	-	-	-	-

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-III					
ENTERPRISE APPLICATION PROGRAMMING **Category: PEC**					
Course Code	:	P24MCAW314	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	Understand the architecture of enterprise applications.
2.	Develop server-side applications using Java EE/Spring.
3.	Work with databases and persistence layers using ORM tools.
4.	Design and implement secure, scalable, and distributed applications.
5.	Explore deployment strategies and enterprise application testing.

Module – 1	**No. of Hours**
Introduction to Enterprise Applications: Definition, Characteristics, types (ERP, CRM, SCM, etc.), and challenges, Enterprise application architecture and layers, Overview of Java EE, Spring Boot introduction, comparison of monolithic v/s micro services architecture.	9
Module – 2	**No. of Hours**
Web Development with S pring: Spring MVC and Controller, Dispatcher Servlet, Handler Mapping, Controller classes, Request Mapping, View Resolvers, Model And View, RESTful Web Services, REST API design, JSON processing, Creating REST controllers with Spring Boot.	9
Module – 3	**No. of Hours**
Business Logic and Dependency Injection: Spring Core & Bean Life cycle, Inversion of Control (IoC), Bean scopes, Configuration (XML/Java-based), Application Context, Service Layer and Transactions, Creating service classes, transaction management, AOP for business concerns (logging, security).	9
Module – 4	**No. of Hours**
Database Access and Persistence: JDBC and Spring JDBC Template, Data Source, connection pooling, querying with templates, Exception handling in JDBC,JPA and Hibernate with Spring, Entity classes, annotations, persistence context, Repositories and query methods.	9
Module – 5	**No. of Hours**
Security, Testing, and Deployment: Spring Security Fundamentals, Authentication, authorization, custom login forms, Securing REST APIs, Testing and Deployment: Unit testing (JUnit, Mockito), integration testing, WAR/JAR packaging, deploying on Tomcat, Docker basics.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand architecture and layers of enterprise applications.
CO2	Build web applications using Spring MVC and REST.
CO3	Implement service layers and apply dependency injection.
CO4	Integrate database operations using JDBC, JPA, and Hibernate.
CO5	Secure, test, and deploy enterprise applications efficiently.

Text Books	
1.	Spring in Action Author: Craig WallsEdition: 6th Edition (or latest available) Publisher: Manning Publications
2.	Enterprise Java Microservices: Building Scalable and Resilient Distributed Systems Author: Ken Finnigan Publisher: O'Reilly Media

Web links and Video lectures (e-Resources)

- https://youtu.be/If1Lw4pLLEo?si=B3F-MHZ8q4N9vh_b
- https://youtu.be/UgX5lgv4uVM?si=GJLcXH9jior1_4pp

ASSESSMENT DETAILS (BOTH CIE AND SEE)

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CONTINUOUS INTERNAL EVALUATION (CIE)

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SEMESTER END EXAMINATION

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CO2	3	3	2	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-
CO5	2	2	-	1	-	-	-	-	-	-	-

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-III					
ADVANCES IN WEB TECHNOLOGIES **Category: PEC**					
Course Code	:	P24MCAW315	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	Understand the syntax and usage of PHP for server-side scripting and develop basic web applications.
2.	Develop web applications using Ruby and Ruby on Rails with database integration.
3.	Design rich internet applications using AJAX and asynchronous communication principles.
4.	Implement AJAX patterns and manage complex XML Http Request scenarios.
5.	Apply responsive design principles using Bootstrap to create modern web interfaces.

Module – 1	**No. of Hours**
Introduction to PHP: Origins and uses of PHP, Overview of PHP, General syntactic characteristics, Primitives, operations and expressions, Output, Control statements, Arrays, Functions, Pattern matching. Building Web applications with PHP: Form handling, Files, Tracking users, cookies, sessions, Using databases, Handling XML	9
Module – 2	**No. of Hours**
Introduction to Ruby and Introduction to Rails: Origins and uses of Ruby, Scalar types and their operations ,Simple input and output, Control statements, Arrays, Hashes, Methods, Classes, Code blocks and iterates, Pattern matching. Overview of Rails, Document requests, Processing forms, Layouts. Rails applications with Databases.	9
Module – 3	**No. of Hours**
Rich Internet Applications With Ajax: Limitations of Classic Web application model, AJAX principles, Technologies behind AJAX, Examples of usage of AJAX; Asynchronous communication and AJAX application model. Ajax with XML HTTP object: Part 1 Creating Ajax Applications: An example, Analysis of example ajax.html, Creating the JavaScript, Creating and opening the XML Http Request object, Data download, Displaying the fetched data, Connecting to the server, Adding Server-side programming, Sending data to the server using GET and POST	9
Module – 4	**No. of Hours**
Ajax with XMLHTTP object: Part 2 Handling multiple XML Http Request objects in the same page, Using two XML Http Request objects, Using an array of XML Http Request objects, AJAX Patterns – Predictive Fetch, Multi-stage download, Periodic Refresh and Fall-back patterns, Submission throttling.	9
Module – 5	**No. of Hours**
Introduction to Bootstrap: What Is Bootstrap? Bootstrap File Structure, Basic HTML Template, Global Styles, Default Grid System, Basic Grid HTML, Offsetting Columns, Nesting Columns, Fluid Grid System, Container Layouts,Responsive Design. Typography, Emphasis Classes, Lists, Code, Tables, Optional Table Classes, Table RowClasses, Forms, Buttons, Images, Icons.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Explain and use PHP for server-side scripting and web application development
CO2	Develop and deploy web applications using Ruby and Rails with database support
CO3	Explain AJAX technology and build AJAX-enabled web applications
CO4	Implement advanced AJAX functionalities using multiple XMLHttpRequest objects and AJAX patterns
CO5	Design responsive and styled web interfaces using Bootstrap framework

Text Books	
1.	Sridhar and M Vijayalakshmi, “Machine Learning”, Oxford University Press, 2021.
2.	M N Murty and Ananthanarayana V S, “Machine Learning: Theory and Practice”, Universities Press (India) Pvt.Limited, 2024.

Reference Text Books	
1.	Tom M. Mitchell, "Machine Learning," McGraw-Hill Education, 2013.
2.	Miroslav Kubat, "An Introduction to Machine Learning," Springer, 2017

Web links and Video lectures (e-Resources)
• https://www.php.net/manual/en/
• https://www.ruby-lang.org/en/documentation/
• https://guides.rubyonrails.org/
• https://developer.mozilla.org/en-US/docs/Web/Guide/AJAX
• https://getbootstrap.com/docs/5.3/getting-started/introduction/

ASSESSMENT DETAILS (BOTH CIE AND SEE)

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CONTINUOUS INTERNAL EVALUATION (CIE)

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SEMESTER END EXAMINATION

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CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	-	-	-	-	-	-	-	-	-	-
CO2	-	-	2	-	3	-	-	-	-	-	-
CO3	1	-	-	2	-	-	-	-	-	-	-
CO4	-	-	2	-	-	-	3	-	-	-	-
CO5	-	-	-	-	3	-	-	3			

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-III					
WEB PROGRAMMING USING JAVA **Category: PEC**					
Course Code	:	P24MCAW316	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:2:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	To understand web technologies and develop dynamic, interactive web applications using Java.
2.	To build client-server-based applications using Java Servlets and JSP.
3.	To integrate backend databases with web front-ends.
4.	To explore the MVC architecture in web development using Java frameworks.

Module – 1	**No. of Hours**
Introduction to Web Development and Java Web Technologies: Basics of Web Programming - HTTP, HTML, CSS, JavaScript overview. Introduction to Java EE, Architecture of Java Web Applications.	9
Module – 2	**No. of Hours**
Java Servlets: Servlet Lifecycle, Writing a basic Servlet, Deployment using web.xml, Servlet Configand Servlet Context, Request and Response Handling, Session Management, Cookies, and URL Rewriting, Redirecting requests (send Redirect v/s forward), Status codes and response headers.	9
Module – 3	**No. of Hours**
JavaServer Pages (JSP): Introduction to JSP and its advantages over Servlets, JSP Architecture, Implicit Objects, Scripting Elements, JSP Directives, Error Handling, JSTL (JSP Standard Tag Library), Advanced JSP Features.	9
Module – 4	**No. of Hours**
JDBC and Database Connectivity: Introduction to JDBC and its architecture, JDBC Drivers, Connection, Statement, ResultSet. Integrating JDBC with JSP and Servlets.	9
Module – 5	**No. of Hours**
MVC Architecture and Java Frameworks: MVC Architecture Pattern in Web Applications, Introduction to Spring MVC Framework -Controllers, Views, Models.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the fundamentals of web development and Java web technologies.
CO2	Develop Java Servlet-based web applications
CO3	Create dynamic websites using JavaServer Pages (JSP).
CO4	Integrate databases with Java web applications using JDBC
CO5	Apply MVC architecture for scalable Java web applications using frameworks.

Text Books	
1.	Web Programming using Java Author: Uttam K. Roy Publisher: Oxford University Press Edition: Latest.
2.	Java Web Programming and Web Services Author: David E. Flanagan Publisher: O'Reilly Media Edition: 2nd Edition
3.	Head First Servlets and JSP Authors: Bryan Basham, Kathy Sierra, Bert Bates Publisher: O'Reilly Media Edition: 2nd Edition.

Web links and Video lectures (e-Resources)
• https://youtu.be/BGTx91t8q50?si=PT8zIooy3p2J_awp
• https://youtu.be/Js4FlB0zTbg?si=XJNOQYzdpcTCLSdT
• https://youtu.be/r4EqfjMsP48?si=p9PbgbqebXYsqV_u

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- Assignments, presentations, Quiz, Simulation, Experimentation, Mini project, oral examination, field work and class participation etc., (for 20 Marks) conducted in the respective course. Course instructors are given autonomy in choosing a few of the above based on the subject relevance and should maintain necessary supporting documents for same.

SEMESTER END EXAMINATION

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
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CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	2	2	-	-	-	-	-
CO4	2	2	2	-	-	-	-	-	-	-	-
CO5	2	-	-	-	-	-	-	2	-	-	-

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER - III					
PROJECT WORK **Category: PROJ**					
Course Code	:	P24MCAP304	CIE	:	50Marks
Teaching Hours L : T : P	:	--	SEE	:	50 Marks
Total Hours	:	25-30 Hrs Per week	Total	:	100 Marks
Credits	:	15	SEE Duration	:	3 Hrs

Course Objectives:

This course will enable students to

- Support independent learning.
- Guide to select and utilize adequate information from varied resources maintaining ethics.
- Guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.
- Develop interactive, communication, organization, time management, and presentation skills.
- Impart flexibility and adaptability.
- Inspire independent and team working.
- Expand intellectual capacity, credibility, judgment, intuition.
- Adhere to punctuality, setting and meeting deadlines.
- Instill responsibilities to one and others.
- Train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas.

Project Work: Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism**.**

- Follow the Software Development life cycle
- Data Collection ,Planning
- Design the Test cases
- Validation and verification of attained results
- Significance of parameters w.r.t scientific quantified data.
- Publish the project work in reputed Journal*

Continuous Internal Evaluation

Project Report: 20 marks:

The basis for awarding the marks shall be the involvement of the student in the project and in the preparation of project report. To be awarded by the internal guide in consultation with external guide if any.

Project Presentation: 20 marks:

The Project Presentation marks of the Project Work shall be awarded by the committee constituted for the purpose by the Head of the Department. The committee shall consist of two faculties from the department with the senior most acting as the Chairperson.

Project Execution: 30 Marks:

The Project Execution marks of the Project Work shall be awarded by the committee constituted for the purpose by the Head of the Department. The committee shall consist of two faculties from the department with the senior most acting as the Chairperson.

Question and Answer: 10 marks:

The student shall be evaluated based on the ability in the Question and Answer session for 10 marks.

Publications 20 marks:

The student want to attend the conference and publish the paper on reputed Journals

Semester End Examination :

SEE marks for the project report (60 Marks), seminar (20 Marks) Publication (10 Marks) and question and answer session (10 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session) by the examiners appointed by the Institution.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Present the project and be able to defend it.
CO2	Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task
CO3	Habituated to critical thinking and use problem solving skills
CO4	Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.
CO5	Work in a team to achieve common goal.
CO6	Learn on their own, reflect on their learning and take appropriate actions to improve it.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	1	-	-	-	-	1	-	1	-	-
CO2	3	1	-	-	2	-	2	-	1	-	-
CO3	1	3	-	-	-	-	1	3	-	2	-
CO4	-	1	-	-	-	-	-	1	1	-	2
CO5	3	1	3	2	2	-	-	3	1	1	-
CO6	3	1	1	1	1	1	1	2	1	2	2

Level 1-High, Level 2-Moderate, Level 3-Low

4th Semester Syllabus

SEMESTER - IV					
TECHNICAL SEMINAR **Category: TS**					
Course Code	:	P24MCAS402	CIE	:	100 Marks
Teaching Hours L : T : P	:	0:4:0	SEE	:	--
Total Hours	:	40	Total	:	100 Marks
Credits	:	2	SEE Duration	:	3 Hrs

Course Objectives

The objective of the seminar is to inculcate self-learning, face audience confidently, enhance communication skill, involve in group discussion and present and exchange ideas.

Each student, under the guidance of a Faculty, is required to:

- Choose, preferably through peer reviewed journals, a recent topic of his/her interest relevant to the Course of Specialization.
- Carryout literature survey, organize the Course topics in a systematic order.
- Prepare the report with own sentences.
- Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities.
- Present the seminar topic orally and/or through power point slides.
- Answer the queries and involve in debate/discussion.
- Submit two copies of the typed report with a list of references.

The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident. The CIE marks for the seminar shall be awarded (based on the relevance of the topic, presentation skill, participation in the question and answer session and quality of report) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculties from the department with the senior most acting as the Chairperson.

Continuous Internal Evaluation

CIE marks for the Technical seminar report (20 marks), seminar (60 marks) and question and answer session (20 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of two faculties from the department with the senior most acting as the Chairperson.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Identify recent technical topics from interested domains.
CO2	Analyze the applicability of modern software tools and technology
CO3	Develop Presentation and Communication skills.
CO4	Develop Technical report preparation skills

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	3	-	-	-	-	1	-	1	1	2
CO2	1	3	-	1	2	-	-	-	1	-	2
CO3	1	-	-	-	-	-	1	-	-	2	2
CO4	1	-	-	-	-	-	-	1	1	2	2

Level 1-High, Level 2-Moderate, Level 3-Low

SEMESTER-IV					
RESEARCH INTERNSHIP / INDUSTRY INTERNSHIP / STARTUP INTERNSHIP **Category: INT**					
Course Code	:	P24MCAI403	CIE	:	50 Marks
Teaching Hours L : T : P	:	--	SEE	:	50 Marks
Total Hours	:	40	Total	:	100 Marks
Credits	:	11	SEE Duration	:	3 Hrs

Course Objectives	
1.	To put theory into practice.
2.	To expand thinking and broaden the knowledge and skills acquired through course work in the field.
3.	To relate to, interact with, and learn from current professionals in the field.
4.	To gain a greater understanding of the duties and responsibilities of a professional.
5.	To understand and adhere to professional standards in the field.
6.	To gain insight to professional communication including meetings, memos, reading, writing, public speaking, research, client interaction, input of ideas, and confidentiality.
7.	To identify personal strengths and weaknesses.
8.	To develop the initiative and motivation to be a self-starter and work independently

Internship/Professional practice

Internship/Professional practice: Students under the guidance of internal guide/s and external guide shall take part in all the activities regularly to acquire as much knowledge as possible without causing any inconvenience at the place of internship.

Seminar: Each student, is required to

1. Present the seminar on the internship orally and/or through power point slides.
2. Answer the queries and involve in debate/discussion.
3. Submit the report duly certified by the external guide.
4. The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

Continuous Internal Evaluation:

CIE marks for the Internship/Professional practice report (20 marks), seminar (60 marks) and question and answer session (20 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculties from the department with the senior most acting as the Chairperson.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Gain practical experience and Acquire knowledge of the industry within industry in which the internship is done.
CO2	Apply knowledge and skills learned to classroom work.
CO3	Develop a greater understanding about career options while more clearly defining personal career goals.
CO4	Identify areas for future knowledge and skill development.
CO5	Expand intellectual capacity, credibility, judgment, intuition.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	3	1	1	-	-	1	-	1
CO2	3	3	3	3	3	-	2	-	-	2	-	1
CO3	1	2	2	3	2	-	2	-	-	1	-	1
CO4	3	3	3	3	3	-	2	-	-	2	-	1
CO5	1	2	2	3	2	-	2	-	-	1	-	1

Level 1-High, Level 2-Moderate, Level 3-Low