3rd Semester Syllabus

Semester: III

SPECIALIZATION - A

ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

Course Name: **MACHINE LEARNING**

Course Code	MMCA311A	CIE Marks	50
Teaching Hours/Week (L:P: T)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Objectives:

1. Define machine learning and problems relevant to machine learning.
2. Interpret a wide variety of learning algorithms.
3. Develop an appreciation for what is involved in learning from data.
4. Differentiate supervised, unsupervised and reinforcement learning.
5. Apply performance evaluation parameters (statistical analysis) on learning algorithms, model selection for problems of machine learning.

Module – 1

Machine Learning: Well, posed learning problems, Designing a Learning System, Perspectives & Issues in Machine Learning.
Concept Learning: Concept learning as search, Find-S algorithm, Candidate Elimination Algorithm, Inductive bias of Candidate Elimination Algorithm.

8 Hours

Module – 2

Classification: Decision Tree Learning - Introduction, Decision tree representation, Appropriate problems, ID3 algorithm, Hypothesis Search Space, Inductive Bias and Issues in Decision Tree Learning.

8 Hours

Module – 3

Prediction: Artificial Neural Network - Introduction, NN representation, Appropriate problems, Perceptron's, Back propagation algorithm & its Remarks.

8 Hours

Module – 4

Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting, MDL principle, Bates optimal classifier, Gibbs algorithm, Naive Bayes classifier (NBC, m-estimate & Text classification).
Instance based learning: k-Nearest Neighbour Learning, Locally weighted regression, Radial basis function.

8 Hours

Module – 5

Clustering: Overview- Types of clustering, Types of clusters, K-Means, Agglomerative Hierarchical, Clustering, Density-Based Clustering, Graph-Based Clustering, Cluster evaluation. **8 Hours**

Course Outcomes:

The students should be able to:	
CO1	Apply suitable algorithms such as Find-S and Candidate Elimination to solve well-posed concept learning problems.
CO2	Construct decision trees using ID3 and evaluate classification performance in appropriate problem settings.
CO3	Implement artificial neural networks and apply perceptron and backpropagation algorithms for predictive modeling.
CO4	Apply Bayesian methods and instance-based learning techniques like k-NN to develop models for classification and prediction.
CO5	Implement clustering techniques such as K-Means, hierarchical, and density-based clustering for grouping and evaluating datasets.

Reference Books:

1. "Machine Learning", Tom M Mitchell, Tata McGraw-Hill, 1997
2. "Machine Learning", Saikat Dutt Subramanian Chandramouli Amit Kumar Das, Pearson India Education Services Pvt. Ltd, 2019
3. "Introduction to Machine Learning", Ethem Alpaydin, 4th edition, MIT press, 2020

e-Resources:

1. https://onlinecourses.nptel.ac.in/noc22_cs29/preview

Semester: III

SPECIALIZATION - A

ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

Course Name: **NATURAL LANGUAGE PROCESSING**

Course Code	MMCA311B	CIE Marks	50
Teaching Hours/Week (L:P: T)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Objectives:

1. Introduce the fundamental techniques of natural language processing.
2. Analyze the natural language text.
3. Describe types of classifiers used for text classification.
4. Understand the concepts of Text mining.
5. Illustrate information retrieval techniques

Module – 1

Introduction to NLP: NLP in real world, NLP tasks, Language – Building Blocks of Language, NLP challenges, Machine Learning, Deep Learning and NLP overview, Approaches to NLP – Heuristics based NLP, Machine Learning for NLP, Deep Learning for NLP
NLP Pipeline: Generic NLP pipeline, Data Acquisition

8 Hours

Module – 2

NLP Pipeline: Text Extraction and Clean up – Normalization, Spelling Correction, System Specific Error Correction, Preprocessing – Word Tokenization, Stemming and Lemmatization
Text Representation: Vector Space Model, Bag of words, N – gram, TF – IDF, Word Embeddings – Continuous bag of words (CBOW), Skip Gram.

8 Hours

Module – 3

Text Classification: Naïve Bayes classifier, Logistic Regression, Support Vector Machine, CNNs and LSTMs for Text Classification, Case study – Corporate Ticketing

8 Hours

Module – 4

Information Extraction (IE): IE Applications, IE Tasks, Pipeline for IE, Key phrase Extraction, Named Entity Recognition (NER) – Building and NER system, NLP using Active Learning, Disambiguity and Linking Relationship Extraction - Approaches to RE

8 Hours

Module – 5

Chat bots

A simple FAQ chat bot, Taxonomy of chat bots – Goal oriented Dialog, Chit chats, Pipeline for building dialog systems, Components of Dialog system – Dialog Act classification, identifying slots, Response Generation, End – to – End approach, Deep Reinforcement Learning for Dialog Generation, Human – in – the – Loop.

8 Hours

Course Outcomes:

The students should be able to:	
CO1	Apply NLP concepts and pipelines to process and prepare raw text data for language modeling tasks
CO2	Implement preprocessing techniques and represent text using models such as Bag of Words, TF-IDF, and Word Embeddings.
CO3	Apply classification algorithms like Naïve Bayes, SVM, CNN, and LSTM for solving real-world text classification problems.
CO4	Apply Information Extraction techniques including Named Entity Recognition and Relationship Extraction to extract structured information from unstructured text.
CO5	Build simple dialog systems and apply deep learning approaches for chatbot development and response generation.

Reference Books:

1. "Practical Natural Language Processing: A Comprehensive Guide to Building Real-World NLP Systems", Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta & Harshit Surana, Oreilly, 1st Edition, 2020
2. "Speech and Language Processing",Jurafsky Dan & Martin James H, Prentice Hall 3rd Edition, 2023
3. "Natural Language Understanding", James Allen, Pearson Education, 3rd Edition 2012

e-Resources:

1. https://onlinecourses.nptel.ac.in/noc23_cs45/preview
2. https://nptel.ac.in/courses/106/105/106105158/
3. http://www.nptelvideos.in/2012/11/natural-language-processing.html

Semester: III

SPECIALIZATION - A

ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

Course Name: **DEEP LEARNING**

Course Code	MMCA311C	CIE Marks	50
Teaching Hours/Week (L:P: T)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Objectives:

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

Module – 1

Introduction: 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. **8 Hours**

Module – 2

Multilayer Perceptron's: Introduction, Batch Learning and On-Line Learning, The Back-Propagation Algorithm, XOR Problem, Heuristics for Making the Back- Propagation Algorithm Perform Better, Back Propagation and Differentiation. **8 Hours**

Module – 3

Regularization for Deep Learning: Parameter Norm Penalties - L2 Parameter Regularization, Dataset Augmentation, Semi-Supervised Learning. Optimization for Training Deep Models: Challenges in Neural Network Optimization – Ill Conditioning, Local Minima, Plateaus, Saddle Points and Other Flat Regions. **8 Hours**

Module – 4

Convolution neural 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, Convolutional Networks and the History of Deep Learning. **8 Hours**

Module – 5

Sequence Modelling: 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. **8 Hours**

Course Outcomes:

The students should be able to:	
CO1	Apply the fundamentals of neural networks and the perceptron model to solve linear classification problems.
CO2	Implement multilayer perceptron's using the backpropagation algorithm to model non-linear functions and solve the XOR problem.
CO3	Apply regularization and optimization techniques to improve the performance and generalization of deep learning models.
CO4	Implement convolutional neural networks (CNNs) to perform image processing and classification tasks efficiently.
CO5	Apply recurrent neural networks (RNNs) and their gated variants like LSTM to solve sequence modeling problems in NLP and time-series data.

Reference Books:

1. Neural networks and Learning Machines, Simon Haykin, Third Edition, Pearson, 2016
2. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016.

e-Resources:

1. https://www.deeplearningbook.org/lecture_slides.html
2. https://www.coursera.org/learn/neural-networks-deep-learning
3. https://onlinecourses.nptel.ac.in/noc20_cs62/preview

Semester: III

SPECIALIZATION - A

ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

Course Name: **COMPUTER VISION**

Course Code	MMCA311D	CIE Marks	50
Teaching Hours/Week (L:P: T)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Objectives:

1. Understand the fundamentals of computer vision, image formation, and digital imaging systems.
2. Explore various image processing techniques including filtering, Fourier transforms, and geometric transformations.
3. Learn and apply methods for image restoration, segmentation, and noise handling.
4. Examine techniques for color image processing and understand the role of color in segmentation.
5. Study morphological operations, feature extraction, and pattern classification methods in image analysis.

Module – 1

Introduction and Image Formation: Definition of computer vision, A brief history, **Image Formation:** Photometric image formation, The digital camera, **Image Processing:** Point Operators, Linear Filtering. **8 Hours**

Module – 2

Image Processing: More Neighborhood operators, Fourier Transforms, Pyramids and wavelets, and Geometric Transformations. **8 Hours**

Module – 3

Image Restoration and Reconstruction: A model of Image degradation/restoration process, restoration in the presence of noise only, periodic noise reduction by frequency domain filtering. **Image Segmentation:** Fundamentals, Point, Line and edge detection, thresholding (Foundation & Basic global thresholding only), Segmentation by region growing & region splitting & merging. **8 Hours**

Module – 4

Color Image Processing: Color fundamentals, color models, Pseudocolor image processing, full color image processing, color transformations, color image smoothing and sharpening, Using color in image segmentation, Noise in color images. **8 Hours**

Module – 5

Morphological Image Processing: Preliminaries, Erosion and Dilation, opening and closing, Hit-or-miss transform, some basic morphological algorithms. Feature Extraction: Background, Boundary pre-processing (Boundary following & Chain codes only). **Image pattern Classification**: Background, Patterns and classes, Pattern classification by prototype matching (Minimum distance classifier only). **8 Hours**

Course Outcomes:

The students should be able to:	
CO1	Apply image formation principles and point/linear filtering techniques for basic image processing tasks.
CO2	Use Fourier Transforms, pyramids, and geometric transformations to enhance and manipulate digital images.
CO3	Implement image restoration and segmentation techniques such as edge detection, thresholding, and region-based methods for object separation.
CO4	Apply color image processing techniques including color transformations, smoothing, and segmentation using various color models.
CO5	Apply morphological operations and feature extraction techniques for image analysis and perform basic pattern classification using prototype matching.

Reference Books:

1. "Computer Vision: Algorithms and Applications" (Texts in Computer Science), Richard Szeliski, 2nd Edition, 2022, Springer.
2. "Digital Image Processing", Rafael C G., Woods R E. and Eddins S L, Pearson, 4th edition, 2019.
3. David Forsyth and Jean Ponce, Computer Vision: A Modern Approach, 2nd Edition, Pearson, 2015.
4. Reinhard Klette, Concise Computer Vision - An Introduction into Theory and Algorithms, Springer, 2014.

e-Resources:

1. https://onlinecourses.nptel.ac.in/noc19_cs58/preview
2. Virtual Labs: https://cse19-iiith.vlabs.ac.in/
3. https://onlinecourses.nptel.ac.in/noc21_ee78/preview
4. Introduction to Machine Vision: https://www.youtube.com/watch?v=tY2gczObpfU
5. https://coral.ise.lehigh.edu/optml/files/2019/10/0ptML_CV_tutorial_1_compressed.pdf

Semester: III

SPECIALIZATION - B
DATA SCIENCE & ANALYTICS

Course Name: **DATA MINING & DATA WAREHOUSING**

Course Code	MMCB311A	CIE Marks	50
Teaching Hours/Week (L:P: T)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Objectives:

1. Introduction to general issues of Data Warehouse and Data Mining.
2. Understanding of the different architectures and mining techniques.
3. The role and functions of Data Warehouse and Data Mining.
4. Explain the stages and process different data mining techniques.
5. Learn mining and warehouse techniques through the use of different tools

Module – 1

Introduction to Data Warehousing: Basic Concepts: Data Warehousing: A multitier Architecture, Data warehouse models: Enterprise warehouse, Data mart and virtual warehouse, Extraction, Transformation and loading, Data Cube: A multidimensional data model, Stars, Snowflakes and Fact constellations: Schemas for multidimensional Data models, Dimensions: The role of concept Hierarchies, Measures: Their Categorization and computation, Typical OLAP Operations. **8 Hours**

Module – 2

Introduction to Data Mining: Introduction, what is Data Mining, Definition, KDD, Challenges, Data Mining Tasks, Data Preprocessing- Data Cleaning, Missing Data, Dimensionality Reduction, Feature Subset Selection, Discretization and Binarization, Data Transformation; Measures of similarity and Dissimilarity-Basics. **8 Hours**

Module – 3

Association Analysis: Association Analysis: Problem Definition, Frequent Item set Generation, Rule generation. Alternative Methods for Generating Frequent Item sets, FPGrowth Algorithm, Evaluation of Association Patterns. **8 Hours**

Module – 4

Classification: Decision Trees Induction, Method for Comparing Classifiers, Rule Based Classifiers, Nearest Neighbor Classifiers, Bayesian Classifiers. **8 Hours**

Module – 5

Clustering Analysis: Overview, K-Means, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation, Density-Based Clustering, Graph-Based Clustering, Scalable Clustering Algorithms. **8 Hours**

Course Outcomes:

The students should be able to:	
CO1	Apply data warehousing concepts such as ETL processes, multidimensional data modeling, and OLAP operations to design data storage solutions.
CO2	Perform data preprocessing techniques including cleaning, transformation, and similarity measurement to prepare datasets for mining.
CO3	Implement association rule mining using algorithms like Apriori and FP-Growth to discover frequent patterns in transactional data.
CO4	Apply classification techniques such as decision trees, Bayesian classifiers, and k-nearest neighbor to build predictive models.
CO5	Apply clustering algorithms including K-Means, DBSCAN, and hierarchical clustering for unsupervised data analysis and pattern discovery.

Reference Books:

1. "Data Warehousing and Data Mining", Dr. Jugnesh Kumar, Bpb Publications, 2024
2. "Introduction to Data Mining", Pang-Ning Tan, Vipin Kumar, Michael Steinbanch, Pearson, 2ND Edition 2021
3. "Data Mining-Concepts and Techniques", Jiawei Han, Micheline Kamber, Morgan Kaufmann, 4th Edition 2022

e-Resources:

1. https://nptel.ac.in/courses/106/106/106106093/
2. https://nptel.ac.in/courses/110/107/110107092/
3. https://nptel.ac.in/courses/106/105/106105174/

Semester: III

SPECIALIZATION - B

DATA SCIENCE & ANALYTICS

Course Name: **BIG DATA ANALYTICS**

Course Code	MMCB311B	CIE Marks	50
Teaching Hours/Week (L:P: T)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Objectives:

1. Understand the fundamental concepts of big data, including architecture, sources, storage, and preprocessing techniques.
2. Explore the Hadoop ecosystem and its components for managing and processing big data.
3. Study NoSQL databases like MongoDB and Cassandra for scalable big data storage solutions.
4. Learn the MapReduce framework for distributed data processing and analyze data using Hive and Pig.
5. Apply Spark for data analytics and understand mining techniques for text and web content.

Module – 1

Introduction to Big Data Analytics: Big Data, Scalability and Parallel Processing, Designing Data Architecture, Data Sources, Quality, Pre-Processing and Storing, Data Storage and Analysis, Big Data Analytics Applications and Case Studies.

8 Hours

Module – 2

Introduction to Hadoop: Introduction, Hadoop and its Ecosystem, Hadoop Distributed File System, MapReduce Framework and Programming Model, Hadoop Yarn, Hadoop Ecosystem Tools.

Hadoop Distributed File System Basics: HDFS Design Features, Components, HDFS User Commands.

Essential Hadoop Tools: Using Apache Pig, Hive, Sqoop, Flume, Oozie, HBase.

8 Hours

Module – 3

NoSQL Big Data Management, MongoDB and Cassandra: Introduction, NoSQL Data Store, NoSQL Data Architecture Patterns, NoSQL to Manage Big Data, Shared-Nothing Architecture for Big Data Tasks, MongoDB, Databases, Cassandra Databases.

8 Hours

Module – 4

Introduction to MapReduce Map Tasks: Reduce Tasks and MapReduce Execution, Composing MapReduce for Calculations and Algorithms, Hive, HiveQL, Pig.

8 Hours

Module – 5

Spark and Big Data Analytics: Spark, Introduction to Data Analysis with Spark. Text, Web Content and Link Analytics: Introduction, Text Mining, Web Mining, Web Content and Web Usage Analytics, Page Rank, Structure of Web and Analyzing a Web Graph. **8 Hours**

Course Outcomes:

The students should be able to:	
CO1	Apply big data analytics concepts to design scalable architectures and preprocess data for analysis across different sources.
CO2	Implement data storage and processing using Hadoop ecosystem tools such as HDFS, MapReduce, Hive, Pig, Sqoop, and Flume.
CO3	Apply NoSQL database models using MongoDB and Cassandra to manage and manipulate unstructured and semi-structured big data.
CO4	Implement MapReduce programming for parallel data processing and apply HiveQL and Pig for querying large datasets.
CO5	Apply Spark for big data analysis and implement techniques for text mining, web content analysis, and web usage analytics including PageRank.

Reference Books:

1. "Big Data Analytics Introduction to Hadoop, Spark, and Machine Learning", Raj Kamal and Preeti Saxena, McGraw Hill Education, 2019
2. "Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data", Douglas Eadline, Pearson Education, 1st Edition, 2016
3. "Big data and Analytics", Seema Acharya and Subhashini Chellappan Wiley India Publishers, 2nd Edition, 2019

e-Resources:

1. https://www.youtube.com/watch?v=n_Krer6YWY4
2. https://onlinecourses.nptel.ac.in/noc20_cs92/preview
3. https://www.digimat.in/nptel/courses/video/106104189/L01.html

Semester: III

SPECIALIZATION - B
DATA SCIENCE & ANALYTICS

Course Name: **SOCIAL MEDIA ANALYTICS**

Course Code	MMCB311C	CIE Marks	50
Teaching Hours/Week (L:P: T)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Objectives:

1. Understand the fundamentals, structure, and need for Social Media Analytics (SMA) in organizational decision-making.
2. Gain knowledge about network structures, key measures, and visualization techniques in social media networks.
3. Learn techniques for text, action, and hyperlink analytics within social media environments.
4. Explore location-based analytics and search engine analytics, including their tools and privacy implications.
5. Analyze real-world applications of SMA in public and private sectors, while understanding the ethical and privacy concerns.

Module – 1

Social Media Analytics: An Overview Core Characteristics of Social Media, Types of Social Media, Social media landscape, Need for Social Media Analytics (SMA), SMA in small & large organizations.

Purpose of Social Media Analytics, Social Media vs. Traditional Business Analytics, Seven Layers of Social Media Analytics, Types of Social Media Analytics, Social Media Analytics Cycle, Challenges to Social Media Analytics, Social Media Analytics Tools.

8 Hours

Module – 2

Social Network Structure, Measures & Visualization

Basics of Social Network Structure - Nodes, Edges & Tie Describing the Networks Measures - Degree Distribution, Density, Connectivity, Centralization, Tie Strength & Trust Network Visualization - Graph Layout, Visualizing Network features, Scale Issues.

Social Media Network Analytics - Common Network Terms, Common Social Media Network Types, Types of Networks, Common Network Terminologies, Network Analytics Tools.

8 Hours

Module – 3

Social Media Text, Action & Hyperlink Analytics

Social Media Text Analytics, Types of Social Media Text, Purpose of Text Analytics, Steps in Text Analytics, Social Media Text.

Analysis Tools: Social Media Action Analytics, Common Social Media Actions, Actions Analytics Tools Social Media Hyperlink Analytics, Types of Hyperlinks, Types of Hyperlink Analytics, Hyperlink Analytics Tools

8 Hours

Module – 4

Social Media Location & Search Engine Analytics: Location Analytics - Sources of Location Data, Categories of Location Analytics, Location Analytics and Privacy Concerns, Location Analytics Tools Search Engine Analytics - Types of Search Engines, Search Engine Analytics, Search Engine Analytics Tools **8 Hours**

Module – 5

Social Media Analytics Applications and Privacy: social media in public sector- Analyzing public sector social media, analyzing individual users, case study. Business use of social media - Measuring success, Interaction and monitoring, case study. Privacy-Privacy policies, data ownership and maintaining privacy online. **8 Hours**

Course Outcomes:

The students should be able to:	
CO1	Apply social media analytics frameworks, tools, and cycles to evaluate digital engagement and organizational use of social platforms.
CO2	Use network structure concepts and visualization techniques to analyze and interpret social network relationships and behaviors.
CO3	Apply text, action, and hyperlink analytics tools to extract and interpret insights from various types of social media content.
CO4	Use location and search engine analytics tools to analyze user behavior and content visibility across geographic and search platforms.
CO5	Apply social media analytics for real-world business and public sector scenarios while addressing data privacy and ethical concerns

Reference Books:

1. "Creating Value with Social Media Analytics", Gohar F. Khan, CreateSpace Independent Publishing, 1st Edition 2018
2. "Social Media Analytics Strategy", Alex Gonsalves, Apress, 1st Edition 2017
3. "Social Media Marketing", Tracy L. Tuten, Michael R, Solomon, Sage, 2018

e-Resources:

1. https://onlinecourses.nptel.ac.in/noc22_cs117/preview

Semester: III

SPECIALIZATION - B
DATA SCIENCE & ANALYTICS

Course Name: **STATISTICAL ANALYSIS USING R**

Course Code	MMCB311D	CIE Marks	50
Teaching Hours/Week (L:P: T)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Objectives:

1. Understand the basics of R programming including data structures, operations, and packages.
2. Explore various techniques of data visualization using R for effective graphical representation.
3. Apply descriptive statistical measures to summarize and understand data characteristics.
4. Perform statistical hypothesis testing using appropriate tests and interpret the outcomes.
5. Develop and evaluate predictive models using regression analysis and advanced statistical techniques in R.

Module – 1

Introduction: R programming - Installing R and R Studio – R Studio Overview - Working in the Console - Arithmetic Operators - Logical Operations - Using Functions - Getting Help in R and Quitting R Studio Installing and loading packages. Data structures, variables, and data types in R: Creating Variables - Numeric, Character and Logical Data - Vectors - Data Frames - Factors - Sorting Numeric, Character, and Factor Vectors - Special Values.

8 Hours

Module – 2

Data Visualization: Scatter Plots - Box Plots - Scatter Plots and Box and-Whisker Plots Together -Customize plot axes, labels, add legends, and add colors.

8 Hours

Module – 3

Descriptive statistics: Measures of central tendency - Measures of variability - Skewness and kurtosis - Summary functions, describe functions, and descriptive statistics by group.

8 Hours

Module – 4

Testing of Hypothesis: T-test, Paired Test, correlation, Chi Square test, Analysis of Variance and Correlation.

8 Hours

Module – 5

Predictive Analytics: linear Regression model, Non-Linear Least Square, multiple regression analysis, Logistic Regression, Panel Regression Analysis, ARCH Model, GARCH models, VIF model.

8 Hours

Course Outcomes:

The students should be able to:	
CO1	Apply R programming concepts to create and manipulate data structures such as vectors, data frames, and factors for basic data handling
CO2	Use R programming to create and customize visualizations such as scatter plots and box plots for data exploration and presentation.
CO3	Apply descriptive statistical techniques in R to summarize and interpret data distributions using summary functions and group-wise statistics.
CO4	Perform hypothesis testing in R using statistical tests like t-test, chi-square test, ANOVA, and correlation to validate assumptions.
CO5	Implement predictive analytics models in R such as linear and logistic regression, panel regression, and time-series models (ARCH, GARCH) for forecasting.

Reference Books:

1. "Statistics - An introduction using R", Michael J. Crawley, Wiley, 2nd Edition 2014
2. "A First Course in Statistical Programming with R", W. John Braun & Duncan Murdoch, Cambridge University Press, 3rd Edition 2021
3. "Statistics using R", Purohit, S.G.; Gore, S.D. and Deshmukh, S.R., Narosa Publishing House, New Delhi, 2nd Edition 2015

e-Resources:

1. https://onlinecourses.nptel.ac.in/noc24_mg113/preview

Semester: III

SPECIALIZATION - C
SECURITY

Course Name: **ETHICAL HACKING**

Course Code	MMCC311A	CIE Marks	50
Teaching Hours/Week (L:P: T)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Objectives:

1. Understand the techniques and methodologies used in footprinting, scanning, and enumeration in network security.
2. Explore system-level security permissions and vulnerabilities in both Windows and Unix environments.
3. Examine hacking techniques involving dial-up, PBX, voicemail, VPNs, and network devices.
4. Analyze vulnerabilities in wireless networks, firewalls, and learn about Denial of Service (DoS) attacks.
5. Investigate remote control insecurities, web-based attacks, cryptographic exploits, and social engineering methods.

Module – 1

Casing the Establishment: What is foot printing, Internet Foot printing, Scanning, Enumeration, basic banner grabbing, Enumerating Common Network services. Case study: Network Security Monitoring. **8 Hours**

Module – 2

Securing permission: Securing file and folder permission, Using the encrypting file system, Securing registry permissions. Securing service: Managing service permission, Default services in windows 2000 and windows XP. Unix: The Quest for Root, Remote Access vs Local access, Remote access, Local access, After hacking root. **8 Hours**

Module – 3

Dial-up, PBX, Voicemail and VPN hacking, Preparing to dial up, War-Dialing, Brute Force Scripting PBX hacking, Voice mail hacking, VPN hacking, **Network Devices:** Discovery Autonomous System Lookup, Public Newsgroups, Service Detection, Network Vulnerability, Detecting Layer 2 Media. **8 Hours**

Module – 4

Wireless Hacking: Wireless Foot printing, Wireless Scanning and Enumeration, Gaining Access, Tools that exploiting WEP Weakness, Denial of Services Attacks, Firewalls: Firewalls landscape, Firewall Identification-Scanning Through firewalls, packet Filtering, Application Proxy Vulnerabilities, Denial of Service Attacks, Motivation of Dos Attackers, Types of DoS attacks, Generic Dos Attacks, UNIX and Windows DoS. **8 Hours**

Module – 5

Remote Control Insecurities, Discovering Remote Control Software, Connection, Weakness, VNC, Microsoft Terminal Server and Citrix ICA, Advanced Techniques Session Hijacking, Back Doors, Trojans, Cryptography, Subverting the systems Environment, Social Engineering, Web Hacking, Web server hacking web application hacking, Hacking the internet Use, Malicious Mobile code, SSL fraud, E-mail Hacking, IRC hacking, Global countermeasures to Internet User Hacking. **8 Hours**

Course Outcomes:

The students should be able to:	
CO1	Apply foot printing, scanning, and enumeration techniques to identify vulnerabilities in network services and systems.
CO2	Implement security measures to protect file systems, services, and operating system resources in both Windows and Unix environments.
CO3	Use war-dialing, scripting, and discovery techniques to assess vulnerabilities in dial-up systems, PBX, voicemail, VPNs, and network devices.
CO4	Apply wireless hacking methods and firewall evasion techniques to assess wireless security and identify potential denial-of-service vulnerabilities.
CO5	Perform advanced cyberattack simulations such as session hijacking, backdoor deployment, web application hacking, and evaluate countermeasures against them.

Reference Books:

1. "The Future of Hacking: The Rise of Cybercrime and the Fight to Keep Us Safe", Laura S. Scherling, Bloomsbury Academic, 2025
2. "Ethical Hacking: Techniques, Tools, and Countermeasures", 4th Edition, Michael G. Solomon, Sean-Philip Oriyano, Jones & Bartlett Learning,2022
3. "Hacking Exposed: Network Security Secrets & Solutions", 7th Edition, Stuart McClure, Joel Scambray and Goerge Kurtz, Tata McGraw Hill, 2012

e-Resources:

1. https://onlinecourses.nptel.ac.in/noc22_cs13/preview

Semester: III

SPECIALIZATION - C
SECURITY

Course Name: **CYBER SECURITY**

Course Code	MMCC311B	CIE Marks	50
Teaching Hours/Week (L:P: T)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Objectives:

1. Understand the fundamentals of cybercrime, its origins, classifications, and global legal perspectives.
2. Explore how cybercriminals plan and execute attacks using various social and technological methods.
3. Examine the tools and techniques used in cybercrimes including malware, phishing, and DoS attacks.
4. Analyze various phishing and identity theft techniques and explore effective countermeasures.
5. Understand the concepts and procedures in digital forensics and evidence handling for cyber investigations.

Module – 1

Introduction to Cybercrime:
Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Cybercriminals, Classifications of Cybercrimes, An Indian Perspective, Hacking and Indian Laws., Global Perspectives

8 Hours

Module – 2

Cyber Offenses:
How Criminals Plan Them: Introduction, How criminals plan the attacks, Social Engineering, Cyber Stalking, Cyber Cafe & cybercrimes.
Botnets: The fuel for cybercrime, Attack Vector.

8 Hours

Module – 3

Tools and Methods used in Cybercrime: Introduction, Proxy Servers, Anonymizers, Phishing, Password Cracking, Key Loggers and Spyways, Virus and Worms, Trozen Horses and Backdoors, Steganography, DoS and DDOS Attacks, Attacks on Wireless networks.

8 Hours

Module – 4

Phishing and Identity Theft: Introduction, methods of phishing, phishing techniques, spear phishing, Types of phishing scams, Phishing toolkits and spy phishing, Counter measures, Identity Theft

8 Hours

Module – 5

Understanding Computer Forensics: Introduction, Historical Background of Cyber forensics, Digital Forensics Science, Need for Computer Forensics, Cyber Forensics and Digital Evidence, Digital Forensic Life cycle, Chain of Custody Concepts, network forensics. **8 Hours**

Course Outcomes:

The students should be able to:	
CO1	Apply fundamental concepts of cybercrime and information security to classify different types of cybercrimes from Indian and global perspectives.
CO2	Use cyber offense planning methods such as social engineering and botnet attacks to analyze common cybercrime tactics.
CO3	Apply various cybercrime tools and techniques like phishing, spyware, DoS/DDoS, and steganography to simulate cyberattack scenarios.
CO4	Demonstrate phishing and identity theft techniques and implement corresponding countermeasures to mitigate their impact.
CO5	Apply the digital forensic lifecycle and tools to examine digital evidence and support investigation procedures in cybercrime cases.

Reference Books:

1. Big Breaches: "Cyber-security Lessons for Everyone", Neil Daswani, Moudy Elbayadi Feb 2021
2. "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Sunit Belapure and Nina Godbole, Wiley India Pvt Ltd, ISBN: 978-81- 265-21791, 2011, First Edition (Reprinted 2018)

e-Resources:

1. https://onlinecourses.nptel.ac.in/noc23_cs127/preview

Semester: III

SPECIALIZATION - C
SECURITY

Course Name: **CRYPTOGRAPHY & NETWORK SECURITY**

Course Code	MMCC311C	CIE Marks	50
Teaching Hours/Week (L:P: T)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Objectives:

1. Understand the fundamentals of cryptography, including classical and modern cryptographic techniques.
2. Study and analyse block cipher and stream cipher algorithms and their cryptographic principles.
3. Explore public key cryptography systems and key exchange algorithms used for secure communication.
4. Learn about digital signatures, authentication protocols, and email/web security standards.
5. Examine system-level security mechanisms and protocols for secure electronic transactions in e-commerce.

Module – 1

Foundations of Cryptography and Security: Ciphers and Secret Message, Security Attacks and Services. Mathematical Tools for Cryptography: Substitutions and Permutations, Modular Arithmetic, Euclid's Algorithm, Finite Fields, Polynomial Arithmetic. Design Principle of Block ciphers: Theory of Block Cipher Design. Cipher Network Structures, DES and Triple DES, Modes of Operation (ECB, CBC, OFB, CFB), Strength (or Not) Of DES

8 Hours

Module – 2

Block Cipher Algorithms: IDEA, CAST, Blowfish, Twofish, Rijndael (AES). Pseudo Random Numbers and stream ciphers: Pseudo random sequences, Linear Congruential Generators, Cryptographic Generators, Design of Stream Cipher, RC4, RC5

8 Hours

Module – 3

Public Key Cryptography: Prime Numbers and Testing for Primality, Factoring Large Numbers, Discrete Logarithms RSA, Diffie- Hellman, ElGamal, Introduction of Elliptic acre Cryptosystems Key Management, Key Exchange Algorithms, Public – Key Cryptography Standards. Hashes and Message Digests: Message Authentication, MD5, SHA-1, RIPEMD, HMAC

8 Hours

Module – 4

Digital Signatures, Certificates, and Standards: Digital Signature Standard (DSS and DSA), Public key Infrastructure, Digital Certificates and Basics of PKCS Standards. Authentication: Kerberos V 4 and V 5, X.509 Authentication Service. Electronic Mail Security: Pretty Good Privacy (PGP), S /MIME, X.400. IP and Web Security Protocols: IPSec and Virtual Private Networks, Secure Sockets and Transport Layer (SSL and TLS).

8 Hours

Module – 5

System Security: Computer Virus, Firewall and Design Principles, Reference: Chapter 18, 19, & 20 of Cryptography and Network Security. Electronic Commerce Security: Electronic Payment Systems, Secure Electronic Transaction (SET), Protocols (CyberCash, iKey) Ecash (DigiCash), Smart Card Based Systems

8 Hours

Course Outcomes:

The students should be able to:	
CO1	Apply mathematical tools and block cipher principles to design and analyze classical and modern symmetric encryption algorithms like DES and AES.
CO2	Implement various block cipher algorithms and stream ciphers, applying pseudo-random number generation techniques for cryptographic purposes.
CO3	Apply public key cryptography methods including RSA, Diffie-Hellman, and Elliptic Curve Cryptosystems for secure key exchange and encryption.
CO4	Utilize digital signature schemes, certificate infrastructures, and authentication protocols to ensure message integrity and secure communication.
CO5	Apply system security techniques including virus detection, firewall configuration, and electronic commerce security protocols to protect digital assets.

Reference Books:

1. "Cryptography and Network Security", William Stallings, Pearson 6th edition, 2013
2. "Cryptography and Information Security", V. K Pachghare, PHI 2nd Edition, 2015
3. "Cryptography and Network Security", Behrouz A. Foruzan, Tata McGraw Hill 2007.

e-Resources:

1. https://onlinecourses.nptel.ac.in/noc22_cs90/preview

Semester: III

SPECIALIZATION - C
SECURITY

Course Name: **CYBER CRIME & DIGITAL FORENSICS**

Course Code	MMCC311D	CIE Marks	50
Teaching Hours/Week (L:P: T)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Objectives:

1. Understand the nature, scope, and categories of cybercrime, including common tactics like social engineering.
2. Examine various cyber offenses, such as unauthorized access, malware attacks, and white-collar digital crimes.
3. Familiarize with the fundamentals and tools of digital forensics and system/network forensic techniques.
4. Learn about the procedures and tools used in cybercrime investigation and evidence recovery.
5. Understand the legal, ethical, and policy frameworks governing cybercrime and forensic evidence handling.

Module – 1

Introduction and Overview of Cyber Crime, Nature and Scope of Cyber Crime, Types of Cyber Crime, Social Engineering, Categories of Cyber Crime, Property Cyber Crime.

8 Hours

Module – 2

Unauthorized Access to Computers, Computer Intrusions, White collar Crimes, Viruses and Malicious Code, Internet Hacking and Cracking, Virus Attacks, Pornography, Software Piracy, Intellectual Property, Mail Bombs, Exploitation, Stalking and Obscenity in Internet, Digital laws and legislation, Law Enforcement Roles and Responses.

8 Hours

Module – 3

Introduction to Digital Forensics, Forensic Software and Hardware, Analysis and Advanced Tools, Forensic Technology and Practices, Forensic Ballistics and Photography, Face, Iris and Fingerprint Recognition, Audio Video Analysis, Windows System Forensics, Linux System Forensics, Network Forensics.

8 Hours

Module – 4

Introduction to Cyber Crime Investigation, Investigation Tools, eDiscovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery, Hands on Case Studies, Encryption and Decryption Methods, Search and Seizure of Computers, Recovering Deleted Evidences, Password Cracking. **8 Hours**

Module – 5

Laws and Ethics, Digital Evidence Controls, Evidence Handling Procedures, Basics of Indian Evidence ACT IPC and CrPC , Electronic Communication Privacy ACT, Legal Policies. **8 Hours**

Course Outcomes:

The students should be able to:	
CO1	Apply foundational knowledge of cybercrime types and social engineering techniques to identify and categorize various cyber offenses.
CO2	Utilize knowledge of unauthorized access methods, malware, and hacking techniques to analyze and simulate cyber threats and attacks.
CO3	Employ digital forensic tools and techniques to perform system forensics on Windows, Linux, and network environments for evidence gathering.
CO4	Apply cybercrime investigation methodologies, including eDiscovery, digital evidence collection, and password cracking to real-world case scenarios.
CO5	Demonstrate the application of laws, ethical principles, and evidence handling procedures in cybercrime investigation and digital forensics.

Reference Books:

1. “Cybercrime And Digital Forensics: An Introduction”, Thomas J. Holt, Adam M. Bossler, Kathryn C. Seigfried-Spellar, Routledge, 3rd Edition, 2022
2. "Handbook Of Digital Forensics and Cyber Crime", Dr. Meenal Dhal, Dimpal, Ms. Jasleen Kaur, Prof. Anup Kumar Kapoor, Selective and Scientific Books1st Edition, 2024
3. “Computer Forensics and Investigations”, Nelson Phillips and Enfinger Steuart, Cengage Learning, New Delhi, 2009.

e-Resources:

1. https://onlinecourses.swayam2.ac.in/cec20_lb06/preview
2. https://onlinecourses.swayam2.ac.in/cec21_ge10/preview

Semester: III

SPECIALIZATION - D
CLOUD COMPUTING

Course Name: **CLOUD WITH AWS**

Course Code	MMCD311A	CIE Marks	50
Teaching Hours/Week (L:P: T)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Objectives:

1. Provide foundational knowledge on cloud computing concepts, AWS pricing, and cost management tools.
2. Introduce students to AWS account setup, global infrastructure, and console navigation.
3. Familiarize students with AWS Identity and Access Management (IAM) and various core AWS services.
4. Explain and demonstrate AWS storage services, especially Amazon S3, and Virtual Private Cloud (VPC) components.
5. Enable students to configure and manage AWS compute (EC2), databases (RDS, DynamoDB), and monitoring services (CloudWatch).

Module – 1

Introduction: Defining Cloud Computing, Fundamentals of the Cloud, Traditional Data Centers, Cloud Service Models, Key Cloud Concepts, The Benefits of Cloud, The Different Cloud Providers, AWS Billing and Pricing, AWS Pricing Principles, AWS Organization, AWS Cost Management Tool, The Billing and Cost Management Console, AWS Resource and Cost Allocation Tags, Consolidated Billing, AWS Cost Explorer, AWS Budget, Automated Billing, AWS Pricing Calculator. **8 Hours**

Module – 2

Getting Started with AWS: AWS Accounts, AWS Free Tier, Securing an AWS Account, The AWS Management Console, The AWS Global Infrastructure. **8 Hours**

Module – 3

AWS Identity and Access Management: Identity and Access Management, A Closer Look at AWS Identity and Access Management, AWS Core Services, Storage Services, Compute Services, Database Services, Networking Services. **8 Hours**

Module – 4

AWS Storage Services and Virtual Private Cloud: Overview of Amazon S3, Amazon S3 Demo, Storage Classes, S3 Standard, Amazon S3 Intelligent-Tiering, S3 Intelligent-Tiering, Standard IA, Infrequent Access, One Zone-Infrequent Access, VPC, Introduction to VPC, Creating subnetworks inside the VPC, Public Subnet, Private Subnet, Internet Gateway, Route Table, NAT Gateway, Security Groups and NACLs.

8 Hours

Module – 5

Elastic Compute Cloud, High-Level Architecture, Databases: Compute Services in AWS, Amazon Elastic Compute Cloud, EC2, An AWS EC2 Instances, Create an EC2 Instance, High-Level Architecture, Autoscaling, Load Balancer, Databases, Data Types, Relational Databases, NoSQL Databases, DynamoDB Overview, Create Your First Amazon RDS Database, create a Subnet Group, Create an RDS Database, AWS Security Services Overview, Amazon CloudWatch. **8 Hours**

Course Outcomes:

The students should be able to:	
CO1	Apply fundamental cloud computing concepts and AWS pricing models to optimize cost management and billing for cloud resources.
CO2	Utilize AWS Management Console and security best practices to set up and secure AWS accounts and environments effectively.
CO3	Implement AWS Identity and Access Management (IAM) policies to control user permissions and secure cloud resources.
CO4	Configure and manage AWS storage services like Amazon S3 and design Virtual Private Cloud (VPC) architectures including subnets, gateways, and security groups.
CO5	Deploy and manage AWS compute services such as EC2 instances, Auto Scaling, Load Balancers, and database services including RDS and DynamoDB for scalable cloud applications.

Reference Books:

1. "Cloud Computing concepts, technology and architecture", Thomas Erl, Pearson, 2024.
2. "Cloud Computing with AWS", Pravin Mishra, APRESS, 2023.
3. "The Most Complete Guide to Amazon Web Service from Beginner to Advanced Level", Raoul Alongi, Amazon Asia- Pacific Holdings, 2019

e-Resources:

1. https://onlinecourses.nptel.ac.in/noc21_cs14/preview

Semester: III

SPECIALIZATION - D
CLOUD COMPUTING

Course Name: **DEVOPS**

Course Code	MMCD311B	CIE Marks	50
Teaching Hours/Week (L:P: T)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Objectives:

1. Introduce the evolution and fundamentals of DevOps, including its lifecycle and tools with a focus on Azure DevOps.
2. Enable students to create and manage projects using Azure Boards across different processes (Basic, Scrum, CMMI).
3. Teach the concepts of version control using Git, including local repository setup and integration with GitHub.
4. Guide students in developing CI/CD pipelines using Azure DevOps services and understanding key pipeline concepts.
5. Familiarize students with Maven, its architecture, plugins, and integration tools such as Jacoco for code coverage.

Module – 1

Introduction To Devops: Evolution of waterfall, Agile and DevOps, Need for DevOps, Benefits of DevOps, DevOps stages, DevOps Lifecycle, DevOps tools and their functionality, Azure Devops, usage of Azure Devops-Organization, creation of Organization, projects and Process, services of Azure.

8 Hours

Module – 2

AZURE Boards with Basic Process: Boards, creation of work item- Epic, features, project backlog item, task, workflow, Sprints, adding columns and fields, create users, managing dashboards, setting permissions queries. Azure boards using CMMI and Scrum Process, customize project using inherited process.

8 Hours

Module – 3

Version Control with GIT: Version control system, central vs distributed version control system, Introduction to GIT, installation and setting up GIT, Creating a local Git repository, operations like pull, push, commit, clone, merge, Git Branches, handling Git Hub repository using visual studio code.

8 Hours

Module – 4

Azure DevOps CI/ CD Pipelines: Introduction to CI/ CD, creating pipeline, releases, stages, azure pipeline with Azure services, triggers, key concepts- agents, approval, artifacts, job, run stage, YAML templates, SONAR cloud integration

8 Hours

Module – 5

Introduction To MAVIN: Overview of various build tools, what is Maven, Maven architecture, Maven Plugins, Archetypes, Maven commands, integration of Jacoco plugin for code coverage, applications.

8 Hours

Course Outcomes:

The students should be able to:	
CO1	Apply DevOps principles and lifecycle stages to design and implement efficient software development workflows using Azure DevOps.
CO2	Utilize Azure Boards to create and manage work items, configure project backlogs, sprints, dashboards, and customize processes for Agile project management.
CO3	Perform version control operations using Git, including repository setup, branching, merging, and managing remote repositories via GitHub integrated with Visual Studio Code.
CO4	Build and deploy continuous integration and continuous delivery (CI/CD) pipelines in Azure DevOps, configuring triggers, stages, approvals, and integrating tools like SonarCloud.
CO5	Use Maven build tool to manage project dependencies, build lifecycle, and integrate plugins such as JaCoCo for code coverage analysis in software development projects.

Reference Books:

1. "A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises", Roberto Vormittag, Kindle Edition, 2nd Edition, 2016.
2. "Linux for Beginners: An Introduction to the Linux Operating System and Command Line", Jason Cannon, Kindle Edition, 2014.
3. "Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps", David Johnson, Create Space Independent Publishing Platform, 2nd Edition, 2016.

Semester: III

SPECIALIZATION - D
CLOUD COMPUTING

Course Name: **DESIGN AND OPERATION OF DATA CENTERS**

Course Code	MMCD311C	CIE Marks	50
Teaching Hours/Week (L:P: T)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Objectives:

1. Introduce the fundamental concepts, architecture, and goals of data centers in enterprise environments.
2. Familiarize students with various data center design topologies and their components across layers.
3. Explain the importance of data center security, including threats, vulnerabilities, and mitigation mechanisms.
4. Provide foundational knowledge of cryptographic techniques, security frameworks, and lifecycle management.
5. Explore the performance metrics and evaluation techniques used for data center components and network traffic

Module – 1

Overview of Data Centers: Data Centers defined, Data center goals, Roles of Data Center in the Enterprise, Application Architecture Models, Data center Architecture, Data Center Services.

8 Hours

Module – 2

Data Center Design Overview: Types of Server Farms and Data Centres, Data Center Topologies-generic layer 3/layer 2 design, Alternate layer 3/layer 2 design, Multiple Tier design, Fully redundant Layer 2/layer 3 design.

8 Hours

Module – 3

Data Center Security: Need for a secure Data center, Vulnerabilities and common attacks-scanning or probing, DoS, DDoS, viruses and worms, internet attacks, session hijacking, Layer 2 attacks, Network Security Infrastructure-ACLs, Firewalls, Layer 2 security

8 Hours

Module – 4

Security Fundamentals and Framework: Cryptography-Symmetric and Asymmetric Encryption, Cryptographic Hashing Algorithms, HMACs. Security policies, security lifecycle, Secure management framework.

8 Hours

Module – 5

Performance Metrics of Data Center Devices: Traffic Patterns Overview, Traffic patterns in Data Center, Performance metrics, Multilayer Switch Metrics, Firewall metrics. **8 Hours**

Course Outcomes:

The students should be able to:	
CO1	Apply knowledge of data center architecture and application models to analyze and design enterprise data center solutions.
CO2	Implement various data center design topologies such as multi-tier and fully redundant Layer 2/Layer 3 designs to optimize server farm performance.
CO3	Utilize security principles and tools including firewalls, ACLs, and Layer 2 security to protect data centers against common vulnerabilities and attacks.
CO4	Apply cryptographic techniques such as symmetric/asymmetric encryption and hashing algorithms to secure data center communications and management frameworks.
CO5	Measure and analyze traffic patterns and performance metrics of data center devices, including multilayer switches and firewalls, to ensure optimal data center operations.

Reference Books:

1. Data center fundamentals", Mauricio Arregoces, Cisco press, 2016.
2. "Data Centers Design and Operations",Charles Nehme, Kindle Edition, 2018
3. "Data center Design from beginner to Professional", B A Ayomaya, Kindle Edition, 2018

e-Resources:

https://www.udemy.com/course/data-center-essentials/?couponCode=ST19MT280525G3

Semester: III

SPECIALIZATION - D
CLOUD COMPUTING

Course Name: **BLOCK CHAIN TECHNOLOGY**

Course Code	MMCD311D	CIE Marks	50
Teaching Hours/Week (L:P: T)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Objectives:

1. Introduce the fundamentals, architecture, and types of blockchain technology and its evolution.
2. Explore decentralized systems, distributed ledgers, and the role of hash functions in securing blockchain.
3. Understand consensus mechanisms and components of popular blockchain platforms like Ethereum.
4. Analyze the working of Bitcoin, including its transactions, wallets, mining processes, and related technologies.
5. Examine real-world use cases and vertical solutions of blockchain across different industries.

Module – 1

Basics of Blockchain: Introduction, Concept of Blockchain, History, Definition of Blockchain, Fundamentals of Blockchain, Characteristics of Blockchain, Consensus in Trust-Building Exercise, Public, Private, and Hybrid Blockchains, Distributed Ledger Technologies, DLT Decentralized Applications and Databases, Architecture of Blockchain, Transactions, Chaining Blocks, Value Proposition of Blockchain Technology.

8 Hours

Module – 2

Decentralized System: Distributed Decentralized Databases, Decentralized Enterprise, Decentralization, Disintermediation, Decentralized Enterprise Regulation

Hash Functions: Hashing, Message Authentication Code, Secure Hash Algorithms (SHA-1), Secure Hash Algorithm Version 3, Distributed Hash Tables, Hashing and Data Structures, Hashing in Blockchain Mining.

8 Hours

Module – 3

Consensus: Consensus Approach, Consensus Algorithms, Byzantine Agreement Methods

Blockchain Components: Ethereum, History, Ethereum Virtual Machine, Working of Ethereum, Ethereum Clients, Ethereum Key Pairs, Ethereum Addresses, Ethereum Wallets, Ethereum Transactions, Ethereum Languages, Ethereum Development Tools.

8 Hours

Module – 4

Bitcoins:
Working of Bitcoin, Merkle Trees, Bitcoin Block Structure, Bitcoin Address, Bitcoin Transactions, Bitcoin Network, Bitcoin Wallets, Bitcoin Payments, Bitcoin Clients, Bitcoin Supply

Decentralized Applications
Mining in Blockchain Bitcoin, Blocks Validation and Identification, Bitcoins Creation, Mining Hardware, Mining Software, Running Miner Software, Executing Several Miners, Bitcoins Management, Reasons for Bitcoin Mining, Swarm, Robotic Possibilities, Sidechain Hopping, Blockchain Forks.

8 Hours

Module – 5

Blockchain Vertical Solutions and Use Cases
Blockchain, Blockchain in Insurance, Life Insurance and Claim Processing in Case of Death Healthcare, Assets Management, Financial Institutional Assets, Smart Assets, Electronic Currency, Manufacturing.

8 Hours

Course Outcomes:

The students should be able to:	
CO1	Apply fundamental blockchain concepts and architectures to design and analyze blockchain-based distributed ledger systems.
CO2	Utilize cryptographic hash functions and hashing techniques to ensure data integrity and security within blockchain networks.
CO3	Implement and evaluate consensus algorithms and blockchain components using Ethereum, including wallets, transactions, and smart contracts.
CO4	Demonstrate practical knowledge of Bitcoin operations, including mining, block validation, and transaction handling in blockchain environments.
CO5	Apply blockchain technology to solve real-world problems across various domains such as insurance, healthcare, finance, and manufacturing through vertical solutions.

Reference Books:

1. "Blockchain Technology and Applications" Manoj Kumar M V, Annappa B, Likewin Thomas, Sourav Kanti Addya, Niranjanamurthy M, CRC Press, 1st Edition 2023
2. Mastering Blockchain - Distributed ledgers, decentralization and smart contracts explained", Imran Bashir, Packt Publishing Ltd, 2nd Edition 2017
3. "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Arvind Narayanan, Joseph Bonneau, Edward W. Felten, Andrew Miller, Steven Goldfeder and Jeremy Clark, Princeton University Press, 2016

e-Resources:

1. https://onlinecourses.nptel.ac.in/noc22_cs44/preview

Semester: III

Course Name: **PROJECT WORK**

Course Code	MPRJ384	CIE Marks	100
Teaching Hours/Week (L:P: T)	0:0:2	SEE Marks	100
Total Hours of Pedagogy	Two contact hour/week for interaction between the faculty and student	Total Marks	200
Credits	15	Exam Hours	03

Course Objectives:

1. Identify and define a real-world problem relevant to the domain of study.
2. Apply knowledge from the curriculum in developing a software/hardware/system-based solution.
3. Enhance collaborative work, project planning, and time management skills.
4. Use modern development tools, platforms, and technologies in the design and implementation of the project.
5. Develop problem-solving and innovative thinking through research and exploration.

Project work is a significant component aimed at fostering research, practical application of knowledge, and innovation. The evaluation process generally follows these steps:

1. **Selection and Approval of Project Work:**
   - Topic Selection: Students propose project topics, often in consultation with their faculty advisor.
   - Approval Process: The proposed topic is submitted for approval by a project committee or department, ensuring alignment with academic standards and relevance.

2. **Project Execution:**
   - Research and Development: Students carry out research, experiments, or development work as per the project plan.
   - Periodic Reviews: Regular progress reviews are conducted by faculty to monitor the project's progress and provide feedback.
   - Documentation: Students maintain a detailed record of their methodology, data, results, and analysis.

3. **Submission of the Project Report**:
   - Format and Guidelines: The report must follow the prescribed format by the university or department.
   - Plagiarism Check: The report is often checked for plagiarism to ensure originality.

4. **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, and application of the project work.

5. Grading Criteria (Guidelines only)

- Report Quality: Depth of research, organization, and clarity of the document.
- Presentation Skills: Effectiveness in communicating key aspects of the project.
- Technical Merit: Innovation, accuracy, and the applicability of the research.
- Viva Performance: Understanding of the subject, responses to questions, and ability to discuss the work effectively.

6. Final Marks Allocation:

- Marks Allocation: Typically, evaluation is a blend of internal (guided by the department) and external (examiner's input) assessments, distributed over the report, presentation, and viva.
- Pass Requirement: Students must meet a minimum threshold to pass, as per academic guidelines

This structured evaluation ensures a comprehensive assessment of the student's practical and research capabilities, preparing them for further research or professional practice.

ASSESSMENT OF CIE MARKS

The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the project work, shall be based on the evaluation of the project work Report, project presentation skill, and question and answer session in the ratio 50:25:25.

ASSESSMENT OF SEE MARKS

SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work shall be based on the evaluation of project work report, project presentation skill, and question and answer session in the ratio 50:25:25

Course Outcomes:

The students should be able to:	
CO1	Apply core computer science concepts and programming skills to design and develop software solutions for complex real-world problems.
CO2	Analyze system requirements and design efficient algorithms and data structures to optimize performance in project implementations.
CO3	Implement software testing and debugging techniques to ensure robustness and reliability of computer science applications.
CO4	Evaluate the effectiveness and efficiency of developed solutions through performance analysis and validation against project goals.
CO5	Interpret project results to identify improvements, limitations, and propose future enhancements based on systematic analysis.

4th Semester
Syllabus

Semester: IV

PROFESSIONAL ELECTIVE – MMC411X

Course Name: **PROMPT ENGINEERING**

Course Code	MMC4111	CIE Marks	50
Teaching Hours/Week (L:P: T)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Objectives:

1. Introduce the fundamentals of prompt engineering and its role in large language models (LLMs).
2. Establish the foundational understanding of natural language processing (NLP), generative models, and text representation techniques.
3. Explore different types of prompts and design strategies including advanced prompting methods and detection techniques.
4. Enable students to develop, evaluate, and refine effective prompts for various NLP tasks.
5. Analyze current trends, ethical implications, and real-world case studies in prompt engineering.

Module – 1

Introduction to Prompt Engineering: Large Language Model, Working of LLM, Prompt Engineering, importance of Prompt Engineering, Types of prompts: security threats, system failures, performance bottlenecks, Benefits and limitations of Prompt Engineering, Benefits and limitations of Prompt Engineering, Case studies highlighting the impact of prompts on computing systems Real-world applications across various domains

8 Hours

Module – 2

Foundations of NLP and Generative Models: Overview of NLP tasks and applications, Preprocessing techniques for text data, Basic NLP tools and libraries (NLTK, SpaCy), Text Representation and Feature Engineering - Bag-of-Words model, Word embeddings (Word2Vec, GloVe), Deep learning-based text representations (BERT, Transformer). Generative Models - Overview of generative modeling, Probabilistic generative models, Autoencoders and variational inference.

8 Hours

Module – 3

Prompt Types and Techniques: Zero-shot vs. Few-shot learning with prompts, Task-specific prompt design strategies, Advanced techniques like Chain-of-Thought prompting, Introduction to prompt engineering tools and resources, Prompt Detection Techniques- Anomaly detection methods, Threshold-based approaches, Machine learning techniques for prompt detection

8 Hours

Module – 4

Prompt Development and Evaluation: Exercises - case studies in crafting prompts for various tasks (e.g., text generation, question answering), Techniques for evaluating prompt effectiveness and factual accuracy, Refining and iterating on prompts based on results, bias detection and mitigation in prompts

8 Hours

Module – 5

Current trends and case studies of Prompt Engineering: Emerging trends and advancements in prompt engineering Ethical considerations and potential societal impacts Discussion on the future of human-AI collaboration through prompts, Case Studies: Analysis of real-world prompt events, Design and implementation of prompt-resistant solutions, Evaluation of prompt engineering techniques in practice

8 Hours

Course Outcomes:

The students should be able to:	
CO1	Apply prompt engineering techniques to effectively interact with large language models for a variety of real-world tasks.
CO2	Implement basic and advanced prompt types such as zero-shot, few-shot, and chain-of-thought prompting for specific NLP applications.
CO3	Use NLP pre-processing tools and text representation methods (e.g., BERT, Word2Vec) to prepare data for prompt-based model interaction.
CO4	Demonstrate the development and refinement of prompts to improve model outputs in tasks like text generation and question answering.
CO5	Utilize prompt engineering tools and methods to address common challenges such as bias, inaccuracy, or inefficiency in AI responses.

Reference Books:

1. "Prompt Engineering: The Future of Language Generation", Michael Ferguson, Michael Ferguson, 2023
2. "Prompt Engineering for Generative AI", James Phoenix, Mike Taylor, O'Reilly, 2024
3. "Unlocking the Secrets of Prompt Engineering: Master the Art of Creative Language Generation to Accelerate Your Journey from Novice to Pro", Gilbert Mizrahi, 1st Edition, 2024

e-Resources:

1. https://onlinecourses.nptel.ac.in/noc25_cs45/preview

Semester: IV

PROFESSIONAL ELECTIVE – MMC411X

Course Name: **DATA ENGINEERING**

Course Code	MMC4112	CIE Marks	50
Teaching Hours/Week (L:P: T)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Objectives:

1. Understand the fundamentals of data engineering and big data ecosystems.
2. Apply ETL/ELT methods for structured and unstructured data.
3. Work with data processing tools such as Hadoop, Spark, and Kafka.
4. Design data warehousing solutions and implement data pipelines.
5. Leverage cloud platforms for scalable data engineering.

Module – 1

Introduction to Data Engineering: Overview of Data Engineering, Data Engineers vs Data Scientists, Data Lifecycle, Architecture and Ecosystem, Types of Data: Structured, Semi-Structured, Unstructured, Data Storage Types: Databases, Data Lakes, and Warehouses, Introduction to Big Data and its characteristics.

8 Hours

Module – 2

ETL/ELT and Data Ingestion Techniques: Data Ingestion: Batch and Streaming Approaches, ETL vs ELT: Concepts, Tools, and Workflows, Data Cleaning and Transformation Techniques, Tools: Apache Nifi, Talend, Airflow, Hands-on Activity: Simple ETL pipeline in Python

8 Hours

Module – 3

Big Data Processing Frameworks: Distributed Systems Overview, Hadoop Ecosystem, Apache Spark: RDDs, DataFrames, Spark SQL, Real-Time Data Processing using Apache Kafka & Spark Streaming, Hands-on: Parse CSV/JSON files with Spark

8 Hours

Module – 4

Data Warehousing and Modeling: OLTP vs OLAP, Dimensional Modeling: Star and Snowflake Schemas, Data Warehouse Tools: BigQuery, Amazon Redshift, Snowflake, Hands-on: Design and load data into a data warehouse

8 Hours

Module – 5

Cloud-Based Data Engineering: Overview of AWS, GCP, and Azure, Cloud ETL Tools: AWS Glue, GCP Dataflow, Azure Data Factory, Data Pipeline Orchestration with Apache Airflow, CI/CD for Data Pipelines. **8 Hours**

Course Outcomes:

The students should be able to:	
CO1	Apply data engineering concepts to design and implement data ingestion pipelines using batch and streaming approaches.
CO2	Use ETL/ELT tools and techniques to perform data cleaning, transformation, and loading in practical scenarios.
CO3	Implement big data processing workflows using Apache Spark and Kafka for real-time and batch data analytics.
CO4	Construct data warehouse models such as star and snowflake schemas and load data into cloud-based data warehousing platforms.
CO5	Develop cloud-based data engineering pipelines using AWS, GCP, or Azure services and orchestrate workflows with Apache Airflow.

Reference Books:

1. "Data Engineering with Python", Paul Crickard, Packt Publishing, 2020
2. "Fundamentals of Data Engineering", Joe Reis, Matt Housley, Shroff/O'Reilly, 1st edition, 2022
3. "Designing Data-Intensive Applications", Martin Kleppmann, Shroff/O'Reilly, 1st edition, 2017

e-Resources:

1. https://onlinecourses.nptel.ac.in/noc21_cs69/preview

Semester: IV

PROFESSIONAL ELECTIVE – MMC411X

Course Name: **AGENTIC AI**

Course Code	MMC4113	CIE Marks	50
Teaching Hours/Week (L:P: T)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Objectives:

1. Introduce the concept, evolution, and significance of Agentic AI and differentiate it from traditional AI systems.
2. Explore various agent architectures, planning techniques, and agent behaviors in dynamic environments.
3. Familiarize students with modern frameworks and tools such as LangChain, AutoGPT, and BabyAGI for building intelligent agents.
4. Examine the principles and challenges in multi-agent systems including communication, cooperation, and distributed problem-solving.
5. Analyze practical applications, ethical concerns, and future directions of agentic AI, including designing autonomous assistant agents.

Module – 1

Introduction to Agentic AI: Definition, evolution, and significance, Types of agents: Simple reflex, model-based, goal-based, utility-based, learning agents, The Perceive-Think-Act loop, Traditional AI vs. Agentic AI, Examples: AutoGPT, research assistants, self-driving vehicles

8 Hours

Module – 2

Architectures and Planning: Rational agents, environment modeling, Agent architectures: Rule-based, Layered, BDI (Belief-Desire-Intention), Planning techniques: STRIPS, GOAP, Agent memory and state persistence, Case Study: LangChain agent structure

8 Hours

Module – 3

Agentic Frameworks and Tools: LangChain, AutoGPT, BabyAGI: Architecture and capabilities, Chains, memory, and tools in LangChain, Integration with vector databases (FAISS), Prompts as reasoning tools, Hands-on: Building a basic agent using LangChain

8 Hours

Module – 4

Multi-Agent Systems: Agent communication protocols and languages, Concepts: Coordination, cooperation, negotiation, Distributed AI and problem solving, Real-world applications: Gaming, swarm robotics, MAS Case Study: ChatGPT agents collaborating

8 Hours

Module – 5

Applications and Ethics: Applications in automation, education, customer support, Limitations: Hallucination, alignment issues, Ethical AI design and safety mechanisms, Future trends: Toward AGI **8 Hours**

Course Outcomes:

The students should be able to:	
CO1	Apply different types of agent models (simple reflex, goal-based, utility-based) to design intelligent agent behaviors for real-world scenarios.
CO2	Use agent architectures and planning techniques like STRIPS and GOAP to develop rational and goal-oriented agent systems.
CO3	Implement basic agentic applications using frameworks such as LangChain, AutoGPT, and BabyAGI, integrating memory and external tools.
CO4	Demonstrate multi-agent communication, coordination, and negotiation protocols by simulating distributed AI problem-solving environments.
CO5	Develop autonomous agents addressing practical use cases while applying ethical AI design principles to mitigate alignment and safety issues.

Reference Books:

1. "Mastering Agentic AI: A Practical Guide to Building Self-Directed AI Systems that Think, Learn, and Act Independently", Ted Winston, Kindle Edition 2025
2. "An Introduction to MultiAgent Systems", Michael Wooldridge, Wiley, 2nd Edition, 2009
3. "Artificial Intelligence: A Modern Approach", Stuart Russell & Peter Norvig, Pearson, 3rd Edition 2009

e-Resources:

1. https://www.youtube.com/watch?v=pXD9MKxlyko

Semester: IV

PROFESSIONAL ELECTIVE – MMC411X

Course Name: **GENERATIVE AI**

Course Code	MMC4114	CIE Marks	50
Teaching Hours/Week (L:P: T)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Objectives:

1. Introduce the fundamentals of Generative AI and its applications, challenges, and underlying probabilistic principles.
2. Provide hands-on experience in building generative models using TensorFlow and Keras.
3. Explore various generative model architectures (RBMs, VAEs, GANs, LSTMs, Transformers).
4. Understand the challenges and limitations of generative models.
5. Examine real-world and emerging applications of Generative AI in domains such as image synthesis, drug discovery, and video generation.

Module – 1

An Introduction to Generative AI: "Drawing" Data from Models, Applications of AI, the rules of probability, why use generative models? Style transfer and image transformation, Unique challenges of generative models.

Setting Up a Tensor Flow Lab: Deep neural network development and Tensor Flow, VSCode Docker: A lightweight virtualization solution, Kubernetes: Robust management of multi-container applications, Kubeflow: an end-to-end machine learning lab, A brief tour of Kubeflow's components, Kubeflow pipelines Using Kubeflow Katib to optimize model hyper parameters.

8 Hours

Module – 2

Building Blocks of Deep Neural Networks: Perceptrons – a brain in a function, Multi-layer perceptrons and backpropagation, Varieties of networks: Convolution and recursive, Networks for sequence data, Building a better optimizer.

Teaching Networks to Generate Digits: The MNIST database, Restricted Boltzmann Machines: generating pixels with statistical mechanics, Stacking Restricted Boltzmann Machines to generate images: the Deep Belief Network 117 Creating an RBM using the TensorFlow Keras layers API 120 Creating a DBN with the Keras Model API.

8 Hours

Module – 3

Painting Pictures with Neural Networks Using VAEs: Painting Pictures with Neural Networks Using VAEs, Creating separable encodings of images, The variational objective, Inverse Autoregressive Flow, Importing CIFAR, Creating the network from TensorFlow
Image Generation with GANs: The taxonomy of generative models Generative adversarial networks, Vanilla GAN Improved GANs, Progressive GAN, Challenges.

8 Hours

Module – 4

The Rise of Methods for Text Generation: Representing text, Text generation and the magic of LSTMs, LSTM variants and convolutions for text
NLP 2.0: Using Transformers to Generate Text: Attention, Contextual embedding's, Self-attention, Transformers, GPT 1, 2, 3

8 Hours

Module – 5

Composing Music with Generative Models: Getting started with music generation, Music generation using LSTMs, Music generation using GANs, Muse GAN – polyphonic music generation.
Emerging Applications in Generative AI: Introduction Finding new drugs with generative models, Solving partial differential equations with generative modelling, Few shot learning for creating videos from images, Generating recipes with deep learning.

8 Hours

Course Outcomes:

The students should be able to:	
CO1	Apply TensorFlow, Kubeflow, and related tools to set up and manage deep learning environments for developing generative AI models.
CO2	Implement various deep neural network architectures, including perceptron's, convolutional networks, and recursive networks, to solve pattern recognition problems.
CO3	Develop generative models such as Restricted Boltzmann Machines (RBMs), Deep Belief Networks (DBNs), Variational Autoencoders (VAEs), and Generative Adversarial Networks (GANs) for image generation tasks.
CO4	Use recurrent neural networks (LSTMs) and Transformer models to generate coherent text data and analyze their underlying mechanisms.
CO5	Construct generative models for specialized applications such as music composition and emerging domains like drug discovery and video generation through deep learning techniques.

Reference Books:

1. "Generative AI 360°" , Hitesh Motwani, ZebraLearn Publication, 1st Edition 2025
2. "Generative AI for Everyone", Karthikeyan Sabesan, Sivagamisundari, Nilip Dutta, BPB Publications, 2024
3. "Generative AI with Python and TensorFlow 2", Joseph Babcock Raghav Bali, Packt Publishing Ltd, 2021

e-Resources:

1. https://onlinecourses.swayam2.ac.in/imb24_mg116/preview

Semester: IV

PROFESSIONAL ELECTIVE – MMC411X

Course Name: **CROSS PLATFORM APPLICATION DEVELOPMENT**

Course Code	MMC4115	CIE Marks	50
Teaching Hours/Week (L:P: T)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Objectives:

1. Introduce the need and benefits of cross-platform development along with its limitations.
2. Familiarize students with popular frameworks such as Flutter and React Native.
3. Teach the foundational concepts of Dart and Flutter for building mobile applications.
4. Explore UI development and animations in Flutter and React Native.
5. Equip students with hands-on skills in setting up environments, handling components, navigation, and accessing APIs.

Module – 1

Introduction: What is Cross-Platform Development, Need for Cross-Platform Development, Native vs Cross Platform Development, Benefits and drawbacks of Cross-Platform Development, Popular Cross Platform Development frameworks – Flutter, React Native, Xamarin, Ionic, Sencha

8 Hours

Module – 2

Basics of Flutter: Introduction of Flutter, Understanding Widget Lifecycle Events, Understanding Widget Tree and Element Tree, Basics of Flutter installation, creating a Hello World App, Learning Dart Basics – Data types, Variables, Operators, Flow Statements (if-else, for, while, do-while, break, continue, switch-case), Functions, importing packages and using classes

8 Hours

Module – 3

User Interface through Flutter: Widgets: Using basic widgets, using images and icons, Using the form widget; Adding Animation to app: Using Animated Container, Using Animated CrossFade, Using Animated Opacity, Using Animation Controller, Using Staggered Animation; Building Layouts

8 Hours

Module – 4

Basics of React Native: Introduction to React Native, Setting Up the Development Environment, Understanding Components and States, Creating Your First React Native App

8 Hours

Module – 5

User Interface through React Native: Navigation in React Native, Flexbox, Images, ListView, ScrollView, APIs – MapView & GeoLocation, Native Alert and WebView

8 Hours

Course Outcomes:

The students should be able to:	
CO1	Apply cross-platform development concepts by building simple applications using popular frameworks such as Flutter and React Native.
CO2	Develop user interfaces using Flutter widgets, animations, and layout techniques to create responsive mobile apps.
CO3	Implement Dart programming constructs including data types, control flow, functions, and classes to build functional Flutter applications.
CO4	Build basic React Native applications by managing components, states, and navigation to deliver interactive user experiences.
CO5	Utilize React Native UI elements like Flexbox, ListView, ScrollView, and APIs (MapView, GeoLocation) to enhance app functionality and performance.

Reference Books:

1. "Beginning Flutter, a Hands-on Guide to App Development", Marco L. Napoli, Wiley, 2020
2. "React Native for Mobile Development", Akshat Paul, Abhishek Nalwaya, Apress Publication, 2019
3. "React and React Native", Adam Boduch and Roy Derks, Packt Publishing, 2020

e-Resources:

1. https://archive.nptel.ac.in/courses/106/106/106106156/
2. https://www.techtarget.com/searchmobilecomputing/definition/cross platform-mobile-development

Semester: IV

Course Name: **TECHNICAL SEMINAR**

Course Code	MMC452	CIE Marks	100
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	--
Total Hours of Pedagogy	Two contact hour/week for interaction between the faculty and student	Total Marks	100
Credits	2	Exam Hours	--

Course Objectives:

1. Develop students ability to explore recent technological trends and innovations.
2. Enhance technical writing and oral presentation skills.
3. Promote literature survey and critical thinking.
4. Expose students to research ethics and proper citation formats.
5. Prepare students for higher studies, research, or professional presentations.

TS: Technical Seminar: Students can present the seminar based on the new technologies in the seminar by all postgraduate students of the program shall be mandatory. Seminar shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/ complete shall be declared as fail in the seminar course and have to complete the same during the subsequent semester.

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 (50 marks)
- Presentation Skills (25 marks)
- Question and Answer session (25 marks)

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 faculty from the department with the senior most acting as the Chairperson

Course Outcomes:

The students should be able to:	
CO1	Identify, explore, and select a relevant technical topic from current technologies.
CO2	Perform a detailed literature survey using journals, conferences, and patents.
CO3	Prepare a well-structured technical report in standard format.
CO4	Deliver an effective seminar presentation using audio-visual tools.
CO5	Defend the chosen topic and respond to questions confidently.

Semester: IV

Course Name: **RESEARCH INTERNSHIP/INDUSTRY-INTERNSHIP/STARTUP INTERNSHIP**

Course Code	MINT483	CIE Marks	100
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	100
Total Hours of Pedagogy	Two contact hour/week for interaction between the faculty and student	Total Marks	200
Credits	11	Exam Hours	03

Course Objectives:

1. Provide real-world exposure to IT industry practices, tools, and technologies.
2. Enhance technical and professional skills through hands-on work in live projects.
3. Apply theoretical knowledge from coursework to solve practical problems.
4. Develop workplace discipline, time management, and teamwork skills.
5. Prepare students for employment or further academic research by improving confidence and job-related capabilities.

Industry Internship: The main objective of the industry internship is to ensure that the intern is exposed to a real-world environment and gain practical experience. Often, it may be a practical exposure to the theory that has been learned during the academic period. The industry internship helps students 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 research under the guidance of a mentor or within a research team. These internships can take place in academic institutions, research organizations, government agencies, or private companies

Research /Industry Internship: In the third-semester Students have to be in touch with a guide/mentor/coordinator and regularly submit the report referred to the progress internship. Based on the progress report the Guide/Mentor/coordinator has to enter the CIE marks. he/she has to attend the SEE at the parent Institute.

ASSESSMENT OF CIE MARKS

The CIE marks awarded for the internship, shall be group wise size at the institution level with the participation of all guides of the internship. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the internship, shall be based on the evaluation of the diary, report, presentation skill and question and answer session in the ratio 50:25:25.

ASSESSMENT OF SEE MARKS

Contribution to the internship and the performance of each student shall be assessed individually in semester-end examination (SEE) conducted at the department. Marks shall be awarded based on the evaluation of the diary, report, presentation skill and question and answer session in the ratio 50:25:25.

Course Outcomes:

The students should be able to:	
CO1	Demonstrate understanding of real-time industry operations, tools, and software systems.
CO2	Apply academic knowledge to solve practical problems and complete assigned tasks.
CO3	Communicate effectively in a professional environment—written and oral.
CO4	Work independently or as part of a team in a time-bound, goal-oriented setting.
CO5	Prepare comprehensive internship reports and deliver structured presentations.

ASSESSMENT DETAILS

Professional Elective Course (PEC)

CIE: 50 MARKS

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	2*	50%	25
(ii)	Alternate Assessment Tools (AAT) (B)	3	50%	25
	Total Marks			50

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications, Mini project and other cooperative and problem-based learning.

SEE:

The semester end exam question paper will be set for 100 marks and the marks scored by the student will be proportionately reduced to 50.

- The question paper will have ten full questions carrying equal marks.
- Each full question carries 20 marks
- There will be two full questions (with a maximum of 3 sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions selecting one full question from each module.