Course Title: Data Encryption & Compression Lab							
Course Code: MCSELAJ224					Examination Scheme		
Total Number of Lecture Hours: 50					External	36	
					Internal	14	
Lecture (L)	0	Practical (P)	4	Tutorial (T)	0	Total Credits	2

List of Experiments

1. Study the use of network reconnaissance tools like WHOIS, dig, traceroute, nslookup to gather information about networks and domain registrars.
2. Configure and demonstrate use of Traffic monitoring tools such as Wireshark, ethereal, tcpdump, etc with security perspective.
3. Implement the following encryption and decryption techniques using high level programming languages
   a. Ceaser cipher b. Substitution cipher c. Hill Cipher d. DES e. AES.
4. Implementation and study of vulnerabilities in RSA algorithm.
5. Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript.
6. Calculate the message digest of a text using the SHA-1 and MD5 algorithms.
7. Study of the features of firewall in providing network security and configuration of Firewall Security in various platforms (windows/linux).

This is only a suggested list of experiments/simulations. The instructor is encouraged to familiarize students with additional relevant exercises.

Course Title: Steganography & Digital Watermarking Lab									
Course Code: MCSELAK224							Examination Scheme		
Total Number of Lecture Hours: 48							External	36	
							Internal	14	
Lecture (L)	0	Practical (P)	4	Tutorial (T)		0	Total Credits		2

Course Objectives: *The aim of this lab is to provide practical knowledge and hands-on experience in implementing steganographic techniques, analyzing hidden data through steganalysis, exploring spatial and transform domain approaches, and evaluating the security, capacity, and robustness of digital information hiding systems.*

List of Experiments

1. Implementation of basic Steganography concepts (Hide text in images manually using simple techniques like Least Significant Bit (LSB)).
2. Perform basic Steganalysis: (Detect hidden data using statistical methods or visual inspection).
3. Implement a pure Steganography model (Hide and retrieve data without a key using simple embedding).
4. Implement text hiding in an image using LSB technique (Use Python/Matlab and evaluate parameters like security, capacity, and imperceptibility).
5. Implement Spatial Domain Steganography (Hide secret messages into spatial pixel values directly).
6. Implement Transform Domain Steganography using DCT/DWT (Apply embedding in the frequency domain, e.g., JPEG compression).
7. Experiment with Steganography tools like EzStego, S-Tools, Hide4PGP (Hide and retrieve text/images using existing tools and compare effectiveness).
8. Implement detection using Primary Sets Method (Detect LSB manipulation based on pixel grouping and statistical analysis).
9. Analyze hidden data using image texture properties (Use filters or statistical texture features to detect embedding).
10. Implement a simple distortion attack and measure impact (Introduce noise/compression and check Steganography robustness).
11. Generate customized covers and select appropriate ones for hiding sensitive information.

This is only a suggested list of experiments/simulations. The instructor is encouraged to familiarize students with additional relevant exercises.

Recommended Books:

Course Outcomes:

1. *Implement fundamental steganography techniques such as Least Significant Bit (LSB) embedding for hiding and retrieving text or image data manually and through programming tools like Python/Matlab.*
2. *Perform basic steganalysis to detect hidden data in media files using statistical methods, visual inspection, and primary set-based detection techniques.*
3. *Develop and evaluate steganographic models by applying spatial and transform domain techniques (DCT/DWT) and assess security, capacity, and imperceptibility parameters.*
4. *Analyze the robustness and security of steganographic methods by conducting distortion attacks (e.g., noise, compression), using texture-based detection, and experimenting with real-world steganography tools and cover generation techniques.*

Level of CLO-PLO Mapping

CLOs	PLOs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	2	2	1	3	-	-	1	1	2	1	2
2	3	3	2	2	2	1	-	2	1	2	-	2
3	3	3	3	2	2	1	-	1	1	2	1	2
4	3	3	3	3	2	1	1	2	2	2	1	3

Course Title: Information Theory & Coding Lab							
Course Code: MCSELAL224					Examination Scheme		
Total Number of Lecture Hours: 50					External	36	
					Internal	14	
Lecture (L)	0	Practical (P)	4	Tutorial (T)	0	Total Credits	2

List of Experiments

1. **Computation of Entropy and Mutual Information**
   - Write a program to calculate entropy, joint entropy, conditional entropy, and mutual information for given probability distributions.
2. **Verification of Shannon's Source Coding Theorem**
   - Simulate a source and verify Shannon's entropy limits practically by generating random messages and computing coding lengths.
3. **Simulation of Information Channels and Calculation of Channel Capacity**
   - Model a Binary Symmetric Channel (BSC) and a Binary Erasure Channel (BEC); compute and analyze their channel capacities.
4. **Implementation of Huffman Coding**
   - Develop Huffman encoding and decoding algorithms for lossless data compression and validate efficiency compared to entropy.
5. **Implementation of Arithmetic Coding**
   - Write a program to implement arithmetic encoding and decoding for given symbol probabilities.
6. **Design and Simulation of Linear Block Codes**
   - Generate and decode (n, k) Linear Block Codes using generator and parity-check matrices.
7. **Implementation of Hamming Code for Error Detection and Correction**
   - Encode messages using Hamming (7,4) code and simulate error detection and correction at the receiver.
8. **Design and Testing of Cyclic Redundancy Check (CRC)**
   - Implement CRC generation and detection using given generator polynomials and simulate single and burst errors.
9. **Error Detection using Simple Parity and Checksums**
   - Simulate basic error detection using parity bits (even/odd) and checksum methods for message blocks.

This is only a suggested list of experiments/simulations. The instructor is encouraged to familiarize students with additional relevant exercises.

Course Title: Security Assessment & Risk Analysis Lab							
Course Code: MCSELAM224					Examination Scheme		
Total Number of Lecture Hours: 50					External	36	
					Internal	14	
Lecture (L)	0	Practical (P)	4	Tutorial (T)	0	Total Credits	2

List of Experiments

1. **Identification of Critical Information Assets and Their Security States**
   - Perform asset classification and map information states (storage, transmission, processing) to corresponding security requirements.
2. **Threat Modeling and Vulnerability Assessment**
   - Use tools like Microsoft Threat Modeling Tool or OWASP Threat Dragon to identify, document, and categorize system vulnerabilities and threats.
3. **Operational Security (OPSEC) Survey and Planning**
   - Conduct a sample OPSEC survey for a mock organization and develop an OPSEC plan outlining critical information and protective measures.
4. **Risk Identification and Risk Register Preparation**
   - Identify organizational risks and prepare a detailed risk register with threat types, vulnerability mapping, and potential impacts.
5. **Cryptography Basics: Implementation of Symmetric and Asymmetric Encryption**
   - Write simple encryption/decryption programs using AES and RSA to demonstrate confidentiality in data transmission and storage.
6. **Key Management Simulation**
   - Simulate secure key exchange and electronic key management practices, including generation, distribution, and revocation.

This is only a suggested list of experiments/simulations. The instructor is encouraged to familiarize students with additional relevant exercises.

Course Title: Secure Coding Lab									
Course Code: MCSELAN224							Examination Scheme		
Total Number of Lecture Hours: 50							External	36	
							Internal	14	
Lecture (L)	0	Practical (P)	4	Tutorial (T)	0	Total Credits		2	

Course Objectives

1. *To develop awareness of common software vulnerabilities and hands-on methods for their mitigation.*
2. *To apply secure coding practices in real-world programming scenarios.*
3. *To use automated tools for detecting and fixing vulnerabilities.*
4. *To build secure applications through effective input validation, access control, and error handling.*

List of Experiments

1. Buffer overflow attack demonstration and mitigation (C/C++)
2. Integer overflow and format string vulnerabilities
3. SQL Injection: Identification and prevention (Web application)
4. Cross-Site Scripting (XSS) and Cross-Site Request Forgery (CSRF) handling
5. Authentication flaws and secure session management (Java/Python)
6. Secure input validation and output encoding
7. Writing secure login modules using encryption and hash functions

This is only a suggested list of experiments/simulations. The instructor is encouraged to familiarize students with additional relevant exercises.

Course Outcomes:

After successful completion of this lab, students will be able to:

1. *Identify and replicate common vulnerabilities in sample code (e.g., buffer overflows, SQL injection).*
2. *Apply appropriate secure coding techniques to fix identified vulnerabilities.*
3. *Use code analysis and security testing tools to detect insecure code.*
4. *Implement secure authentication, session management, and input validation in web and application software.*

Level of CLO-PLO Mapping

CLOs	PLOs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	3	2	3	2	1	0	1	0	1	0	2
2	3	3	3	2	3	1	0	1	1	1	0	2
3	3	2	3	3	3	1	0	1	0	1	0	2
4	3	3	3	2	3	2	0	1	1			

Course Title: Network Security Lab							
Course Code: MCSELA0224					Examination Scheme		
Total Number of Lecture Hours: 30					External	36	
					Internal	14	
Lecture (L)	0	Practical (P)	4	Tutorial (T)	0	Total Credits	2

Course Objectives

To introduce the fundamental concepts relevant to internetworking, design issues, simulations and performance evaluation of different protocols under diverse scenarios.

List of Experiments

1. Study the use of network reconnaissance tools like WHOIS, dig, traceroute, nslookup to gather information about networks and domain registrars.
2. Configure and demonstrate use of Traffic monitoring tools such as Wireshark, ethereal, tcpdump, etc with security perspective.
3. Implement the following encryption and decryption techniques using high level programming languages
   a. Ceaser cipher b. Substitution cipher c. Hill Cipher d. DES e. AES.
4. Implementation and study of vulnerabilities in RSA algorithm.
5. Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript.
6. Calculate the message digest of a text using the SHA-1 and MD5 algorithms.
7. Study of the features of firewall in providing network security and configuration of Firewall Security in various platforms (windows/linux).
8. Implement web security with Open SSL tool kit.
9. Study of different types of vulnerabilities in websites/Web Applications/Email.
10. Mini Project: Objectives: To implement Networking concepts;
    Outcomes of mini project:
    i. The learner will be able to understand, identify, analyze and design the engineering problems, implement the same using current techniques, skills, and tools and validate the solution including both hardware and software.
    ii. Understand, identify vulnerabilities related to network security and also present and communicate the countermeasures for the same.
    iii. Able to recognize the need of studied tools to exploit/cover network threats and attacks with the gained skills and knowledge that is useful for life-long learning

This is only a suggested list of experiments/simulations. The instructor is encouraged to familiarize students with additional relevant exercises.

Course Learning Outcomes:

1. *CLO1: Demonstrate the use of network reconnaissance and traffic monitoring tools (WHOIS, dig, traceroute, Wireshark, tcpdump, etc.) from a security perspective.* (Apply, Understand)
2. *CLO2: Implement classical and modern cryptographic techniques (Caesar, Substitution, Hill, DES, AES, RSA, Diffie-Hellman, SHA, MD5) using programming and scripting languages.* (Apply, Analyze)
3. *CLO3: Configure and evaluate network security mechanisms such as firewalls, SSL/TLS, and web application security to address vulnerabilities.* (Apply, Evaluate)
4. *CLO4: Design and implement a mini-project in network security that identifies threats, analyzes vulnerabilities, and validates solutions using modern tools and techniques.* (Create, Analyze, Evaluate)

Level of CLO-PLO Mapping

CLOs	PLOs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	2	1	2	3	–	–	–	–	–	–	2
2	3	3	2	2	3	–	–	–	–	–	–	2
3	3	3	3	3	3	1	–	1	–	1	1	2
4	3	3	3	3	3	1	–	1	3	3	2	3

PROGRAM ELECTIVE-V

Course Title: Big Data Processing Frameworks							
Course Code: MCSEDAA324					Examination Scheme		
Total Number of Lecture Hours: 50					External	72	
					Internal	28	
Lecture (L)	4	Practical (P)	0	Tutorial (T)	0	Total Credits	4

Course Objectives

1. *To understand the core concepts and architecture of big data processing frameworks.*
2. *To enable students to process and analyze massive datasets using distributed computing tools like Hadoop and Spark.*
3. *To develop practical skills in data ingestion, transformation, and real-time analytics using modern big data frameworks.*
4. *To apply scalable algorithms and best practices in big data application development.*

Course Content	No. of Teaching Hours
UNIT 1	**10 Hrs**
Introduction to Big Data and Hadoop Ecosystem Characteristics of Big Data: Volume, Velocity, Variety, Veracity, Value, Challenges in Big Data Management, Hadoop Architecture: HDFS, MapReduce, YARN, Hadoop Ecosystem Tools: Hive, Pig, HBase, Flume, Sqoop	
UNIT 2	**12 Hrs**
Apache Spark Fundamentals Spark Architecture and Components: Driver, Executor, Cluster Manager, RDDs and DataFrames, Transformations and Actions, Spark SQL and DataFrames, Introduction to Structured Streaming	
UNIT 3	**12 Hrs**
Data Processing and Analytics in Spark Data ingestion using Kafka, Flume, and Sqoop, ETL operations in Spark, Machine Learning with Spark MLlib, Graph Processing with GraphX, Spark Tuning and Performance Optimization	
UNIT 4	**14 Hrs**
Real-Time Processing and Case Studies Real-time Data Processing using Spark Streaming, Integration with NoSQL databases: Cassandra, HBase, Case Studies: Log Analysis, Fraud Detection, Recommendation Systems, Industry Use Cases and Trends in Big Data Frameworks	

Recommended Books:

1. *Tom White, "Hadoop: The Definitive Guide," O'Reilly Media.*
2. *Holden Karau, Andy Konwinski, Patrick Wendell, and Matei Zaharia, "Learning Spark," O'Reilly Media.*
3. *Bill Chambers and Matei Zaharia, "Spark: The Definitive Guide," O'Reilly Media.*
4. *Chuck Lam, "Hadoop in Action," Manning Publications*

Course Outcomes

1. *Understand and explain big data architecture, tools, and frameworks.*
2. *Develop and deploy big data applications using Hadoop and Spark.*
3. *Perform batch and real-time analytics using Spark SQL and Streaming.*
4. *Evaluate and apply big data frameworks to solve real-world business problems.*

Level of CLO-PLO Mapping

CLOs	PLOs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	2	-	-	3	-	-	-	-	1	-	-
2	3	3	2	2	3	-	-	-	-	2	-	-
3	2	3	3	2	3	-	-	-	-	2	-	-
4	2	3	3	3	3	-	-	-	-	2	2	-

Course Title: Cloud Computing							
Course Code: MCSEDAB324					Examination Scheme		
Total Number of Lecture Hours: 48					External	72	
					Internal	28	
Lecture (L)	4	Practical (P)	0	Tutorial (T)	0	Total Credits	4

Course Objectives

- *To introduce the basic concepts and principles of Cloud Computing, its architecture, and service models.*
- *To develop the ability to design and deploy scalable, reliable, and cost-efficient cloud-based applications.*
- *To impart knowledge about various cloud deployment models (public, private, hybrid) and cloud architecture patterns.*

Course Content	No. of Teaching Hours
UNIT 1	**12 Hrs**

Overview of Computing Paradigm: Recent trends in Computing: Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing. Evolution of cloudcomputing, business driver for adopting cloud computing
Introduction to Cloud Computing: Introduction to Cloud Computing (NIST Model), History of Cloud Computing, Cloud service providers. Properties, Characteristics & Disadvantages, Role of Open Standards Cloud Computing Architecture: Cloud computing stack: Comparison with traditional computing architecture (client/server), Services provided at various levels, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services. Service Models (XaaS):
Infrastructure as a Service (IaaS), Platform as a Service(PaaS), Software as a Service(SaaS)

UNIT 2	12 Hrs

Deployment Models: Public cloud, Private cloud, Hybrid cloud, Community cloud
Infrastructure as a Service (IaaS): IaaS definition, Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, and Virtual Machine (VM)
Resource Virtualization: Server, Storage, Network. Virtual Machine (resource) provisioning and manageability, storage as a service, Data storage in cloud computing (storage as a service).
Examples: Amazon EC2, Renting, EC2 Compute Unit, Platform and Storage, pricing, customers

UNIT 3	12 Hrs

Platform as a Service (PaaS): What is PaaS? Service Oriented Architecture (SOA). Cloud Platform and Management: Computation, Storage. Examples: Google App Engine, MS Azure
Software as a Service (SaaS): Introduction to SaaS, Web services, Web 2.0, Web OS, Case Study on SaaS

UNIT 4	12 Hrs

Service Management in Cloud Computing: Service Level Agreements(SLAs), Billing & Accounting, Comparing Scaling Hardware: Traditional vs. Cloud, Economics of scaling: Benefitting enormously, Managing Data
Cloud Security: Infrastructure Security: Network level security, Host level security, Application level security. Data security and Storage: Data privacy and security Issues, Jurisdictional issues raised by Data location, Identity & Access Management. Authentication in cloud computing.
Case Study on Open Source & Commercial Clouds: Eucalyptus, Microsoft Azure, Amazon EC2

Recommended Books:

1. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
2. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wile, 2011

Course Outcomes:

1: Explain cloud computing principles and service models.
2: Successfully deploy and manage cloud-based applications.
3: Apply best practices for cloud service management.
4: Assess the economic aspects of cloud computing platforms

Level of CLO-PLO Mapping

CLOs	PLOs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	2	2	1	2	3	1	2	-	-	2	-	1
2	2	3	2	3	3	2	1	1	-	2	1	1
3	1	2	2	2	2	3	3	1	-	1	2	3
4	2	3	2	3	1	2	1	1	-	3	3	3

Course Title: Distributed Databases												
Course Code: MCSEDAC324								Examination Scheme				
Total Number of Lecture Hours: 48								External		72		
								Internal		28		
Lecture (L)	4	Practical (P)	0	Tutorial (T)		0	Total Credits		4			

Course Objectives

- To understand the architecture and key concepts of distributed databases.
- To explore query processing and optimization techniques in distributed environments.
- To study transaction management, concurrency control, and recovery mechanisms in distributed systems.
- To examine distributed data storage, replication, and distributed system reliability.

Course Content	No. of Teaching Hours
UNIT 1	10 Hrs

Introduction to Distributed Databases:
Distributed database concepts and architecture, Goals and challenges of distributed databases, Types of distributed databases, Data fragmentation, allocation, and replication

UNIT 2	12 Hrs

Distributed Query Processing:
Query decomposition and data localization, Query optimization techniques, Join strategies in distributed databases, Cost models for distributed query optimization

UNIT 3	12 Hrs

Transaction Management in Distributed Databases:
ACID properties in distributed context, Distributed transactions and commit protocols (2PC, 3PC), Concurrency control: locking mechanisms, timestamp ordering, Deadlock detection and resolution

UNIT 4	14 Hrs

Reliability, Replication, and Current Trends:
Distributed database recovery techniques, Database replication: models and consistency, Fault tolerance and system reliability, Trends: NoSQL and New SQL in distributed environments

Recommended Books:

1. *M. Tamer Ozsu Patrick Valduriez , Principles of Distributed Database Systems, Springer, 4th Ed.*
2. *Stefano Ceri, Giuseppe Pelagatti, Distributed Databases: principles and systems, McGraw Hill.*
3. *Elmasri and Navathe, Fundamentals of Database Systems, Pearson*
4. *Recent papers and articles on distributed data management from IEEE/ACM Digital Libraries*

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

1. Explain the architecture, models, and design issues of distributed databases.
2. Analyze distributed query processing and optimization strategies.
3. Apply concurrency control and recovery techniques in a distributed setting.
4. Evaluate data fragmentation, replication, and consistency models in distributed environments.

Level of CLO-PLO Mapping

CLOs	PLOs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	2	2	2	2	0	0	0	0	0	0	1
2	3	3	3	2	2	0	0	0	0	1	0	1
3	2	3	3	3	3	0	0	0	0	1	0	1
4	2	2	3	2	3	1	0	1	1	1	0	2

Course Title: Natural Language Processing							
Course Code: MCSEDAD324					Examination Scheme		
Total Number of Lecture Hours: 50					External	72	
					Internal	28	
Lecture (L)	4	Practical (P)	0	Tutorial (T)	0	Total Credits	4

Course Objectives

1. *To provide students with a comprehensive understanding of the key concepts, techniques, and tools used in Natural Language Processing (NLP).*
2. *To familiarize students with linguistic resources and statistical models used in various NLP tasks.*
3. *To explore advanced topics like discourse analysis, machine translation, & ethical challenges in NLP.*

Course Content	No. of Teaching Hours
UNIT 1	14 Hrs

Human languages, ambiguity, and language processing paradigms. Phases in natural language processing and key applications. Text representation and encoding schemes in computers. Linguistic resources – corpus creation, balanced corpora. Regular expressions and finite state automata for word recognition and lexical analysis. Morphological analysis and finite state transducers. Introduction to statistical approaches – n-gram models, smoothing techniques, and entropy. Overview of classification models – HMM, Maximum Entropy, and CRF. Part-of-speech tagging – stochastic tagging, HMM-based tagging, and transformation-based tagging (TBL); handling unknown words and named entities.

UNIT 2	12 Hrs

Overview of natural language grammars; basic linguistic elements – lexemes, phonemes, phrases, idioms. Grammatical constructs – word order, agreement, tense, aspect, and mood. Context-free grammars and their role in natural language syntax. Parsing strategies – unification-based parsing and probabilistic parsing using TreeBank data. Introduction to semantics – meaning representation, lexical semantics, and the use of WordNet. Word Sense Disambiguation.

UNIT 3	12 Hrs

Discourse analysis – reference resolution, co-reference constraints, pronoun resolution, and discourse coherence. Applications of NLP – spell-checking, text summarization, and information retrieval. Vector space model, term weighting, and linguistic challenges such as synonymy and polysemy. Introduction to machine translation – basic methods and challenges.

UNIT 4	12 Hrs

Formal language theory and the Chomsky hierarchy in the context of NLP. Overview of structured prediction with Conditional Random Fields. Challenges in NLP – ambiguity, sparse data, low-resource language processing, and multilingual NLP. Ethical issues in NLP – bias, fairness, and interpretability in language technologies. Recent trends – pre-trained transformers (e.g., BERT, GPT), large-scale language modeling, and emerging directions in NLP research

Recommended Books

1. ***"An Introduction to Natural Language Processing, Third Edition"*** *by Daniel Jurafsky and James H. Martin, Tata McGraw-Hill*
2. ***"Computational Linguistics and Speech Recognition"*** *by James H. Martin, Pearson Education*
3. ***"Natural Language Processing with Python"*** *by S Bird, E Klein, and Edward LoperO'Reilly Media*
4. ***"Foundations of Statistical Natural Language Processing"*** *Christopher D. Manning and Hinrich Schutze, MIT Press*

Course Outcomes

CLO1: Understand the foundational concepts and techniques in NLP, including text representation and linguistic resources.
CLO2: Apply NLP methods such as part-of-speech tagging, parsing, and word sense disambiguation.
CLO3: Solve practical problems in information retrieval, discourse analysis, and machine translation.
CLO4: Identify & evaluate challenges in NLP, including ambiguity, resource limitations etc

Level of CLO-PLO Mapping

CLOs	PLOs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	2	1	2	2	1	-	1	1	2	-	2
2	3	3	2	3	3	1	-	1	2	2	-	2
3	3	3	3	3	3	2	-	2	3	3	-	2
4	2	3	2	3	2	3	-	3	1	2	-	3

Course Title: Social Network Data Analytics									
Course Code: MCSEDAE324							Examination Scheme		
Total Number of Lecture Hours: 50							External	72	
							Internal	28	
Lecture (L)	4	Practical (P)	0	Tutorial (T)		0	Total Credits		4

Course Objectives

1. *To understand the basic concepts and models of social network analysis.*
2. *To explore methods for analyzing the structure and dynamics of social networks.*
3. *To study algorithms for mining data from large-scale social networks.*
4. *To gain insight into real-world applications like influence maximization, link prediction, and recommendation.*

Course Content	No. of Teaching Hours
UNIT 1	10 Hrs
Introduction to Social Networks Social network definition and types (online/offline, explicit/implicit). Graph theory basics: nodes, edges, degree, paths. Properties of social networks: small world, scale-free, clustering. Examples: Facebook, Twitter, LinkedIn, citation networks	
UNIT 2	12 Hrs
Network Measures and Models Centrality measures: degree, betweenness, closeness, eigenvector. Community detection: modularity, hierarchical clustering. Random graph models: Erdős–Rényi, Watts–Strogatz, Barabási–Albert. Influence and homophily in networks	
UNIT 3	12 Hrs
Mining Social Network Data Crawling social network data. Link prediction techniques. Influence maximization models (independent cascade, linear threshold). Recommendation systems in social networks.	
UNIT 4	14 Hrs
Applications and Tools Real-world applications: marketing, health, security. Case studies: misinformation detection, political polarization. Tools: Gephi, NetworkX, SNAP, Neo4j. Ethical issues in social network analysis (privacy, bias, fairness)	

Recommended Books:

1. *Charu C. Aggarwal*, Social Network Data Analytics, *Springer*
2. *David Easley and Jon Kleinberg*, Networks, Crowds, and Markets, *Cambridge University Press*
3. *Stanley Wasserman and Katherine Faust*, Social Network Analysis: Methods and Applications, *Cambridge University Press*
4. *Matthew A. Russell*, Mining the Social Web, *O'Reilly Media*
5. *Research papers from ACM/IEEE conferences (WSDM, KDD, WWW)*

Course Outcomes

After successful completion of this course, students will be able to:

1. *Explain the fundamentals and types of social networks and their properties.*
2. *Apply network analysis metrics and models to interpret social graphs.*
3. *Implement and evaluate algorithms for mining social network data.*
4. *Analyze applications of social network analysis in various domains such as marketing, recommendation, and cybersecurity.*

Level of CLO-PLO Mapping

CLOs	PLOs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	2	1	1	1	0	0	1	0	0	0	1
2	3	3	2	2	2	1	1	1	0	1	0	2
3	3	3	3	3	3	1	1	1	1	1	1	2
4	3	2	1	2	3	1	1	2	1	2	1	-

Course Title: GPU Computing							
Course Code: MCSEDAF324					**Examination Scheme**		
Total Number of Lecture Hours: 48					**External**	**72**	
					Internal	**28**	
Lecture (L)	**4**	**Practical (P)**	**0**	**Tutorial (T)**	**0**	**Total Credits**	**4**

Course Objectives

- *Introduction to parallel computing paradigms with a focus on GPU*
- *Harness the massively parallel GPU architecture for solving computationally demanding tasks.*
- *Introduction to NVIDIA CUDA and industry standard OpenCL frameworks.*
- *Understanding GPU programming through scientific computational problems.*

Course Content	No. of Teaching Hours
UNIT 1	**12 Hrs**
Review of traditional computer architecture, Brief history, GPU Architecture, Clock speeds, CPU / GPU comparisons, Heterogeneity, Accelerators, Parallel programming, CUDA OpenCL / OpenACC, Kernels Launch parameters, Thread hierarchy, Warps/Wavefronts, Threadblocks/Workgroups, Streaming multiprocessors, 1D/2D/3D thread mapping, Device properties, Simple programs	
UNIT 2	**12 Hrs**
Memory hierarchy, Locality of reference, Spatial and temporal locality, DRAM / global, local / shared, private / local, textures, Constant memory, Pointers, Parameter passing, Arrays and dynamic memory, Multi-dimensional arrays, Memory allocation, Memory copying across devices, Programs with matrices, Performance evaluation with different memories, Unified virtual memory	
UNIT 3	**12 Hrs**
Synchronization: Memory consistency, Barriers (local versus global), Atomics, Memory fence. Prefix sum, Reduction, Programs for concurrent data, Structures such as worklists, linked-lists. Synchronization across CPU and GPU, Functions: device functions, host functions, kernels functions, Using libraries (such as Thrust), and developing libraries.	
UNIT 4	**12 Hrs**
Programming support, Debugging GPU programs, Profiling, Profile tools, Performance aspects, Streams: Asynchronous processing, tasks, Task-dependence, Overlapped data transfers, Default stream, Synchronization with streams, Events, Event-based synchronization - Overlapping data transfer and kernel execution, pitfalls, Case studies: Image Processing, Graph algorithms, Simulations, Deep learning	

Recommended Books:

- David Kirk and Wen-mei Hwu, Programming Massively Parallel Processors: A Hands-On Approach, 2nd Edition, Publisher: Morgan Kaufman, 2012.
- Shane Cook, CUDA Programming: A Developer's Guide to Parallel Computing with GPUs, Morgan Kaufman; 2012.
- The CUDA Handbook: A Comprehensive Guide to GPU Programming: 1st edition, 2nd edition.

Course Outcomes:

1. Understand parallel computing paradigms including GPU architecture and development frameworks viz. CUDA and OpenCL.
2. Analyse memory hierarchy and comprehend advanced concepts like unified virtual memory.
3. Implement efficient algorithms for common application kernels, such as matrix multiplication.
4. Highlight the important role of GPUs in domains such as image processing, deep learning, etc.

Level of CLO-PLO Mapping

CLOs	PLOs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	2	2	1	3	-	-	-	-	-	-	2
2	3	3	2	2	2	-	-	-	-	-	-	2
3	3	3	3	2	3	-	-	-	2	1	2	2
4	3	3	2	2	3	1	-	-	-	2	1	3

Course Title: Web Search & Information Retrieval												
Course Code: MCSEDAG324									Examination Scheme			
Total Number of Lecture Hours: 48									External		72	
									Internal		28	
Lecture (L)	4	Practical (P)	0	Tutorial (T)		0	Total Credits					

Course Objectives

1. *To introduce fundamental concepts and techniques in Information Retrieval (IR) and Web Search.*
2. *To explore models of document indexing, retrieval, and ranking.*
3. *To understand web-scale search engines, crawling, and link-based ranking algorithms.*
4. *To provide hands-on understanding of IR evaluation and personalization.*

Course Content	No. of Teaching Hours
UNIT 1	**10 Hrs**
Introduction to Information Retrieval Introduction to IR and Search Engines, Components of an IR System, Document Representation: Tokenization, Stop Words, Stemming, Term Frequency and Weighting Schemes (TF, TF-IDF)	
UNIT 2	**12 Hrs**
Retrieval Models Boolean Retrieval Model, Vector Space Model, Probabilistic IR Models, Language Models for IR, Latent Semantic Indexing (LSI)	
UNIT 3	**12 Hrs**
Web Search and Architecture Web Crawling and Indexing, Link Analysis: PageRank and HITS, Duplicate Detection and Near Duplicate Detection, Metadata, Structured Data, and Semantic Search, Search Advertising and Monetization Models	
UNIT 4	**14 Hrs**
Evaluation and Personalization IR Evaluation Metrics: Precision, Recall, F-Measure, MAP, NDCG, A/B Testing for IR Systems, Relevance Feedback and Query Expansion, Personalization Techniques and Recommender Systems, Ethics, Bias, and Privacy in Web Search	

Recommended Books

1. **Introduction to Information Retrieval** – Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze (Cambridge University Press)
2. **Search Engines: Information Retrieval in Practice** – Bruce Croft, Donald Metzler, Trevor Strohman (Pearson)
3. **Mining the Web: Discovering Knowledge from Hypertext Data** – Soumen Chakrabarti

Course Outcomes

After successful completion of the course, the student will be able to:

1. *Understand core concepts of information retrieval and document representation.*
2. *Apply and compare IR models such as vector space, probabilistic, and language models.*
3. *Analyze and implement web search engine components such as crawling, indexing, and ranking.*
4. *Evaluate IR* systems using standard metrics and apply personalization and recommendation techniques.

Level of CLO-PLO Mapping

CLOs	PLOs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	2	2	2	2	0	0	0	0	1	0	1
2	3	3	2	3	2	0	0	0	0	1	0	2
3	3	3	3	3	3	1	0	0	1	1	0	3
4	3	3	3	3	2	1	0	1	1	1	0	3

Course Title: Software Defined Networks												
Course Code: MCSEDAH324								Examination Scheme				
Total Number of Lecture Hours: 48								External	72			
								Internal	28			
Lecture (L)	4	Practical (P)	0	Tutorial (T)		0	Total Credits		4			

Course Objectives

To introduce the fundamental and ground breaking concepts of SDNs, traditional network management issues, the OpenFlow Protocol and the different SDN Controllers. The students will develop the skills needed to become a practitioner or carry out research projects in this domain.

Course Content	No. of Teaching Hours
UNIT 1	**12 Hrs**

SDN Background and Motivation: Evolving network requirements-The SDN Approach: Requirements, SDN Architecture, Characteristics of Software-Defined Networking, Comparison of SDN and Conventional networks, Hybrid Networks, Hybrid Network use Cases

SDN and NFV-Related Standards: Standards-Developing Organizations, Industry Consortia, Open Development Initiatives.

SDN Data plane and OpenFlow: SDN data plane: Data plane Functions, Data plane protocols, Openflow logical network Device: Flow table Structure, Flow Table Pipeline, The Use of Multiple Tables, Group Table- OpenFlow Protocol.

UNIT 2	12 Hrs

SDN Control Plane: SDN Control Plane Architecture: Control Plane Functions, Southbound Interface, Northbound Interface, East/Westbound Interface, Routing, Floodlight/OpenDaylight controllers, REST APIs, Cooperation and Coordination among Controllers.

Mininet: A simulation environment for SDN, Hand-on-experiments in Mininet. SDN network updates, SDN scalability

UNIT 3	12 Hrs

SDN Application Plane: SDN Application Plane Architecture: Northbound Interface, Network Applications, User Interface- Network Services Abstraction Layer: Abstractions in SDN, Programming SDN networks

Traffic Engineering: Network Measurement, Monitoring and Management, SDN network correctness verification

UNIT 4	12 Hrs

SDN Security: Security issues in SDN data plane, control plane and management plane.

Network Functions Virtualization: Background and Motivation for NFV- Virtual Machines- NFV Concepts: Simple Example of the Use of NFV, NFV Principles, High-Level NFV Framework, NFV Benefits and Requirements- NFV Reference Architecture: NFV Management and Orchestration

Recommended Books:

1. T. D. Nadeau and K. Gray, "Software Defined Networking", O'Reilly.
2. J. F. Kurose "Computer Networking", Addison-Wesley.
3. Jim Doherty, "SDN and NFV Simplified".
4. Rahamatullah Khondoker, "SDN and NFV Security: Security Analysis of Software-Defined Networking and Network Function Virtualization", Springer.
5. D. E. Comer, "Internetworking with TCP/IP", Volume I, 2 and 3, PHI.

Course Outcomes:

1. *Student will understand the concept of challenges in conventional network addressed by SDN*
2. *Emulation and evaluation of SDNs.*
3. *Programming, Monitoring, Measurement and Management in SDN*
4. *SDN complements security and NFV.*

Level of CLO-PLO Mapping

CLOs	PLOs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	3	3	1	1	-	1	1	-	1	1	2
2	1	1	2	1	3	1	2	3	2	3	2	2
3	3	2	2	2	2	-	1	1	-	1	1	2
4	2	2	3	1	1	-	1	1	2	1	1	3

Course Title: Block Chain Technology									
Course Code:MCSEDAI324						Examination Scheme			
Total Number of Lecture Hours: 50						External	72		
						Internal	28		
Lecture (L)	4	Practical (P)	0	Tutorial (T)	0	Total Credits	4		

Course Objectives

This course is intended to study the basics of Blockchain technology. During this course learner will explore various aspects of Blockchain technology like application in various domains. By implementing learner will have idea about private and public Blockchain, and smart contract.

Course Content	No. of Teaching Hours
UNIT 1	**10 Hrs**
Introduction: Need for Distributed Record Keeping, Modeling faults and adversariesByzantine Generals problem Consensus algorithms and their scalability problems. Why Nakamoto Came up with Blockchain based cryptocurrency? Technologies Borrowed in Blockchain–hash pointers, consensus, byzantine fault-tolerant distributed computing, digital cash, etc **Basic Distributed Computing:** Atomic Broadcast, Consensus, Byzantine Models of fault tolerance	
UNIT 2	**10 Hrs**
Basic Crypto primitives: Hash functions, Puzzle friendly Hash, Collison resistant hash, digital signatures, public key crypto, verifiable random functions, Zero-knowledge systems **Blockchain 1.0:** Bitcoin Blockchain, the challenges, and solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus, Bitcoin scripting language and their use	
UNIT 3	**10 Hrs**
Blockchain 2.0: Ethereum and Smart Contracts, The Turing Completeness of Smart Contract Languages and verification challenges, using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts **Blockchain 3.0:** Hyperledger fabric, the plug and play platform and mechanisms in permissioned blockchain	
UNIT 4	**10 Hrs**
Blockchain Applications: Cryptocurrency Exchange, Internet of Things, Medical Record Management System, Domain Name Service, Supply chain and logistics monitoring, future of Blockchain. **Privacy, Security issues in Blockchain:** Pseudo-anonymity vs. anonymity, Zcash and Zk- SNARKS for anonymity preservation, attacks on Blockchains–such as Sybil attacks, selfish mining, 51% attacks, etc.	

Recommended Books:

1. A. Narayanan, J. Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press.
2. Chris Burniske and Jack Tatar, "Cryptoassets".
3. S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, „Blockchain Technology: Cryptocurrency and Applications", Oxford University Press, 2019.
4. Antony Lewis,"The Basics of Bitcoins and Blockchains".
5. Elad Elrom, "The Blockchain Developer".

Course Outcomes:

1. Understanding Block chain fundamentals and creating basic blocks.
2. Able to Develop Block chain Applications in a structured manner
3. Ability to create own crypto currency and get familiarity with future currencies.
4. Able to Evaluate and Analyze Block chain Systems

Level of CLO-PLO Mapping

CLOs	PLOs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	2	3	-	3	2	3	-	1	1	1	1
2	1	2	2	3	3	2	1	1	1	2	3	3
3	1	2	2	2	3	1	2	1	1	1	1	1
4	1	2	2	3	-	1	2	-	1	2	1	3

Course Title: Big Data Processing Frameworks Lab												
Course Code: MCSELAA324									**Examination Scheme**			
Total Number of Lecture Hours: 30									**External**		**36**	
									Internal		**14**	
Lecture (L)	**0**	**Practical (P)**	**4**	**Tutorial (T)**		**0**	**Total Credits**					**2**

Course Objectives

1. *To provide hands-on experience in using Hadoop and Spark frameworks.*
2. *To implement data processing workflows using Hive, Pig, and Spark SQL.*
3. *To practice developing streaming applications and integrating with Kafka.*
4. *To apply performance tuning techniques and visualize insights.*

List of Experiments

1. Setup and configuration of Hadoop and Spark environments
2. Implementing HDFS file operations and MapReduce programs
3. Writing HiveQL scripts for data analytics
4. Data ingestion with Flume and Sqoop
5. Data processing using Spark RDDs and DataFrames
6. ETL workflow implementation in Spark
7. Real-time streaming data processing with Spark Streaming
8. Integration of Spark with Kafka
9. Machine Learning using Spark MLlib
10. Mini-project using big data pipelines (e.g., recommendation engine, fraud detection)

Course Learning Outcomes:

1. *Demonstrate Hadoop and Spark setup and perform data operations.*
2. *Implement data ingestion, transformation, and querying on big datasets*
3. *Develop real-time processing applications using Spark Streaming.*
4. *Apply and test big data solutions for real-world analytics problems.*

Level of CLO-PLO Mapping

CLOs	PLOs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	2	-	-	3	-	-	-	-	1	-	-
2	3	3	2	-	3	-	-	-	-	2	-	-
3	2	3	3	2	3	-	-	-	-	2	-	-
4	2	3	3	3	3	-	-	-	-	2	2	-

45

Course Title: Cloud Computing Lab							
Course Code: MCSELAB324						Examination Scheme	
Total Number of Lecture Hours:30						External	36
						Internal	14
Lecture (L)	0	Practical (P)	4	Tutorial (T)	0	Total Credits	2

List of Experiments

1. Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs.
3. Install Google App Engine. Create hello world app and other simple web applications using python/java.
4. Use GAE launcher to launch the web applications.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
8. Install Hadoop single node cluster and run simple applications like wordcount.

This is only a suggested list of experiments/simulations. The instructor is encouraged to familiarize students with additional relevant exercises.

Course Learning Outcomes:

1. *CLO1: Demonstrate installation and configuration of virtual machines, compilers, and basic applications on different operating systems. (Apply, Understand)*
2. *CLO2: Develop and deploy simple web applications using cloud platforms such as Google App Engine and OpenStack. (Apply, Create)*
3. *CLO3: Simulate cloud computing scenarios using tools like CloudSim and analyze scheduling algorithms. (Apply, Analyze, Evaluate)*
4. *CLO4: Configure and execute cloud-based big data frameworks such as Hadoop for distributed computing tasks. (Apply, Analyze)*

Level of CLO-PLO Mapping

CLOs	PLOs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	2	2	1	3	–	–	–	–	–	–	2
2	3	2	3	2	3	–	–	–	1	2	2	2
3	3	3	2	3	3	–	–	–	–	1	–	2
4	3	3	2	2	3	–	–	–	1	1	2	3

Course Title: Distributed Databases Lab							
Course Code: MCSELAC324					Examination Scheme		
Total Number of Lecture Hours: 30					External	36	
					Internal	14	
Lecture (L)	0	Practical (P)	4	Tutorial (T)	0	Total Credits	2

Course Objectives

1. Familiarize students with relational database fundamentals including schema design, normalization, integrity rules, and SQL operations as a foundation for distributed systems.
2. Expose students to distributed database design strategies such as fragmentation, replication, allocation, and security mechanisms.
3. Provide hands-on experience in distributed query processing and transaction management, including concurrency control and recovery.
4. Enable students to apply distributed algorithms and parallel database concepts using modern tools and open-source DBMS platforms.

List of Experiments

1. Create relational schemas, apply constraints, and integrity rules.
2. Implement SELECT, JOIN, GROUP BY, and Aggregations on sample datasets.
3. Implement horizontal and vertical fragmentation of relations (simulate across multiple databases).
4. Create user roles and privileges; simulate view management for security.
5. Execute queries across multiple databases (using PostgreSQL FDW or MySQL Federated engine).
6. Implement transactions in SQL using COMMIT, ROLLBACK, SAVEPOINT.
7. Demonstrate lost update, dirty read, unrepeatable read, phantom read → resolve using isolation levels.
8. Implement table-level and row-level locking, simulate deadlocks and resolution.
9. Demonstrate object storage and querying using MongoDB / Cassandra.
10. Build a simple object distribution application with MongoDB references/embedded docs.

Course Learning Outcomes:

CLO1: Design and implement normalized relational schemas in an RDBMS, applying integrity rules and relational operations. (Apply, Analyze)

CLO2: Demonstrate distributed database design through fragmentation, replication, and allocation strategies. (Apply, Analyze)

CLO3: Execute distributed queries and analyze query optimization techniques across multiple databases. (Analyze, Evaluate)

CLO4: Implement distributed transactions with concurrency control and recovery using SQL isolation levels and locking mechanisms. (Apply, Analyze)

Level of CLO-PLO Mapping

CLOs	PLOs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	2	2	1	2	–	–	–	–	–	–	2
2	3	3	3	2	2	–	–	–	–	–	–	2
3	3	3	2	3	3	–	–	–	–	1	–	2
4	3	3	3	2	3	–	–	1	–	1	1	2

Course Title: Natural Language Processing Lab							
Course Code: MCSELAD324						Examination Scheme	
Total Number of Lecture Hours: 30						External	36
						Internal	14
Lecture (L)	0	Practical (P)	4	Tutorial (T)	0	Total Credits	2

Course Objectives

5. To provide students with hands-on experience in implementing foundational NLP techniques like regular expressions, finite state automata, and statistical models for text processing.
6. To familiarize students with modern NLP techniques, including **BERT-based models**, for advanced tasks like text classification, named entity recognition, and machine translation.
7. To equip students with the skills to apply and fine-tune pre-trained transformer models (like BERT) for real-world NLP applications such as sentiment analysis, discourse analysis, and information retrieval.

Suggested List of experiments

1. Implement regular expressions and finite state automata for word recognition and lexical analysis.
2. Perform morphological analysis using finite state transducers.
3. Apply statistical models such as n-grams, HMM, and CRF for tasks like part-of-speech tagging and named entity recognition.
4. Implement context-free grammar parsing and probabilistic parsing for syntactic analysis.
5. Perform word sense disambiguation using both machine learning and dictionary-based approaches.
6. Work on discourse analysis tasks like reference resolution and co-reference resolution.
7. Apply text summarization techniques for extracting key information from documents.
8. Implement BERT-based models for text classification, named entity recognition, and question answering tasks.
9. Fine-tune pre-trained BERT models on custom datasets for tasks like sentiment analysis and machine translation.
10. Complete a mini-project on an advanced NLP application, utilizing transformer-based models (e.g., BERT, GPT).

Course Learning Outcomes:

CLO1: Students will be able to implement basic NLP techniques such as word recognition, part-of-speech tagging, and syntactic parsing using traditional models and finite state automata.

CLO2: Students will develop proficiency in using BERT and other transformer-based models for tasks such as text classification, named entity recognition, and question answering.

CLO3: Students will be able to perform text summarization, discourse analysis, and information retrieval using modern NLP techniques and statistical models.

CLO4: Students will gain experience in fine-tuning pre-trained models like BERT on custom datasets to solve real-world problems, including sentiment analysis and machine translation.

Level of CLO-PLO Mapping

CLOs	PLOs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	3	2	2	2	1	-	1	2	2	-	2
2	3	3	3	3	3	1	-	1	2	3	-	3
3	3	3	3	3	3	2	-	2	3	3	-	3
4	3	3	3	3	3	1	-	1	3	3	-	3

Course Title: Social Network Data Analytics Lab							
Course Code: MCSELAE324					Examination Scheme		
Total Number of Lecture Hours: 30					External	36	
					Internal	14	
Lecture (L)	0	Practical (P)	4	Tutorial (T)	0	Total Credits	2

Course Objectives:

1. *To provide hands-on experience with social network data collection, visualization, and analysis.*
2. *To implement core algorithms for centrality, community detection, and influence analysis.*
3. *To use modern tools and libraries for real-world social network data mining.*
4. *To enable students to extract insights from real-world social datasets through analysis and visualization.*

List of Experiments

1. **Graph Basics:** Represent and visualize simple networks using NetworkX or Gephi.
2. **Centrality Measures:** Compute degree, closeness, betweenness, and eigenvector centrality.
3. **Community Detection:** Apply modularity-based and label propagation algorithms.
4. **Network Structure:** Identify small-world and scale-free properties in real-world datasets.
5. **Graph Visualization:** Use Gephi to visualize Twitter or Facebook datasets.
6. **Social Media Crawling:** Extract data from Twitter using Tweepy API.
7. **Link Prediction:** Implement Jaccard, Adamic-Adar, and common neighbor algorithms.
8. **Influence Maximization:** Simulate Independent Cascade and Linear Threshold models.
9. **Recommender Systems:** Create a basic friend or content recommendation engine using graph proximity.
10. **Case Study:** Analyze retweet/repost networks during a trending event (e.g., elections, disasters).

This is only a suggested list of experiments/simulations. The instructor is encouraged to familiarize students with additional relevant exercises.

Recommended Books:

Course Outcomes:

After completing the lab, students will be able to:

1. *Represent and analyze social networks using real-world tools and libraries.*
2. *Apply algorithms for centrality, community detection, and graph metrics.*
3. *Extract, process, and visualize social media data using APIs and visualization tools.*
4. *Analyze influence, recommend connections, and derive insights from large-scale networks.*

Level of CO-PO Mapping

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	2	2	2	2	0	0	1	0	0	0	1
2	3	3	3	2	2	1	1	1	1	1	0	2
3	3	3	3	3	3	1	1	1	1	1	1	2
4	3	3	3	3	3	1	1	2	1	2	1	3

Course Title: GPU Computing Lab												
Course Code: MCSELAF324								Examination Scheme				
								External		36		
Total Number of Lecture Hours: 30								Internal		14		
Lecture (L)	0	Practical (P)	4	Tutorial (T)		0	Total Credits		2			

Course Objectives

1. *To understand and explore GPU architecture and the CUDA programming model.*
2. *To develop efficient parallel code using CUDA/OpenCL/OpenACC for various computing problems.*
3. *To understand GPU memory hierarchy and optimize memory usage for performance.*
4. *To implement and test parallel algorithms on real-world data using GPU acceleration.*

List of Experiments

1. Write simple programs using CUDA to understand kernel launches and thread hierarchies.
2. Programs using 1D, 2D, and 3D thread mapping to manipulate arrays and matrices.
3. Implement matrix operations using GPU with global memory and shared memory.
4. Use different memory types (global, shared, constant) and evaluate their performance.
5. Parallel implementation of scan and reduction algorithms using thread synchronization.
6. Explore memory consistency and atomic functions in CUDA.
7. Use NVIDIA Nsight / Visual Profiler to debug and optimize GPU programs.
8. **Mini-Project:** Choose one of the following: image filtering, graph BFS/DFS, deep learning kernel simulation, or numerical simulation using GPU.

Course Outcomes:

1. *Understand the architecture of modern GPUs and fundamentals of GPU programming*
2. *Develop and debug CUDA programs with proper use of memory hierarchy*
3. *Implement parallel algorithms using thread synchronization and shared memory*
4. *Optimize GPU programs using profiling tools and asynchronous execution models*

Level of CLO-PLO Mapping

CLOs	PLOs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	2	-	-	3	-	-	-	-	1	-	-
2	3	3	2	-	3	-	-	-	-	1	-	-
3	2	3	3	2	2	-	-	-	-	2	-	-
4	2	3	3	3	3	-	-	-	-	2	2	-

Course Title: Web Search and Information Retrieval Lab							
Course Code: MCSELAG324					Examination Scheme		
Total Number of Lecture Hours: 30					External	36	
					Internal	14	
Lecture (L)	0	Practical (P)	4	Tutorial (T)	0	Total Credits	2

Course Objectives

1. *To understand and implement basic algorithms for information retrieval and web search.*
2. *To explore document representation techniques like term frequency and TF-IDF.*
3. *To design and implement simple search engines and evaluate their performance.*
4. *To understand and apply crawling, indexing, and ranking techniques.*

List of Experiments

1. **Document Representation**: Implement term frequency (TF), term frequency-inverse document frequency (TF-IDF).
2. **Basic Search Engine**: Build a simple search engine using the vector space model.
3. **Web Crawler**: Implement a simple web crawler using Python/Java and parse HTML documents.
4. **Text Preprocessing**: Apply text preprocessing techniques such as tokenization, stop word removal, and stemming.
5. **Ranking Algorithms**: Implement a basic ranking algorithm using TF-IDF and compare it with BM25
6. **PageRank Algorithm**: Implement the PageRank algorithm for ranking web pages based on link structure.
7. **Web Search Optimization**: Implement query expansion to improve the quality of search results.
8. **Evaluation Metrics**: Implement and evaluate Precision, Recall, F-Measure, Mean Average Precision (MAP).
9. **Advanced Ranking Algorithms**: Implement algorithms such as HITS or combine with personalized search results.

This is only a suggested list of experiments/simulations. The instructor is encouraged to familiarize students with additional relevant exercises.

Course Outcomes:

After completing this lab, students will be able to:

1. *Implement document representation methods such as term frequency and vector space model.*
2. *Develop simple search engines and web crawlers.*
3. *Apply ranking algorithms like PageRank and evaluate IR system performance.*
4. *Implement personalization techniques and evaluate search results using standard metrics.*

Level of CLO-PLO Mapping

CLOs	PLOs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	3	2	2	3	1	0	0	0	1	0	1
2	3	3	3	3	3	1	0	0	0	1	0	2
3	3	3	3	3	3	1	0	0	1	1	0	2
4	3	3	3	3	2	1	0	1	1			

Course Title: Software Defined Network Lab							
Course Code: MCSELAH324						Examination Scheme	
Total Number of Practical Hours: 48						External	36
						Internal	14
Lecture (L)	0	Practical (P)	4	Tutorial (T)	0	Total Credits	2

Course Objectives

To introduce the fundamental concepts of SDNs, design issues, simulations and performance evaluation of different protocols under diverse scenarios.

List of Experiments

1. Introduction to mininet, miniedit and SDN Controllers
2. Configure and demonstrate use of Traffic monitoring tools such as Wireshark, ethereal, tcpdump, etc.
3. Introduction to OpenFlow
4. Implement the SDN scenarios and understand the interfacing between different layers.
5. Routing within an SDN
6. Introduction of following aspect of SDNs and means to achieve
   a. Security b. Fault tolerance c. Monitoring c. Traffic Measurement
7. The overview of SDN Controller and the introduction of different modules in a NOS
8. Mini Project: Objectives: To implement concepts of next generation networking;
   Outcomes of mini project:
   i. The learner will be able to understand, identify, analyze and design the engineering problems, implement the same using current techniques, skills, and tools and validate the solution including both hardware and software.
   ii. Understand, identify vulnerabilities related to network security and also present and communicate the countermeasures for the same.
   iii. Able to recognize the need of studied tools to exploit/cover networking issues and attacks with the gained skills and knowledge that is useful for life-long learning

This is only a suggested list of experiments/simulations. The instructor is encouraged to familiarize students with additional relevant exercises.

Course Learning Outcomes:

1. *CLO1: Demonstrate the use of Mininet, Miniedit, OpenFlow, and SDN controllers to emulate and configure software-defined networks. (Apply, Understand)*
2. *CLO2: Configure and analyze traffic using monitoring tools (Wireshark, tcpdump, etc.) to evaluate network behavior and performance. (Apply, Analyze)*
3. *CLO3: Implement and evaluate SDN scenarios including routing, interfacing of layers, and mechanisms for security, fault tolerance, monitoring, and traffic measurement. (Apply, Analyze, Evaluate)*
4. *CLO4: Design and implement a mini-project in SDN that integrates next-generation networking concepts, addresses vulnerabilities, and validates solutions using modern tools. (Create, Apply, Evaluate)*

Level of CLO-PLO Mapping

CLOs	PLOs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	2	2	1	3	–	–	–	–	–	–	2
2	3	3	2	3	3	–	–	–	–	1	–	2
3	3	3	3	2	3	1	–	1	–	2	1	2
4	3	3	3	3	3	1	1	1	3	3	2	3

Course Title: Blockchain Technology Lab							
Course Code:MCSELAI324						Examination Scheme	
Total Number of Lecture Hours: 48						External	36
						Internal	14
Lecture (L)	0	Practical (P)	4	Tutorial (T)	0	Total Credits	2

List of Experiments

1. Creating Merkle tree
2. Creation of Block
3. Block chain Implementation Programming code
4. Creating ERC20 token
5. Java code to implement blockchain in Merkle Trees
6. Java Code to implement Mining using block chain
7. Java Code to implement peer-to-peer using block chain
8. Creating a Crypto-currency Wallet

This is only a suggested list of experiments/simulations. The instructor is encouraged to familiarize students with additional relevant exercises.

OPEN ELECTIVE

(MCSEOXX324)

Course Title: Business Analytics							
Course Code: MCSEOBA324					Examination Scheme		
Total Number of Lecture Hours: 40					External	54	
					Internal	21	
Lecture (L)	3	Practical (P)	0	Tutorial (T)	0	Total Credits	3

Course Objectives

- *Understand the role of business analytics within an organization.*
- *Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization. Gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.*
- *To become familiar with processes needed to develop, report, and analyze business data.*
- *Use decision-making tools/Operations research techniques.*
- *Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.*

Course Content	No. of Teaching Hours
UNIT 1	**10Hrs**
Business analytics: Overview and scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process & organisation, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Review of probability distribution and data modelling, sampling & estimation methods overview. Trendiness & Regression Analysis: Modelling Relationships & Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, Visualizing & Exploring Data, Business Analytics Technology.	
UNIT 2	**10 Hrs**
Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.	
UNIT 3	**10 Hrs**
Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.	
UNIT 4	**10 Hrs**
Decision Analysis: Formulating Decision Problems, Decision Strategies with Outcome Probabilities, Decision Trees, Value of Information, Utility and Decision Making. Recent Trends in: Embedded & collaborative business intelligence, Visual data recovery, Data Storytelling & Data journalism.	

Recommended Books:

1. *Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.*
2. *Business Analytics by James Evans, persons Education.*

Course Learning Outcomes: *After completing this course the students will:*

1. *demonstrate knowledge of data analytics.*
2. *demonstrate the ability of think critically in making decisions based on data and deep analytics.*
3. *demonstrate the ability to use technical skills in predicative and prescriptive modelling to support business decision-making.*
4. *demonstrate the ability to translate data into clear, actionable insights.*

Level of CLO-PLO Mapping

CLOs	PLOs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	3	2	2	2	1	1	1	1	2	1	2
2	3	3	3	3	2	2	1	1	1	2	1	3
3	3	3	3	3	3	2	1	1	2	2	1	3
4	3	3	3	3	2	2	1	1	2	3	1	3

Course Title: Industrial Safety							
Course Code: MCSEOIS324					Examination Scheme		
Total Number of Lecture Hours: 40					External	54	
					Internal	21	
Lecture (L)	3	Practical (P)	0	Tutorial (T)	0	Total Credits	3

Course Objectives

- *To provide fundamental knowledge of industrial safety measures, accident prevention techniques, and legal safety frameworks.*
- *To introduce maintenance engineering concepts, like cost, wear, corrosion, and prevention strategies.*
- *To develop skills for systematic fault tracing and maintenance of industrial machinery and equipment.*
- *To promote the practice of periodic and preventive maintenance for enhancing equipment life and operational efficiency.*

Course Content	No. of Teaching Hours
UNIT 1	**10Hrs**
Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.	
UNIT 2	**10 Hrs**
Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment. Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.	
UNIT 3	**10 Hrs**
Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault-finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.	
UNIT 4	**10 Hrs**
Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance.	

Recommended Books:

1. *Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.*
2. *Maintenance Engineering, H. P. Garg, S. Chand and Company.*
3. *Foundation Engineering Handbook, Winterkorn, Hans. Chapman & Hall London.*

Course Learning Outcomes: *After completing this course the students will:*

1. *Understand the causes, effects, and prevention methods for industrial accidents, and explain relevant safety regulations.*
2. *Apply maintenance engineering concepts to reduce equipment failures and extend service life.*
3. *Develop and use decision trees for effective fault diagnosis in mechanical, hydraulic, pneumatic, thermal, and electrical systems.*
4. *Plan and implement periodic and preventive maintenance schedules for different types of industrial equipment.*

Level of CLO-PLO Mapping

CLOs	PLOs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	2	2	2	2	3	3	2	1	1	2	2
2	3	3	2	3	2	2	2	2	1	2	1	2
3	3	3	3	3	3	2	1	2	2	2	2	2
4	3	3	3	3	2	2	2	2	2	2	2	3

Course Title: Operations Research							
Course Code: MCSEOOR324					**Examination Scheme**		
Total Number of Lecture Hours: 40					**External**	**54**	
					Internal	**21**	
Lecture (L)	**3**	**Practical (P)**	**0**	**Tutorial (T)**	**0**	**Total Credits**	**3**

Course Objectives:

1. *To introduce students to mathematical modelling and optimization techniques for decision-making.*
2. *To provide foundational knowledge of linear, non-linear, and dynamic programming problems and their solution methods.*
3. *To develop analytical skills using tools such as network flow models, scheduling, inventory control, and game theory.*
4. *To enable students to apply operations research techniques in real-life engineering and computational scenarios using simulation and algorithmic strategies.*

Course Content	**No. of Teaching Hours**
UNIT 1	**10Hrs**
Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming	
UNIT 2	**10 Hrs**
Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT	
UNIT 3	**10 Hrs**
Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.	
UNIT 4	**10 Hrs**
Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation	

Recommended Books:

1. *H.A. Taha, Operations Research, An Introduction, PHI, 2008*
2. *J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008*
3. *Hitler Libermann Operations Research: McGraw Hill Pub. 2009*
4. *Pannerselvam, Operations Research: Prentice Hall of India 2010*

Course Learning Outcomes: *After completing this course the students will:*

1. *Formulate and solve linear programming problems using simplex, dual simplex, and sensitivity analysis methods.*
2. *Apply techniques of nonlinear programming, CPM/PERT, to solve optimization problems.*
3. *Analyze inventory, scheduling, & queuing models to optimize resource allocation & service efficiency. Use advanced topics such as game theory, dynamic programming, simulation, and graph theory to model complex decision-making problems.*

Level of CLO-PLO Mapping

CLOs	**PLOs**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	3	3	3	2	2	1	1	1	1	2	1	2
2	3	3	3	3	3	2	1	1	2	2	1	2
3	3	3	3	3	2	2	1	1	1	2	1	2
4	3	3	3	3	3	2	2	2	2	2	2	3

89

Course Title: Cost Management of Engineering Projects							
Course Code: MCSEOCE324					Examination Scheme		
Total Number of Lecture Hours: 40					External	54	
					Internal	21	
Lecture (L)	3	Practical (P)	0	Tutorial (T)	0	Total Credits	3

Course Objectives

- *To provide foundational knowledge of strategic cost management & its role in engineering projects.*
- *To develop an understanding of cost concepts in decision-making & their application in project execution.*
- *To equip students with the skills for cost estimation, budgeting, and cost control throughout a project's lifecycle.*
- *To introduce tools like ERP, TQM, and optimization methods (LP, PERT/CPM) for efficient project and cost management.*

Course Content	No. of Teaching Hours
UNIT 1	**10Hrs**
Introduction and Overview of the Strategic Cost Management Process Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.	
UNIT 2	**10 Hrs**
Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types & contents. Project execution Project cost control. Bar charts & Network diagram. Project commissioning: mechanical and process.	
UNIT 3	**10 Hrs**
Cost Behaviour and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning,	
UNIT 4	**10 Hrs**
Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing. Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.	

Recommended Books:

1. *Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi*
2. *Charles T. Horngren and George Foster, Advanced Management Accounting*
3. *Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting*
4. *N.D. Vohra, Quantitative Techniques* in Management, Tata McGraw Hill Book Co. Ltd.

Course Learning Outcomes: *After completing this course the students will:*

4. *Understand strategic cost management principles and various cost concepts applicable in decision-making.*
5. *Explain phases of project execution & identify causes of cost overruns and control mechanisms.*
6. *Apply marginal costing, break-even analysis, & pricing strategies to support managerial decisions.*
7. *Implement quantitative techniques such as Linear Programming, PERT/CPM, and simulation for cost optimization.*

Level of CLO-PLO Mapping

CLOs	PLOs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	3	2	2	1	2	2	1	1	2	1	2
2	3	3	3	3	2	3	2	1	2	2	2	2
3	3	3	2	2	2	2	1	1	1	2	1	2
4	3	3	3	3	3	2	2	2	1	2	1	3

Course Title: Composite Materials							
Course Code: MCSEOCM324					Examination Scheme		
Total Number of Lecture Hours: 40					External	54	
					Internal	21	
Lecture (L)	3	Practical (P)	0	Tutorial (T)	0	Total Credits	3

Course Objectives

- *To introduce the fundamentals, classification, and characteristics of composite materials.*
- *To develop understanding of different reinforcement materials and their roles in composites.*
- *To familiarize students with manufacturing techniques for metal, ceramic, polymer, and carbon-carbon matrix composites.*
- *To impart knowledge on mechanical behavior, strength analysis, and failure criteria of composite structures.*
- *To enhance students' skills in analyzing the properties and performance of composite materials for various engineering applications.*

Course Content	No. of Teaching Hours
UNIT 1	**10Hrs**
Introduction: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance. REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.	
UNIT 2	**10 Hrs**
Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.	
UNIT 3	**10 Hrs**
Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.	
UNIT 4	**10 Hrs**
Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.	

Recommended Books:

1. *Material Science and Technology – Vol 13 – Composites by R. W. Cahn – VCH, West Germany.*
2. *Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R.*
3. *Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.*

Course Learning Outcomes: *After completing this course the students will:*

1. *Understand the classification, advantages, and functional requirements of composite materials.*
2. *Analyze the properties and preparation methods of various reinforcement fibers and particles.*
3. *Evaluate manufacturing techniques for different types of matrix composites and their applications.*
4. *Analyze mechanical behaviour and apply rules of mixtures to predict composite performance.*

Level of CLO-PLO Mapping

CLOs	PLOs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	2	2	1	1	2	2	1	1	1	1	2
2	3	3	3	2	2	2	2	1	1	1	1	2
3	3	3	3	3	2	2	2	1	1	1	1	2
4	3	3	3	3	2	2	2	1	1	1	1	2

Course Title: Waste to Energy							
Course Code: MCSEOWE324					Examination Scheme		
Total Number of Lecture Hours: 40					External	54	
					Internal	21	
Lecture (L)	3	Practical (P)	0	Tutorial (T)	0	Total Credits	3

Course Objectives

- *To introduce the fundamental concepts and classification of waste materials suitable for energy production.*
- *To understand the various thermal, thermochemical, and biochemical technologies used for energy conversion from waste.*
- *To impart knowledge about design, construction, and operational features of gasifiers, combustors, and biogas plants.*
- *To analyze and evaluate different waste-to-energy processes for sustainable energy solutions.*
- *To familiarize students with national biomass energy programs and real-world applications of waste-to-energy technologies.*

Course Content	No. of Teaching Hours
UNIT 1	**10Hrs**
Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods – Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.	
UNIT 2	**10 Hrs**
Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers –Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.	
UNIT 3	**10 Hrs**
Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.	
UNIT 4	**10 Hrs**
Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion – Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.	

Recommended Books:

1. *Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.*
2. *Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.*
3. *Biomass Conversion and* Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

Course Learning Outcomes: *After completing this course the students will:*

1. *Understand classification of waste and the technologies used for converting waste into energy.*
2. *Analyze the design and operation of various biomass gasification and combustion systems.*
3. *Evaluate the construction and working of pyrolysis devices and biogas plants.*
4. *Compare different biomass conversion methods including thermochemical and biochemical processes.*

Level of CLO-PLO Mapping

CLOs	PLOs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	2	2	2	2	2	2	1	1	1	1	2
2	3	3	3	3	2	2	2	1	1	1	1	2
3	3	3	2	2	3	2	2	1	1	1	1	2
4	3	3	2	2	2	2	2	1	1	1	1	3

92

AUDIT COURSE

Course Title: English for Research paper writing							
Course Code: MCSEARP124							
Total Number of Lecture Hours: 32							
Lecture (L)	2	Practical (P)	0	Tutorial (T)	0	Total Credits	0

Course Objectives

- Understand that how to improve your writing skills and level of readability
- Learn about what to write in each section
- Understand the skills needed when writing a Title
- Ensure the good quality of paper at very first-time submission

Course Content	No. of Teaching Hours
UNIT 1	**8 Hrs**
Foundations of Academic Writing: Planning and preparation for writing, Understanding word order, Breaking up long and complex sentences, Structuring paragraphs and sentences effectively, Achieving conciseness and eliminating redundancy, Avoiding ambiguity and vagueness in writing	
UNIT 2	**8 Hrs**
Developing Clarity and Integrity in Research Writing: Clarifying authorship and contributions, Highlighting key findings with clarity, using hedging and critique appropriately, paraphrasing techniques and avoiding plagiarism, Useful academic phrases, Ensuring high-quality first-time paper submission	
UNIT 3	**8 Hrs**
Structure and Components of a Research Paper: Understanding the main sections of a research paper, Writing effective abstracts and introductions, Reviewing literature critically, Describing methods and presenting results, Writing discussion and conclusion sections, Conducting the final review and quality check	
UNIT 4	**8 Hrs**
Skill-Based Writing: Title writing techniques, Abstract writing skills, Introduction writing strategies, Skills for writing literature reviews, Methods section writing skills, Presenting results effectively, Writing coherent discussions, Crafting impactful conclusions	

Books:

- Goldbort R (2006) Writing for Science, Yale University Press
- Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
- Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book.
- Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

Course Learning Outcomes:

CLO1: Apply principles of sentence structure, paragraph organization, and clarity to produce concise, well-structured academic writing.

CLO2: Demonstrate ethical research writing through proper paraphrasing, citation, hedging, and use of academic phrases.

CLO3: Construct key sections of a research paper—including abstracts, introductions, methods, results, and conclusions—using standard academic formats.

CLO4: Employ targeted writing skills to enhance each section of a research paper, from title to conclusion, for effective scholarly communication.

Course Title: Disaster Management							
Course Code: MCSEADM124							
Total Number of Lecture Hours: 50							
Lecture (L)	2	**Practical (P)**	0	**Tutorial (T)**	0	**Total Credits**	0

Course Objectives

- To introduce the fundamental concepts of disasters, their classification, and their impact on life and the environment.
- To analyse various types of natural and man-made disasters, along with their causes, consequences, and geographic distribution.
- To develop understanding of disaster preparedness, risk assessment, and mitigation strategies at local, national, and global levels

Course Content	No. of Teaching Hours
UNIT 1	**8 Hrs**
Introduction to disaster studies, Definition and significance of disasters, Difference between hazard and disaster, Natural and man-made disasters: classification, nature, types, and magnitude	
UNIT 2	**8 Hrs**
Repercussions of disasters: economic loss, human and animal casualties, ecosystem damage; Natural disasters: earthquakes, volcanism, cyclones, tsunamis, floods, droughts, famines, landslides, avalanches; Man-made disasters: nuclear accidents, industrial hazards, oil spills, epidemics, wars and conflicts	
UNIT 3	**8 Hrs**
Disaster-prone areas in India, Seismic zones, Areas prone to floods, droughts, landslides, avalanches, cyclonic and coastal hazards (with special reference to tsunami), Post-disaster diseases and epidemics	
UNIT 4	**8 Hrs**
Disaster preparedness: monitoring, risk evaluation using remote sensing and data, community and government preparedness; Risk assessment and reduction strategies; Global cooperation and public participation; Mitigation concepts and strategies, structural and non-structural mitigation, disaster mitigation programs in India	

Books:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies" New Royal book Company.
2. Sahni, Pardeep Et. Al. (Eds.)," Disaster Mitigation Experiences and Reflections", Prentice Hall of India, New Delhi.

Goel S. L., Disaster Administration And Management Text And Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi.

Course Learning Outcomes:

CLO1: Understand the nature, types, and causes of natural and man-made disasters.
CLO2: Assess the socio-economic and environmental impacts of different disasters.
CLO3: Identify disaster-prone regions in India and recognize post-disaster health risks.
CLO4: Apply basic principles of disaster preparedness, risk assessment, and mitigation strategies for effective disaster management.

Course Title: Sanskrit for Technical Knowledge							
Course Code: MCSEATK124							
Total Number of Lecture Hours: 50							
Lecture (L)	2	Practical (P)	0	Tutorial (T)	0	Total Credits	0

Course Objectives

- To introduce students to the basic structure and pronunciation of Sanskrit, focusing on alphabets and fundamental grammar.
- To provide a foundational understanding of Sanskrit roots (Dhatus) and their application in forming technical vocabulary.
- To enable students to read, comprehend, and translate basic technical texts and vocabulary from Sanskrit to English and vice versa

Course Content	No. of Teaching Hours
UNIT 1	**8 Hrs**
Importance of Sanskrit in Indian tradition and technical knowledge, Order of Sanskrit alphabets (Swaras and Vyanjanas), Basic pronunciation practice	
UNIT 2	**8 Hrs**
Introduction to roots (Dhatus) and their significance, Basic grammar: nouns, pronouns, simple verbs, and sentence structure	
UNIT 3	**8 Hrs**
Basic technical terms in Sanskrit (elements, tools, actions), Introduction to technical content in ancient Sanskrit literature (like Vedas, Sulbasutras, Aryabhatiya)	
UNIT 4	**8 Hrs**
Reading simple Sanskrit passages, Comprehension exercises, Translation of short technical sentences (Sanskrit ↔ English)	

Books:

- "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
- "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumb shastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
- "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

Course Learning Outcomes:

CLO1: Understand basic Sanskrit structure, pronunciation, and sentence formation.
CLO2: Apply Sanskrit roots (Dhatus) to form technical terms.
CLO3: Translate basic technical terms between Sanskrit and English.
CLO4: Comprehend and translate simple Sanskrit passages with technical content.

Course Title: Value Education							
Course Code: MCSEAVE124							
Total Number of Lecture Hours: 50							
Lecture (L)	**2**	**Practical (P)**	**0**	**Tutorial (T)**	**0**	**Total Credits**	**0**

Course Objectives

- Understand the significance of human values and ethics in personal and professional life
- Develop a positive mindset, self-discipline, and responsible behavior.
- Encourage social harmony, environmental awareness, and national unity through value education.

Course Content	No. of Teaching Hours
UNIT 1	**8 Hrs**
Values and Self-Development: Understanding social values and individual attitudes, Work ethics and their importance, Indian vision of humanism, Moral vs non-moral valuation, Standards and principles, Value judgments	
UNIT 2	**8 Hrs**
Importance of Cultivating Values: Cultivation of personal values, Sense of duty, Devotion, Self-reliance, Confidence, Concentration, Truthfulness, Cleanliness, Honesty, Humanity, National Unity, Patriotism, Love for nature, Discipline	
UNIT 3	**8 Hrs**
Personality and Behaviour Development: Soul and scientific attitude, Positive thinking, Integrity and discipline, Punctuality, Love and kindness, Avoiding fault thinking, Free from anger, Dignity of labour, Universal brotherhood and religious tolerance, True friendship, Happiness vs suffering, Love for truth, Awareness of self-destructive habits, Association and cooperation, Saving nature	
UNIT 4	**8 Hrs**
Character and Competence: Holy books vs blind faith, Self-management and good health, Science of reincarnation, Equality, Nonviolence, Humility, Role of women, All religions share the same message, Mind your mind, Self-control, Honesty, Effective study habits	

Books:

- Chakraborty, S.K. "Values and Ethics for Organizations: Theory and Practice", Oxford University Press, New Delhi.
- Tripathi, A.N. "Human Values", New Age International Publishers, New Delhi.
- Rao, V.K. "Value Education and Human Rights", Rajat Publications, New Delhi.
- Naagarazan, R.S. "Professional Ethics and Human Values", New Age International Publishers, New Delhi.
- Covey, Stephen R. "The 7 Habits of Highly Effective People", Simon & Schuster, New York

Course Learning Outcomes:

CLO1: Apply key human values in everyday personal and professional situations.
CLO2: Demonstrate ethical conduct, responsibility, and self-discipline.
CLO3: Develop a well-rounded personality with empathy and integrity.
CLO4: Show respect for diversity, sustainable living, and social harmony

Course Title: Constitution of India							
Course Code: MCSEACI224							
Total Number of Lecture Hours: 50							
Lecture (L)	2	**Practical (P)**	0	**Tutorial (T)**	0	**Total Credits**	0

Course Objectives

- To provide students with an understanding of the historical evolution, philosophy, and fundamental principles of the Indian Constitution.
- To develop knowledge of the structure, powers, and functions of the organs of governance, including Parliament, Executive, and Judiciary.
- To enable students to examine local administration, the role of elected officials, the Election Commission, and institutions for the welfare of SC/ST/OBC communities and women.

Course Content	No. of Teaching Hours
UNIT 1	**8 Hrs**
History, Philosophy, and Constitutional Rights: History of Making of the Constitution; Drafting Committee (Composition & Working); Preamble; Salient Features; Fundamental Rights; Right to Equality; Right to Freedom; Right against Exploitation; Right to Freedom of Religion; Cultural and Educational Rights; Right to Constitutional Remedies; Directive Principles of State Policy; Fundamental Duties	
UNIT 2	**8 Hrs**
Organs of Governance: Parliament (Composition, Qualifications and Disqualifications, Powers and Functions); Executive (President, Governor, Council of Ministers); Judiciary (Appointment and Transfer of Judges, Qualifications, Powers and Functions)	
UNIT 3	**8 Hrs**
Local Administration: District Administration (Head: Role and Importance); Municipalities (Mayor and Role of Elected Representative, CEO of Municipal Corporation); Panchayati Raj (Zila Panchayat, Block Level, Village Level: Roles of Elected and Appointed Officials, Importance of Grassroot Democracy)	
UNIT 4	**8 Hrs**
Election Commission and Welfare Institutions: Election Commission (Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission); Institutes and Bodies for Welfare of SC/ST/OBC and Women	

Books:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Course Learning Outcomes:

CLO1: Understand the historical evolution, philosophical foundations, and the framework of the Indian Constitution, including Fundamental Rights, Directive Principles, and Fundamental Duties.
CLO2: Analyze the structure, composition, powers, and functions of the organs of governance—Parliament, Executive, and Judiciary—in India.
CLO3: Examine the organization and functioning of local administration, including municipalities and the Panchayati Raj system, and assess the role of elected and appointed officials in grassroots democracy.
CLO4: Evaluate the role and functioning of the Election Commission and other constitutional bodies, and understand institutional mechanisms for the welfare of SC/ST/OBC communities and women.

Course Title: Pedagogy Studies							
Course Code: MCSEAPS224							
Total Number of Lecture Hours: 32							
Lecture (L)	**2**	**Practical (P)**	**0**	**Tutorial (T)**	**0**	**Total Credits**	0

Course Objectives

- To introduce students to the conceptual framework, theories of learning, and research methodology related to pedagogical practices.
- To develop understanding of curriculum, teacher education, and pedagogical strategies used in formal and informal classrooms.
- To enable students to analyze the effectiveness of pedagogical practices, professional development approaches, and identify research gaps for improving teaching and learning outcomes.

Course Content	No. of Teaching Hours
UNIT 1	**8 Hrs**
Introduction and Methodology: Aims and Rationale; Policy Background; Conceptual Framework and Terminology; Theories of Learning; Curriculum; Teacher Education; Research Questions; Overview of Methodology and Searching	
UNIT 2	**8 Hrs**
Thematic Overview of Pedagogical Practices: Pedagogical Practices Used by Teachers in Formal and Informal Classrooms in Developing Countries; Curriculum; Teacher Education	
UNIT 3	**8 Hrs**
Evidence and Effectiveness of Pedagogical Practices: Evidence on the Effectiveness of Pedagogical Practices; Methodology for In-Depth Stage: Quality Assessment of Included Studies; Supporting Effective Pedagogy through Teacher Education, Curriculum, and Guidance Materials; Theory of Change; Strength and Nature of the Body of Evidence; Pedagogic Theory and Pedagogical Approaches; Teachers' Attitudes and Beliefs; Pedagogic Strategies	
UNIT 4	**8 Hrs**
Professional Development, Barriers, and Future Directions: Professional Development: Alignment with Classroom Practices and Follow-Up Support; Peer Support; Support from Head Teacher and Community; Curriculum and Assessment; Barriers to Learning (Limited Resources and Large Class Sizes); Research Gaps and Future Directions; Research Design; Contexts; Pedagogy; Teacher Education; Curriculum and Assessment; Dissemination and Research Impact	

Books:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
4. www.pratham.org/images/resource%20working%20paper%202.pdf.

Course Learning Outcomes:

CLO1: Understand the conceptual framework, theories of learning, and research methodology used to study pedagogical practices.

CLO2: Analyze the thematic overview of pedagogical practices in formal and informal classrooms, including curriculum and teacher education.

CLO3: Evaluate the effectiveness of pedagogical practices, teachers' attitudes and beliefs, and the role of curriculum and guidance materials in supporting learning outcomes.

CLO4: Assess professional development strategies, barriers to learning, and identify research gaps to inform future educational policy and practice.

Course Title: Stress Management by Yoga							
Course Code: MCSEASM224							
Total Number of Lecture Hours: 32							
Lecture (L)	**2**	**Practical (P)**	**0**	**Tutorial (T)**	**0**	**Total Credits**	0

Course Objectives

- To introduce students to the foundational concepts of Yoga, including the eight parts of Ashtanga and their relevance to daily life.
- To develop understanding and practice of Yam and Niyam, promoting ethical living and self-discipline.
- To enable students to learn and perform Asan and Pranayam techniques, and understand their physical and mental health benefits.

Course Content	No. of Teaching Hours
UNIT 1	**8 Hrs**
Introduction to Yoga: Definitions of the Eight Parts of Yoga (Ashtanga)	
UNIT 2	**8 Hrs**
Yam and Niyam: Do's and Don'ts in Life; Yam: Ahinsa, Satya, Astheya, Brahmacharya, Aparigraha; Niyam: Shaucha, Santosh, Tapa, Swadhyay, Ishwarpranidhan	
UNIT 3	**8 Hrs**
Asan (Yoga Poses) Various Yoga Poses and Their Benefits for Mind and Body	
UNIT 4	**8 Hrs**
Pranayam (Breathing Techniques) Regularization of Breathing Techniques and Its Effects; Types of Pranayam	

Books:

1. 'Yogic Asanas for Group Tarining-Part-I" : Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

Course Learning Outcomes:

CLO1: Understand the definitions and eight parts of Yoga (Ashtanga) and their significance in daily life.

CLO2: Explain and practice Yam and Niyam, including ethical principles and personal disciplines for holistic living.

CLO3: Demonstrate various Yoga poses (Asan) and analyze their physical and mental health benefits.

CLO4: Apply Pranayam techniques for the regulation of breathing and evaluate their effects on mind and body.

Course Title:Personality Development through life enlightenment skills							
Course Code: MCSEAPD224					Examination Scheme		
Total Number of Lecture Hours: 32					External	54	
					Internal	21	
Lecture (L)	3	Practical (P)	0	Tutorial (T)	0	Total Credits	3

Course Objectives

- To develop self-awareness and a clear understanding of one's personality, strengths, and weaknesses.
- To cultivate positive attitude, motivation, self-esteem, and emotional intelligence for personal growth.
- To enhance communication, leadership, teamwork, and time-management skills.
- To apply life-enlightenment concepts for stress management, ethical living, and holistic personality development.

Course Content	No. of Teaching Hours
UNIT 1	8 Hrs

Self-Awareness & Personality

- Understanding personality: traits, types, and dimensions.
- Self-analysis tools: SWOT.
- Setting life-goals and purpose.

UNIT 2	8 Hrs

Attitude, Motivation & Emotional Intelligence

- Developing positive attitude and self-esteem.
- Motivation (internal vs external) and its influence on personality.
- Emotional intelligence (EQ) and its role in personal growth.

UNIT 3	8 Hrs

Communication, Leadership & Teamwork

- Effective communication: verbal, non-verbal, and listening skills.
- Leadership qualities and team dynamics.
- Time management and work ethics.

UNIT 4	8 Hrs

Life-Enlightenment & Stress Management

- Principles from wisdom literature for ethical and purposeful living.
- Stress management techniques: meditation, mindfulness, yoga.
- Holistic development: integrating physical, mental, emotional, and spiritual aspects.

Course Outcomes

CO1: Analyze their personality and create a personal development plan using self-awareness tools like SWOT.

CO2: Demonstrate positive attitude, self-motivation, and emotional intelligence in personal and professional settings.

CO3: Communicate effectively, lead teams, and manage time efficiently.

CO4: Apply life-enlightenment principles and stress-management techniques for holistic growth and ethical decision-making.