Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur

An Autonomous Institute Affiliated to RTM Nagpur University

Scheme of Instructions and Syllabus

Scheme of Instructions for First Year M. Tech. Programme in Computer Science & Engineering

Semester – II

Sr. No.	Course Category	CourseCode	Course Title	L	T	P	Contact Hrs/week	Credits	Exam Scheme				
									CT - 1	CT - 2	TA / CA	ESE	TOTAL
1.	PCC	MCS21201	Advanced Machine Learning	4	-	-	4	4	20	20	-	60	100
2.	PCC	MCS21202	TCP/IP and Network Programming	4	-	-	4	4	20	20	-	60	100
3.	PCC	MCS21203	Computer Programming-II Lab	-	-	4	4	2	-	-	50	50	100
4.	PEC	MCS21204-06	Professional Elective - III	4	-	-	4	4	20	20	-	60	100
5.	PEC	MCS21207-09	Professional Elective – IV	4	-	-	4	4	20	20	-	60	100
6.	CC	MCS21210	Research Methodology#	2	-	-	2	2	20	20	-	60	100
			Total	**18**	**-**	**04**	**22**	**20**	**100**	**100**	**50**	**350**	**600**

PROGRESSIVE TOTAL CREDITS= 22+20 = 42

HOD	**Dean Academics**	**Vice Principal**	**Principal**	**Nov , 2024**	**1.00**	**Applicable for AY 2024-25 Onwards**
Chairman				**Date of Release**	**Version**	

Dean Academics (PG
Tulsiramji Gaikwad-Patil College
of Engineering and Technology
Nagpur (M.S.)

Dr. Premanand Naktode
Principal
TGPCET, Nagpur

Department of Computer Science And Engineering
Tulsiramji Gaikwad-patil College of Engineering
Nagpur

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Scheme of Instructions and Syllabus

Scheme of Instructions for First Year/Second Year M. Tech. Programme in Computer Science & Engineering

List of Professional Elective Courses

Semester – I			
Professional Elective - I		**Professional Elective - II**	
MCS21105	Digital Image Processing	**MCS21108**	Advanced Operating Systems
MCS21106	Advanced Data Mining	**MCS21109**	Data Science
MCS21107	Embedded System	**MCS21110**	Cryptography &Information Security

Semester – II			
Professional Elective - III		**Professional Elective - VI**	
MCS21204	Computer Vision	**MCS21207**	Cloud Computing
MCS21205	Big Data Analytics	**MCS21208**	Data Preparation and Analysis
MCS21206	Internet of Things	**MCS21209**	Digital Forensics

Chairman	**Dean Academics**	**Vice Principal**	**Principal**	**Nov , 2024**	**1.00**	**Applicable for AY 2024-25 Onwards**
				Date of Release	**Version**	

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First Year (Semester-II) M.Tech. (CSE)

Course Code: MCS21201 Course Name : Advanced Machine Learning

TeachingScheme	
Lectures	4 Hrs/week
Tutorial	-
Total Credit	4

ExaminationScheme	
CT-1	20 Marks
CT-2	20 Marks
TA	-
ESE	60 Marks
Total	100 Marks
Duration of ESE: 03Hrs 00Min.	

Course Objective:

1	To introduce the basic concepts of machine learning and range of problems that can be handled by machine learning
2	To introduce the concepts of instance based learning and decision tree induction
3	To introduce the concepts of linear separability, Perceptron and SVM
4	To learn the concepts of probabilistic inference, graphical models and evolutionarylearning
5	To learn the concepts of ensemble learning, dimensionality reduction and clustering

Course Contents

Unit I	**Introduction**: Learning, Types of Machine Learning, Machine Learning Examples , DecisionTree Learning Concept learning: Introduction, Version Spaces and the Candidate Elimination Algorithm. Learning with Trees: Decision Tree Learning, the Big Picture Linear Discriminants: Learning Linear Separators , The Perceptron Algorithm , Margins
Unit II	Estimating Probabilities from Data, Bayes Rule, MLE, MAP Naive Bayes: Conditional Independence, Naive Bayes: Why and How, Bag of Words LogisticRegression : Maximizing Conditional likelihood , Discriminants: The Perceptron, Linear Separability, Linear Regression Multilayer Perceptron (MLP): Going Forwards, Backwards, MLP in practices, Deriving back
Unit III	Support Vector Machines: Geometric margins, Primal and Dual Forms, Kernalizing SVM Generalization & Overfitting: Sample Complexity, Finite Hypothesis classes, VC Dimension Based Bounds Some Basic Statistics: Averages, Variance and Covariance, The Gaussian, The Bias-Variance Tradeoff Bayesian learning: Introduction, Bayes theorem. Bayes Optimal Classifier, Naive Bayes Classifier. Graphical Models: Bayesian networks, Approximate Inference, Making Bayesian Networks, Hidden Markov Models, The Forward Algorithm.
Unit IV	Model Selection & Regularization: Structural Risk Minimization, Regularization, k-Fold Cross validation Linear Regression: Linear regression, minimizing squared error and maximizing dataLikelihood Neural Networks: Back Propagation, Deep Neural Networks: Convolution, Convolution Neural Networks, LeNet-5 architecture Boosting: Boosting Accuracy, Ada Boosting, Bagging
Unit V	Clustering: Introduction, Similarity and Distance Measures, Outliers, Hierarchical Methods, Partitional Algorithms, Clustering Large Databases, Clustering with Categorical Attributes, Comparison. Dimensionality Reduction: Linear Discriminant Analysis, Principal Component Analysis Interactive Learning: Active Learning, Active Learning, Common heuristics,

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	Sampling bias , Safe Disagreement Based Active Learning Schemes Semi-Supervised Learning: Semi-supervised Learning, Transductive SVM, Co-training Reinforcement Learning: Markov Decision Processes, Value Iteration, Q-Learning
Text Books	
T1	Machine Learning: A Probabilistic Perspective" by Kevin P. Murphy.
T2	"Machine Learning Yearning" by Andrew Ng
ReferenceBooks	
1	Tom M. Mitchell, Machine Learning, Mc Graw Hill, 1997
2	Stephen Marsland, Machine Learning - An Algorithmic Perspective, CRC Press,2009.
Useful Links	
1	https://nptel.ac.in/courses/106106139
2	https://www.youtube.com/watch?v=Liws4MShq1A

	Course Outcomes	CL	Class Session
1	Understand strengths and weakness of different machine learning techniques.	2	9
2	Analyze suitable model parameter for different machine learning technique.	3	9
3	Design & implement various machine learning algorithms to a wide range of real world applications.	3	9
4	Evaluate available learning methods to develop the research based solutions in different domains	4	9
5	**Apply** various clustering techniques, dimensionality reduction methods, active learning strategies, and reinforcement learning algorithms to solve real-world problems in machine learning and data analysis.	4	9

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First Year (Semester-II) M.Tech. (CSE)

Course Code: MCS21202 Course Name : TCP / IP and Network Programming

TeachingScheme	
Lectures	4 Hrs/week
Tutorial	-
Total Credit	4

ExaminationScheme	
CT-1	20 Marks
CT-2	20 Marks
TA	-
ESE	60 Marks
Total	100 Marks
Duration of ESE:03Hrs 00Min.	

Course Objective:

1	To Understand the fundamentals of computer networks and their types, OSI and TCP/IP reference models and their layers.
2	To Learn IP addressing schemes and subnetting techniques & Understand routing protocols and IP routing.
3	Understand TCP and UDP protocols in detail, and Gain hands-on experience with socket programming for network communication.
4	To Learn advanced networking protocols, network security and encryption techniques.
5	To Understand real-time systems and IoT-based network programming.

Course Contents

Unit I	**Introduction to Computer Networks and TCP/IP Model**: Computer Networks Overview, OSI and TCP/IP Models, Basic Networking Devices, Introduction to Network Protocols.
Unit II	**IP Addressing, Subnetting, and Routing:** IP Addressing, Subnetting Techniques, Routing Protocols and Techniques, IPv6 Overview.
Unit III	**Transport Layer Protocols and Socket Programming:** Transport Layer Protocols: TCP & UDP, Socket Programming: Introduction to socket programming concepts, TCP and UDP socket programming in C/Python, Client-Server Model: Socket functions, Binding, Listening, Accepting connections and Sending/Receiving data. Error Control and Flow Control: Windowing, Acknowledgments, Sequence numbers. Techniques for avoiding congestion and packet loss.
Unit IV	**Advanced Networking Protocols and Network Security**: Application Layer Protocols: HTTP, FTP, DNS, SMTP, POP3, IMAP, Web technologies: HTML, HTTP, Web Sockets, Network Security Fundamentals: Introduction to network security threats: DoS, DDoS, Man-in-the-middle, MITM attacks. Secure Network Protocols.
Unit V	**Network Programming in Real-Time Systems and IoT:** Introduction to Real-Time Systems, IoT Protocols, Network Programming for IoT.

Text Books

1	Computer Networking: A Top-Down Approach by James F. Kurose & Keith W. Ross
2	TCP/IP Illustrated by W. Richard Stevens.

ReferenceBooks

1	*Data and Computer Communications* by William Stallings
2	*IoT Fundamentals* by David Hanes, Gonzalo Salgueiro

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UsefulLinks	
1	https://nptel.ac.in/courses/106105162
2	https://nptel.ac.in/courses/106105183

	Course Outcomes	CL	Class Session
1	**Understand** the TCP/IP stack and its implementation, fundamental network devices and their functions.	2	9
2	**Demonstrate** the IP addressing, Subnetting, and routing concepts & Configure and troubleshoot network settings.	3	9
3	**Understand** network programs using sockets, Differentiate between TCP and UDP protocols	3	9
4	**Implement** secure protocols in network communication.	4	9
5	**Apply** the concept of real-time systems and IoT Program and deploy network applications in IoT environments.	4	9

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First Year (Semester-II) M.Tech. (CSE)

Course Code:MCS21204 Professional Elective – III (Computer Vision)

Teaching Scheme	
Lectures	4Hrs/week
Tutorial	-
Total Credit	4

Examination Scheme	
CT-1	20 Marks
CT-2	20 Marks
TA	-
ESE	60 Marks
Total	100 Marks
Duration of ESE:03sHrs 00Min.	

Course Objective:

1	In this course students will learn basic principles of image formation, image processing algorithms and recognition from single or multiple images (video).
2	This course emphasizes the core vision tasks of scene understanding and recognition.
3	Applications to object recognition, image analysis, image retrieval and object tracking will be discussed.

Course Contents

Unit I	**Overview of computer vision and its applications:** Image Formation and Representation: Imaging geometry, radiometry, digitization, cameras and Projections, rigid and affine transformation.
Unit II	**Image Processing:** Pixel transforms, color transforms, histogram processing, histogram equalization, filtering, convolution, Fourier transformation and its applications in sharpening, blurring and noise removal **Feature detection:** edge detection, corner detection, line and curve detection, active contours, SIFT and HOG descriptors, shape context descriptors, Morphological operations
Unit III	**Segmentation**: Active contours, split & merge, watershed, region splitting, region merging, graph-based segmentation, mean shift and model finding, Normalized cut. **Object recognition and shape representation:** alignment, appearance-based methods, invariants, image eigen spaces.
Unit IV	**Camera calibration:** camera models; intrinsic and extrinsic parameters; radial lens distortion; direct parameter calibration; camera parameters from projection matrices; orthographic, weak perspective, affine, and perspective camera models
Unit V	**Motion representation:** the motion field of rigid objects; motion parallax; optical flow, the image brightness constancy equation, affine flow; differential techniques; feature-based techniques; regularization and robust estimation. **Motion tracking:** statistical filtering; iterated estimation; observability and linear systems; the Kalman filter

Text Books

1	Computer Vision: Algorithms and Applications, R. Szeliski, Springer, 2011.
2	Introductory techniques for 3D computer vision, E. Trucco and A. Verri, Prentice Hall, 1998.

Reference Books

1	Digital Image Processing, Rafael C. Gonzalez
2	Multiple View Geometry in Computer Vision", by Hartley and isserman

Useful Links

1	https://archive.nptel.ac.in/courses/106/105/106105216/
2	https://archive.nptel.ac.in/courses/106/106/106106224/

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	CourseOutcomes	CL	Class Session
1	**Learn** fundamentals of computer vision and its applications	2	9
2	**Understand** the basic image processing operations to enhance, segment the images.	2	9
3	**Analyzing** and extraction of relevant features of the concerned domain problem.	4	9
4	**Apply** the motion concepts and its relevance in real time applications	3	9
5	**Apply** the knowledge in solving high level vision problems like object recognition, image classification etc.	3	9

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First Year (Semester-II) M.Tech. (CSE)

Course Code: MCS21205 Professional Elective-III (Big Data Analytics)

Teaching Scheme	
Lectures	4 Hrs/week
Tutorial	-
Total Credit	4

Examination Scheme	
CT-1	20 Marks
CT-2	20 Marks
TA	-
ESE	60 Marks
Total	100 Marks
Duration of ESE :03Hrs 00Min.	

Course Objective:

1	To understand Data Analytics Life Cycle and Business Challenges
2	To learn the core technologies used for big data storage and processing
3	To apply distributed computing frameworks like Apache Hadoop and Apache Spark to process large-scale data sets efficiently.
4	To explore big data technologies and tools.
5	To understand the ethical considerations and privacy issues involved in big data analytics

Course Contents

Unit I	**Introduction to Big Data Analysis** Definition of Big Data, Big data characteristics & considerations, Characteristics of Big data, Challenges and applications of Big Data, Enabling Technologies for Big Data, Big Data distribution packages.
Unit II	**Big Data Platforms** Overview of Apache Spark, HDFS, YARN, Map Reduce, MapReduce Programming Model with Spark, Cassandra, Cassandra Internals, HBase, HBase Internals. Hive (SQL): Introduction to Hive, Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, Hive QL, Tables, Spark: Introduction to data analytics with Spark, programming with RDDS, Working with key value pairs, Advanced spark programming. Hbase : HBasic, Concepts, Clients, Example, Hbase Versus RDBMS.
Unit III	**Big Data Applications** Overview of Big Data Machine Learning, Mahout, Big Data Machine Learning Algorithms in Mahout- K means, Naïve Bayes etc. Machine learning with Spark, Machine Learning Algorithms in Spark, Spark MLlib, Deep Learning for Big Data, Graph Processing: Pregel, Graph, Spark GraphX
Unit IV	**Data Analytics Lifecycle** Need of Data analytic lifecycle, Key roles for successful analytic projects, various phases of Data analytic lifecycle: Discovery, Data Preparation, Model Planning, Model Building, Communicating Results, Operationalization.

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Unit V	**Database for the Modern Web** Introduction to mongoDB key features, Core server tools, MongoDB through the JavaScript' Shell, Creating and querying through Indexes, Document-oriented, principles of schema design, Constructing queries on databases, collections and documents, MongoDBquery language.
Text Books	
1	"Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Bart Baesens, Wiley and SAS Business Series.
2	"Big Data Principals and Paradiagram", Rajkumar Buyya, Rodrigo N. Calheiros, Amir Vahid Dastjerdi, Morgan Kaufmann, Elsevier, ISBN: 978-0-12-805394-2
Reference Books	
1	"BIG Data and Analytics", Sima Acharya, Subhashini Chhellappan,Wiley publication, ISBN: 978-8126554782
2	Data Mining: Concepts and Techniques Second Edition – Jiawei Han and Micheline Kamber – Morgan KaufMan Publisher
Useful Links	
1	https://www.coursera.org/specializations/big-data
2	https://onlinecourses-archive.nptel.ac.in/

	Course Outcomes	CL	Class Session
1	**Understand** Data Analytics Lifecycle to address big data analytics projects	2	9
2	**Apply** appropriate analytic techniques and tools to analyze big data, create statistical models, and identify insights that can lead to actionable results	3	9
3	**Perform** business challenge as an analytics challenge	3	9
4	**Evaluate** the appropriate data visualizations to clearly communicate analytic insights to business sponsors and analytic audiences	4	9
5	**Analyze** how advanced analytics can be leveraged to create competitive advantage	4	9

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First Year (Semester-II) M.Tech. (CSE)

Course Code: MCS21206 Professional Elective – III Course Name:- Internet of Things (IoT)

TeachingScheme	
Lectures	4 Hrs/week
Tutorial	-
Total Credit	4

ExaminationScheme	
CT-1	20 Marks
CT-2	20 Marks
TA	-
ESE	60 Marks
Total	100 Marks
Duration of ESE:03Hrs 00Min.	

Course Objective:

1	To understand fundamentals of Internet of Things (IoT), its key components, architecture, and communication protocols.
2	To understand the role and functionality of hardware components.
3	To Learn about data management practices and security measures in IoT systems.
4	To study the wide range of real-world IoT applications.
5	To Understand the tools, platforms, and programming languages used for IoT development.

Course Contents

Unit I	**Introduction to Internet of Things (IoT)** Introduction to IoT, IoT System Architecture, Components of IoT , IoT vs M2M (Machine-to-Machine) , IoT Communication Models IoT Protocols, IoT Standards and Frameworks
Unit II	**IoT Hardware and Networking** Embedded Systems for IoT , IoT Sensors and Actuators , Networking Technologies in IoT , IoT Communication Protocols , IoT Network Architectures, Data Transmission
Unit III	**IoT Data Management and Security** Data Management in IoT, Big Data Analytics for IoT, Cloud Computing in IoT, IoT Security Challenges , IoT Security Solutions, Cyber Threats and Attacks in IoT
Unit IV	**IoT Applications** Smart Homes and Buildings, Industrial IoT (IIoT), Healthcare IoT, Agriculture and Environmental IoT, Smart Cities and IoT, IoT in Transportation and Automotive.
Unit V	**IoT Development and Future Trends** IoT Development Tools, IoT Prototyping and Deployment, IoT System Integration, IoT Frameworks, Emerging IoT Trends, Challenges and Opportunities in IoT.

Text Books

1	"Internet of Things: A Hands-On Approach" by Arshdeep Bahga and Vijay Madisetti.
2	"Internet of Things: Architecture and Design Principles" by Raj Kamal
3.	"Building the Internet of Things" by Maciej Kranz

ReferenceBooks

1	"Internet of Things: Concepts and Applications" by S. C. Gupta and J. P. Gupta.
2	"Internet of Things (IoT): From Theory to Practice" by S. Rajasekaran, S. Sivanandam, and A. K. S. Anjaneyulu.

UsefulLinks

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1	https://archive.nptel.ac.in/courses/106/105/106105166/
2	https://onlinecourses.nptel.ac.in/noc21_cs17/preview
3	https://archive.nptel.ac.in/courses/106/105/106105195/
4	https://archive.nptel.ac.in/noc/courses/noc21/SEM2/noc21-cs63/

	CourseOutcomes	CL	Class Session
1	**Understand** the fundamental concepts of IoT, its architecture, and communication protocols	2	9
2	**Apply** knowledge of IoT hardware components, sensors, and networking technologies to design simple IoT systems using appropriate communication protocols.	3	9
3	**Evaluate** IoT data management and security practices to ensure effective data storage, analysis, and secure communication in IoT systems.	3	9
4	**Design** IoT-based solutions tailored to specific real-world problems.	4	9
5	**Create** IoT applications by utilizing development tools , programming languages and the role of emerging technologies	4	9

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First Year (Semester-II) M.Tech. (CSE)

Course Code: MCS21207 Professional Elective IV (Cloud Computing)

Teaching Scheme	
Lectures	4 Hrs/week
Tutorial	-
Total Credit	4

Examination Scheme	
CT-1	20 Marks
CT-2	20 Marks
TA	-
ESE	60 Marks
Total	100 Marks
Duration of ESE :03Hrs 00Min.	

Course Objective:

1	To provide an in-depth and comprehensive knowledge of the Cloud Computing fundamental issues, chnologies, applications and implementations.
2	To expose the students to the frontier areas of Cloud Computing
3	To motivate students to do programming and experiment with the various cloud computing vironments
4	To shed light on the Security issues in Cloud Computing
5	To introduce about the Cloud Standards

Course Contents

Unit I	History of Centralized and Distributed Computing - Overview of Distributed Computing, Cluster computing, Grid computing. Technologies for Network based systems- System models for Distributed and cloud computing- Software environments for distributed systems and clouds.
UnitII	Introduction to Cloud Computing- Cloud issues and challenges - Properties - Characteristics - Service models, Deployment models. Cloud resources: Network and API - Virtual and Physical computational resources - Data-storage. Virtualization concepts - Types of Virtualization- Introduction to Various Hypervisors - High Availability (HA)/Disaster Recovery (DR) using Virtualization, Moving VMs
Unit III	Service models - Infrastructure as a Service (IaaS) - Resource Virtualization: Server, Storage, Network - Case studies. Platform as a Service (PaaS) - Cloud platform & Management: Computation, Storage - Case studies. Software as a Service (SaaS) - Web services - Web 2.0 - Web OS - Case studies – Anything as a service (XaaS).
Unit IV	Cloud Programming and Software Environments – Parallel and Distributed Programming paradigms – Programming on Amazon AWS and Microsoft Azure – Programming support of Google App Engine – Emerging Cloud software Environment.
Unit V	Cloud Access: authentication, authorization and accounting - Cloud Provenance and meta-data - Cloud Reliability and fault-tolerance - Cloud Security, privacy, policy and compliance- Cloud federation, interoperability and standards.

Text Books

1	Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, "Distributed and cloud computing from Parallel Processing to the Internet of Things", Morgan Kaufmann, Elsevier – 2012
2	Cloud Computing: Concepts, Technology, Security & Architecture, 2nd Edition – Pearson by Thomas Erl (Author), Eric Barceló Monroy (Author)

Reference Books

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1	Barrie Sosinsky, " Cloud Computing Bible" John Wiley & Sons, 2010
2	Tim Mather, Subra Kumaraswamy, and Shahed Latif, Cloud Security and Privacy An Enterprise Perspective on Risks and Compliance, O'Reilly 2009
Useful Links	
1	https://archive.nptel.ac.in/courses/106/105/106105167/
2	https://youtu.be/NzZXz3fJf6o

	Course Outcomes	CL	Class Session
1	**Understand** the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications of cloud computing	2	9
2	**Identify** the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.	3	9
3	**Demonstrate** the core issues of cloud computing such as security, privacy, and interoperability.	6	9
4	**Analyse** the appropriate cloud computing solutions and recommendations according to the applications used.	6	9
5	**Apply** research and write a research paper, and present the research online.	2	9

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First Year (Semester-II) M.Tech. (CSE)

Course Code: MCS21208 Professional Elective IV (Data Preparation and Analysis)

Teaching Scheme	
Lectures	4 Hrs/week
Tutorial	-
Total Credit	4

Examination Scheme	
CT-1	20 Marks
CT-2	20 Marks
TA	-
ESE	60 Marks
Total	100 Marks
Duration of ESE :03Hrs 00Min.	

Course Objective:

1	To understand the role of a data preparation and provide foundational understanding of the importance of data preparation in the analytics process system.
2	To learn Data Cleaning and Transformation Techniques
3	To explore and summarize datasets effectively, using visualization techniques and descriptive statistics to uncover insights.
4	To apply methods for integrating data from multiple sources and performing feature engineering to enhance predictive and descriptive models.
5	To understand to solve the real-world problems by applying data preparation, transformation, and analysis techniques using statistical tools and programming languages.

Course Contents

Unit I	**Introduction to Data Preparation** Types of Data: Structured, Semi-Structured, and Unstructured, Data Collection Techniques: Surveys, Web Scraping, APIs, and Databases, Understanding Data Quality: Completeness, Consistency, Validity, Timeliness, Overview of Data Pre-processing: Goals and Steps, Tools for Data Preparation: Excel, Python (pandas), R, SQL
Unit II	**Data Cleaning** Handling Missing Data: Removal, Imputation (Mean, Median, Mode, Advanced Methods), Identifying and Removing Duplicates, Outlier Detection and Treatment: ZScore, IQR, and Visual Approaches, Addressing Data Inconsistencies: Formatting, Unit Standardization, Dealing with Noisy Data: Smoothing Techniques, Data Parsing and Tokenization
Unit III	**Data Transformation** Scaling and Normalization: Min-Max, Z-Score, Logarithmic Scaling, Encoding Categorical Data: One-Hot Encoding, Label Encoding, Feature Engineering: Feature Extraction, Feature Selection, Feature Creation, Dimensionality Reduction: PCA (Principal Component Analysis), t-SNE. Data Aggregation and Pivoting, Data Sampling Techniques: Random Sampling, Stratified Sampling

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Unit IV	**Exploratory Data Analysis (EDA)** Introduction to EDA: Objectives and Importance, Univariate Analysis: Histograms, Box Plots, Summary Statistics, Multivariate Analysis: Scatter Plots, Heatmaps, Correlation Matrices, Data Visualization Techniques: Bar Charts, Line Graphs, Pie Charts, Violin Plots, Identifying Patterns and Trends: Time-Series Analysis Basics Hypothesis Generation and Validation
Unit V	**Advanced Data Preparation and Automation** Introduction to Data Pipelines: ETL (Extract, Transform, Load) Concepts, Automating Data Preparation with Tools: Python Scripts, KNIME, Alteryx, Handling Large Datasets: Chunking, Parallel Processing, Dealing with Imbalanced Data: SMOTE, Oversampling, Under sampling, Introduction to Big Data Tools: Hadoop, Spark for Data Preparation.
Text Books	
1	Foster Provost and Tom Fawcett, Data Science for Business, 1st Edition, Morgan Kaufmann, 1999
2	Dorian Pyle; Data Preparation for Data Mining, Morgan Kaufmann Publishers, 1999
Reference Books	
1	Peter Bruce, Andrew Bruce, Peter Gedeck; Python for Data Analysis, 2nd edition, O'Reilly Media, 2020
2	Pang-Ning Tan, Michael Steinbach, Anuj Karpatne, Vipin Kumar; Introduction to Data Mining, 2nd edition, Pearson, 2019
Useful Links	
1	https://www.geeksforgeeks.org/what-is-data-preparation/
2	https://www.talend.com/resources/what-is-data-preparation/

	Course Outcomes	CL	Class Session
1	**Understand** Data Preparation Techniques	2	9
2	**Apply** various data visualization and summary statistics tools to explore datasets.	3	9
3	**Perform** efficient data storage and retrieval queries using SQL.	3	9
4	**Evaluate** the cost and efficiency of various Query Operations such as Selection, Sorting, and Join in different query execution scenarios.	4	9
5	**Analyze** how different schedules impact the recoverability of a database during system failures and the role of transaction logs in ensuring recoverable states.	4	9

HOD
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Tulsiramji Gaikwad-patil College of Engineering
Nagpur

Dean Academics (PG)
Tulsiramji Gaikwad-Patil College
of Engineering and Technology
Nagpur (M.S.)

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Tulsiramji Gaikwad-Patil College of Engineering and Technology
WardhaRoad,Nagpur-441108
NAAC Accredited (A+ Grade)
An Autonomous Institute affiliated to RTMNU Nagpur

First Year (Semester-II) M. Tech. (CSE)

Course Code: MCS21209 PROFESSIONAL ELECTIVE IV (Digital Forensics)

Teaching Scheme	
Lectures	4 Hrs /week
Tutorial	-
Total Credit	4

Examination Scheme	
CT-1	20 Marks
CT-2	20 Marks
TA	-
ESE	60 Marks
Total	100 Marks
Duration of ESE: 03Hrs. 00Min.	

Course Objective:

1	Familiarize the student about digital and computer forensics.
2	Enable the student to learn analysis of crime scene
3	Learn the methods of investigation using digital forensic techniques.
4	Manage and present evidences
5	Demonstrate investigation process with case study

Course Contents

Unit I	**Digital Forensics overview**–Digital Forensics Science: Forensics science, computer forensics, and digital forensics. Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/ Employment Proceedings, Computer Forensics Services, Benefits of Professional Forensics Methodology Steps Taken by Computer Forensics Specialists, Types of computer forensic technology, Types of computer forensic systems, case studies.
Unit II	**Understanding Digital Forensic Investigation**–Computer Forensics Evidence and Capture: Data Recovery, Role of data backup in data recovery, Hiding and Recovering Hidden Data. Evidence collection and Data seizure: why collecting evidence? Types of evidence, Rules of evidence, Methods of collection of evidence, Reconstruction of evidence, Parts of gathering evidence, Seizure data evidence..
Unit III	**Duplication and Preservation of Digital Evidence:** Preserving the Digital crime scene, Computer Evidence Processing Steps, Legal Aspects of Collecting and Preserving Computer Forensic Evidence, Computer Image Verification and Authentication: Special Needs of Evidential Authentication, Practical Considerations, computer Forensics Analysis: Discovery of Electronic Evidence, Identification of Data,
Unit IV	**Current computer forensics tools**- software, hardware tools, validating and testing forensic software, addressing data-hiding techniques, performing remote acquisitions, E-Mail investigations- investigating email crime and violations, understanding E-Mail servers, specialized E-Mail forensics tool.

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Unit V	**Advanced Computer Forensics**: Advanced Encryption: The Need to Conceal, Advanced Hacking, Advanced Tracker Hackers, Computer Forensics Resources. Mobile Forensics: mobile forensics techniques, mobile forensics tools. Legal Aspects of Digital Forensics: IT Act 2000, amendment of IT Act 2008.
Text Books	
1	Computer Forensics computer crime scene investigation, second edition, John R.Vacca , John Sammons
2	The Basics of Digital Forensics, Elsevier. John Vacca, Computer Forensics: Computer Crime Scene Investigation, Laxmi Publications
Reference Books	
1	Vacca, J, Computer Forensics, Computer Crime Scene Investigation, 2nd Ed, Charles River Media, 2005,ISBN: 1-58450-389.
2	Angus M.Marshall, " Digital forensics: Digital evidence in criminal investigation", John – Wiley and Sons, 2008
Useful Links	
1	https://www.nitt.edu/home/academics/departments/cse/programmes/mtech/curriculum/semester_1/electives/ digital_forensics/
2	https://onlinecourses.swayam2.ac.in/cec20_lb06/preview

	Course Outcomes	CL	Class Session
1	**Understand** the basics of digital forensics.	2	9
2	**Implement** the capture, duplication, and preservation of digital evidence.	6	9
3	**Analyze** the digital evidence to find the digital artifacts	3	9
4	**Design** computer forensics Various tools	4	9
5	**Understand** the legal aspects of the digital forensics	4	9

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