

Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur

An Autonomous Institute Affiliated to RTM Nagpur University



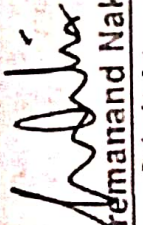
Scheme of Instructions and Syllabus

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

Semester – II

Sr. No.	Course Category	Course Code	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.	RM	MME21204	Literature Review & Research Methodology	2	-	-	2	2	-	-	25	25	50
Total				18	-	04	22	20	80	80	75	325	550

PROGRESSIVE TOTAL CREDITS= 22+20 = 42

 Dean Academics (PG)	 Vice Principal	 Dr. Premanand Naktode Principal	Nov, 2024	Date of Release	1.00	Version	Applicable for AY 2024-25 Onwards

Department of Computer Science And Engineering and Technology

Tulsiramji Gaikwad-patil College of Engineering Nagpur (M.S.)

Nagpur

TGPCET, Nagpur

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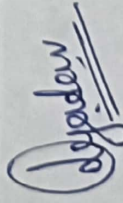
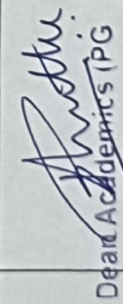
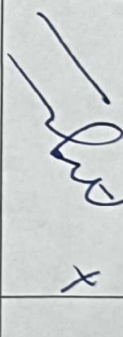

Scheme of Instructions and Syllabus

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

				Nov, 2024	1.00	Applicable for AY 2024-25 Onwards
Pragyan	Dr. Pramanand Naktode Dean Academics (PG)	X	Dr. Pramanand Naktode Principal	Date of Release	Version	

TGPCET, Nagpur

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

Course Code: MCS21201 Course Name : Advanced Machine Learning

Teaching Scheme		Examination Scheme	
Lectures	4 Hrs/week	CT-1	20 Marks
Tutorial	-	CT-2	20 Marks
Total Credit	4	TA	-
		ESE	60 Marks
		Total	100 Marks
		Duration of ESE: 03Hrs 00Min.	

Course Objective:

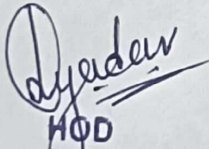
1	To introduce the basic concepts of machine learning and range of problems that can be handled by machine learning
2	To introduce the concepts of instance based learning and decision tree induction
3	To introduce the concepts of linear separability, Perceptron and SVM
4	To learn the concepts of probabilistic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

Course Contents

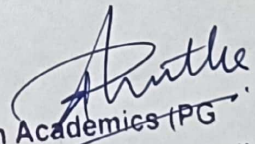
Unit I	Introduction: Learning, Types of Machine Learning, Machine Learning Examples , Decision Tree Learning Concept learning: Introduction, Version Spaces and the Candidate Elimination Algorithm. Learning with Trees: Decision Tree Learning, the Big Picture Linear Discriminants: Learning Linear Separators , 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 Logistic Regression : 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, Kernelizing 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 data Likelihood 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,

	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

Teaching Scheme		Examination Scheme	
Lectures	4 Hrs/week	CT-1	20 Marks
Tutorial	-	CT-2	20 Marks
Total Credit	4	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.

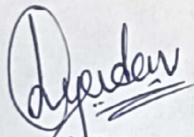
Reference Books

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

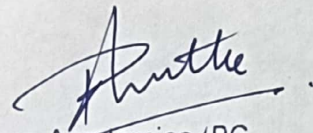


UsefulLinks	
1	https://nptel.ac.in/courses/106105162
2	https://nptel.ac.in/courses/106105183

	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			Examination Scheme	
Lectures	4Hrs/week		CT-1	20 Marks
Tutorial	-		CT-2	20 Marks
Total Credit	4		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/

	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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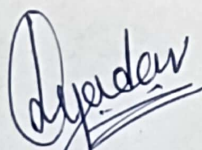
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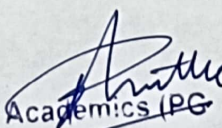
	<p style="text-align: center;">Tulsiramji Gaikwad-Patil College of Engineering and Technology Wardha Road, Nagpur-441108 NAAC Accredited (A+ Grade) An Autonomous Institute affiliated to RTMNU Nagpur</p>			
First Year (Semester-II) M.Tech. (CSE)				
Course Code: MCS21205 Professional Elective-III (Big Data Analytics)				
Teaching Scheme			Examination Scheme	
Lectures	4 Hrs/week		CT-1	20 Marks
Tutorial	-		CT-2	20 Marks
Total Credit	4		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.			

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)

Teaching Scheme		Examination Scheme	
Lectures	4 Hrs/week	CT-1	20 Marks
Tutorial	-	CT-2	20 Marks
Total Credit	4	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 Madiseti.
2	"Internet of Things: Architecture and Design Principles" by Raj Kamal
3.	"Building the Internet of Things" by Maciej Kranz

Reference Books

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.

Useful Links




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		Examination Scheme	
Lectures	4 Hrs/week	CT-1	20 Marks
Tutorial	-	CT-2	20 Marks
Total Credit	4	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, technologies, 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 environments
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






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		Examination Scheme	
Lectures	4 Hrs/week	CT-1	20 Marks
Tutorial	-	CT-2	20 Marks
Total Credit	4	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		

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, 2 nd edition, O'Reilly Media, 2020
2	Pang-Ning Tan, Michael Steinbach, Anuj Karpatne, Vipin Kumar; Introduction to Data Mining, 2 nd 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


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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		Examination Scheme	
Lectures	4 Hrs /week	CT-1	20 Marks
Tutorial	-	CT-2	20 Marks
Total Credit	4	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

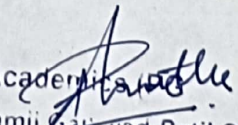
Unit I	Digital Forensics overview –Digital Forensics Science: Forensics science, computer forensics, and digital forensics. Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/ Employment Proceedings, Computer Forensics Services, Benefits of Professional Forensics 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.

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_1b06/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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