



Tulsiramji Gaikwad - Patil College of Engineering and Technology

Wardha Road, Nagpur-441108
NAAC Accredited with A+ Grade



(An Autonomous Institute Affiliated to RTM Nagpur University, Nagpur)

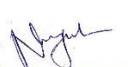



Scheme of Instructions for Third Year of B.Tech.(UG) Programme CSE - **Data Science**

Sixth Semester

Sr	Sem	Type	BoS / Dept	Sub Code	Subject	T/P	Contact Hours			Credits	% Weightage			ESE Duration	Total Marks
							L	P	Hrs		CT/IA	CA	ESE		
1	VI	PCC	DS	BDS33601	Software Engineering	T	2	0	2	2	14	6	30	2 Hrs	100
2		PCC	DS	BDS33602	Big Data Computing	T	3	0	3	3	30	10	60	3 Hrs	100
3		PCC	DS	BDS33603	Big Data Computing - Lab	P	0	2	2	1	25	-	25	2 Hrs	100
4		PCC	DS	BDS33604	Data Visualization Technique	T	3	0	3	3	30	10	60	3 Hrs	100
5		PCC	DS	BDS33605	Data Visualization Technique- Lab	P	0	2	2	1	25	-	25	2 Hrs	50
6		PEC	DS	BDS33606-09	Program Elective Course –II	T	4	0	4	4	30	10	60	3Hrs	50
7		PEC	DS	BDS33610-13	Program Elective Course – III	T	4	0	4	4	30	10	60	3 Hrs	50
8		MDM	ECE	BEC33612	Microprocessor and Microcontroller	T	2	0	2	2	14	6	30	2 Hrs	50
9		VSEC	DS	BDS33614	Data Analysis using R- Lab/ Power BI - Lab	P	0	4	4	2	50	-	50	2 Hrs	50
Total							18	8	26	22	248	52	400	22 Hrs	650

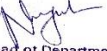



Course Category	BSC/ ESC (Basic Science Course/ Engineering Science Course.)	PCC/PEC (Program Core courses)	VSEC (Skill Course)	Multidisciplinary Courses		Humanities Social Science & Management				Experiential Learning Courses				CC (Co-Curricular Courses)
				MDM (Multidisciplinary minor)	OE(Open Elective)	AEC (Ability Enhancement Course)	IKS(Indian Knowledge System)	VEC(Value education Course)	Management Course	Research Methodology	CEP	Project	Internship /OJT	
Credits	-	10/08	02	02	-	-	-	-	-	-	-	-	-	-
Cumulative Sum	16 / 13	41/12	08	10	08	06	02	04	02	-	02	-	-	04

PROGRESSIVE TOTAL CREDITS: 106+22=128

 Head of Department CSE - Data Science Tulsiramji Gaikwad-Patil College of Engineering and Technology, Nagpur	 Dean Academics Tulsiramji Gaikwad-Patil College of Engineering and Technology, Nagpur	 Vice Principal (Academics) TGPCEET, NAGPUR	 Dr. Premanand Naktode Principal TGPCEET, Nagpur	Nov,2025	1.00	Applicable for A Y 2023-24 Onwards
Chairperson	Dean Academics	Vice Principal (Academics)	Principal	Date of Release	Version	

PEC List:-

Professional Elective Courses							
Sr. No	Domain wise Cluster		PEC-I	PEC-II	PEC-III	PEC-IV	PEC-V
	Semester		V	VI		VII	VIII
1	Domain-1	Course Code	BDS33506	BDS33606	BDS33610	BDS34702	BDS34803
		Network and Security	Cyber Law and Ethics	Cryptography	Computer Security	Cloud Security	Network Security Administration
2	Domain-2	Course Code	BDS33507	BDS33607	BDS33611	BDS34703	BDS34804
		AI ML	Artificial Intelligence	Machine Learning	Natural Language Processing	Neural Network	Deep Learning
3	Domain-3	Course Code	BDS33508	BDS33608	BDS33612	BDS34704	BDS34805
		IoT	TCP/IP	Mobile Computing	Ad-Hoc Sensor Networks	Internet of Things	Cloud Computing and IoT
4	Domain-4	Course Code	BDS33509	BDS33609	BDS33613	BDS34705	BDS34806
		Digital Healthcare	Introduction of Digital Healthcare	Medical Imaging Analysis with AI	Introduction to Internet of Medical Thing	Healthcare Data Management and Security	Mobile Health Applications

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Program: B.Tech Third Year (CSE- Data Science)

Semester		Course Code		Course Name	
VI		BDS33601		Software Engineering	
Teaching Scheme		Examination Scheme(Th)		Examination Scheme(P)	
Theory(Th)	2Hrs/Week	CT-I	7	-	-
Practical(P)	-	CT-II	7	-	-
Total Credits	02	CA	6	-	-
Duration of ESE: 3Hrs		ESE	30	-	-
		Total Marks	50	-	-

Course Outcomes: After the completion of this course, students will be able to-

CO1 **Understand** software engineering fundamentals and process models.

CO2 **Apply** requirements and design engineering with suitable modeling techniques.

CO3 **Explain** AI engineering concepts and SE principles for AI/ML systems.

Course Content

Unit I	Introduction to Software Engineering , Role of Software Engineer, software development phases, Process Models: Waterfall Model, RAD Model, Incremental model, Spiral Model, Agile Model.
Unit II	Requirements Engineering: Eliciting Requirements, Negotiating, Validating requirements, Requirements Analysis, Analysis Modeling Approaches, Scenario-Based Analysis, Object Oriented Analysis, Requirements Modeling strategies, Types of Modeling, Flow Oriented Modeling, and Class based modeling. Design Engineering: Design Engineering Concept, Effective modular design, Design models: Data and Architectural Design. User Interface Design: Rules, User Interface Analysis and Design.
Unit III	AI Engineering: Introduction to AI Engineering, AI systems vs. Traditional software systems, AI, ML/AI project lifecycle, Data-driven and model-driven development, Software Engineering Foundations for AI: Requirements engineering for AI systems, Functional vs. non-functional requirements, Architecture patterns for AI systems.

Text Books

1	Roger S. Pressman, "Software Engineering – A Practitioner's Approach", Seventh Edition, McGraw-Hill International Edition, 2010.
2	Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education Asia, 2011.

Reference Books



1	Moh'd A. Radaideh, "Software Project Management: With PMI, IEEE-CS, and Agile-SCRUM", De Gruyter, 2024
2	Roger S. Pressman, Bruce R. Maxim, "Software Engineering: A Practitioner's Approach", McGraw-Hill Education, 2020, 9th Edition

Useful Links

1	https://onlinecourses.nptel.ac.in/noc19_cs70/preview
2	https://archive.nptel.ac.in/courses/106/105/106105218/


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Program: B.Tech Third Year (CSE- Data Science)					
Semester		Course Code		Course Name	
VI		BDS33602		Big Data Computing	
Teaching Scheme		Examination Scheme(Th)		Examination Scheme(P)	
Theory(Th)	3	CT-I	15	-	-
Practical(P)	0	CT-II	15	-	-
Total Credits	3	CA	10	-	-
Duration of ESE: 3Hrs		ESE	60	-	-
		Total Marks	100	-	-
Course Outcomes: After the completion of this course, students will be able to-					
CO1	Understand Big Data fundamentals, characteristics, and applications.				
CO2	Explain Hadoop architecture and tools like Pig, Hive, and HBase.				
CO3	Analyze Big Data processing with Spark, Storm, and Flink.				
CO4	Classify NoSQL databases and apply Big Data storage formats.				
CO5	Use Big Data ingestion, analytics, and visualization tools.				
Course Content					
Unit I	Introduction to Big Data: Introduction to Big Data – Definitions and Evolution, 5Vs of Big Data (Volume, Variety, Velocity, Veracity, Value), Sources and Types of Big Data, Challenges in Big Data Management, Applications of Big Data in various domains (healthcare, retail, IoT, social media, etc.)				
Unit II	Hadoop Ecosystem and HDFS: Overview of Hadoop Architecture, Hadoop Distributed File System (HDFS), Introduction to MapReduce: Programming Model and Execution, Hadoop YARN Architecture, Hadoop Ecosystem Components: Pig, Hive, HBase				
Unit III	Advanced Big Data Processing Frameworks: Apache Spark: Introduction, Features, and Architecture, Spark RDDs, DataFrames, and Spark SQL, Transformations and Actions in Spark, Spark vs. MapReduce, Introduction to Real-time Processing with Apache Storm and Flink				
Unit IV	NoSQL Databases and Data Storage: Introduction to NoSQL and CAP Theorem, Types of NoSQL Databases: Key-Value Stores (Redis), Column-Oriented Stores (HBase, Cassandra), Document-Oriented Stores (MongoDB), Graph Databases (Neo4j), Data Serialization Formats: Avro, Parquet, JSON, ORC				
Unit V	Data Ingestion, Analytics, and Visualization: Data Ingestion Tools: Sqoop, Flume, Kafka, Data Analysis using Python or R on Big Data platforms, Introduction to Spark MLlib for Machine Learning, Visualization Tools: Tableau, Power BI, Case Studies on Real-world Big Data Applications				
Text Books					
1	Jure Leskovec, Anand Rajaraman, Jeff Ullman, “Mining of Massive Datasets”, Cambridge University Press, 3rd Edition, 2020				
2	Seema Acharya, Subhashini Chellappan, “Big Data and Analytics”, Wiley India Pvt. Ltd, 1st Edition, 2015				
Reference Books					
1	Tom White, “Hadoop: The Definitive Guide”, O’Reilly Media, 4th Edition				
2	Rajkumar Buyya, Rodrigo N. Calheiros, Amir Vahid Dastjerdi, “Big Data: Principles and Paradigms”, Morgan Kaufmann (Elsevier), 1st Edition				

Useful Links	
1	https://onlinecourses.nptel.ac.in/noc20_cs92/preview
2	https://archive.nptel.ac.in/courses/106/104/106104189/


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Program: B.Tech Third Year (CSE- Data Science)

Semester		Course Code		Course Name	
VI		BDS33603		Big Data Computing - lab	
Teaching Scheme		Examination Scheme(Th)		Examination Scheme(P)	
Theory(Th)	-	CT-I	-	-	
Practical(P)	2	CT-II	-	-	
Total Credits	1	CA	-	CA	25
Duration of ESE:		ESE	-	ESE	25
		Total Marks	-	Total Marks	50

Course Outcomes: After the completion of this course, students will be able to-

CO1	Install Apache Hadoop and its components.
CO2	Develop MapReduce programs for basic text and numeric processing.
CO3	Solve real-world problems using advanced MapReduce techniques.
CO4	Analyze structured data using MapReduce for actionable insights.
CO5	Perform large-scale log file analysis to extract user behavior metrics.

Pre-Requisites: Python

Sr.no	List of Experiments	COs												
1	Install Apache Hadoop	CO 1												
2	Develop a MapReduce program to calculate the frequency of a given word in agiven file.	CO 1												
3	Develop a MapReduce program to find the maximum temperature in each year.	CO 2												
4	Develop a MapReduce program to find the grades of student's.	CO 2												
5	Develop a MapReduce program to implement Matrix Multiplication	CO 3												
6	Develop a MapReduce to find the maximum electrical consumption in each year given electrical consumption for each month in each year.	CO 3												
7	Develop a MapReduce to analyze weather data set and print whether the day is shinny or cool day.	CO 4												
8	Develop a MapReduce program to find the number of products sold in each country by considering sales data containing fields like <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>Tranction Date</td> <td>Prod uct</td> <td>Pri ce</td> <td>Payment Type</td> <td>Na me</td> <td>Ci ty</td> <td>St ate</td> <td>Cou ntry</td> <td>Account_ Created</td> <td>Last_L ogin</td> <td>Latit ude</td> <td>Longi tude</td> </tr> </table>	Tranction Date	Prod uct	Pri ce	Payment Type	Na me	Ci ty	St ate	Cou ntry	Account_ Created	Last_L ogin	Latit ude	Longi tude	CO 4
Tranction Date	Prod uct	Pri ce	Payment Type	Na me	Ci ty	St ate	Cou ntry	Account_ Created	Last_L ogin	Latit ude	Longi tude			
9	Develop a MapReduce program to find the tags associated with each movie by analyzing movie lens data.	CO 5												
10	XYZ.com is an online music website where users listen to various tracks, the data gets collected which is given below. The data is coming in log files and looks like as shown below.	CO 5												

	UserId	TrackId	Shared	Radio	Skip
	111115	222	0	1	0
	111113	225	1	0	0
	111117	223	0	1	1
	111115	225	1	0	0

Write a MapReduce program to get the following

- Number of unique listeners
- Number of times the track was shared with others
- Number of times the track was listened to on the radio
- Number of times the track was listened to in total
- Number of times the track was skipped on the radio

Text Books

1	Jure Leskovec, Anand Rajaraman, Jeff Ullman, "Mining of Massive Datasets", Cambridge University Press, 3rd Edition, 2020
2	Seema Acharya, Subhashini Chellappan, "Big Data and Analytics", Wiley India Pvt. Ltd, 1st Edition, 2015

Reference Books



1	Tom White, "Hadoop: The Definitive Guide", O'Reilly Media, 4th Edition
2	Rajkumar Buyya, Rodrigo N. Calheiros, Amir Vahid Dastjerdi, "Big Data: Principles and Paradigms", Morgan Kaufmann (Elsevier), 1st Edition

Useful Links

1	https://onlinecourses.nptel.ac.in/noc20_cs92/preview
2	https://archive.nptel.ac.in/courses/106/104/106104189/


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Program: B.Tech Third Year (CSE- Data Science)

Semester		Course Code		Course Name	
VI		BDS33604		Data Visualization Technique	
Teaching Scheme		Examination Scheme(Th)		Examination Scheme(P)	
Theory(Th)	3HRS/week	CT-I	15	-	-
Practical(P)	-	CT-II	15	-	-
Total Credits	3	CA	10	-	-
Duration of ESE: 3Hrs		ESE	60	-	-
		Total Marks	100	-	-

Course Outcomes: After the completion of this course, students will be able to-

CO1	Understand principles of effective data visualization.
CO2	Design visualizations for complex, multivariate data.
CO3	Create interactive dashboards for dynamic data exploration.
CO4	Visualize geospatial data using maps and overlays to interpret location-based information.
CO5	Integrate statistical analysis into visual representations.

Course Content

Unit I	Introduction to Data Visualization: Introduction to data visualization, The importance of visual communication in data science., Principles of effective data visualization, Types of visualizations (e.g., bar charts, line graphs, pie charts, histograms), Hands-On Activity Creating simple visualizations in Excel.
Unit II	Understanding Data Types and Visualization Types: Types of data: Categorical vs. Numerical, Visualization choices based on data type, Introduction to color theory in data visualization.
Unit III	Advanced Visualization with Python: Customizing visualizations in Python. Advanced chart types: Heat maps, Pair plots, and Violin plots, Introduction to Plotly for interactive visualizations.
Unit IV	Exploratory Data Analysis (EDA): Principles of EDA, Visualizing distributions and relationships between variables, Visualizing missing data and outliers.
Unit V	Dashboard Design and Data Storytelling: Principles of dashboard design. data: visualizing trends, comparisons, and insights .Introduction to Tableau for interactive dashboards.

Text Books

1	Data Visualization: A Practical Introduction" by Kieran Healy
2	Interactive Data Visualization for the Web" by Scott Murray
3	"Data Visualization: A Practical Introduction" by Kieran Healy



Reference Books

1	Data Visualization: A Practical Introduction" by Kieran Healy
2	Storytelling with Data: A Data Visualization Guide for Business Professionals" by Cole Nussbaumer Knaflic.
3	The Visual Display of Quantitative Information" by Edward Tufte

4	Visualize This: The Flowing Data Guide to Design, Visualization, and Statistics" by Nathan Yau
Useful Links	
1	https://elearn.nptel.ac.in/shop/iit-workshops/completed/data-visualization-with-r/
2	https://onlinecourses.nptel.ac.in/noc25_bt43/preview
3	https://nptel.ac.in/courses/102105556
4	https://nptel.ac.in/courses/106107220
5	https://archive.nptel.ac.in/noc/courses/noc17/SEM2/noc17-mg24/


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Program: B.Tech Third Year (CSE- Data Science)				
Semester		Course Code		Course Name
VI		BDS33605		Data Visualization Technique - lab
Teaching Scheme		Examination Scheme(Th)		Examination Scheme(P)
Theory(Th)	-	CT-I	-	-
Practical(P)	2	CT-II	-	-
Total Credits	1	CA	-	CA 25
Duration of ESE:		ESE	-	ESE 25
		Total Marks	-	Total Marks 50
Course Outcomes: After the completion of this course, students will be able to-				
CO1	Understand various data visualization tools with a focus on Tableau's features and interface.			
CO2	Demonstrate the ability to connect, prepare, and manipulate data in Tableau			
CO3	Apply data transformation techniques for meaningful chart design visualizations.			
CO4	Create visually engaging dashboards with diverse chart types.			
CO5	Design storytelling dashboards using actions and layouts.			
Pre-Requisites: Python				
Sr.no	List of Experiments			COs
1	Introduction to various Data Visualization tools.			CO 1
2	Introduction to Tableau and Installation			CO 1
3	Demonstration on connecting to Data and preparing data for visualization in Tableau			CO 2
4	Demonstrate to creating a View - formatting charts, adding filters, creating calculated fields and defining parameters.			CO 2
5	Implementation of data Aggregation and Statistical functions in Tableau.			CO 3
6	Demonstration on data Visualizations in Tableau.			CO 3
7	Implementation of basic Dashboards in Tableau			CO 4
8	Demonstrate to display calculated fields in visualizations (e.g., Profit Ratio = Profit/Sales).			CO 4
9	Demonstrate to create a parameter to control the chart (e.g., select measure: Sales or Profit).			CO 5
10	Dashboard Design and Storytelling – Components of Dashboard, Understanding how to place worksheets in Containers, Action filters and its types.			CO 5
Text Books				
1	Practical Tableau: 100 Tips, Tutorials, and Strategies from a Tableau Zen Master, Ryan Sleeper, Oreilly Publications, 2018			
2	“Learning Tableau” by Joshua N. Milligan			
Reference Books				
1	Mamta Mittal, Abhishek Raheja, “Data Visualization and Storytelling with Tableau”, CRC Press, 2023			
Useful Links				
1	https://elearn.nptel.ac.in/shop/iit-workshops/completed/data-to-dashboard-mastering-visual-storytelling-with-tableau-batch-2/?v=c86ee0d9d7ed			

2	https://elearn.nptel.ac.in/shop/completed-courses/short-term-programs-completed/data-to-dashboard-mastering-visual-storytelling-with-tableau/?v=c86ee0d9d7ed
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Program: B.Tech Third Year (CSE- Data Science)

Semester		Course Code		Course Name	
VI		BDS33606		PEC – II (Cryptography)	
Teaching Scheme		Examination Scheme(Th)		Examination Scheme(P)	
Theory (Th)	4 Hrs./ Week	CT-I	15 Marks	-	-
Practical (P)	-	CT-II	15 Marks	-	-
Total Credits	4	CA	10 Marks	-	-
Duration of ESE: 3 Hrs		ESE	60 Marks	-	-
		Total Marks	100 Marks	-	-

Pre-Requisites: Basic understanding of computer networks and internet concepts.

Course Outcomes: After the completion of this course, students will be able to-

CO1	Explain the fundamentals of cryptographic algorithms and network security.
CO2	Analyze symmetric encryption algorithms and modern algorithms with modes of operation.
CO3	Apply public key cryptography algorithms such as RSA and Diffie-Hellman.
CO4	Implement hash functions and digital signatures.
CO5	Understand authentication protocols and key management techniques.

Course Content

Unit I	Introduction to Cryptography: Security goals (confidentiality, integrity, availability, etc.), Attacks: passive and active, Security services and mechanisms, Introduction to cryptography, Substitution and transposition techniques
Unit II	Symmetric Key Cryptography: Block ciphers and the Data Encryption Standard (DES), Advanced Encryption Standard (AES), Modes of operation (ECB, CBC, CFB, OFB, CTR), Modern symmetric algorithms (e.g., Blowfish, RC4)
Unit III	Asymmetric Key Cryptography: Principles of public key cryptosystems, RSA algorithm, Key distribution and management, Diffie-Hellman key exchange, ElGamal cryptosystem
Unit IV	Cryptographic Hash Functions and Digital Signatures: Hash functions: SHA-1, SHA-2, MD5, Message Authentication Codes (MAC), Digital signatures and authentication protocols, Digital Signature Standard (DSS)
Unit V	Network Security Applications: Authentication applications (Kerberos), IP security (IPSec), Secure Socket Layer (SSL) and Transport Layer Security (TLS), Email security (PGP, S/MIME), Firewalls and intrusion detection systems (IDS)

Text Books

1	William Stallings, Cryptography and Network Security: Principles and Practice
2	Behrouz A. Forouzan, Cryptography and Network Security

Reference Books



1	Charlie Kaufman, Network Security: Private Communication in a Public World
2	Atul Kahate, Cryptography and Network Security

Useful Links

1	https://onlinecourses.nptel.ac.in/noc22_cs90/preview
2	https://archive.nptel.ac.in/courses/106/105/106105162/


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Program: B.Tech Third Year (CSE- Data Science)				
Semester		Course Code		Course Name
VI		BDS33607		PEC – II (Machine Learning)
Teaching Scheme		Examination Scheme(Th)		Examination Scheme(P)
Theory(Th)	4	CT-I	15	-
Practical(P)	0	CT-II	15	-
Total Credits	4	CA	10	CA
Duration of ESE: 3Hrs		ESE	60	ESE
		Total Marks	100	Total Marks
				25 Marks
				25 Marks
				50 Marks
Pre-Requisites:				
Course Outcomes: After the completion of this course, students will be able to-				
CO1	Apply regression and decision trees across ML paradigms.			
CO2	Use PCA, LDA, and factor analysis for dimensionality reduction.			
CO3	Evaluate classifiers like Naïve Bayes and SVM with tuning.			
CO4	Analyze clustering methods for unsupervised learning.			
CO5	Apply association rules and recommendation techniques.			
Course Content				
Unit I	Introduction: ML Techniques and overview, Learn from data evaluation: Data Mining vs. Data Analysis Vs. Data Science, Types of Machine Learning: supervised, Unsupervised, Semi supervised and Reinforcement Learning, Types of supervised learning: Regression – Linear regression, design Linear regression model, Logistic Regression, design Logistic Regression model, Decision Tree Learning, design Decision Tree Learning model, Random Forest, design Random Forest model			
Unit II	Dimensionality Reduction: Feature selection, Feature extraction, Factor analysis, Regression vs Factor Analysis, Multicollinearity, PCA, Eigen vector, Eigen value, LDA, Maximum separable lines, Design PCA model			
Unit III	Supervised Learning: Naïve Bayes Classifier, Likelihood, Confusion Matrix, Evaluation Matrices – Accuracy, Precision, Recall, F1-Score, Specificity, Implementation of Navie Bayes, SVM, Hyperplane, Margin, Hyper parameter Optimization, Hyper parameter search and model building			
Unit IV	Unsupervised Learning: Cluster Analysis, classification of clustering, K-means Clustering, Euclidean Distance, centroid, implement k-means clustering, Fuzzy C-means Clustering, Hierarchical Clustering, dendrogram, implement hierarchical clustering			
Unit V	Association Rules: Association Rules Parameters, Association Rule Mining, Apriori Algorithm, Market Basket Analysis, implement Market Basket Analysis, Recommendation Engine, types of Recommendation Engine, User Based Collaborative Filtering, Content Based Filtering, implement Market Basket Analysis			
Text Books				
1	Tom M Mitchell, Machine Learning, McGraw – Hill Education (India) Private Limited, 2013.			
2	Machine Learning: An Algorithmic Perspective, CRC Press, 2009, by Stephen Marsland			
3	Chris Bishop, Pattern Recognition and Machine Learning			

4	Dr. Nilesh Shelke, Dr. Gopal Sakarkar, Dr N V Choudhari, Introduction to Machine Learning, GanuPrakashan
Reference Books	
1	Ethem Adpaydin, Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004
2	Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms, Worked Examples, and Case Studies by John D. Kelleher, Brian Mac Namee, and Aoife D'Arcy
3	Machine Learning for Beginners, by Chris Sebastian, Kindle Edition
Useful Links	
1	https://nptel.ac.in/courses/106106139
2	https://onlinecourses.nptel.ac.in/noc23_cs18/preview


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Program: B.Tech Third Year (CSE- Data Science)

Semester		Course Code		Course Name	
VI		BDS33608		PEC – II (Mobile Computing)	
Teaching Scheme		Examination Scheme(Th)		Examination Scheme(P)	
Theory (Th)	4 Hrs./ Week	CT-I	15 Marks	-	-
Practical (P)	-	CT-II	15 Marks	-	-
Total Credits	4	CA	10 Marks	-	-
Duration of ESE: 3 Hrs		ESE	60 Marks	-	-
		Total Marks	100 Marks	-	-

Pre-Requisites: Basic understanding of computer networks and internet concepts.

Course Outcomes: After the completion of this course, students will be able to-

CO1	Understand mobile computing concepts, applications, and platforms.
CO2	Explain wireless communication and mobile network standards.
CO3	Analyze mobile IP and routing in MANETs.
CO4	Evaluate transport protocols for mobile environments.
CO5	Develop basic mobile apps using Android and iOS features.

Course Content

Unit I	Introduction to Mobile Computing: Overview of Mobile Computing: Definition and scope, Applications and benefits, Evolution of mobile computing, Mobile Devices and Systems: Types of mobile devices, Mobile operating systems (Android, iOS), Mobile application development platforms
Unit II	Mobile Communication and Networks: Wireless Communication Fundamentals: Radio wave propagation, Modulation techniques, Multiple access techniques (FDMA, TDMA, CDMA, OFDMA) Cellular Networks: Architecture of cellular systems GSM, GPRS, UMTS, LTE, and 5G, Handoff and roaming
Unit III	Mobile Network Layer: Mobile IP: Mobile IP protocol, Agent discovery, registration, and tunneling, Route optimization, Mobile Ad-hoc Networks (MANETs): Characteristics and challenges, Routing protocols (DSDV, AODV, DSR), Applications of MANETs
Unit IV	Mobile Transport Layer Transport Protocols for Mobile Computing: Traditional TCP and its limitations in mobile environments, TCP enhancements for wireless networks (e.g., Indirect TCP, Mobile TCP), Overview of other transport protocols (UDP, SCTP)
Unit V	Overview of Mobile Application Development, User Interface Design: Principles of mobile UI/UX design, Responsive design and adaptation for different screen sizes, Mobile Application Programming: Basics of Android and iOS development, Using APIs and web services, Accessing device features (GPS, camera, sensors)



Text Books

1	"Mobile Computing: Principles, Devices, and Systems" by Asoke K. Talukder, Roopa R. Yavagal, and Hasan Ahmed
2	"Fundamentals of Mobile and Pervasive Computing" by Frank Adelstein, Sandeep K. S. Gupta, Golden G. Richard III, and Loren Schwiebert
3	"Mobile Computing" by Asoke K. Talukder, Hasan Ahmed, and Roopa R. Yavagal

Reference Books	
1	"Mobile Computing Handbook" edited by Mohammad Ilyas and Imad Mahgoub
2	"Handbook of Wireless Networks and Mobile Computing" edited by Ivan Stojmenovic
3	"Mobile Computing: Technology, Applications, and Service Creation" by Asoke K. Talukder and Manish Chaitanya
4	"Mobile Computing and Wireless Networks: Concepts, Methodologies, Tools, and Applications" edited by Information Resources Management Association
Useful Links	
1	https://archive.nptel.ac.in/courses/106/106/106106147/
2	https://archive.nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs13/


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Program: B.Tech Third Year (CSE- Data Science)

Semester		Course Code		Course Name	
VI		BDS33609		PEC-II (Medical Imaging Analysis with AI)	
Teaching Scheme		Examination Scheme(Th)		Examination Scheme(P)	
Theory(Th)	4Hrs/Week	CT-I	15	-	-
Practical(P)	-	CT-II	15	-	-
Total Credits		CA	10	-	-
Duration of ESE: 3Hrs		ESE	60	-	-
		Total Marks	100	-	-

Course Outcomes: After the completion of this course, students will be able to-

CO1	Understand the concepts of medical imaging modalities and their applications in healthcare.
CO2	Apply image pre-processing and enhancement techniques to improve the quality of medical images.
CO3	Implement CNNs, GANs, and Transformers for medical image analysis.
CO4	Apply AI techniques for medical image classification and anomaly detection.
CO5	Evaluation of case studies and real-world applications of AI in medical image processing.

Course Content

Unit I	Fundamentals of Medical Imaging: Overview of medical imaging modalities (X-ray, MRI, CT, etc.), Image acquisition techniques and parameters, Characteristics of medical image data
Unit II	Image Preprocessing and Enhancement : Noise reduction and image denoising techniques, Contrast, enhancement and histogram equalization, Image normalization techniques, Image registration techniques
Unit III	AI Techniques for Medical Image Analysis: Introduction to convolutional neural networks (CNNs), Image segmentation using CNNs and other techniques, Feature extraction and representation learning, Medical Image Generation
Unit IV	Medical Image Classification and Anomaly Detection: Binary and multiclass classification of medical images using Transformer, Detection of abnormalities and lesions, Case studies on AI applications in medical imaging analysis
Unit V	AI in Clinical Imaging Practice – Case Studies and Applications: Case study: AI in radiology – automated tumor detection (e.g., lung, brain, breast cancer), AI for retinal disease diagnosis (e.g., diabetic retinopathy using fundus images), Role of AI in COVID-19 chest X-ray/CT scan analysis, Generative models (e.g., GANs) for data augmentation in rare disease diagnosis, Transformer-based approaches for organ segmentation and 3D reconstruction, Ethical and performance evaluation of AI models on real clinical datasets, Deployment of AI tools in hospitals: workflow integration and user feedback

Text Books

1	S. Kevin Zhou. Deep Learning for Medical Image Analysis. Cham: Springer International Publishing, 2017
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Reference Books

1	Atam P. Dhawan. Medical Image Analysis. Hoboken, NJ: Wiley-IEEE Press, 2003.
2	Jacob Beutel, Harold L. Kundel, and Richard L. Van Metter, eds. Handbook of Medical Imaging, Volume 1: Physics and Psychophysics. Bellingham, WA: SPIE Press, 2000.

Useful Links



1	https://onlinecourses.nptel.ac.in/noc22_bt34/preview
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Program: B.Tech Third Year (CSE- Data Science)					
Semester		Course Code		Course Name	
VI		BDS33610		PEC – III (Computer Security)	
Teaching Scheme		Examination Scheme(Th)		Examination Scheme(P)	
Theory (Th)	4 Hrs./ Week	CT-I	15 Marks	-	-
Practical (P)	-	CT-II	15 Marks	-	-
Total Credits	4	CA	10 Marks	-	-
Duration of ESE: 3 Hrs		ESE	60 Marks	-	-
		Total Marks	100 Marks	-	-
Pre-Requisites: Basic understanding of computer networks and internet concepts.					
Course Outcomes: After the completion of this course, students will be able to-					
CO1	Understand information security needs and OSI security architecture.				
CO2	Analyze of various cryptography algorithms, key management.				
CO3	Describe message authentication, hash functions, and PKI.				
CO4	Analyze network security protocols, firewalls, IDS/IPS, and classical cryptography.				
CO5	Adapting software vulnerability, Electronic Payment, Electronic Mail Security				
Course Content					
Unit I	Need of Information Security: Introduction, History of Information security, Attributes of security- authentication, access control, confidentiality, authorization, integrity, non-reproduction. OSI Security Architecture: attacks, services and mechanisms. Security Attacks, Security services, A model of Internetwork Security. Conventional Encryption: Classical Encryption Techniques and Problems on classical ciphers, Security architecture.				
Unit II	Introduction to Secret key and cryptography: Encrypt given messages using DES, AES, IDEA, Problems on cryptography algorithms, Principles, finite fields, stream cipher, block cipher modes of operation, DES, Triple DES, AES, IDEA, RC5, key distribution. Introduction to Public key and Cryptography: Encrypt given messages using ECC, Problems on key generation, cryptography algorithms Principles, Introduction to number theory, RSA-algorithm, security of RSA, Key management- Diffie-Hellman key exchange, man-in-the-middle attack, Elliptical curve cryptography				
Unit III	Message Authentication and Hash Functions: Authentication Requirements and Functions, Hash Functions and their Security, MD5 Message Digest Algorithm, Kerberos. Key Management: Digital Certificates-Certificate types, X.509 Digital Certificate format, Digital Certificate in action, Certificate Authentication.				
Unit IV	Introduction to Network Security: Network, Transport and Periphery Security, Study of IPSEC, TLS, and SSL. Firewalls - design principles, trusted systems, Intrusion Detection System, Intrusion Prevention System. Implementation and analysis of IPSEC, TLS and SSL, Introduction to cryptography - Classical cryptography.				
Unit V	Software Vulnerability: Phishing, Buffer Overflow, Cross-site Scripting (XSS), SQL Injection. Electronic Payment: Payment Types, Enabling Technologies-Smart Cards and Smart Phones, Cardholder Present E-Transaction-Attacks, Chip Card Transactions, Payment over Internet-Issues and Concerns, Secure Electronic Transaction, Online Rail Ticket Booking. Electronic Mail Security: Pretty Good Privacy, S/MIME.				
Text Books					

1	Cryptography and network security - principles and practices, William Stallings, Pearson Education, 2002.
2	Network Security and Cryptography, Bernard Menezes, Cengage Learning.
Reference Books	
1	Information System Security, Nina Godbole, Wiley India, 2008.
2	Network security, private communication in a public world, Charlie Kaufman, Radia Perlman and Mike Speciner, Prentice Hall, 2002.
Useful Links	
1	https://nptel.ac.in/courses/108/104/108104139/
2	http://nptel.ac.in/courses/117107095


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Program: B.Tech Third Year (CSE- Data Science)

Semester		Course Code		Course Name	
VI		BDS33611		PEC-III (Natural language Processing)	
Teaching Scheme		Examination Scheme(Th)		Examination Scheme(P)	
Theory(Th)	4Hrs/Week	CT-I	15	-	-
Practical(P)	0	CT-II	15	-	-
Total Credits	4	CA	10	-	-
Duration of ESE: 3Hrs		ESE	60	-	-
		Total Marks	100	-	-

Pre-Requisites:

Course Outcomes: After the completion of this course, students will be able to-

CO1	Understand morphology, regex, and apply finite-state automata in NLP.
CO2	Apply n-gram models and POS tagging for syntactic analysis.
CO3	Analyze syntax using context-free grammars and parse trees.
CO4	Interpret semantics using predicate logic and word sense disambiguation.
CO5	Evaluate discourse, dialogue systems, and machine translation methods.

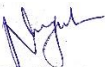
Course Content

Unit I	OVERVIEW AND MORPHOLOGY: Introduction – Models -and Algorithms, Regular Expressions, Basic Regular Expression Patterns, Finite State Automata Understand the wireless sensor network principles. Morphology, Inflectional Morphology, Derivational Morphology, Finite-State Morphological Parsing, Porter Stemmer.
Unit II	WORD LEVEL AND SYNTACTIC ANALYSIS: N-grams Models of Syntax ,Counting Words , L T P C 3 0 0 3 Unsmoothed N-grams .Smoothing- Back-off Deleted Interpolation ,Entropy - English Word Classes - Tag sets for English Part of Speech Tagging, Rule Based Part of Speech Tagging ,Stochastic Part of Speech Tagging, Transformation, Based Tagging.
Unit III	CONTEXT FREE GRAMMARS: Context Free Grammars for English Syntax- Context, Free Rules and Trees, -Understand the network simulation tools. Sentence, Level Constructions– Agreement, Sub Categorization .Parsing, Top-down – Early Parsing, feature Structures, Probabilistic Context-Free Grammars.
Unit IV	SEMANTIC ANALYSIS: Representing Meaning, Meaning Structure of Language-First Order Predicate Calculus Representing Linguistically Relevant Concepts, Syntax-Driven Semantic Analysis, Semantic Attachments, and Syntax-Driven Analyzer. Robust Analysis, Lexemes and Their Senses, Internal Structure - Word Sense Disambiguation, Information Retrieval.
Unit V	LANGUAGE GENERATION AND DISCOURSE ANALYSIS: Discourse, Reference Resolution, Text Coherence, Discourse Structure, Coherence. Dialog and Conversational Agents, Dialog Acts, Interpretation -Conversational Agents. Language Generation, Architecture-Surface Realizations ,Discourse Planning .Machine Translation, Transfer Metaphor, Interlingua – Statistical Approaches.

Text Books

1	Daniel Jurafsky and James H Martin, "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", Prentice
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	Hall, 2nd Edition, 2008.
2	C. Manning and H. Schutze, “Foundations of Statistical Natural Language Processing”, MIT Press. Cambridge, MA:,1999.
Reference Books	
1	C. Manning and H. Schutze, “Foundations of Statistical Natural Language Processing”, MIT Press. Cambridge, MA:,1999.
2	Bharati A., Sangal R., Chaitanya V.. Natural language processing: a Paninian perspective, PHI, 2000.
Useful Links	
1	https://nptel.ac.in/courses/106105158
2	https://archive.nptel.ac.in/courses/106/106/106106211/


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Program: B.Tech Third Year (CSE- Data Science)

Semester		Course Code		Course Name	
VI		BDS33612		PEC-III (Ad-Hoc Sensor Networks)	
Teaching Scheme		Examination Scheme(Th)		Examination Scheme(P)	
Theory(Th)	4Hrs/Week	CT-I	15	-	-
Practical(P)	0	CT-II	15	-	-
Total Credits	4	CA	10	-	-
Duration of ESE: 3Hrs		ESE	60	-	-
		Total Marks	100	-	-

Pre-Requisites:

Course Outcomes: After the completion of this course, students will be able to-

CO1	Understand Ad-hoc network fundamentals and MAC protocol design.
CO2	Analyze routing protocols and power-aware strategies.
CO3	Examine multicast routing architectures and approaches.
CO4	Evaluate transport protocols and security in Ad-hoc networks.
CO5	Assess QoS and energy-efficient techniques at MAC and network layers.



Course Content

Unit I	Ad-hoc Wireless Networks Introduction, Issues in Ad-hoc Wireless Networks, Ad-hoc Wireless Internet, MAC protocols for Ad-hoc Wireless Networks, Issues in designing a MAC protocol, Design goals of MAC Protocols, Classification of MAC Protocols, Contention-Based Protocols, Contention-Based Protocols with Reservation Mechanisms, Contention -Based protocols With Scheduling Mechanisms, MAC Protocols that use directional Antennas.
Unit II	Routing Protocols for Ad-hoc Wireless Networks Introduction, Issues in designing a Routing Protocol for Ad-hoc Wireless Networks, Classification of Routing Protocols, Table Driven Routing Protocols, On-Demand Routing Protocols, Hybrid Routing Protocols, Hierarchical Routing Protocols and Power - Aware Routing Protocols.
Unit III	Multicast Routing in Ad-hoc Wireless Networks Introduction, Issues in Designing a Multicast routing Protocol, Operation of Multicast Routing Protocols Architecture Reference Model for Multicast Routing protocols, Classification of Multicast Routing Protocols, Tree based Multicast Routing Protocols and Mesh-Based Multicast Routing Protocols.
Unit IV	Transport Layer and Security Protocols for Ad-hoc Networks Introduction, Issues in Designing a Transport Layer Protocol, Design Goals of Transport Layer Protocol, Classification of Transport Layer Solution, TCP over Transport Layer Solutions, Other Transport Layer Protocols for Ad-hoc Networks, Security in Ad-hoc Wireless Networks, Issues and Challenges in security provisioning, Network Security attacks, Key Management and Secure Touting Ad-hoc Wireless Networks.
Unit V	Quality of Service and Energy Management in Ad-hoc Wireless Networks Introduction, Issues and Challenges In Providing Quality of Service in Ad-hoc Wireless Networks, Classification of QOS Solutions, MAC Layer Solutions, Network Layer Solutions, Energy Management in Ad-hoc Wireless Networks Introduction, Need for Energy Management in Ad-hoc Wireless Networks, Classification of Energy Management Schemes, Battery

	management schemes, Transmission Management Schemes, System Power Management Schemes
Text Books	
1	Ramjee Prasad, Anand Raghawa Prasad, Alben Mihovska, Nidhi, “6G Enabling Technologies: New Dimensions to Wireless Communication, River Publishers
2	Prashant Ranjan, Ram Shringar Rao, Krishna Kumar, Pankaj Sharma, “Wireless Communication: Advancements and Challenges”, CRC Press
Reference Books	
1	Mohammed Usman, Mohd Wajid, Mohd Dilshad Ansari, “Enabling Technologies for Next Generation Wireless Communications”, CRC Press
2	Vandana Sharma, Balamurugan Balusamy, Gianluigi Ferrari, “Wireless Communication Technologies: Roles, Responsibilities, and Impact of IoT, 6G, and Blockchain Practices”, CRC Press
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc21_ee66/preview
2	https://archive.nptel.ac.in/courses/108/106/106106167/


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Program: B.Tech Third Year (CSE- Data Science)					
Semester		Course Code		Course Name	
VI		BDS33613		PEC–III (Introduction to Internet of Medical Things)	
Teaching Scheme		Examination Scheme(Th)		Examination Scheme(P)	
Theory(Th)	4Hrs/Week	CT-I	15	-	-
Practical(P)	-	CT-II	15	-	-
Total Credits	04	CA	10	-	-
Duration of ESE: 3Hrs		ESE	60	-	-
		Total Marks	100	-	-
Pre-Requisites:					
Course Outcomes: After the completion of this course, students will be able to-					
CO1	Understand IoMT concepts, evolution, and healthcare impact.				
CO2	Evaluate wearable sensors and smart medical devices.				
CO3	Apply sensor and communication technologies to IoMT systems.				
CO4	Analyze IoMT in disease management and real-time monitoring.				
CO5	Design secure, scalable IoMT architectures with real-time analytics.				
Course Content					
Unit I	Introduction to Internet of Medical Things (IoMT): Definition and scope of IoMT, Evolution and current trends, Opportunities and challenges of IoMT adoption.				
Unit II	IoMT Devices and Applications : Wearable sensors and health trackers, Remote patient monitoring devices, Smart medical devices for home healthcare				
Unit III	Design and Implementation of IoMT Systems: Sensor technologies and data acquisition methods, Communication protocols for IoMT devices, Cloud-based platforms and analytics				
Unit IV	IoMT in Clinical Practice: IoMT applications in disease management, Real-time monitoring and intervention, Case studies on successful implementation				
Unit V	IoMT System Architecture and Development: Architecture of IoMT systems: sensing layer, network layer, data processing, and application layer, Communication protocols in IoMT (e.g., Bluetooth Low Energy, Zigbee, LoRaWAN, MQTT), Embedded system design for medical devices (e.g., microcontrollers, edge devices), IoMT data security and privacy: encryption, access control, HIPAA compliance, Cloud and edge computing integration for real-time analytics				
Text Books					
1	Sudip Misra and Subhadeep Sarkar. Internet of Things in Healthcare: Technologies, Applications, and Challenges. Boca Raton: CRC Press, 2017.				
Reference Books					
1	Eric Topol and Steven R. Steinhubl. Wearable Sensors in Healthcare. Cambridge, MA: Academic Press, 2019.				
2	Athanasios V. Vasilakos and Jun Peng, eds. The Internet of Things in Healthcare: Potentials and Challenges. Cham: Springer International Publishing, 2020.				

Useful Links	
1	https://onlinecourses.nptel.ac.in/noc22_cs53/preview
2	https://archive.nptel.ac.in/noc/courses/noc20/SEM2/noc20-cs66/


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Program: B.Tech Third Year (CSE- Data Science)

Semester		Course Code		Course Name	
VI		BEC33612		Microprocessor and Microcontroller	
Teaching Scheme		Examination Scheme(Th)		Examination Scheme(P)	
Theory(Th)	2	CT-I	7	-	-
Practical(P)	-	CT-II	7	-	-
Total Credits	2	CA	6	-	-
Duration of ESE: 2 Hrs		ESE	30	-	-
		Total Marks	50	-	-

Pre-Requisites:

Course Outcomes: After the completion of this course, students will be able to-

CO1	Explain the structure, organization, and instruction set of 8086 microprocessor.
CO2	Implement interfacing of 8086 microprocessor with input output devices by using program Peripheral devices.
CO3	Analyze the organizational structure & instruction set of microcontroller 8051.

Course Content

Unit I	8086 microprocessor, Pin diagram, Architecture, features and operating modes, Flag Register, memory organization & interfacing, Addressing modes, complete instruction set, Interrupt structure.
Unit II	I/O interfacing, Interfacing of peripherals like 8255 PPI, multiplexed 7-seg display & Matrix keyboard interface using 8255. Programmable Keyboard/Display controller 8279, Serial communication, Classification & transmission formats. USART 8251, Pins & block diagram, interfacing with 8086 & programming.
Unit III	Comparison of microprocessor & micro-controller, Introduction to 8051 microcontroller; Pin diagram, architecture, features & operation, Ports, memory organization, SFR's, Flags, Counters/Timers, Serial ports. Interfacing of external RAM & ROM with 8051. 8051, Interrupt structure, Instruction set of 8051; data transfer, logical, arithmetic & branching instructions, Addressing modes.

Text Books

1	M.A. Mazidi & J.G. Mazidi, the 8051 Micro-controller and Embedded system, 3rd Indian reprint, Pearson Education
2	Microprocessor 8086/8088 Family Programme Interfacing: Liu & Gibson.
3	Programming PIC Micro-controllers with XC8 by Authors: Subero, Armstrong.

Reference Books

1	Micro-controllers – Peatman, Mc Graw Hill.
2	Microprocessors & Microcomputers based system design by Md. Rafiquzzaman.
3	Introduction to Microprocessors for Engineers and Scientists, P. K. Ghosh, P. R. Sridhar, PHI Publication.



Useful Links

1	https://onlinecourses.nptel.ac.in/noc22_ee12/preview
2	https://nptel.ac.in/courses/108105102

3	https://nptel.ac.in/courses/108/105/108105159/
4	https://nptel.ac.in/courses/108/104/108104139/
5	https://nptel.ac.in/courses/117/106/117106108/


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Program: B.Tech Third Year (CSE- Data Science)					
Semester		Course Code		Course Name	
VI		BDS33614		Data Analysis using R- Lab	
Teaching Scheme		Examination Scheme(Th)		Examination Scheme(P)	
Theory(Th)	-	CT-I	-	-	
Practical(P)	4	CT-II	-	-	
Total Credits	2	CA	-	CA	50
Duration of ESE:		ESE	-	ESE	50
		Total Marks	-	Total Marks	100
Course Outcomes: After the completion of this course, students will be able to-					
CO1	Demonstrate configure of the R environment and essential packages for data analysis.				
CO2	Apply basic R programming concepts to solve problems.				
CO3	Work with R data structures and perform string operations.				
CO4	Import data and perform exploratory data analysis in R.				
CO5	Create visualizations such as bar charts and pie charts and perform basic statistical analysis using R.				
Sr.no	List of Experiments				COs
1	Download and install R-Programming environment and install basic packages using install. Packages () command in R.				CO 1
2	Learn al the basics of R-Programming (Data types, Variables, Operators etc.)				CO 1
3	Implement R-Loops with different examples				CO 2
4	Learn the basics of functions in R and implement with examples.				CO 2
5	Implement data frames in R. Write a program to join columns and rows in a data frame using c bind () and r bind () in R.				CO 3
6	Implement different String Manipulation functions in R.				CO 3
7	Implement different data structures in R(Vectors ,Lists ,Data Frames)				CO 4
8	Write a program to read acsv file and analyze the data in the file in R				CO 4
9	Create pie charts and bar charts using R.				CO 5
10	Create a data set and do statistical analysis on the data using R.				CO 5
Text Books					
1	Hadley Wickham, Mine Çetinkaya-Rundel, and Garrett Grolemund, “R for Data Science”, (2nd Edition)				
2	Jonathon Love and Michael J. Crawley, “Data Analysis Using R”				
Reference Books					
1	Jared P. Lander, R for Everyone: Advanced Analytics and Graphics, 2nd edition, Pearson Education, 2018.				
2	S. R. Mani Sekhar and T. V. Suresh Kumar, Programming with R, 1 st Edition, CENGAGE, 2017				
Useful Links					


1	https://nptel.ac.in/courses/111104147
2	https://onlinecourses.nptel.ac.in/noc22_ma34/preview


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Program: B.Tech Third Year (CSE- Data Science)					
Semester		Course Code		Course Name	
VI		BDS33614		Power BI - Lab	
Teaching Scheme		Examination Scheme(Th)		Examination Scheme(P)	
Theory(Th)	-	CT-I	-	-	
Practical(P)	4	CT-II	-	-	
Total Credits	2	CA	-	CA	50
Duration of ESE:		ESE	-	ESE	50
		Total Marks	-	Total Marks	100
Course Outcomes: After the completion of this course, students will be able to-					
CO1	Import and clean data from various sources like Excel and CSV using Power Query for effective data preparation.				
CO2	Develop a variety of visualizations and interactive dashboards to explore and present data insights.				
CO3	Apply DAX formulas to create calculated columns and time-based metrics for advanced data analysis.				
CO4	Build data models by establishing relationships between multiple tables to enable comprehensive analysis.				
CO5	Publish reports using Power BI Service, and enhance reports with custom visuals, themes, and interactivity.				
Sr.no	List of Experiments				COs
1	Load data from an Excel or CSV file and perform basic data cleaning in Power Query.				CO 1
2	Create common chart types to explore the data visually.				CO 1
3	Create an interactive sales dashboard.				CO 2
4	Use DAX to create time-based metrics.				CO 2
5	Build a data model from multiple related tables.				CO 3
6	Add advanced formatting to enhance report interactivity.				CO 3
7	Create complex DAX expressions.				CO 4
8	Enable detailed exploration of data.				CO 4
9	Import custom visuals and apply report themes.				CO 5
10	Publish reports to Power BI Service.				CO 5
Text Books					
1	Daniil Maslyuk, “Microsoft Power BI Data Analyst Certification Guide: PL-300 Exam Guide”, Packt Publishing				
2	Alberto Ferrari & Marco Russo, “Analyzing Data with Power BI and Power Pivot for Excel”, Microsoft Press				
Reference Books					
1	Alberto Ferrari & Marco Russo, “The Definitive Guide to DAX”, Microsoft Press				
2	Adam Aspin, “Pro Power BI Desktop”, Apress				
Useful Links					

1	https://elearn.nptel.ac.in/shop/completed-courses/partnering-closed/unleash-your-datas-potential-mastering-transformations-with-power-query-editor/?v=c86ee0d9d7ed
2	https://nielit.gov.in/calicut/content/powerbi


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