TULSIRAMJI GAIKWAD-PATIL
College of Engineering & Technology

Mohgaon, Wardha Road, Nagpur - 441 108

DEPARTMENT OF CSE-DATA SCIENCE

Structure & Curriculum

From

Academic Year 2023-24

Vision of Institute

To emerge as a learning Center of Excellence in the National Ethos in domains of Science, Technology and Management.

Mission of Institute

[M1]. To strive for rearing standard and stature of the students by practicing high standards of professional ethics, transparency and accountability.

[M2]. To provide facilities and services to meet the challenges of Industry and Society.

[M3]. To facilitate socially responsive research, innovation and entrepreneurship.

[M4]. To ascertain holistic development of the students and staff members by inculcating knowledge and profession as work practices.

Vision of the Department

To achieve excellent standards of quality-education by creating Data Science Engineers who are empowered with latest tools and technologies to provide customer oriented innovations to industry towards serving the greater cause of society.

Mission of the Department

[M1]. To develop professionals who are skilled in the area of Data Science
[M2]. To undertake industry academic collaboration to enhance competency in graduates.
[M3]. To foster innovative ideas amongst students for becoming leaders.
[M4]. To create an environment of research culture.
[M5]. To impart social and ethical values for inculcating the culture of lifelong learning.

Program Education Objectives (PEO)

- Acquire fundamental knowledge of mathematics, science and engineering to analyze, design and implement solutions to the Data Science problems
- Understand emerging concepts and trends in Data Science.
- Apply Data Science tools to develop innovative computational systems.
- The students are encouraged to develop the habit of lifelong learning to face the challenges.
- The students will be embedded as a responsible individual having ethical and social values to lead the society and to nurture team spirit.

Program Outcomes (PO)

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and software tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Lifelong learning:** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

Program Specific Outcomes (PSO)

PSO-1: Visualize, curate, and prepare data for use with a variety of statistical/AI methods and models and recognize how the quality of the data and the means of data collection may affect conclusions.

PSO-2: Ability to use modern software packages and scalable computing infrastructure to formulate problems, identify and gather relevant existing data, and analyze the data to provide insights

PSO-3: Utilize contemporary computing technologies, such as machine learning, AI, parallel and distributed computing, to solve practical problems characterized by large-scale data

Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur

SCHEME OF INSTRUCTION & SYLLABI

Programme: Data Science

Scheme of Instructions: Third Year B.Tech.in Data Science

Semester – V

Sr. No.	Course Category	CourseCode	Course Title	L	T	P	Contact Hrs./Wk	Credits	EXAM SCHEME				
									CT1	CT2	TA/CA	ESE	TOTAL
1	PCC	BDS3501	Software Engineering & Project Management	3	-	-	3	3	15	15	10	60	100
2	PCC	BDS3502	Software Engineering & Project Management Lab	-	-	2	2	1	-	-	25	25	50
3	PCC	BDS3503	Design & Analysis of Algorithms	3	-	-	3	3	15	15	10	60	100
4	PCC	BDS3504	Data Analytics	3	-	-	3	3	15	15	10	60	100
5	PCC	BDS3505	Data Analytics - Lab	-	-	2	2	1	-	-	25	25	50
6	PCC	BDS3506	Object Oriented programming with Java	-	-	2	2	1			25	25	50
7	PEC	BDS3507-10*	Program Elective-I	3	-	-	3	3	15	15	10	60	100
8	PEC	BDS3511-14*	Program Elective-II	3	-	-	3	3	15	15	10	60	100
9	OEC	BSSXX01-19#	Open Elective-I	4	-	-	4	4	15	15	10	60	100
10	MCC	BAU3505	Heritage	2	-	-	2	Audit	-	-	-	-	-
			Total	**21**	**-**	**6**	**27**	**22**	**90**	**90**	**135**	**435**	**750**

L- Lecture T-Tutorial P-Practical CT1- Class Test 1 CT2- Class Test 2 TA/CA- Teacher Assessment/Continuous Assessment

ESE- End Semester Examination (For Laboratory End Semester performance)

*** Indicates out of the four course codes each student has to select any one PEC from the list provided at the end of structure.**

 # Indicates out of the 19 course codes each student has to select any one OEC except BDSXX17, BDSXX18 & BDSXX19 from the list provided at the end of structure.

Course Category	HSMC (Hum., Soc. Sc, Mgmt.)	BSC (Basic Sc.)	ESC (Engg. Sc.)	PCC (Programme Core courses)	PEC (Programme Elective courses)	OEC (Open Elective courses from other discipline)	Project / Seminar / Industrial Training	MCC (Mandatory Courses)
Credits	--	--	-	12	06	04	-	Yes
Cumulative Sum	9	25	23	33	06	04	01	--

PROGRESSIVE TOTAL CREDITS :79+22 =101

Head of Department
CSE - Data Science
Tulsiramji Gaikwad-Patil College of Engineering and Technology, Nagpur

Dean Academics
Dean Academics
Tulsiramji Gaikwad-Patil College Of Engineering and Technology, Nagpur

Dr. Pragati Patil
Vice-Principal
Tulsiramji Gaikwad Patil College of Engineering & Technology, Nagpur

Principal
Principal
Tulsiramji Gaikwad Patil College Of Engineering and Technology, Nagpur

List of Electives offered by Department of Data Science

Professional Elective Courses								
Sr. No	Domain wise Cluster		PEC-I	PEC-II	PEC-III	PEC-IV	PEC-V	PEC-VI
			Semester-V		Semester-VI		Semester-VI	
1	Domain -1	Course Code	**BDS3507**	**BDS3511**	**BDS3606**	**BDS3610**	**BDS4706**	**BDS4710**
		Data visualization and system Design	Computer Graphics	Digital Image Processing	Computer Vision	Design patterns	Compiler Design	Data Warehousing & ETL
2	Domain -2	Course Code	**BDS3508**	**BDS3512**	**BDS3607**	**BDS3611**	**BDS4707**	**BDS4711**
		Network Security	Wireless Security	Ethical hacking	Security in Wireless Ad Hoc Networks	Cyber Law in India	Block chain Security	Business Intelligence
3	Domain -3	Course Code	**BDS3509**	**BDS3513**	**BDS3608**	**BDS3612**	**BDS4708**	**BDS4712**
		Neural Network and Computing techniques	Soft Computing	Mobile Computing	Convolution Neural network	Quantum Computing	Natural Language Processing	Artificial Neural Network
4	Domain -4	Course Code	**BDS3510**	**BDS3514**	**BDS3609**	**BDS3613**	**BDS4709**	**BDS4713**
		Programming Languages	Python for Data Science	Client Side Scripting-Java Script	Server Side Scripting-PHP	R Programming	No SQL	Data Mining

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

Program: Data Science

List of Open Electives Offered

Sr. No.	Name of Host Programme	Open Elective Course Code	Title of the Course
1.	Computer Science & Engineering	BCSXX01	Cyber Law and Ethics
2.	Computer Science & Engineering	BCSXX02	Blockchain Technology
3.	Information Technology	BITXX03	Cyber Security
4.	Information Technology	BITXX04	Artificial Intelligence
5.	Electronics and Communication Engineering	BECXX05	Internet of Things
6.	Electronics and Communication Engineering	BECXX06	Embedded Systems
7.	Civil Engineering	BCEXX07	Introduction to Art and Aesthetics
8.	Civil Engineering	BCEXX08	Metro Systems and Engineering
9.	Mechanical Engineering	BMEXX09	Nanotechnology and Surface Engineering
10.	Mechanical Engineering	BMEXX10	Automobile Engineering
11.	Electrical Engineering	BEEXX11	Power Plant Engineering
12.	Electrical Engineering	BEEXX12	Electrical Materials
13.	Aeronautical Engineering	BAEXX13	Avionics
14.	Aeronautical Engineering	BAEXX14	Unmanned Aerial Vehicles
15.	Biotechnology	BBTXX15	Biomaterials
16.	Biotechnology	BBTXX16	Food and Nutrition Technology
17	DATA SCIENCE	BDSXX17	Soft Computing Techniques
18	DATA SCIENCE	BDSXX18	Machine Leaning & Its Application
19	DATA SCIENCE	BDSXX19	Introduction of Data Science

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

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

Semester	Course Code	Name of Course
V	BDS3501	Software Engineering and Project Management

Teaching Scheme		Examination Scheme	
Lectures	3Hrs/week	CT-1	15 Marks
Tutorial	0	CT-2	15 Marks
Total Credit	3	TA	10 Marks
		ESE	60 Marks
		Total	100 Marks
		Duration of ESE: 03Hrs 00Min.	

Course Objective:

1	To understand general idea of software engineering
2	Design various software process models
3	Develop skills required for software testing
4	Understand project management, planning, scheduling, risk management and process metrics.

Course Contents

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.
Unit III	Design Engineering: Design Engineering Concept, Effective modular design, Design models: Data and Architectural Design. User Interface Design: Rules, User Interface Analysis and Design.
Unit IV	Software testing: Fundamentals, Internal and external views of Testing, white box testing, black box testing, Unit Testing, Integration Testing. Validation Testing, Debugging.
Unit V	Project Management, Metrics for Process and Projects, Project Estimation, Planning: Project Plan, Planning Process, Risk Management, Risk Identification, Risk Projection, RMMM, Scheduling and Tracking

Text Books

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

Reference Books

R.1	Rajib Mall, "Fundamentals of Software Engineering", Third Edition, PHI Learning Private Limited, 2009.
R.2	Object Oriented Software Engineering, 6th Edition by Leth Bridge, TATA McGraw Hil
R.3	Kelkar S.A., "Software Engineering", Prentice Hall of India Pvt Ltd, 2007.
R.4	Software Project Management: A Unified Framework (paperback) (The Addison-wesley ObjectTechnology)

Head of Department
CSE - Data Science
Tulsiramji Gaikwad-Patil College of Engineering and Technology, Nagpur

Dean Academics
Tulsiramji Gaikwad-Patil
College Of Engineering

Useful Links	
1	Best Online Resources for Software Engineering Students in 2023 - Forage (theforage.com)
2	Best Software Engineering Courses & Certificates Online [2024] | Coursera
3	Best Online Software Engineering Courses and Programs | edX
4	Top Free Software Engineering Courses & Tutorials Online - Updated [December 2023] (udemy.com)

Course Outcomes		CL	Class Session
After the completion of this course, students will be able to-			
BDS3501.1	Evaluate different process models.	5	9
BDS3501.2	Implement the Concepts of requirements engineering and Analysis Modeling.	3	9
BDS3501.3	Apply systematic procedure for software design.	3	9
BDS3501.4	Compare the various software testing techniques	4	9
BDS3501.5	Analyze basics of software project management, perform planning and estimate risk	4	9

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

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

Semester	Course Code	Name of Course
V	BDS3502	Software Engineering and Project Management Lab

Pre-Requisites: UML

Teaching Scheme		Examination Scheme	
Practical	2 Hrs/week	CA	25 Marks
Total Credit	1	ESE	25 Marks
		Total	50 Marks
		Duration of ESE: 02 Hrs 00 Min.	

Sr. No.	List of Experiment	COs
1	Introduction to UML.	CO2
2	Develop UML diagram-Building the Class and Object diagrams for the given project.	CO2
3	Develop UML diagram- Building the Use Case diagram for the given project.	CO2
4	Develop UML diagram- Building the Activity diagram for given project.	CO2
5	Develop UML diagram-Building the Class and Object diagrams for the given project.	CO2
6	Develop UML diagram-Building the Sequence diagrams for the given project.	CO3
7	Develop DFD model for the given project.	CO3
8	Software Testing-Implementation of testing approaches of white box testing	CO4
9	To study and create Software Requirement Specification document for given project.	CO5
10	Case study for risk management	CO5

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	Object-Oriented Software Engineering: A Use Case Driven Approach First Edition by Ivar Jacobson, Addison-Wesley; First Edition (January 1, 1992)
2	Systems Analysis and Design: An Object-Oriented Approach with UML 6th Edition by Alan Dennis, Barbara Wixom, David Tegarden, Wiley; 6th edition (November 17, 2020)

Useful Links

1	UML Class Diagram Tutorial (visual-paradigm.com)
2	UML Diagram Tutorial: A Complete Guide to UML Diagrams (softwaretestinghelp.com)

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

Course Outcomes		CL	Class Session
After the completion of this course, students will be able to-			
BDS3502.1	Evaluate different process models.	5	9
BDS3502.2	Implement the Concepts of requirements engineering and Analysis Modeling.	3	9
BDS3502.3	Apply systematic procedure for software design.	3	9
BDS3502.4	Compare the various software testing techniques	4	9
BDS3502.5	Analyze basics of software project management, perform planning and estimate risk	4	9

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

Tulsiramji Gaikwad-Patil College of Engineering and Technology Wardha Road, Nagpur-441108 NAAC Accredited (A+ Grade) An Autonomous Institute affiliated to RTMNU Nagpur		
Semester	**Course Code**	**Name of Course**
V	BDS3503	Design & Analysis of Algorithms

Teaching Scheme	
Lectures	3Hrs/week
Tutorial	0
Total Credit	3

Examination Scheme	
CT-1	15 Marks
CT-2	15 Marks
TA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE: 03Hrs 00Min.	

Course Pre-requisite: Data Structure and Algorithm

Course Objective:

1	Grasp basic algorithm design techniques such as divide-and-conquer, greedy algorithms, dynamic programming, backtracking, and branch-and-bound.
2	Learn to analyze the time and space complexity of algorithms using Big O, Big Omega, and Big Theta notations.
3	Practice solving problems using the learned techniques and analyzing their efficiency.
4	Study the design and analysis of approximation algorithms for problems that are hard to solve exactly.

Course Contents

Unit I	Introduction: Characteristics of Algorithm, Analysis of Algorithm: Asymptotic analysis of complexity bounds- Best, average and worst case behavior, Performance measurements of Algorithm, Time and space complexity of Algorithm. Analysis of recursive algorithm through recurrence relations: Substitution method, Recursion method and Masters' theorem. Principles of designing algorithms. Introduction Fundamental Algorithmic Strategies
Unit II	Divide and Conquer- basic strategy, Analysis of Quick Sort, Merge Sort- Quick Sort Randmised Version Strassen's matrix multiplication, Maximum array problem, Closest pair of points problem, Convex hull problem **Greedy method-** basic strategy, fractional knapsack problem, Minimum cost spanning trees, Huffman Coding, activity selection problem, Finding maximum sum possible equal to sum of three stacks, K Centers Problem.
Unit III	Dynamic Programming -basic strategy, Bellman ford algorithm, all pairs shortest path, Multistage graphs, optimal Binary search trees, traveling salesman problem, String Editing, Longest Common Subsequence problem, 0/1 Knapsack Problem, Chained Matrix Multiplication.
Unit IV	Backtracking: General Method, applications-n-queen problem, sum of subsets problem, graph coloring, Hamiltonian cycles. Branch and Bound: General method, applications – Traveling salesman problem,0/1 knapsack problem-LC branch and bound solution, FIFO Brach and Bound solution.
Unit V	NP-Hard and NP Complete problems: Basic concepts, Non Deterministic algorithms, NP-Hard and NP Complete classes, NP- Hard problems, Cook's Theorem

Text Books

T.1	Design & Analysis of Computer Algorithms by Aho, Pearson education. Horowitz, Sa Rajsekharam
T.2	Thomas H. Cormen et.al. "Introduction to Algorithms", Prentice Hall of India.
T.3	Horowitz and Sahani, Fundamentals of computer Algorithms, Galgotia, ISBN 81-2612-9.

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

Reference Books	
R.1	R. C. T. Lee, SS Tseng, R C Chang, YT Tsai, Introduction to Design and Analysis Algorithms, A Strategic approach, Tata McGraw Hill
R.2	Anany Levitin, Introduction to the Design & Analysis of Algorithm, Pearson, ISBN 7758-835-4.
R.3	Algorithm Design: Foundations, Analysis and Internet examples, M.T.Goodrich R.Tomassia, John Wiley and sons
Useful Links	
1	https://nptel.ac.in/courses/106/101/106101060/
2	https://nptel.ac.in/courses/106/106/106106131/

Course Outcomes		CL	Class Session
After the completion of this course, students will be able to-			
BDS3503.1	Analyze recurrence relations for algorithms by using mathematical formulation and complexity analysis.	4	9
BDS3503.2	Implement algorithms for fundamental problem-solving paradigms.	3	9
BDS3503.3	Analyze Dynamic programming Paradigms to solve problems.	4	9
BDS3503.4	Implement efficient solutions for computational challenges.	3	9
BDS3503.5	Execute solutions of NP class problems using algorithm.	3	9

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

Tulsiramji Gaikwad-Patil College of Engineering and Technology Wardha Road, Nagpur-441108 NAAC Accredited (A+ Grade) An Autonomous Institute affiliated to RTMNU Nagpur		
Semester	**Course Code**	**Name of Course**
V	BDS3504	Data Analytics

Teaching Scheme	
Lectures	3Hrs/week
Tutorial	0
Total Credit	3

Examination Scheme	
CT-1	15 Marks
CT-2	15 Marks
TA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE: 03Hrs 00Min.	

Course Objective:

1	To provide strong foundation for data analytics and application area related to it.
2	To understand the underlying core concepts and emerging technologies in data analytics.

Course Contents

Unit I	Introduction: Data Analytics: Definition and importance, Types of data analytics: Descriptive, Diagnostic, Predictive, Prescriptive, Data Analytics Process: Data collection, Data cleaning, Data exploration and visualization, Data modeling, Interpretation and communication of results, Applications of Data Analytics
Unit II	Data Collection and Data Preprocessing, Data Sources and Data Types, Structured vs. unstructured data, Internal and external data sources, Data Collection Methods, Surveys, sensors, web scraping, APIs, Data Preprocessing Techniques: Data cleaning (handling missing values, outliers) Data transformation (normalization, standardization) Data integration (merging datasets) Data reduction (dimensionality reduction, feature selection)
Unit III	Data Visualization: Types of visualizations: histograms, bar charts, scatter plots, box plots, heatmaps Tools for data visualization: Matplotlib, Seaborn, Tableau, Identifying Patterns and Relationships, Correlation analysis, Trend analysis
Unit IV	Data Modeling and Statistical Analysis, Fundamentals of Statistical Analysis: Hypothesis testing, Confidence intervals, Regression Analysis: Linear regression, Multiple regression Classification Techniques: Logistic regression, Decision trees, Support vector machine
Unit V	Advanced Analytics and Emerging Trends: Text Analytics and Natural Language Processing (NLP): Text preprocessing techniques, Sentiment analysis, Topic modeling, Ethical Considerations in Data Analytics: Data privacy and security, Ethical use of data, Bias and fairness in data analytics

Text Books

T.1	Dr Anil Maheshwari, Data Analytics Made Accessible, Publisher: Amazon.com Services LLC.
T.2	"An Introduction to Statistical Learning with Applications in R" by Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani

Reference Books

R.1	"Mining of Massive Datasets" by Jure Leskovec, Anand Rajaraman, and Jeffrey Ullman
R.2	"Data Mining and Analysis: Fundamental Concepts and Algorithms" by Mohammed J. Zaki and Wagner Meira Jr.

Useful Links

1	Data Analytics with Python: https://onlinecourses.nptel.ac.in/noc21_cs45/preview
2	https://iimskills.com/data-analytics-courses-at-nptel/

Head of Department
CSE - Data Science
Tulsiramji Gaikwad-Patil College of

Dean Academics
Tulsiramji Gaikwad-Patil
College Of Engineering
and Technology, Nagpur

Course Outcomes		CL	Class Session
After the completion of this course, students will be able to-			
BDS3504.1	Analyze the various types of data analytics along with applications.	4	9
BDS3504.2	Apply skills in handling Data Collection and Data Preprocessing	3	9
BDS3504.3	Prepare the various data visualization tools to present data insights.	6	9
BDS3504.4	Evaluate various predictive models using regression, classification, and clustering techniques.	5	9
BDS3504.5	Apply the advanced techniques to solve complex data analytics problems.	3	9

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

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

Semester	Course Code	Name of Course
V	BDS3505	Data Analytics Lab

Pre-Requisites: UML

Teaching Scheme		Examination Scheme	
Practical	2 Hrs/week	CA	25 Marks
Total Credit	1	ESE	25 Marks
		Total	50 Marks
		Duration of ESE: 02 Hrs 00 Min.	

Sr. No.	List of Experiment	COs
1	Install, configure and run Hadoop and HDFS	CO1
2	Implement word count / frequency programs using MapReduce.	CO1
3	Implement an MR program that processes a weather dataset	CO2
4	Implement Linear and logistic Regression	CO2
5	Implement SVM / Decision tree classification techniques	CO3
6	Implement Clustering Technique.	CO3
7	Visualize Data Using Plotting Framework.	CO4
8	Analysis of Social Media Data.	CO4
9	Implementation an Application That Store big Data In Hbse.	CO5
10	Split the dataset into training and test Dataset.	CO5

Text Books

T.1	Dr Anil Maheshwari, Data Analytics Made Accessible, Publisher: Amazon.com Services LLC.
T.2	"An Introduction to Statistical Learning with Applications in R" by Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani

Reference Books

R.1	"Mining of Massive Datasets" by Jure Leskovec, Anand Rajaraman, and Jeffrey Ullman
R.2	"Data Mining and Analysis: Fundamental Concepts and Algorithms" by Mohammed J. Zaki and Wagner Meira Jr.

Useful Links

1	Data Analytics with Python: https://onlinecourses.nptel.ac.in/noc21_cs45/preview
2	https://iimskills.com/data-analytics-courses-at-nptel/

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

Course Outcomes		CL	Class Session
After the completion of this course, students will be able to-			
BDS3505.1	Analyze the various types of data analytics along with applications.	4	9
BDS3505.2	Apply skills in handling Data Collection and Data Preprocessing	3	9
BDS3505.3	Prepare the various data visualization tools to present data insights.	6	9
BDS3505.4	Evaluate various predictive models using regression, classification, and clustering techniques.	5	9
BDS3505.5	Apply the advanced techniques to solve complex data analytics problems.	3	9

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

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

Semester	Course Code	Name of Course
V	BDS3506	Java Programming

Pre-Requisites: C/C++

Teaching Scheme	
Practical	2 Hrs/week
Total Credit	1

Examination Scheme	
CA	25 Marks
ESE	25 Marks
Total	50 Marks
Duration of ESE: 02 Hrs 00 Min.	

Sr. No.	List of Experiment	COs
1	Introduction to Java and java IDE	CO1
2	Write a java program to find whether the give number is Armstrong number or not.	CO1
3	Write a java program to find the Fibonacci series using recursive and non recursive functions	CO2
4	Write a java program to multiply two given matrices.	CO2
5	Write a java program to implement any five string methods	CO3
6	Write a java program to get and display the employee details using classes and object	CO3
7	Write a java program to implement Inheritance.	CO4
8	Write a java program to implement Interface using extends keyword.	CO4
9	Write a java program for creating multiple catch blocks.	CO5
10	Write a java program to implement user defined packages.	CO5

Text Books

T.1	"Effective Java", Joshua Bloch,Addison-Wesley Professional, 8 May 2008
T.2	Java: A Beginner's Guide, Sixth Edition, Herbert Schildt, McGraw Hill Professional, 6 May 2014

Reference Books

R.1	Java: The Complete Reference, Herbert Schildt, McGraw-Hill/Osborne, 2005
R.2	Java Concurrency in Practice, Brian Goetz, Addison-Wesley, 2006

Useful Links

1	https://onlinecourses.nptel.ac.in/noc24_cs105/preview
2	https://www.javatpoint.com/java-tutorial
3	https://www.udemy.com/course/java-tutorial/

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

Course Outcomes		CL	Class Session
After the completion of this course, students will be able to-			
BDS3506.1	Use Java compiler and Java IDE to write and execute java program.	2	9
BDS3506.2	Apply the concept of data types and control statements in java	3	9
BDS3506.3	Understand and use array and strings concepts in java	2	9
BDS3506.4	Understand and Apply Object oriented features and Java concepts	2	9
BDS3506.5	Implement exception handling and packages.	5	9

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

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

Semester	Course Code	Name of Course
V	BDS3507	Program Elective-I Computer Graphics

Teaching Scheme	
Lectures	3Hrs/week
Tutorial	0
Total Credit	3

Examination Scheme	
CT-1	15 Marks
CT-2	15 Marks
TA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE: 03Hrs 00Min.	

Course Objective:

1	Understand the basic principles and concepts of computer graphics.
2	Gain knowledge of the hardware used in computer graphics, including GPUs and display devices.

Course Contents

Unit I	Geometry and line generation: Points ,lines, Planes pixels and frame buffers, types of display devices and its architecture, DDA, Bresenham's algorithms for line generation, Bresenham's algorithms for Circle generation, aliasing, anti aliasing and its techniques.
Unit II	Display files, algorithms for polygon generation, polygon filing algorithm, NDC(Normalized Device Co-ordinates), 2D Transformation: Sclaing Rotation, Translation, rotation about arbitrary point, reflections, Shearing
Unit III	Review of 3D vector algebra- Parallel and perspective projections and transformation-Hidden line/surface Elimination-shading and rendering- ray tracing techniques, Hidden surface and line removal: painter's , Z buffer, Warnock's back-face removal Algorithm
Unit IV	Segment Tables: Operation on Segments, data structure for segments and display files, Windowing and clipping: window viewport, viewing transformations Line and polygon clipping
Unit V	Curve generation: cubic splines, Beziers, blending of curves-other interpolation Techniques, Displaying curves and Surfaces, Shape Description requirement, parametric function

Text Books

T.1	Computer Graphics, R. K. Maurya, John Wiley
T.2	Mathematical elements of Computer Graphics, David F. Rogers, J. Alan Adams, Tata McGraw-Hill
T.3	Procedural elements of Computer Graphics, David F. Rogers, Tata McGraw-Hill.

Reference Books

R.1	Computer Graphics, Donald Hearn and M. Pauline Baker, Prentice Hall of India.
R.2	Computer Graphics Principles and Practice, J.D. Foley, A Van Dam, S. K. Feiner and R. L. Phillips, Addision Wesley
R.3	Principles of Interactive Computer Graphics, William M. Newman, Robert F. Sproull, Tata McGraw-Hill.

Useful Links

1	Computer Graphics: https://onlinecourses.nptel.ac.in/noc24_cs82/preview
2	Learn Essential Computer Graphics Skills: https://www.coursera.org/courses?query=computer%20graphics

Head of Department
CSE - Data Science
Tulsiramji Gaikwad-Patil College of

Dean Academics
Tulsiramji Gaikwad-Patil
College Of Engineering
and Technology

Course Outcomes		CL	Class Session
After the completion of this course, students will be able to-			
BDS3507.1	Demonstrate the concept of Geometry and line generation	3	9
BDS3507.2	Measure the graphics Primitives and 2D Transformations	5	9
BDS3507.3	Analyze the concept of segment tables, windowing and clipping	4	9
BDS3507.4	Implements 3D graphics design, Hidden surfaces and Line removal	4	9
BDS3507.5	Illustrate the concept of curves, surfaces and surface rendering methods	3	9

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

Tulsiramji Gaikwad-Patil College of Engineering and Technology Wardha Road, Nagpur-441108 NAAC Accredited (A+ Grade) An Autonomous Institute affiliated to RTMNU Nagpur			
Semester		**Course Code**	**Name of Course**
V		**BDS3508**	Program Elective-I Wireless Security
Teaching Scheme			**Examination Scheme**
Lectures	3Hrs/week		**CT-1** 15 Marks
Tutorial	0		**CT-2** 15 Marks
Total Credit	3		**TA** 10 Marks
			ESE 60 Marks
			Total 100 Marks
			Duration of ESE: 03Hrs 00Min.

Course Objective:	
1	To provide an overview of various wireless communication technologies and their associated security challenges.
2	To identify and analyze the different types of threats and vulnerabilities in wireless networks.
3	To provide insights into the latest advancements and trends in wireless security technologies.
4	To encourage critical thinking and problem-solving skills in wireless security scenarios.

Course Contents	
Unit I	Introduction to Wireless Security **Fundamentals of Wireless Security**: Overview of wireless communication technologies (Wi-Fi, Bluetooth, Zigbee, etc.), Security challenges in wireless networks, **Wireless Network Architectures and Protocols**: Wireless LAN (WLAN) architecture, Overview of wireless communication protocols
Unit II	Threats and Vulnerabilities in Wireless Networks, **Types of Wireless Security Threats**: Eavesdropping, jamming, man-in-the-middle attacks, Rogue access points, denial-of-service attacks **Wireless Network Vulnerabilities**: Common vulnerabilities in wireless networks, Case studies of wireless network breaches
Unit III	Wireless Security Protocols and Standards, **Overview of Wireless Security Protocols**: Wired Equivalent Privacy (WEP), Wi-Fi Protected Access (WPA) and WPA2 WPA3 and its enhancements, **Encryption and Authentication Mechanisms**: Symmetric and asymmetric encryption, Authentication protocols (EAP, RADIUS, etc.)
Unit IV	Designing and Implementing Secure Wireless Networks, **Best Practices for Wireless Network Security**: Secure network configuration and management, Implementing strong passwords and encryption, **Wireless Intrusion Detection Systems (WIDS)**: Role of WIDS in wireless security, Deploying and managing WIDS
Unit V	Emerging Wireless Security Technologies, Advancements in Wireless Security: Next-generation wireless security technologies, Security in 5G networks Future Trends and Challenges:, Predicting future threats and security challenges Exploring potential solutions and advancements

Text Books	
T.1	Wireless and Mobile Networking Hardcover – Import, 1 August 2022 by Mahbub Hassan
T.2	Wireless Communication and Networking Paperback – 27 October 2023 by Dr. A. Vijayaraj, Kanchan sharma, Navdeep Khare, Ranjeet Yadav

Reference Books	
R.1	Introduction to Wireless and Mobile Systems" by Dharma P. Agrawal and Qing-An Zeng
R.2	"Mobile and Wireless Networks" by Guy Pujolle and Serge Fdida

Head of Department
CSE - Data Science
Tulsiramji Gaikwad-Patil College of

Dean Academics
Tulsiramji Gaikwad-Patil
College Of Engineering
and Technology, Nagpur

Useful Links	
1	Wireless Ad Hoc Networks- https://archive.nptel.ac.in/courses/106/105/106105160/
2	Wireless communication: https://archive.nptel.ac.in/courses/117/102/117102062/

Course Outcomes		CL	Class Session
After the completion of this course, students will be able to-			
BDS3508.1	Analyze concepts of wireless communication technologies, including Wi-Fi, Bluetooth, Zigbee, and cellular networks.	4	9
BDS3508.2	Estimate common security challenges and threats specific to wireless networks.	5	9
BDS3508.3	Apply cryptographic techniques and algorithms used to secure wireless communications.	3	9
BDS3508.4	Analyze common vulnerabilities in wireless networks, including signal interception, jamming, spoofing, and man-in-the-middle attacks.	4	9
BDS3508.5	Appraise emerging trends and technologies in wireless security, such as IoT security, 5G security challenges, and advancements in wireless encryption.	4	9

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

Tulsiramji Gaikwad-Patil College of Engineering and Technology Wardha Road, Nagpur-441108 NAAC Accredited (A+ Grade) An Autonomous Institute affiliated to RTMNU Nagpur		
Semester	**Course Code**	**Name of Course**
V	**BDS3509**	Program Elective-I Soft Computing

Teaching Scheme		**Examination Scheme**	
Lectures	3Hrs/week	**CT-1**	15 Marks
Tutorial	0	**CT-2**	15 Marks
Total Credit	3	**TA**	10 Marks
		ESE	60 Marks
		Total	100 Marks
		Duration of ESE: 03Hrs 00Min.	

Course Objective:

1	Understand Artificial Intelligence, Various types of production systems, characteristics of production systems
2	Understand Neural Networks, architecture, functions and various algorithms involved.
3	Analyze Fuzzy Logic, Various fuzzy systems and their functions.
4	Learn about Genetic algorithms, its applications and advances

Course Contents

Unit I	Introduction to Soft Computing: Artificial Neural Networks- Biological neurons, Basic models of Artificial Neural Networks- Connections, Learning, Activation functions, Mc Culloch and pitts neurons, Hebb Networks.
Unit II	Perceptron networks- Learning rule- Training and testing algorithms, Adaptive Linear Neurons, Back Propagation Networks- Architecture, Training algorithm
Unit III	Fuzzy Logic- fuzzy sets –properties-operations on fuzzy sets, fuzzy relations, operations on fuzzy relations. Fuzzy membership functions, fuzzification, Methods of membership value assignments-intuition-inference-rank ordering, Lambda-cuts for fuzzy sets, defuzzification methods
Unit IV	Truth values and tables in fuzzy Logic, fuzzy propositions, Formation of fuzzy rules Decomposition of rules- Aggregation of rules, Fuzzy inference System- Mamdani and Sugeno types, Neuro-fuzzy hybrid systems – Characteristics- classification
Unit V	Introduction to Genetic Algorithm, operators in genetic algorithm- coding – selection-cross-over mutation, Stopping condition for Genetic algorithm flow, Genetic-neuro hybrid systems, Genetic fuzzy rule based system

Text Books

T.1	S. N. Sivanandam and S. N. Deepa, Principal of Soft computing –John Wiely & sons 2007
T.2	Timothy J. Ross, Fuzzy Logic with engineering applications John Wiley & Sons 2016

Reference Books

R.1	K. Sinha and M.M. Gupta, Soft Computing and Intelligent Systems: Theory & Applications Academics Press/Elsevier 2009
R.2	Driankov D., Hellenoorn H. and Reinfrank M. An Introduction to Fuzzy Control Narosa pub. 2001

Useful Links

Head of Department
CSE - Data Science
Tulsiramji Gaikwad-Patil College of

Dean Academics
Tulsiramji Gaikwad-Patil
College Of Engineering
and Technology, Nagpur

1	Introduction To Soft Computing: https://onlinecourses.nptel.ac.in/noc22_cs54/preview
2	Soft Computing: https://www.iiitdmj.ac.in/ict.iiitdmj.ac.in/downloads/scpser_course-m/Lect1

Course Outcomes		**CL**	**Class Session**
After the completion of this course, students will be able to-			
BDS3509.1	Understand soft computing techniques and their applications	2	9
BDS3509.2	Analyze various neural networks architectures	3	9
BDS3509.3	Implement the fuzzy system based on the fuzzy rules	4	9
BDS3509.4	Evaluate the fuzzy propositions and decomposition rules	4	9
BDS3509.5	Generalize the genetic algorithm based on fuzzy rule	5	9

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

Tulsiramji Gaikwad-Patil College of Engineering and Technology Wardha Road, Nagpur-441108 NAAC Accredited (A+ Grade) An Autonomous Institute affiliated to RTMNU Nagpur			
Semester		**Course Code**	**Name of Course**
V		BDS3510	Program Elective-I Python for Data Science
Teaching Scheme			**Examination Scheme**
Lectures	3Hrs/week		**CT-1** 15 Marks
Tutorial	0		**CT-2** 15 Marks
Total Credit	3		**TA** 10 Marks
			ESE 60 Marks
			Total 100 Marks
			Duration of ESE: 03Hrs 00Min.

Course Objective:

1	To provide a strong foundation in Python programming, focusing on its syntax, data structures, and libraries relevant to data science.
2	To equip students with the skills needed to efficiently handle, clean, and preprocess data using Python libraries such as NumPy and Pandas.
3	To introduce students to basic and advanced statistical concepts and how to apply them using Python to interpret and analyze data.
4	To encourage exploration of current trends and research topics in data science and Python applications.

Course Contents

Unit I	Overview of Python: Introduction to Python programming language, History and features of Python. Setting Up Python Environment: Installing Python and Jupyter Notebook, Introduction to IDEs and text editors for Python (PyCharm, VS Code). Python Basics: Data types (integers, floats, strings, booleans), Variables and basic operations, Control structures (if-else statements, loops), Functions and modules.
Unit II	Data Structures and Libraries: Data Structures in Python: Lists, tuples, sets, and dictionaries, List comprehensions and generator expressions. Introduction to Key Libraries: NumPy: Arrays and matrix operations, Pandas: Data frames, series, and data manipulation, Matplotlib: Basic plotting and data visualization, Seaborn: Advanced data visualization.
Unit III	Data Manipulation with Pandas: Working with DataFrames: Creating and manipulating DataFrames, Importing and exporting data (CSV, Excel, JSON), Data Cleaning: Handling missing values, Data transformation and normalization, Handling duplicates and outliers, Advanced Data Operations: Merging, joining, and concatenating DataFrames, GroupBy operations and pivot tables.
Unit IV	Data Visualization: Matplotlib Basics: Plotting line graphs, bar charts, histograms, and scatter plots, Customizing plots (titles, labels, legends) Seaborn for Statistical Plots: Creating box plots, violin plots, pair plots, and heatmaps, Customizing Seaborn plots, Advanced Visualization Techniques: Plotly for interactive visualizations,Geospatial data visualization with Folium.
Unit V	Capstone Project and Case Studies Real-World Data Science Problems: Case studies from various domains (finance, healthcare, marketing), Capstone Project: Define a problem statement, Data collection and preprocessing, Exploratory data analysis, Model building and evaluation, Presenting the findings and insights

Text Books

Head of Department
CSE - Data Science
Tulsiramji Gaikwad-Patil College of

Dean Academics
Tulsiramji Gaikwad-Patil
College Of Engineering
and Technology, Nagpur

T.1	"Python for Data Analysis" by Wes McKinney
T.2	"Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron
Reference Books	
R.1	"Introduction to Machine Learning with Python: A Guide for Data Scientists" by Andreas C. Müller and Sarah Guido
R.2	"Data Science from Scratch: First Principles with Python" by Joel Grus
R.3	"Think Python: How to Think Like a Computer Scientist" by Allen B. Downey
Useful Links	
1	Python for Data Science: https://onlinecourses.nptel.ac.in/noc22_cs32/preview

Course Outcomes		**CL**	**Class Session**
After the completion of this course, students will be able to-			
BDS35010.1	Understand basics of Python programming, including data structures, control flow, and functions.	2	9
BDS35010.2	Analyze data operations such as merging, grouping, and pivoting.	4	9
BDS35010.3	Apply statistical techniques to analyze data and interpret results.	3	9
BDS35010.4	Design data insights effectively through well-designed visualizations, clear reports, and compelling presentations.	6	9
BDS35010.5	.Develop Capstone Project and Case Studies Real-World Data Science Problems	6	9

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

Tulsiramji Gaikwad-Patil College of Engineering and Technology Wardha Road, Nagpur-441108 NAAC Accredited (A+ Grade) An Autonomous Institute affiliated to RTMNU Nagpur		
Semester	**Course Code**	**Name of Course**
V	**BDS3511**	Program Elective-II Digital Image Processing

Teaching Scheme	
Lectures	3Hrs/week
Tutorial	0
Total Credit	3

Examination Scheme	
CT-1	15 Marks
CT-2	15 Marks
TA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE: 03Hrs 00Min.	

Course Objective:	
1	Overview the Fundamental concepts of Digital Image Processing
2	Understand Digital image processing techniques
3	To Study various similarity based, and dissimilarity based image segmentation approaches
4	Understand the basic concepts of image representation and description

Course Contents	
Unit I	Digital Image Fundamentals: : Digital image representation, Fundamental steps in image processing, Components of Digital Image processing systems, Different types of Digital Images, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization
Unit II	Image Enhancement: Point Processing, Histogram Processing, Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Frequency Domain filtering
Unit III	Image Segmentation: Detection of discontinuities - point, line and edge detection, Edge linking and boundary detection, Thresholding, region based segmentation - region growing, region splitting and merging, Image Segmentation based on color.
Unit IV	Image Compression: Image Compression Models, Lossy compression, loseless compression schemes, JPEG compression standard, Applications of Image Compression Model, Challenges in Image Compression Model
Unit V	Color Image Processing: Color Fundamentals, Laws of color matching, Color Models, Color Enhancement, Smoothing and Sharpening, Color Segmentation, color edge detection

Text Books	
T.1	Digital Image Processing, Gonzalez, Rafael C. and Richard E. Woods, (4th Edition, 1992), Pearson Education, London
T.2	Fundamentals of Digital Image Processing by Sanjay Sharma, S K Kataria and Sons; 2013th edition

Reference Books	
R.1	Fundamental of Digital Image Processing, Anil K Jain, Prentice-Hall, Englewood Cliffs, NJ, 1989
R.2	Digital Image Processing, Sudhir Shelke & Pramod B. Patil Vikas Publishing

Useful Links	
1	http://www.vssut.ac.in/lecture_notes/lecture1423722885.pdf
2	https://onlinecourses.nptel.ac.in/noc21_cs04/preview
3	kupdf.net_fundamentals-of-digital-image-processing-anil-k-jainpdf

Head of Department
CSE - Data Science
Tulsiramji Gaikwad-Patil College of

Dean Academics
Tulsiramji Gaikwad-Patil
College Of Engineering

Course Outcomes		CL	Class Session
After the completion of this course, students will be able to-			
BDS35011.1	Understand how digital images are represented and manipulated in a computer	2	9
BDS35011.2	Apply Image enhancement & restoration techniques to digital image processing	3	9
BDS35011.3	Apply Image segmentation techniques to digital image processing application	3	9
BDS35011.4	Evaluate algorithm for image compression	5	9
BDS35011.5	Analyze Color Image Processing	4	9

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

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

Semester	Course Code	Name of Course
V	BDS3512	Program Elective-II Ethical Hacking

Teaching Scheme		Examination Scheme	
Lectures	3Hrs/week	CT-1	15 Marks
Tutorial	0	CT-2	15 Marks
Total Credit	3	TA	10 Marks
		ESE	60 Marks
		Total	100 Marks
		Duration of ESE: 03Hrs 00Min.	

Course Objective:

1	To evaluate the security of and identify vulnerabilities in target systems, networks or system infrastructure.
2	the process entails finding and then attempting to exploit vulnerabilities to determine whether unauthorized access or other malicious activities are possible
3	Understand Hacking Techniques: Learn the same techniques that malicious hackers

Course Contents

Unit I	Ethical Hacking Overviews : Hacking concept, what is hacking?, Terms we use in hacking., Need of Ethical hacking. Cases of Hacking in India & across the globe Principles of Ethical hacking Basic Principle, Commandments of Ethical Hacking
Unit II	Hacking Methodologies: Types of Hacking, Building the foundation for Ethical hacking, Hacking Phases, Role of Ethical Hacker, Types of Hackers, Roles and Responsibilities
Unit III	Scope & limitations of hacking. :Advantages & scope for hacking, Drawbacks& Limitation of hacking Cyber Threats and Attacks Vectors Threats & categories Attack Vectors and Exploitation
Unit IV	Hacking tools and techniques : Common Hacking Tools, Hacking Techniques, & Approaches Policies and Controls Information Security policies Risk Management & Incident Management Information Security controls
Unit V	Overview of PT / VA: Concept of Penetration testing, Types of Penetration testing, Phases of Penetration testing, Vulnerability Assessment by Penetration testing

Text Books

T.1	Ethical hacking a hands on introduction to breaking it By Daniel G.Graham.
T.2	Introduction to Computer Networks and Cybersecurity -- C-H. Wu and J. D. Irwin

Reference Books

R.1	Hacking: A Beginners' Guide to Computer Hacking, Basic Security, And Penetration Testing by j slavio
R.2	Hands-on Ethical Hacking and Network Defense by James Corley, Kent Backman, and Michael Simpson

Useful Links

1	https://www.hackthissite.org/
2	Ethical Hacking: https://onlinecourses.nptel.ac.in/noc22_cs13/preview

Head of Department
CSE - Data Science
Tulsiramji Gaikwad-Patil College of

Dean Academics
Tulsiramji Gaikwad-Patil
College Of Engineering
and Technology, Nagpur

Course Outcomes		CL	Class Session
After the completion of this course, students will be able to-			
BDS35012.1	Analyze the concept of Ethical hacking.	4	9
BDS35012.2	Distinguish the various types of ethical hacking methodology	4	9
BDS35012.3	Analyze scope and limitations of ethical hacking	4	9
BDS35012.4	Implement the various ethical hacking tools and techniques	5	9
BDS35012.5	Apply penetration testing on various tools	5	9

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

Tulsiramji Gaikwad-Patil College of Engineering and Technology Wardha Road, Nagpur-441108 NAAC Accredited (A+ Grade) An Autonomous Institute affiliated to RTMNU Nagpur		
Semester	**Course Code**	**Name of Course**
V	**BDS3513**	Program Elective-II Mobile Computing

Teaching Scheme	
Lectures	3Hrs/week
Tutorial	0
Total Credit	3

Examination Scheme	
CT-1	15 Marks
CT-2	15 Marks
TA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE: 03Hrs 00Min.	

Course Objective:

1	To provide an overview of the evolution and future trends in mobile computing technologies.
2	To impart knowledge about the various mobile communication systems, including cellular networks, wireless LANs, and Bluetooth.
3	To provide hands-on experience in designing and developing mobile applications using popular development frameworks and tools.
4	To identify the security challenges and threats specific to mobile computing environments.

Course Contents

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	Mobile Application Development **Mobile App Development Frameworks**: Overview of popular frameworks (Android Studio, Xcode, Reactative, Flutter), **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

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

Reference Books

R.1	"Mobile Computing Handbook" edited by Mohammad Ilyas and Imad Mahgoub
R.2	"Handbook of Wireless Networks and Mobile Computing" edited by Ivan Stojmenovic
R.3	"Mobile Computing: Technology, Applications, and Service Creation" by Asoke K. Talukder and Manish Chaitanya

Head of Department
CSE - Data Science
Tulsiramji Gaikwad-Patil College of Engineering

Dean Academics
Tulsiramji Gaikwad-Patil
College Of Engineering

R.4	"Mobile Computing and Wireless Networks: Concepts, Methodologies, Tools, and Applications" edited by Information Resources Management Association
Useful Links	
1	Mobile Computing: https://archive.nptel.ac.in/courses/106/106/106106147/

Course Outcomes		**CL**	**Class Session**
After the completion of this course, students will be able to-			
BDS35013.1	Describe the architecture and functionality of mobile operating systems.	2	9
BDS35013.2	Implement basic security measures for mobile devices and networks.	4	9
BDS35013.3	Analyze the challenges and limitations of mobile computing in various scenarios.	5	9
BDS35013.4	Evaluate the security of mobile computing systems against potential threats.	5	9
BDS35013.5	Design and implement innovative mobile applications that leverage context-aware computing.	6	9

Head of Department
CSE - Data Science
Tulsiramji Gaikwad-Patil College of
Engineering and Technology, Nagpur

Dean A
Tulsiram
College
and Technology, Nagpur

Tulsiramji Gaikwad-Patil College of Engineering and Technology Wardha Road, Nagpur-441108 NAAC Accredited (A+ Grade) An Autonomous Institute affiliated to RTMNU Nagpur			
Semester		**Course Code**	**Name of Course**
V		**BDS3514**	Program Elective-II Client Side Scripting-Java Script

Teaching Scheme		**Examination Scheme**	
Lectures	3Hrs/week	**CT-1**	15 Marks
Tutorial	0	**CT-2**	15 Marks
Total Credit	3	**TA**	10 Marks
		ESE	60 Marks
		Total	100 Marks
		Duration of ESE: 03Hrs 00Min.	

Course Objective:	
1	**Understand** the basic concepts of JavaScript and its role in client-side scripting.
2	**Apply** JavaScript to enhance user interactivity and interface of web pages.
3	**Analyze** and debug JavaScript code for errors and performance issues
4	**Develop** comprehensive web applications incorporating best practices in JavaScript coding and design.

Course Contents	
Unit I	Introduction to JavaScript: History and Evolution of JavaScript, JavaScript Syntax and Basics, Variables and Data Types, Operators and Expressions, Control Structures (if-else, switch, loops), Functions and Scope, Error Handling and Debugging
Unit II	Working with the DOM, Understanding the DOM, Selecting and Manipulating DOM Elements, Event Handling, Event Listeners and Event Object, Common Events (click, load, input, etc.), DOM Traversal and Modification, Creating and Removing Elements
Unit III	Advanced JavaScript Concepts, Objects and Prototypes, Closures and Scope Chains, Asynchronous JavaScript, Callbacks, Promises, Async/Await, JSON and AJAX, Fetch API, XMLHttpRequest
Unit IV	JavaScript in Practice: Form Validation, Built-in Validation Methods, Custom Validation Logic, JavaScript Libraries and Frameworks: Overview of Popular Frameworks (React, Angular, Vue.js), Using jQuery for Simplified DOM Manipulation, Performance Optimization: Minimizing Reflows and Repaints, Efficient Event Handling
Unit V	Modern JavaScript: ES6+ Features, let and const, Arrow Functions, Template Literals, Destructuring, Modules, Web Storage, Local Storage and Session Storage, IndexedDB, Service Workers and PWA Basics, Introduction to TypeScript

Text Books	
T.1	"JavaScript: The Definitive Guide" by David Flanagan
T.2	PHP, MySQL & JavaScript All-in-One for Dummies Paperback by Richard Blum
Reference Books	
R.1	Coding with Javascript for Dummies by Chris Minnick, Eva Holland
R.2	"Speaking JavaScript: An In-Depth Guide for Programmers" by Axel Rauschmayer
Useful Links	
1	Internet Technology: https://archive.nptel.ac.in/courses/106/105/106105084/
2	Java Script: http://ndl.iitkgp.ac.in/he_document/nptel/courses_106_105_106105084_video_lec25

Head of Department
CSE - Data Science
Tulsiramji Gaikwad-Patil College of

Dean Academics
Tulsiramji Gaikwad-Patil
College Of Engineering
and Technology, Nagpur

Course Outcomes		CL	Class Session
After the completion of this course, students will be able to-			
BDS35014.1	Implement the built-in functions and objects provided by JavaScript.	4	9
BDS35014.2	Apply JavaScript to manipulate the DOM and handle events.	3	9
BDS35014.3	Implement JavaScript functions and objects to create interactive web elements.	4	9
BDS35014.4	Evaluate the pros and cons of various JavaScript frameworks	5	9
BDS35014.5	Develop complex web applications using JavaScript and related technologies.	6	9

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

Tulsiramji Gaikwad-Patil College of Engineering and Technology Wardha Road, Nagpur-441108 NAAC Accredited (A+ Grade) An Autonomous Institute affiliated to RTMNU Nagpur		
Semester	**Course Code**	**Name of Course**
V	BDS XX17	Open Elective-I Soft Computing Techniques

Pre-Requisites:

Teaching Scheme		**Examination Scheme**	
Lectures	4Hrs/week	**CT-1**	15 Marks
Tutorial	0	**CT-2**	15 Marks
Total Credit	4	**TA**	10 Marks
		ESE	60 Marks
		Total	100 Marks
		Duration of ESE: 03Hrs 00Min.	

Course Contents

Unit I	Introduction to Soft Computing: Artificial Neural Networks- Biological neurons, Basic models of Artificial Neural Networks- Connections, Learning, Activation functions, Mc Culloch and pitts neurons, Hebb Networks.
Unit II	Perceptron networks- Learning rule- Training and testing algorithms, Adaptive Linear Neurons, Back Propagation Networks- Architecture, Training algorithm
Unit III	Fuzzy Logic- fuzzy sets –properties-operations on fuzzy sets, fuzzy relations, operations on fuzzy relations. Fuzzy membership functions, fuzzification, Methods of membership value assignments- intuition-inference-rank ordering, Lambda-cuts for fuzzy sets, defuzzification methods
Unit IV	Truth values and tables in fuzzy Logic, fuzzy propositions, Formation of fuzzy rules Decomposition of rules- Aggregation of rules, Fuzzy inference System- Mamdani and Sugeno types, Neuro-fuzzy hybrid systems – Characteristics- classification
Unit V	Introduction to Genetic Algorithm, operators in genetic algorithm- coding – selection-cross-over mutation, Stopping condition for Genetic algorithm flow, Genetic-neuro hybrid systems, Genetic fuzzy rule based system

Text Books

1	S. N. Sivanandam and S. N. Deepa, Principal of Soft computing –John Wiely & sons 2007
2	Timothy J. Ross, Fuzzy Logic with engineering applications John Wiley & Sons 2016

Reference Books

1	K. Sinha and M.M. Gupta, Soft Computing and Intelligent Systems: Theory & Applications Academics Press/Elsevier 2009
2	Driankov D., Hellenoorn H. and Reinfrank M. An Introduction to Fuzzy Control Narosa pub. 2001

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

Course Outcomes		CL	Class Session
After the completion of this course, students will be able to-			
BDS XX17.1	Understand soft computing techniques and their applications	2	9
BDS XX17.2	Analyze various neural networks architectures	3	9
BDS XX17.3	Implement the fuzzy system based on the fuzzy rules	4	9
BDS XX17.4	Evaluate the fuzzy propositions and decomposition rules	4	9
BDS XX17.5	Generalize the genetic algorithm based on fuzzy rule	5	9

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

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

Semester	Course Code	Name of Course
V	BDSXX18	OE I -Machine Learning and its Application

Pre-Requisites:

Teaching Scheme	
Lectures	4Hrs/week
Tutorial	0
Total Credit	4

Examination Scheme	
CT-1	15 Marks
CT-2	15 Marks
TA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE: 03Hrs 00Min.	

Course Objective:

1	To understand the need for machine learning for various problem solving.
2	To study the various supervised, semi – supervised and unsupervised learning algorithms in machine learning.
3	To understand the latest trend in machine learning.

Course Contents

Unit I	**Introduction:** ML Techniques and overview, Version Space and Candidate Eliminations, Inductive Bias, Decision Tree Learning - Representation & Algorithm, Hypothesis Evaluation, Heuristic Space Search
Unit II	**Neural Networks and Genetic Algorithms** Neural Network Representation, Problems, Perceptron, Multilayer Networks and Back Propagation Algorithms, Genetic Algorithms, Model Evaluation and Learning
Unit III	**Bayesian and Computational Learning** Bayes Theorem, Concept Learning, Bayes Optimal Classifier, Gibbs Algorithm, Naive Bayes Classifier, Bayesian Belief Network, Probability Learning, Mistake bond Model, Support Vector Machine
Unit IV	**Instance Based Learning** K- Nearest Neighbor Learning, Locally Weighted Regression, Radial Basis Functions, Case Based Learning
Unit V	**Unsupervised Learning:** K means Clustering Algorithm, Reinforcement Learning, Elements of Reinforcement Learning, Exploration vs. Exploitation dilemma, Q – Learning.

Text Books

1	Tom M Mitchell, Machine Learning, McGraw – Hill Education (India) Private Limited, 2013.
2	Machine Learning: An Algorithmic Prespective, CRC Press, 2009, by Stephen Marsland

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

Head of Department
CSE - Data Science
Tulsiramji Gaikwad-Patil College of

Dean Academics
Tulsiramji Gaikwad-Patil
College Of Engineering

Useful Links	
1	https://www.youtube.com/watch?v=Y4qO9unerGs&list=PLYwpaL_SFmcBhOEPwf5cFwqo5B-cP9G4P
2	https://www.youtube.com/watch?v=uB3i-qV6VdM&list=PLxCzCOWd7aiHGhOHV-nwb0HR5US5GFKFI
3	https://www.youtube.com/results?search_query=machine+learning+edureka

Course Outcomes		CL	Class Session
After the completion of this course, students will be able to-			
BDSXX18.1	Differentiate between supervised, unsupervised, semi supervised machine learning approaches	2	9
BDSXX18.2	Discuss the decision tree algorithm and identity and overcome the problems.	2	9
BDSXX18.3	Discuss and apply the back propagation algorithm and genetic algorithms to various problems.	2	9
BDSXX18.4	Apply the Bayesian concepts to machine learning	3	9
BDSXX18.5	Analyzes and suggest appropriate machine learning approaches for various types of problems.	4	9

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

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

Semester	Course Code	Name of Course
V	BDSXX19	OE 1 - Introduction of Data Science

Pre-Requisites:

Teaching Scheme	
Lectures	4
Tutorial	0
Total Credit	4

Examination Scheme	
CT-1	15 Marks
CT-2	15 Marks
TA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE: 03Hrs 00Min.	

Course Objective:

1	Building the fundamentals of data science.
2	Gaining practical experience in programming tools for data sciences
3	Empowering students with tools and techniques used in data science

Course Contents

Unit I	Introduction to Data Science Evolution of Data Science, Data Science Roles, Stages in a Data Science Project, Applications of Data Science in various fields, Data Security Issues. Architecture of data, data acquisition.
Unit II	Data Collection and Data Pre-Processing Data Collection Strategies, Data Pre-Processing Overview, Data Cleaning, Data Integration andTransformation, Data Reduction, Data Discretization.
Unit III	Exploratory Data Analytics Descriptive Statistics, Mean, Standard Deviation, Skewness and Kurtosis, Box Plots, PivotTable, Heat Map, Correlation Statistics, ANOVA
Unit IV	Regression: Linear Regression, Simple Linear Regression, Multiple & Polynomial Regression. Unsupervised Learning, Clustering, Similarity and Distances, Quality Measures of Clustering.
Unit V	Network Analysis, Graphs, Social networks, centrality, drawing centrality of Graphs, PageRank, ego-networks, Community Detection

Text Books

1	Data Science from Scratch-Joel Grus
2	Introduction to Data Structures With Applications, 2nd Edition by Jean-Paul Tremblay Paul Sorenson, McGraw Hill Education India Pvt Ltd.
3	Data Science for Business- Tom Fawcett

Reference Books

1	Designing data-Intensive Applications-Martin Kleppmann
2	Data Science and Big Data Analytics- EMC Education Services
3	The Data Science Handbook- Field Cady

Useful Links

1	https://archive.nptel.ac.in/courses/110/106/110106072/
2	https://www.youtube.com/playlist?list=PLw5h0DiJ-9PCn4shW4X43FSjEqdBwc1Cn
3	https://www.youtube.com/watch?v=W01tIRP_Rqs

Head of Department
CSE - Data Science
Tulsiramji Gaikwad-Patil College of
Engineering and Technology, Nagpur

Course Outcomes		CL	Class Session
After the completion of this course, students will be able to-			
BDSXX19.1	Understand basic concepts of data science and key issues.	3	9
BDSXX19.2	Understand data collection and data pre-processing.	2	9
BDSXX19.3	Apply statistical analytics on datasets.	3	9
BDSXX19.4	Implement regression models on datasets.	3	9
BDSXX19.5	Analyze Social networks and graph	4	9

HoD CSE-DS
Head of Department
CSE - Data Science
Tulsiramji Gaikwad-Patil College of Engineering and Technology, Nagpur

Dean Academics
Dean Academics
Tulsiramji Gaikwad-Patil College Of Engineering and Technology, Nagpur

Vice-Principal
Dr. Pragati Patil
Vice-Principal
Tulsiramji Gaikwad Patil College of Engineering & Technology, Nagpur

Principal
Principal
Tulsiramji Gaikwad Patil College Of Engineering and Technology, Nagpur