TULSIRAMJI GAIKWAD-PATIL College of Engineering & Technology

Mohgaon, Wardha Road, Nagpur - 441 108

Bachelor of Technology
NEP - 2020 Scheme
Session 2024 - 25

Department of Computer Science and Engineering (Data Science)

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.

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Wardha Road, Nagpur-441108

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Scheme of Instructions for Second Year of B.Tech.(UG) Programme Data Science(DS)

Fourth Semester

SN	Sem	Type	BoS/ Dept	Sub. Code	Subject	T/P	Contact Hours				Credits	%Weightage			Total
							L	SL	P	Hrs		CT/IA	CA	ESE	
1	4	PCC	DS	BDS32401	Operating System	T	2	0	0	2	2	14	6	30	50
2	4	PCC	DS	BDS32402	Theory of Computation	T	3	0	0	3	3	30	10	60	100
3	4	PCC	DS	BDS32403	Introduction to Data Science	T	3	0	0	3	3	30	10	60	100
4	4	PCC	DS	BDS32404	Operating System -Lab	P	0	0	2	2	1	-	25	25	50
5	4	PCC	DS	BDS32405	Introduction to Data Science-Lab	P	0	0	2	2	1	-	25	25	50
4	4	MDM	S&H	BSH32402	Mathematics in Data Science	T	2	0	0	2	2	14	6	30	50
5	4	OE		B$$324XX	OE -II	T	2	0	0	2	2	14	6	30	50
6	4	VSEC	DS	BDS32406	DBA (SQL/JDBC)-Lab	P	0	0	4	4	2	-	50	50	100
7	4	AEC	S&H	BSH32404	Leadership and Team Dynamics	P	0	0	4	4	2	-	50	50	100
8	4	HSSM	MBA	BBA32401	Entrepreneurship Development	P	0	0	4	4	2	-	50	50	100
9	4	VEC	S&H	BSH32403	Human Value for Professional Society	T	2	0	0	2	2	14	6	30	50
					TOTAL		**14**	**0**	**16**	**30**	**22**	**116**	**244**	**440**	**800**

Course Category	BSC/ESC (Basic Science Course/Engineering Science Course.)	PCC		Multidisciplinary courses		VSEC	Humanities Social Science & Management				Experiential				CC Co-Curriculr Course(CC)
		Programme Core courses(PCC)	Programme Elective Course(PEC)	MDM	Open Elective(OE)		AEC(Abilityy	Entrepreneurship[Course	IKS(Indian knowledge System)	Value Education Course	Research Methodology	Common Engineering Project(CEP)/Field Projects(FP)	Project	Internsh /OJT	
Credits	-	10	-	2	2	2	2	2	-	2	-	-	-	-	-
Cumul AtiveSum	16/13	20	-	4	6	6	4	4	2	4	-	2	-	-	4

PROGRESSIVE TOTAL CREDITS: 20+22=42

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 Tulsiramji Gaikwad-Patil College Of Engineering & Technology, Nagpur.	Dr. Premanand Naktode Principal TGPCET, Nagpur	Aug,2023	1.00	Applicable for A Y 2023-24 Onwards
Chairperson	Dean Academics	Vice Principal	Principal	Date of Release	Version	

OE List–

Open Elective				
Sr. no.		OE-I	OE-II	OE-III
1		Semester III	Semester IV	Semester V
	Course Code	BDS32307	BDS32407	B$$335XX
	Subjects	OOPs with C++	Introduction to Data Science	Software Engineering and Quality Assurance

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**	**BDS33507**	**BDS33605**	**BDS33609-12**	**BDS34702**	**BDS34803**
		Network and Security	Cyber Security	Mobile and Adhoc Network	Cyber Law	Cyber Forensic	Evidence Acquisition and Recovery
2	Domain-2	**Course Code**	**BDS33508**	**BDS33606**	**BDS33610**	**BDS34703**	**BDS34804**
		AI and IoT	Generative AI	Data Visualization Techniques	Natural Language Processing	IoT for Social Good	Industrial and Medical IoT
3	Domain-3	**Course Code**	**BDS33509**	**BDS33607**	**BDS33611**	**BDS34704**	**BDS34805**
		Computing	Cloud Computing	Mobile Computing	Distributed Computing	Big Data Computing	Reconfigurable Computing
4	Domain-4	**Course Code**	**BDS33510**	**BDS33608**	**BDS33612**	**BDS34705**	**BDS34806**
		Programming Languages	R Programming	Client Side Scripting-Java Script	Server Side Scripting-PHP	Python for Data Science	NoSQL

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

Semester		Course Code		Course Name	
IV		BDS32401		Operating System	
Teaching Scheme		**Examination Scheme(Th)**		**Examination Scheme(P)**	
Theory(Th)	2 Hr / Week	**CT-I**	7	-	-
Practical(P)	-	**CT-II**		-	-
Total Credits	**2**	**CA**	5	-	-
Duration of ESE: 2 Hrs		**ESE**	30	-	-
		Total Marks	**50**	-	-

Pre-Requisites:

Course Outcomes:

CO1	**Analyze** the evolution of OS functionality, structures and layers.
CO2	**Evaluate** a model scheduling algorithm to compute various scheduling criteria.
CO3	**Estimate** page replacement algorithms, memory management problems and segmentation.

Course Content

Unit I	**Introduction:** Evolution of OS, Types of OS, Basic h/w support necessary for modern operating systems, services provided by OS, system programs and system calls, OS structure: Layered, Monolithic, Microkernel Operating Systems.
Unit II	**Process Management:** Process concept, Process control Block, Process states, Primitive and Non-Primitive Processes, Types of scheduler, context switch, threads, multithreading model **Scheduling:** Goals of scheduling and different scheduling algorithm (FIFO, SJF, Priority, and Round Robin).
Unit III	**Memory Management:** Contiguous allocation, Relocation, Paging, Segmentation, Segmentation with paging, demand paging, page faults and instruction restart, page replacement algorithms **File Systems:** File concept, Access methods, Disk space management and space allocation strategies, directory structures, Recovery, Log-structured File System, disk scheduling algorithms.

Text Books

1	Operating System Concepts (8th Edition) by Silberschatz, Peter B. Galvin and Greg Gagne, Wiley Indian Edition (2010).
2	Modern Operating Systems (Third Edition) by Andrew S Tanenbaum, Prentice Hall India (2008)
3	Operating Systems by D.M. Dhamdhere, Tata McGraw Hill 2nd edition

Reference Books

1	Operating Systems (5th Ed) – Internals and Design Principles by William Stallings, Prentice Hall India, 2000
2	Operating System: Concepts and Design by Milan Milenkovik , McGraw Hill Higher Education

Useful Links

1	https://nptel.ac.in/courses/106/105/106105214/
2	https://nptel.ac.in/courses/106/102/106102132/

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

Semester		Course Code		Course Name	
IV		BDS32402		Theory of Computation	
Teaching Scheme		**Examination Scheme(Th)**		**Examination Scheme(P)**	
Theory(Th)	3 Hr / Week	**CT-I**	15	-	-
Practical(P)	-	**CT-II**		-	-
Total Credits	**3**	**CA**	10	-	-
Duration of ESE: 3 Hrs		**ESE**	60	-	-
		Total Marks	**100**	-	-

Pre-Requisites:

Course Outcomes:

CO1	**Understand** formal language, translation logic, essentials of translation, alphabets, language representation and apply it to design Finite Automata and its variants
CO2	**Construct** regular expression to present regular language and understand pumping lemma for RE
CO3	**Design** Context Free Grammars and learn to simplify the grammar
CO4	**Construct** Pushdown Automaton model for the Context Free Language Design Turing Machine for the different requirements outlined by theoretical computer science
CO5	**Understand** different classes of problems, classify and analyze them and study concepts of NP completeness

Course Content

Unit I	**Finite Automata (FA):** An informal picture of FA, Finite State Machine (FSM), Language accepted by FA, Definition of Regular Language. FA without output: Deterministic and Nondeterministic FA (DFA and NFA), epsilon- NFA and inter-conversion. Minimization of DFAs. FA with output: Moore and Mealy machines -Definition, models, inter-conversion
Unit II	**Regular Expression:** Operators of RE, Precedence of operators, Algebraic laws for RE, Language to Regular Expressions, Equivalence of two REs. Pumping Lemma for Regular languages, Closure and Decision properties of Regular languages.
Unit III	**CFG & CFL:** Basic Elements of Grammar Formal Definition of Context Free Grammar, Sentential form, Derivation and Derivation Tree/ Parse Tree, Context Free Language (CFL), Ambiguous Grammar, writing grammar for language. Simplification of CFG: Eliminating Є-productions, unit productions, useless production, and useless symbols. Normal Forms: Chomsky Normal Form, Greibach Normal Form, Pumping Lemma for CFG, Closure properties of CFL, Decision properties of CFL, Chomsky Hierarchy
Unit IV	**Pushdown Automata:** Formal definition of PDA, Equivalence of Acceptance by Final State and Empty stack, Non-deterministic PDA (NPDA), PDA and Context Free Language, Equivalence of PDA and CFG, PDA vs CFLs. Deterministic CFLs. **Turing Machines:** Formal definition of Turing Machines, Language Acceptability by Turing Machines, Design of TM, Description of TM, Techniques for TM Construction
Unit V	**Computability Theory:** Decidable Problems and Un-decidable Problems, Church-Turing Thesis. **Complexity Classes:** Time and Space Measures, The Class P, Examples of problems in P, The Class NP, Examples of problems in NP, P Problem Versus NP Problem, NP-completeness and hard Problems.

Text Books	
1	Michael Sipser, Introduction to the Theory of Computation, CENGAGE Learning, 3 rdEdition ISBBN13:978-81-315-2529-6.
2	Vivek Kulkarni, Theory of Computation, Oxford University Press, ISBN-13: 978-0-19-808458-7.
Reference Books	
1	Operating Systems (5th Ed) – Internals and Design Principles by William Stallings, Prentice Hall India, 2000
2	Operating System: Concepts and Design by Milan Milenkovik , McGraw Hill Higher Education
3	Hopcroft Ulman, Introduction to Automata Theory, Languages and Computations, Pearson Education Asia, 2nd Edition, ISBN: 9788131720479.
Useful Links	
1	https://archive.nptel.ac.in/courses/106/104/106104148/
2	http://www.digimat.in/nptel/courses/video/106104148/L01.html

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

Semester		Course Code		Course Name	
IV		BDS32403		Introduction to Data Science	
Teaching Scheme		**Examination Scheme(Th)**		**Examination Scheme(P)**	
Theory(Th)	3 Hr / Week	**CT-I**	15	-	-
Practical(P)	-	**CT-II**	15	-	-
Total Credits	**3(Th)**	**CA**	10	CA	25 Marks
Duration of ESE: 3Hrs		**ESE**	60	**ESE**	25 Marks
		Total Marks	**100**	**Total Marks**	50 Marks

Pre-Requisites:

Course Outcomes:

CO1	Apply toolboxes in data science
CO2	Understand statistics, measure, learn inference frequency approach
CO3	Utilize learning models.
CO4	To learn and understand various regression testing methods.
CO5	To analyze and apply network using data science

Course Content

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 and Transformation, 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://archive.nptel.ac.in/courses/106/106/106106179/

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

Semester		Course Code		Course Name	
IV		BDS32405		Introduction to Data Science Lab	
Teaching Scheme		**Examination Scheme(Th)**		**Examination Scheme(P)**	
Theory(Th)	-	**CT-I**	-	-	-
Practical(P)	2 Hrs/week	**CT-II**	-	-	-
Total Credits	**1**	**CA**	-	**CA**	25 Marks
Duration of ESE:		**ESE**	-	**ESE**	25 Marks
		Total Marks	-	Total Marks	**50** Marks

Pre-Requisites:

Course Outcomes:

CO1	Understand basic concepts of data science and key issues
CO2	Understand data collection and pre-processing
CO3	Apply statistical analytics on datasets
CO4	Implement regression models on datasets.
CO5	Implement model evaluation and validation of datasets.

Sr.no	List of Experiments
1	Perform and implement various control structures in Python
2	Apply the data frames in python for data reading, preparation and pre-processing
3	Perform the analysis of various dataset and plot histogram on it.
4	Study and Implement various clustering models on data sets
5	Study and Implement Polynomial Regression with Python Implementation
6	To Implement Stock market prediction using python
7	Introduction of Num Pie.
8	Introduction of Panda
9	Case Study-1
10	Mini Project/ Case study

Text Books

1	CathyO 'Neiland Rachel Schutt,“ Doing Data Science”, O'Reilly,2015
2	Raj, Pethuru, “Handbook of Research on Cloud Infrastructures for Big Data Analytics”, IGIGlobal

Reference Books

1	Jojo Moolayil, “Smarter Decisions: The Intersection of IoT and DataScience”,PACKT,2016.
2	David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big data Analytics”, EMC 2013

Useful Links

1	https://archive.nptel.ac.in/courses/110/106/110106072/
2	https://archive.nptel.ac.in/courses/106/106/106106179/

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

Semester		Course Code		Course Name	
IV		BSH32402		Mathematics in Data Science	
Teaching Scheme		Examination Scheme(Th)		Examination Scheme(P)	
Theory(Th)	2 Hrs/week	CT-I	7 Marks	-	-
Practical(P)	-	CT-II	7 Marks	-	-
Total Credits	2(Th)	CA	6 Marks	-	-
Duration of ESE:2Hrs		ESE	30 Marks	-	-
		Total Marks	50 Marks	-	-

Pre-Requisites: NA

Course Outcomes:

CO1	**Analyze** and interpret results from point and interval estimates.
CO2	**Apply** the most appropriate Sampling Techniques for a given applied problems
CO3	**Apply** hypothesis testing to real-world scenarios.

Course Content

Unit I	**Estimation Theory:** Unbiased and efficient estimates, Point estimates and interval estimates, Confidence interval for means, Confidence interval for proportions, Confidence interval for differences and sums of mean and proportions.
Unit II	**Sampling Theory:** Population and sample, Sampling with and without replacement, Population parameters, sample statistics, Sampling distribution of means, and Sampling distribution of proportions
Unit III	**Hypothesis testing:** Introduction, significant level and p-value, Null Hypothesis, Alternative Hypothesis, Type-I and Type-II errors, confidence interval, hypothesis test, t-Test, Z-test, chi square test.

Text Books

1	Higher Engineering Mathematics by B.S. Grewal, 40th Edition, Khanna Publication
2	Advanced Engineering Mathematics by Erwin Kreyszig, 8th Edition, Wiley India
3	Essential Math for Data Science for , by Thomas Nield

Reference Books

1	A Text Book of applied Mathematics, Volume II, by P.N. Wartikar & J.N. Wartikar, Poona Vidyarthi Griha Prakashan
2	Introductory methods of Numerical Analysis, by S.S. Sastry, PHI

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

Semester		Course Code		Course Name	
IV		BSH32404		Leadership and Team Dynamics	
Teaching Scheme		**Examination Scheme(Th)**		**Examination Scheme(P)**	
Theory(Th)	-	**CT-I**	-	-	-
Practical(P)	2 Hrs/Week	**CT-II**	-	-	-
Total Credits	**2**	**CA**	-	**CA**	25 Marks
Duration of ESE:		**ESE**	-	**ESE**	25 Marks
		Total Marks	-	**Total Marks**	**50 Marks**

Pre-Requisites: Basic Understanding of Organizational Behavior, Introduction to Management, Foundations of Psychology, Communication Skills and Problem-Solving and Critical Thinking

Course Outcomes:

CO1	Analyze leadership theories and evaluate their application in team dynamics.
CO2	Apply effective leadership strategies to enhance team performance and collaboration.
CO3	Develop solutions to improve team dynamics through leadership and conflict resolution.

Sr.no	List of Experiments
1	Perform a activity on Icebreakers and Introductions Setting the Stage
2	Perform a activity on Collaborative Problem Solving
3	Perform a activity on Role Assignment and Leadership
4	Perform a activity on Conflict Resolution Exercise
5	Perform a activity on Communication & Listening Skills
6	Perform a activity on Team Decision-Making
7	Perform a activity on Trust-Building Activities
8	Perform a activity on Time Management Challenge
9	Perform a activity on Group Reflection and Feedback
10	Perform a activity on Real-World Engineering Project Simulation

Text Books

1	"Leadership: Theory and Practice" by Peter G. Northouse
2	"Team of Teams: New Rules of Engagement for a Complex World"

Reference Books

1	"The Five Dysfunctions of a Team: A Leadership Fable" by Patrick Lencioni
2	"Leaders Eat Last: Why Some Teams Pull Together and Others Don't" by Simon Sinek

Useful Links

1	https://nptel.ac.in/courses/110107159
2	https://onlinecourses.nptel.ac.in/noc23_mg28/preview

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

Semester		Course Code		Course Name	
IV		BSH32406		Human Value for Professional Society	
Teaching Scheme		**Examination Scheme(Th)**		**Examination Scheme(P)**	
Theory(Th)	2 Hrs/week	**CT-I**	7 Marks	-	-
Practical(P)	-	**CT-II**		-	-
Total Credits	**2 (Th)**	**CA**	6 Marks	-	-
Duration of ESE:2 Hrs		**ESE**	30 Marks	-	-
		Total Marks	**50 Marks**	-	-

Pre-Requisites: NA

Course Outcomes:

CO1	**To explain** the difference between values and ethics and to ensure sustained happiness and prosperity, which are the core aspirations of all human beings.
CO2	**To understand** harmony in the Family and Society-Human Relationship.
CO3	**To apply** in the professional and ethical life.

Course Content

Unit I	**Need, Content and Process for Value Education:-** Meaning and importance of Value Education, Types of Values - Personal Values, Social Values, and Moral Values & Spiritual Values, Relevance of Human values: Integrity, Empathy,
Unit II	**Harmony in the Human Life:-** Define Harmony and significance of Harmony, Importance of - Harmony in the family, society and human relationship, and understand Harmony with self and Nature.
Unit III	**Ethics in the Professional Society:-** Nature, characteristics and scope of professional ethics; Types of Professional Ethics, Professional Values: Trusteeship, Inclusiveness, Commitment, Sustainability, Accountability, Transparency, Impartiality.

Text Books

1	R.R. Gaur, R Sangal, G.P. Bagaria (2009): A Foundation Course in Human Values and Professional Ethics, Excel Books
2	D.R. Kiran (2014) Professional Ethics and Human Values, McGraw Hill Education (India).

Reference Books

1	LaFollette, Hugh, ed. Ethics in Practice: An Anthology. Cambridge: Blackwell,1997
2	Vivian L Vignoles (2017): Identity: Personal and Social, Chapter to appear in Oxford Handbook of Personality and Social Psychology (2nded.), edited by Kay Deaux and Mark Snyder.
3	Happiness and Well-Being, NIOS Module V (Health and well-being)

Useful Links

	https://onlinecourses.nptel.ac.in/noc23_hs89/preview
	https://archive.nptel.ac.in/courses/109/104/109104068

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

Semester	Course Code	Course Name
IV	B$$324XX	**OE – II** (Introduction to Data Science)

Teaching Scheme		Examination Scheme(Th)		Examination Scheme(P)	
Theory(Th)	2 Hr / Week	**CT-I**	7	-	-
Practical(P)	-	**CT-II**	7	-	-
Total Credits	**2(Th)**	**CA**	6	-	-
Duration of ESE: 2 Hrs		**ESE**	30	-	-
		Total Marks	**50**	-	-

Pre-Requisites:

Course Outcomes:

CO1	Apply toolboxes in data science
CO2	Understand statistics, measure, learn inference frequency approach
CO3	Utilize learning models.

Course Content

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 and Transformation, 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

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

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