



TULSIRAMJI GAIKWAD-PATIL
College of Engineering & Technology

Mohgaon, Wardha Road, Nagpur - 441 108



**DEPARTMENT OF COMPUTER SCIENCE AND
ENGINEERING (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

- To strive for rearing standard and stature of the students by practicing high standards of professional ethics, transparency and accountability.
- To provide facilities and services to meet the challenges of Industry and Society.
- To facilitate socially responsive research, innovation and entrepreneurship.
- 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

- To develop professionals who are skilled in the area of Data Science
- To undertake industry academic collaboration to enhance competency in graduates.
- To foster innovative ideas amongst students for becoming leaders.
- To create an environment of research culture.
- 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

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SCHEME OF INSTRUCTION & SYLLABI

Programme: CSE - Data Science

Scheme of Instructions: Second Year B. Tech. in CSE - Data Science

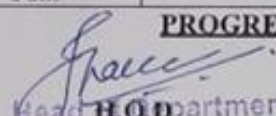
Semester – IV

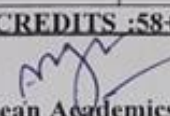
Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME				
									CT-1	CT-2	TA/CA	ESE	TOTAL
1	BSC	BDS2401	Mathematics in Data Science	3	-	-	3	3	15	15	10	60	100
2	PCC	BDS2402	Computer Networks	3	-	-	3	3	15	15	10	60	100
3	PCC	BDS2403	Formal Languages and Automata	3	-	-	3	3	15	15	10	60	100
4	PCC	BDS2404	Database Management Systems	3	-	-	3	3	15	15	10	60	100
5	PCC	BDS2405	Operating System Concepts	3	-	-	3	3	15	15	10	60	100
6	PCC	BDS2406	Artificial Intelligence	3	-	-	3	3	15	15	10	60	100
7	PCC	BDS2407	Artificial Intelligence Lab	-	-	2	2	1	-	-	25	25	50
8	PCC	BDS2408	Database Management Systems Lab	-	-	2	2	1	-	-	25	25	50
9	PCC	BDS2409	Micro Project	-	-	2	2	1	-	-	25	25	50
10	MCC	BAU2404	Group Reading of Classics	2	-	-	2	Audit	-	-	-	-	-
Total				20	00	06	26	21	90	90	135	435	750

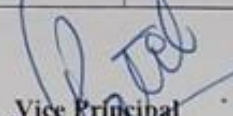
L- Lecture T-Tutorial P-Practical CT1- Class Test 1 CT2- Class Test 2 TA/CA- Teacher Assessment/Continuous Assessment
 ESE- End Semester Examination (For Laboratory End Semester performance)

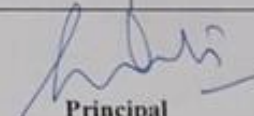
Course Category	HSMC (Hum., Soc. Sc, Mgmt.)	BSC (Basic Sc.)	ESC (Engg. Sc.)	PCC (Programme Core courses)	PEC (Programme Elective courses)	OEC (Open Elective courses from other discipline)	Project / Seminar / Industrial Training	MCC (Mandatory Courses)
Credits	--	04	-	17	--	--	--	--
Cumulative Sum	9	25	14	34	--	--	--	--



PROGRESSIVE TOTAL CREDITS :58+21


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Vice Principal
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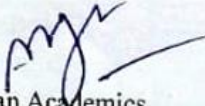

Principal
 Principal
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Semester		Course Code	Name of Course
IV		BDS2401	Mathematics in Data Science
Teaching Scheme		Examination Scheme	
Lectures	3 Hr / Week	CT-1	15 Marks
Tutorial	1 Hr / Week	CT-2	15 Marks
Theory Credits	4	TA	10 Marks
		ESE	60 Marks
		Total	100 Marks
		Duration of : 3 Hrs 00 Min.	
Pre-Requisites: Mathematics – I, Mathematics – II, Mathematics – III			
Course Objectives:			
1	Understand and apply basic principles of Statistics and Probability in a data science context		
2	Recognize the importance and application of Sampling, Estimation theory in data science.		
3	To Employ mathematical reasoning and problem-solving skills in a data-driven environment.		
Course Contents			
Unit I	Statistics: Mean, Median, Mode, Mean deviation, Standard deviation, Multiple regression analysis, Regression equation of three variables, Residual MSE and MAE, Coefficient of determination, Root Mean Square error, Quartile & Percentile, Interquartile Range, Descriptive Statistics, Statistical quality control, Analytic tools for statistic, Stochastic process and models		
Unit II	Sampling Theory: Population and sample, Statistical inference, Sampling with and without replacement, Population parameters, sample statistics, Sampling distribution of means, and Sampling distribution of proportions.		
Unit III	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 IV	Hypothesis testing: Introduction, significant level and p-value, Type-I and Type-II errors, confidence interval, Margin of error, hypothesis test, t-Test, Z-test, proportion testing, t-distribution, chi-square test, ANOVA test		
Unit V	Graph Theory: Basic concepts of graph theory, Digraphs, Basic definitions, Matrix representation of graphs, Sub graphs and quotient graphs, Isomorphic graphs, Paths and circuits, Reach ability and connectedness, Node base, Euler's path & Hamilton's path, Tree, Binary tree, Undirected tree, Spanning tree, Weighted graphs (Only definitions and examples), Minimal spanning tree by Prim's algorithm & Kruskal's algorithm, Representation of algebraic expressions by Venn diagram and binary tree.		
Text Books			
T.1	Essential Math for Data Science, 1 st edition by Thomas Nield, 2022		

T.2	Probability, Statistics and Random Processes by T. Veerarajan, 3 rd edition 2008.
T.3	Fundamentals of Mathematical Statistics (Modern Approach) S.C. Gupta and V. K. Kapoor 10th Edition, 2001
Reference Books	
R.1	A Text Book of Engineering Mathematics N. P. Bali & M. Goyal Laxmi Publication
R.2	Probability, Statistics with Reliability, Queuing and Computer Science Application K.S. Trivedi.
R.3	Higher Engineering Mathematics by B.S. Grewal , 40th Edition Khanna Publication
R.4	Advanced Engineering Mathematics Erwin Kreyszig 8th Edition, Wiley India
Useful Links	
1	https://nptel.ac.in/courses/106/106/106106183/
2	https://nptel.ac.in/courses/111/107/111107058/

Course Outcomes		CL	Class Session
After the completion of this course, students will be able to-			
BDS2401.1	Apply Statistical concepts to real world situation and problem solving.	3	9
BDS2401.2	Apply the most appropriate Sampling Techniques for a given applied problems.	3	9
BDS2401.3	Analyze and interpret results from point and interval estimates.	4	9
BDS2401.4	Apply hypothesis testing to real-world scenarios.	3	9
BDS2401.5	Analyze computational problems in graph theoretical framework.	4	9



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Semester		Course Code		Name of Course	
IV		BDS2402		Computer Networks	
Teaching Scheme			Examination Scheme		
Lectures	3 Hr / Week		CT-1	15 Marks	
Tutorial	1 Hr / Week		CT-2	15 Marks	
Theory Credits	3		TA	10 Marks	
			ESE	60 Marks	
			Total	100 Marks	
			Duration of : 3 Hrs 00 Min.		
Course Objectives:					
1	To understand the computer network architectures.				
2	Study of different protocols at various layers.				
3	Understand TCP/IP and ISO OSI network layer.				
4	Study of design and performance perspective of network architectures.				
5	Introduction to the major concepts involved in network protocols.				
Course Contents					
Unit I	Introduction: Uses and applications of computer networks, Connectionless oriented and connectionless services, Wired and Wireless Network, Network types- LAN, MAN, WAN. Network Devices.				
Unit II	Network Topology: Network topology, Types of Network Topology. Layered Architecture: TCP/IP Model, OSI Model, Difference between TCP/IP and OSI.				
Unit III	Wired Transmission Media: Guided and Unguided Media, characteristics of Transmission Media, Twisted-pair, Coaxial cable, Optical fiber. Wireless LANs: IEEE 802.11, Bluetooth.				
Unit IV	Network Layer: Switching: circuit, packet and message switching. Internet Protocol (IP) – Logical Addressing: IPV4, IPV6. Transport Layer: Elements of Transport protocols: Addressing, Connection establishment, Connection release, Crash recovery, User Datagram Protocol (UDP), Transmission Control Protocol (TCP).				
Unit V	Application Layer: WWW, HTTP, DNS, SMTP, FTP, TFTP, TELNET				
Text Books					
T.1	Computer networks / A.S., Wetherall D.J. Tanenbaum; 5th edition. ; new delhi , pearson education, 2014				
T.2	Data Communications and Networks: 4th edition by Behrouz A. Forouzan. Tata McGraw Hill publication.,2007				
T.3	William Stallings, “Data and Computer Communications”, PHI 6th Edition, 2014				
Reference Books					

R.1	Top down approach to computer networks by Kurose and Ross
R.2	Simon Haykin, "Communication Systems", John Wiley 4th Edition
R.3	Peterson, Simon, "Computer Networks: A Systems Approach", Pearson Education, Asia
R.4	Douglas Comer, "Computer Networks and Internets", Addison Wesley 2nd Edition
Useful Links	
1	https://byjus.com/govt-exams/computer-networks/
2	https://www.pearsonitcertification.com/articles/article.aspx?p=1804869

Course Outcomes		CL	Class Session
After the completion of this course, students will be able to-			
BDS2402.1	Apply Fundamentals of network formation and network devices in physical layer.	3	9
BDS2402.2	Analyze reliable network topology by comparing types and Layered architecture in network layer.	4	9
BDS2402.3	Determine differentiation between wired and wireless Transmission Media	4	9
BDS2402.4	Apply access control protocol for communication in network and reliable transmission of data packets in transport layer.	3	9
BDS2402.5	Examine effective communication in network by application layer.	3	9


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Semester		Course Code	Name of Course	
IV		BDS2403	Formal Language Automata	
Teaching Scheme			Examination Scheme	
Lectures	3 Hr / Week		CT-1	15 Marks
Tutorial	1 Hr / Week		CT-2	15 Marks
Theory Credits	3		TA	10 Marks
			ESE	60 Marks
			Total	100 Marks
			Duration of : 3 Hrs 00 Min.	
Course Objectives:				
1	To provide students an understanding of basic concepts in the theory of computation.			
2	To analyze formal languages and various models of computation.			
3	To exhibit fundamental concepts related with computability theory.			
Course Contents				
Unit I	Introduction-Basic Mathematical Notation and techniques-Finite State systems-Basic Definitions-Finite Automaton-DFA & N DFA-Finite Automaton with ϵ - moves-Regular Languages- Regular Expression-Equivalence of NFA and DFA-Equivalence of N DFA's with and without ϵ -moves-Equivalence of finite Automaton.			
Unit II	Regular Expressions, Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic Laws for Regular Expressions, Properties of Regular Languages Pumping Lemma for Regular Languages, Applications of the Pumping Lemma, Closure Properties of Regular Languages, Decision Properties of Regular Languages			
Unit III	Context-Free Grammars: Chomsky hierarchy of languages. Definition of Context-Free Grammars, Derivations Using a Grammar, Leftmost and Rightmost Derivations, the Language of a Grammar, Sentential Forms, Parse Trees, Applications of Context-Free Grammars, Ambiguity in Grammars and Languages. Push Down Automata,: Definition of the Pushdown Automaton, Acceptance of CFL, Acceptance by Final State and Acceptance by Empty stack, the Languages of a PDA, Equivalence of PDA's and CFG's, Deterministic Pushdown Automata.			
Unit IV	Definitions of Turing machines: behavior, Languages of a TM, TM as accepters, and TM as a computer of integer functions, Types of TMs, Models-Computable languages and functions-Techniques for Turing machine construction-Multi head and Multi tape Turing Machines-The Halting problem-Partial Solvability-Problems about Turing machine.			
Unit V	RECURSIVE AND RECURSIVELY ENUMERABLE LANGUAGES (REL): Properties of recursive and recursively enumerable languages, Un-decidability: A Language that is Not Recursively Enumerable, An Undecidable Problem Undecidable problems about TMs. Context sensitive language and linear bounded automata (LBA), Chomsky hierarchy,			

	Decidability, Post's correspondence problem (PCP), undecidability of PCP., Other Undecidable Problems, and Intractable Problems: The Classes P and NP, An NP-Complete Problem.
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Text Books

T.1	Introduction to Automata Theory, Languages, and Computation, 3rd Edition, John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Pearson Education. 1960
T.2	Introduction to the Theory of Computation, Michael Sipser, 3rd edition, Cengage Learning, 2009


Reference Books


R.1	Introduction to Languages and The Theory of Computation, John C Martin, TMH.
R.2	Introduction to Computer Theory, Daniel I.A. Cohen, John Wiley.
R.3	A Text book on Automata Theory, P. K. Srimani, Nasir S. F. B, Cambridge University Press

Useful Links

1	https://ocw.mit.edu/courses/18-404j-theory-of-computation-fall-2020/video_galleries/video-lectures/
2	https://archive.nptel.ac.in/courses/106/104/106104028/

Course Outcomes		CL	Class Session
After the completion of this course, students will be able to-			
BDS2403.1	Apply basic properties of formal languages to construct Finite Automata.	3	9
BDS2403.1	Design Finite Automata for different Regular Expressions and Languages.	5	9
BDS2403.1	Compare different types of grammar and test the equivalence of pushdown and CFL.	5	9
BDS2403.1	Create a computational model using Turing Machine for the given problem.	6	9
BDS2403.1	Demonstrate basic concept of undecidability, post correspondence & Recursive enumerable Language.	3	9


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Semester		Course Code	Name of Course	
IV		BDS2404	Database Management System	
Teaching Scheme			Examination Scheme	
Lectures	3 Hr / Week		CT-1	15 Marks
Tutorial	1 Hr / Week		CT-2	15 Marks
Theory Credits	3		TA	10 Marks
			ESE	60 Marks
			Total	100 Marks
			Duration of : 3 Hrs 00 Min.	

Course Objectives:


1.	It is aimed at developing skills to design database using data modeling and design techniques.
2.	It is also aimed to developing skills to implement real life applications which involve database handling.
3.	This course also provides carrier opportunities in subject areas of designing, storage techniques and data handling and managing techniques.

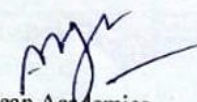
Course Contents



Unit I	Introduction to Management Systems: Significance and advantages, Types of Databases, DBMS Architecture, Functions of DBMS. Relational Model: Entity Relationship Model, Development of ER Diagrams, Extended Entity Relationship Model. Relational model, Database Schema, Relational query languages, Relational algebra, Tuple and Domain Calculus.
Unit II	Relational Database Design: Dependency theory- functional dependencies, Armstrong's axioms for FD's, closure of a set of FD's minimal covers. Normalization of Database Tables: 1NF, 2NF, 3NF, BCNF, Non-loss Decomposition & Dependency preservation, Multi-valued dependencies and 4NF, Join dependencies and definition of 5NF.
Unit III	Query Processing & Optimization: Query processing, Evaluation of relational algebra expressions, Algorithms for SELECT and JOIN operations, Query optimization using Heuristics and Cost Estimation, Materialized Views Storage Structure & strategies : RAID, Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing
Unit IV	Transaction Management: Transaction concepts, properties of transactions, serializability of transactions, Two- Phase Commit protocol, Deadlock, two-phase locking protocol Database Recovery : Failures and their classification, recovery and atomicity, recovery algorithms

Unit V	NoSQL Database: Concepts and evolution, Characteristics and significance, Key-value database, Graph Databases, Document Databases, CRUD Operation.
Text Books	
T.1	Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database System Concepts, 6th Edition, McGraw Hill (SIE), 2013.
T.2	Carlos Coronel, Steven Morris and Peter Rob, Database Principles-Fundamentals of Design, Implementation and Management, 9th Edition, Cengage Learning, 2013.
T.3	Big Data: Principles and Paradigms Amir Vahid Dastjerdi, Rajkumar Buyya, Rodrigo N. Calheiros, Elsevier Science 2007
T.4	NoSQL for Mere Mortals. Dan Sullivan, Addison-Wesley Professional, 2018
Reference Books	
R.1	Alexis Leon and Mathews Leon, Database Management Systems, Vikas Publishing, 2008.
R.2	Next-Generation Databases, Guy Harrison, Apress
R.3	An Introduction to Database Systems(8e Pearson) by Date, Kannan, Swamynathan
Useful Links	
1	https://nptel.ac.in/courses/106/105/106105175/
2	https://onlinecourses.nptel.ac.in/noc21_cs04/preview
3	https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-cs15/

Course Outcomes		CL	Class Session
After the completion of this course, students will be able to-			
BDS2404.1	Analyze data storage problem and derive a data model expressed in the form of an entity relationship or relational model.	4	9
BDS2404.2	Implement relational database design and normalization method of database table.	3	9
BDS2404.3	Evaluate query processing techniques and its strategy	5	9
BDS2404.4	Apply the concepts of transaction management, scheduling, recovery while working in database environment.	3	9
BDS2404.5	Illustrate the issues and concepts of NoSQL databases.	3	9



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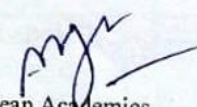

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Semester		Course Code	Name of Course
IV		BDS2405	Operating System Concepts
Teaching Scheme		Examination Scheme	
Lectures	3 Hr / Week	CT-1	15 Marks
Tutorial	1 Hr / Week	CT-2	15 Marks
Theory Credits	3	TA	10 Marks
		ESE	60 Marks
		Total	100 Marks
		Duration of : 3 Hrs 00 Min.	
Course Objectives:			
1.	Introduce general Idea, Structure and Functions of Operating System.		
2.	Making Students aware of basic mechanisms used to handle processes, memory, storage devices and files.		
Course Contents			
Unit I	Introduction: What is Operating System(OS), structure of OS, history of OS, Types of OS: Time sharing, real-time, multi-process (Asynchronous & Synchronous), multiprogramming (loosely coupled, tightly coupled), Distributed, web-based, client-server, peer-to-peer, services of OS, user view & machine view of OS, System calls, Spooling and buffering. Case Studies: Android, Linux, Windows 8.		
Unit II	File Management: File Concept, file attributes, file operations, file system structure, file system implementation, file access methods, Disk Scheduling Algorithms, File protection, free space management on disk. Process Management: Process concept, process scheduling, operations on process, interprocess communication, communication between client-server, multithreaded model, process scheduling criteria, scheduling algorithm.		
Unit III	Memory Management: Preliminaries, Bare machine, resident monitor, swapping, multiple partitions, paging, segmentations, combined systems. Virtual Memory: Overlays, demand-paging performance, of demand paging, page replacement, virtual memory concepts, page replacement algorithms. Allocation algorithm, thrashing.		
Unit IV	Process Synchronization: Critical Section problem, semaphores, classic problems: Dining Philosopher problem, producer-consumer, reader-writers problem, bounded buffer problem, monitors, Atomic transaction, synchronization examples.		
Unit V	Deadlock and Protection: System model, deadlock characterization, methods for handling deadlocks, prevention, detection, recovery, avoidance, Banker's Algorithm. Goal of protection, mechanism & policies, domain protection, access matrix, implementation of access matrix, dynamic protection structures, revocation, existing systems & language based protection, protection problem security.		
Text Books			

T.1	Operating System Principles, Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Wiley India Pvt. Limited, 8yh edition 2009
T.2	Modern Operating Systems – A. S. Tanenbaum, Pearson Education, 4 th Edition 2015
T.3	Operating System- A. S. Godbole, Tata McGraw Hill, third edition, 2005
T.4	Android application Development for Java Programmers by James c. Sheusi, CENGAGE Learning. 1 st Edition 2013
Reference Books	
R.1	Operating Systems concepts and Design – Milan Milenkovic, Tata McGraw Hill
Useful Links	
1	https://nptel.ac.in/courses/106/105/106105214/
2	https://nptel.ac.in/courses/106/106/106106144/
3	https://nptel.ac.in/courses/106/102/106102132/

Course Outcomes		CL	Class Session
After the completion of this course, students will be able to-			
BDS2405.1	Analyze the structure of OS and basic architectural components involved in OS design.	4	9
BDS2405.2	Apply the concept of file system management with the concept of interprocess communication.	3	9
BDS2405.3	Analyze the role of paging, segmentation and virtual memory in operating systems.	4	9
BDS2405.4	Evaluate Critical section problems using process synchronization.	5	9
BDS2405.5	Analyze the mutual exclusion, Deadlock detection and protection problem security of operating system.	4	9



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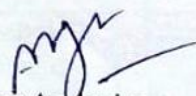

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Semester		Course Code	Name of Course	
IV		BDS2406	Artificial Intelligence	
Teaching Scheme			Examination Scheme	
Lectures	3 Hr / Week		CT-1	15 Marks
Tutorial	1 Hr / Week		CT-2	15 Marks
Theory Credits	3		TA	10 Marks
			ESE	60 Marks
			Total	100 Marks
			Duration of : 3 Hrs 00 Min.	
Course Objectives:				
1	To understand the idea of Artificial Intelligence and challenges involved in designing AI			
2	To understand various knowledge representation.			
3	To develop skills required for ES and life cycle of ES			
4	To represent given problem using state space representation and solve it by using different search techniques.			
5	To understand uncertainty theory in designing AI system.			
Course Contents				
Unit I	Introduction: AI, History, applications, AI problems and AI Techniques, Basics of problem solving, problem representation for toy problems and real world problems, Production system, Structure of agent, rational agent.			
Unit II	Uninformed Search Techniques: Depth-first search, Breadth-first search, comparison of both. Informed Search Techniques: Generate and test, Best First Search, Hill-climbing, Simulated Annealing, and Genetic Algorithms.			
Unit III	Adversarial Search: Two player Games, The min-max algorithm, Alpha-Beta pruning. Constraint Satisfaction Problems: Constraint propagation, backtracking search			
Unit IV	First Order Logic: Models for first order logic, Syntax and Semantics of FOL, Terms, Atomic sentences, complex sentences, Inference in FOL, Unification and lifting, Forward Chaining, Backward Chaining, and Resolution.			
Unit V	Uncertainty Knowledge and Reasoning : rational decisions, basics of probability, axioms of probability, Probability and Baye's Theorem, Bayesian networks Expert system: Development and life cycle of ES, Advantages, characteristics of conventional system and expert system.			

Text Books	
T.1	E. Rich, K. Knight, S. B. Nair; Artificial Intelligence; 3rd Edition; Tata McGraw Hill, 2014.
T.2	Stuart Russel and Peter Norvig; Artificial Intelligence: A Modern Approach; Third Edition; Pearson Education, 2009.
T.3	A First Course in Artificial Intelligence(Mc-Graw Hill) by Deepak Khemani 6 th Edition 2017
Reference Books	
R.1	Denis Rothman; Artificial Intelligence By Example: Develop machine intelligence from scratch using real artificial intelligence use cases; Kindle Edition, Packt Publishing Ltd, 2018.
R.2	Artificial Intelligence a Modern Approach : Russel and Norvig , Pearson Education, 2 nd edition
R.3	Artificial Intelligence – A Practical Approach : Patterson , Tata McGraw Hill, 3 rd edition
Useful Links	
1	https://nptel.ac.in/courses/106102220
2	https://www.uc.edu/content/dam/uc/ce/docs/OLLI/Page%20Content/ARTIFICIAL%20INTELLIGENCER.pdf

Course Outcomes		CL	Class Session
After the completion of this course, students will be able to-			
BDS2406.1	Acquire knowledge of applications of AI, Production system, real world problems	2	9
BDS2406.2	Apply informed and uninformed search strategies.	3	9
BDS2406.3	Evaluate AI techniques using Adversarial Search	5	9
BDS2406.4	Analyze different logics in AI to infer new facts from existing knowledge.	4	9
BDS2406.5	Apply uncertainty theory based on techniques like probability theory	3	9


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Semester		Course Code	Name of Course	
IV		BDS2407	Artificial Intelligence Lab	
Teaching Scheme			Examination Scheme	
Lectures	-		ESE	25 Marks
Tutorial	-		CA	25 Marks
Practical	2 Hr / Week		Total	50 Marks
Practical Credits	1		Duration of : 2 Hrs 00 Min.	
Course Objectives:				
1	To understand the idea of Artificial Intelligence and challenges involved in designing AI.			
2	To understand various knowledge representation.			
3	To develop skills required for ES and life cycle of ES			
4	To represent given problem using state space representation and solve it by using different search techniques.			
5	To understand uncertainty theory in designing AI system.			
Sr. No.	List of Experiments			COs
1	Write a program that list four addresses in a label form, each address should list a name, one- line address, city, state & pin-code.			CO1
2	Write a program for diagnosis the childhood diseases.			CO1
3	Write a program to demonstrate the effective use of Cut and Fail.			CO2
4	Write a program to find roots of quadratic equation. (consider all possible cases)			CO2
5	Write a program to find minimum & maximum from give Numbers.			CO3
6	Write a program to solve water – Jug problem.			CO3
7	Write a program to find factorial of given number.			CO4
8	Write a program to input user name and password from user and repeatedly asking if any one of them is wrong.			CO4
9	Write a program to implement Tower of Hanoi problem			CO5
10	Write a program for traveling salesman problem.			CO5
Text Books				
T.1	E. Rich, K. Knight, S. B. Nair; Artificial Intelligence; 3rd Edition; Tata McGraw Hill, 2014.			
T.2	Stuart Russel and Peter Norvig; Artificial Intelligence: A Modern Approach; Third Edition; Pearson Education, 2009.			
T.3	A First Course in Artificial Intelligence(Mc-Graw Hill) by Deepak Khemani 6 th Edition2017			
Reference Books				
R.1	Denis Rothman; Artificial Intelligence By Example: Develop machine intelligence from			

	scratch using real artificial intelligence use cases; Kindle Edition, Packt Publishing Ltd, 2018.
R.2	Artificial Intelligence a Modern Approach : Russel and Norvig , Pearson Education, 2 nd edition
R.3	Artificial Intelligence – A Practical Approach : Patterson , Tata McGraw Hill, 3 rd edition
Useful Links	
1	https://nptel.ac.in/courses/106102220
2	https://www.uc.edu/content/dam/uc/ce/docs/OLLI/Page%20Content/ARTIFICIAL%20INTELLIGENCEr.pdf

Course Outcomes		CL	Class Session
After the completion of this course, students will be able to-			
BDS2407.1	Acquire knowledge of applications of AI, Production system, real world problems	2	4
BDS2407.2	Apply informed and uninformed search strategies.	3	4
BDS2407.3	Evaluate AI techniques using Adversarial Search	5	4
BDS2407.4	Analyze different logics in AI to infer new facts from existing knowledge.	4	4
BDS2407.5	Apply uncertainty theory based on techniques like probability theory	3	4



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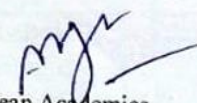

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Semester		Course Code		Name of Course	
IV		BDS2408		Database Management System Lab	
Teaching Scheme			Examination Scheme		
Lectures	-	ESE		25 Marks	
Tutorial	-	CA		25 Marks	
Practical	2 Hr / Week	Total		50 Marks	
Practical Credits	1	Duration of : 2 Hrs 00 Min.			
Course Objectives:					
1.	It is aimed at developing skills to design database using data modeling and design techniques.				
2.	It is also aimed to developing skills to implement real life applications which involve database handling.				
3.	This course also provides carrier opportunities in subject areas of designing, storage techniques and data handling and managing techniques.				
Sr. No.	List of Experiments				COs
1	Introduction to MySQL.				CO1
2	To study and execute the DDL commands of SQL * CREATE * ALTER * RENAME * DROP				CO1
3	To study and execute the DML commands of SQL: Insert, Select, Update, Delete				CO2
4	Write SQL queries to implement Keys constraints				CO2
5	Implementation of different types of Aggregate function with suitable examples				CO3
6	Implementation of different types of operators in SQL				CO3
7	To perform queries based on Group By, Having, Order By clause				CO4
8	Study & Implementation of Subqueries				CO4
9	Study ER diagram. Analyze the Bus Reservation System and come with the entities in it. Identify what Data has to be persisted in the databases.				CO5
10	Study and implement NoSql				CO5
Text Books					
T.1	Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database System Concepts, 6th Edition, McGraw Hill (SIE), 2013.				
T.2	Carlos Coronel, Steven Morris and Peter Rob, Database Principles-Fundamentals of Design, Implementation and Management, 9th Edition, Cengage Learning, 2013.				
T.3	Big Data: Principles and Paradigms Amir Vahid Dastjerdi, Rajkumar Buyya, Rodrigo N. Calheiros, Elsevier Science2007				
T.4	NoSQL for Mere Mortals. Dan Sullivan, Addison-Wesley Professional, 2018				
Reference Books					
R.1	Alexis Leon and Mathews Leon, Database Management Systems, Vikas Publishing, 2008.				
R.2	Next-Generation Databases, Guy Harrison, A press				

R.3	An Introduction to Database Systems(8e Pearson) by Date, Kannan,Swamynathan
Useful Links	
1	https://nptel.ac.in/courses/106/105/106105175/
2	https://onlinecourses.nptel.ac.in/noc21_cs04/preview
3	https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-cs15/

Course Outcomes		CL	Class Session
After the completion of this course, students will be able to-			
BDS2408.1	Analyze data storage problem and derive a data model expressed in the form of an entity relationship or relational model.	4	4
BDS2408.2	Implement relational database design and normalization method of database table.	3	4
BDS2408.3	Evaluate query processing techniques and its strategy.	5	4
BDS2408.4	Apply the concepts of transaction management, scheduling, recovery while working in database environment.	3	4
BDS2408.5	Illustrate the issues and concepts of NoSQL databases.	3	4



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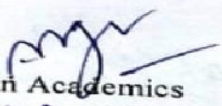
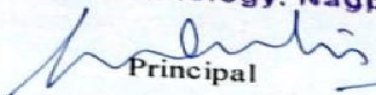

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Semester		Course Code	Name of Course
IV		BDS2409	Micro Project
Teaching Scheme		Examination Scheme	
Lectures	-	ESE	25 Marks
Tutorial	-	CA	25 Marks
Practical	2 Hr / Week	Total	50 Marks
Practical Credits	1	Duration of : 2 Hrs 00 Min.	
Course Objectives:			
1.	To be able to apply some of the techniques/principles students have been taught.		
2.	To do effective trouble-shooting of the micro project.		
3.	To develop effective communication skill by delivering a seminar based on micro project		

Course Outcomes		CL	Class Session
After the completion of this course, students will be able to-			
BDS2409.1	Demonstrate a through and systematic understanding of project contents.	3	4
BDS2409.2	Apply methodologies and professional way of documentation and communication.	3	4
BDS2409.3	Analyze the key stages in development of the project.	4	4
BDS2409.4	Elaborate and Implement the idea in micro project for mini project.	5	4
BDS2409.5	Develop Software skills by learning various algorithms and methodology.	6	4


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