Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur

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

SCHEME OF INSTRUCTION & SYLLABI

Programme: Computer Science and Engineering

Scheme of Instructions: Third Year B.Tech. in Computer Science and Engineering

Semester–V

Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs/Wk	Credits	Exam Scheme				
									CT-1	CT-2	CA	ESE	TOTAL
1	**PCC**	BCS33501	Computer Network	3	-	-	3	3	15	15	10	60	100
2	**PCC**	BCS33502	Design and Analysis of Algorithms	3	-	-	3	3	15	15	10	60	100
3	**PCC**	BCS33503	Software Engineering	3	-	-	3	3	15	15	10	60	100
4	**PEC**	BCS33505-07	Program Elective–I	4	-	-	4	4	15	15	10	60	100
5	**MDM**	BEC33510	Microprocessor and Micro Controller	4	-	-	4	4	15	15	10	60	100
6	**OEC**	BXXXX01	Open Elective-III	2	-	-	2	2	7	8	5	30	50
6	**PCC**	BCS33508	Computer Network Lab	-	-	2	2	1	-	-	25	25	50
7	**PCC**	BCS33509	Design and Analysis of Algorithms Lab	-	-	2	2	1	-	-	25	25	50
			Total	**19**		**4**	**23**	**21**	**82**	**83**	**105**	**380**	**650**

L-Lecture SL-Self Learning P-Practical NHL-Notional Hrs/Wk (Total Notional Hrs)
CT1-ClassTest1 TA/CA-Teacher Assessment/Continuous Assessment CT2-ClassTest2 ESE-End Semester Examination (For Laboratory End Semester Performance)

Course Category	BSC/ESC(Basic Science Course/Engineering Science Course.)	PCC (Programme Core courses)	PEC (Programme Elective courses)	OEC (Open Elective Course)	Multi-disciplinary courses	VSEC (Skill Course)	VEC (Value Education Courses)	Humanities Social Science & Management		Experiential Learning Courses	CC (Liberal Learning Courses)
								AEC(Ability Enhancement Course)	IKS(Indian Knowledge System)		
Credits		11	4	2	4	-	-	-		-	
Cumulative Sum	16/13	32	4	8	8	6	4	10		2	4

PROGRESSIVETOTALCREDITS:87+21=108

HOD Dept. of Computer Science & Engine Tulsiramji Gaikwad Patil Colleg Engineering & Technology	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	**Apr. , 2025**	**1.00**
Chairman	**Dean Academics**	**Vice Principal**	**Principal**	**Date of Release**	**Version**

Applicable forAY 2025-26 Onwards

Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur

SCHEME OF INSTRUCTION& SYLLABI

Program: Computer Science & Engineering

List of Electives offered by

Computer Science & Engineering

Course Code	Professional Elective- I
	Semester V
BCS33506	Artificial Intelligence
BCS33507	Principles of Distributed Systems
BCS33508	Design Patterns
BCS33509	Introduction to Data Science

Course Code	Professional Elective- II	Course Code	Professional Elective- III
	Semester VI		Semester VI
BCS33605	Neural Network and Fuzzy Logic	BCS33609	TCP/IP
BCS33606	Cloud Computing	BCS33610	Computer Graphics
BCS33607	Software Project Management	BCS33611	Network Security
BCS33608	Data Visualization Techniques	BCS33612	Blockchain and Distributed Ledger Technology

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Third Year (Semester-VI) B.Tech. (CSE)

Course Code:BCS33501(Computer Network)

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

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

Course Objective:

1	**To understand** the fundamentals of computer networks, including network types, topologies, models, transmission media, and networking devices.
2	**To analyze** data link layer concepts including error control, MAC protocols, Ethernet standards, switching techniques, and VLANs.
3	**To understand** network layer functions, IP addressing, routing algorithms, congestion control, and key network protocols ensuring efficient data delivery and performance.
4	**To explore** transport layer protocols, connection services, flow and congestion cont mechanisms, TCP operations, and basics of socket programming with QoS considerations..
5	**To comprehend** application layer protocols, network services, fundamentals of cryptography, network security mechanisms, and wireless and mobile network technologies..

Course Contents

Unit I	**Introduction to Computer Networks & OSI Model:** Basics of Computer Networks, Network Types**:** LAN, MAN, WAN, WLAN, PAN, Network Topologies**:** Bus, Star, Ring, Mesh, Hybrid, OSI Model**:** Layers, Functions, Protocols, TCP/IP Model**:** Comparison with OSI Model, Data Transmission Media**:** Wired & Wireless, Network Devices**:** Hub, Switch, Router, Gateway, Modem
Unit II	**Data Link Layer & MAC Protocols**: Error Detection & Correction**:** Parity, CRC, Hamming Code , Flow Control & Error Control Techniques, Framing & MAC Addressing, Multiple Access Protocols **:** ALOHA, CSMA, CSMA/CD, CSMA/CA, Ethernet Standards**:** IEEE 802.3, Fast Ethernet, Gigabit Ethernet, Switching Techniques **:** Circuit, Packet, Message Switching, VLANs and Virtual Circuit Networks
Unit III	**Network Layer & Routing:** Network Layer Functions & Protocols, IP Addressing**:** IPv4 & IPv6, Subnetting, CIDR , Routing Algorithms**:** Distance Vector, Link State, OSPF, RIP, BGP, Congestion Control**:** Leaky Bucket, Token Bucket, Quality of Service (QoS) and Network Performance, ICMP, ARP, RARP, DHCP, NAT
Unit IV	**Transport Layer & Congestion Control:** Transport Layer Protocols**:** TCP, UDP, SCTP , Connection-Oriented vs. Connectionless Services, TCP Flow Control, Congestion Control, and Error Control, Three-Way Handshake & TCP Timers, Multiplexing & Demultiplexing, Socket Programming Basics, QoS Mechanisms in Transport Layer
Unit V	**Application Layer & Network Security:** DNS, HTTP, FTP, SMTP, SNMP, POP3, IMAP,WWW, Proxy Servers, Load Balancing, Cryptography Basics**:** Symmetric & Asymmetric Encryption, Network Security Threats**:** Malware, Phishing, DoS/DDoS Attacks, Firewalls, IDS, IPS, VPN, SSL/TLS . Recent trends in Computer Network.

Text Books	
T1	"**Data Communications and Networking"** – *Behrouz A. Forouzan*
T2	**"Computer Networking: A Top-Down Approach"** – *James F. Kurose & Keith W. Ross*
Reference Books	
R1	**"Computer Networks"** – *Andrew S. Tanenbaum & David J. Wetherall*
R2	**"TCP/IP Protocol Suite"** – *Behrouz A. Forouzan*
Useful Links	
1	https://nptel.ac.in/courses/106/106/106106091/
2	https://nptel.ac.in/courses/106/101/106101092/
3	https://nptel.ac.in/courses/106/105/106105183/
4	https://nptel.ac.in/courses/106/101/106101092/
5	https://nptel.ac.in/courses/106/105/106105183/

Sr. no.	Course Outcomes	CL	Class Session
1	**Understand** the fundamental concepts, network architectures, and communication models.	2	9
2	**Explain** data transmission techniques, error control mechanisms, and multiple access protocols.	2	9
3	**Apply** IP addressing, subnetting, and routing algorithms to design efficient networks.	3	9
4	**Analyze** transport layer functionalities, congestion control techniques, and QoS parameters.	4	9
5	**Evaluate** network security threats and implement security measures such as encryption and firewalls.	5	9

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Third Year (Semester-V) B.Tech. (CSE)

Course Code:BCS33502(Design Analysis & Algorithm)

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

Course Objective:

1	To understand fundamentals of algorithms, analysis, and design.
2	To analyze & explore Divide and Conquer, Greedy, and other algorithmic strategies for solving complex Problem
3	To design & develop expertise in Dynamic Programming for efficient problem-solving.
4	To demonstrate Dynamic Programming to solve complex optimization problems efficiently.
5	To comprehend the principles and complexity of NP-Hard and NP-Complete problems.

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 algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem. Principles of designing algorithms. Introduction to Fundamental Algorithmic Strategies
Unit II	**Divide and Conquer**- basic strategy, Strassen's matrix multiplication, Maximum sub-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 ,Find 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 Branch 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

T1	"Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein
T2	Dynamic Programming and Optimal Control" by Dimitri P. Bertsekas (Wiley Publishers)

Reference Books

R1	Introduction to Algorithms,3rd Edition, T.H.Cormen, C.E.Leiserson, R.L.Rivest, and C.Stein, PHI Pvt.Ltd.
R2	Design and Analysis of algorithms, Aho, Ullman and Hopcroft, Pearson Education,2004.
R3	Algorithm Design: Foundations, Analysis and Internet examples, M.T.Goodrich and 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/

Sr. no.	Course Outcomes	CL	Class Session
1	**Understand** mathematical formulation, complexity analysis and methodologies to solve the recurrence relations for algorithms.	2	9
2	**Analyze and Construct** different designing methods for development of algorithms to realistic problems, such as divide and conquer, greedy	3	9
3	**Demonstrate** Dynamic programming Paradigms to solve real life problems.	4	9
4	**Demonstrate** Backtracking Paradigms to solve real life problems.	4	9
5	**Evaluate** NP class problems and formulate solutions using standard approaches.	6	9

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Program: B. Tech. Third Year

Semester-V | **Software Engineering : BCS33503 (CSE)**

Teaching Scheme		Examination Scheme (Th)		Examination Scheme(P)	
Theory (Th)	3 Hrs./ Week	**CT-I**	15 Marks	-	-
Practical(P)	-	**CT-II**	15 Marks	-	-
Total Credits	**3(Th)**	**CA**	10 Marks	-	-
Duration of ESE:3 Hrs.		**ESE**	60 Marks	-	-
		Total Marks	**100 Marks**	-	-

Pre-Requisites:

Course Objectives:

1.	To Understand the basic concept of software engineering, characteristics, principles, practice, software process model, Data models, Design Concepts, Testing Strategy, Quality Management, and Reverse Engineering
2.	To Analyze software process models and data models
3.	To Design and demonstrate designing concepts and architectural design.
4.	To Demonstrate testing strategies and product metrics.
5.	To Comprehend Quality management, risk management and reverse engineering.

Course Contents

Unit-I	**Introduction To Software Engineering:** Software Characteristics, Software Engineering A Layered Technology, Software Process Framework, Software Myths **Software Engineering Principles and Practice:** Communication Practices, Planning Practices, Modeling Practices, Construction Practice & Deployment, System Engineering Hierarchy, System Modeling.
Unit-II	**Software Process Models:** The Waterfall Model, Incremental Process Models, Evolutionary Process Models, Specialized Process Models, Software Deployment **Data Modeling:** Scenario Based Modeling, Flow Oriented Modeling, Class based Modeling, Behavioral Model.
Unit-III	**Design Concepts:** Abstraction, Pattern modularity, Information hiding, Design classes, Refactoring. **Creating an Architectural Design:** Software architecture, Data design, Architectural styles and patterns, Architectural Design, assessing alternative architectural designs, mapping data flow into a software architecture.
Unit-IV	**Testing Strategies:** A strategic approach to software testing, test strategies for conventional software, Black-Box and White-Box testing, Validation testing, System testing, the art of Debugging. **Product Metrics:** Software Quality, Framework for Product metrics, Metrics for Analysis Model, Metrics for Design Model, Metrics for testing. Metrics for Process and Products, Metrics for software quality
Unit-V	**Quality Management:** Software quality assurance, Software Reviews, Formal technical reviews, Statistical Software quality Assurance, Software reliability, The ISO 9000 quality standards. **Risk management:** Risk strategies, Software risks, Risk identification, Risk refinement, RMMM, Risk Response Control, **Risk Analysis:** Agile management using Jira, Change Management- Software Configuration Management, Software reengineering.

	Reverse Engineering: A practical approach, Recent Trends in Software Engineering
Text Books:-	
1	Software Engineering – A Practitioner's Approach (Sixth Edition) Roger Pressman (TMH)
2	Software Engineering (Ninth Edition) Ian Summerville (Pearson Education)
3	Software Engineering : Theory and Practice (Fourth Edition) Pfleeger
Reference Books:-	
1	Software Engineering – Schaum's Series (TMH)
2	Software Engineering : A Primer, Waman S Jawadekar , Tata McGrawHill, 2008
3	Rajib Mall, Software Project Management, 5th Edition, McGrawHill
Useful Links:-	
1.	**https://nptel.ac.in/course/106/101/106101061/**
2.	**https://nptel.ac.in/courses/106/105/106105087/**

	Course Outcome	CL	Class Sessions
BCS33503.1	**Understand** the Knowledge of Basic Software Engineering Principles and Practices.	1	9
BCS33503.2	**Analyze** Fundamentals of Software Process Models	2	9
BCS33503.3	**Design** Architectural styles and patterns	3	9
BCS33503.4	**Construct** Software Testing Strategies, Unit Testing, System Testing and Product Metrics	4	9
BCS33503.5	**Demonstrate** Steps for Improving the Software Quality	5	9

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Third Year (Semester-V) B.Tech. (CSE)

Course Code: BCS33506(Artificial Intelligence)

Teaching Scheme	
Lectures	3Hrs/week
Tutorial	-
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 basic concepts of Artificial Intelligence.
2	To analyze the Problem Solving methods using various search strategies for AI. to Apply basic principles of AI in solutions that require problem solving, inference, perception.
3	To apply the knowledge representation, and learning To know about basic concepts of knowledge and its representation technique and reasoning.
4	To Acquire skills to manage uncertainty within AI systems through probabilistic and fuzzy logic approaches.
5	To Explore machine learning principles and the development of expert systems, including various techniques.

Course Contents

Unit I	**Fundamentals of Artificial Intelligence:** AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the conceptof rationality, the nature of environments, structure of agents, problem solving agents, problem formulation.
Unit II	**Searching**- Searching for solutions, uniformed search strategies – Breadth first search, depth first Search.Search with partial information (Heuristic search) Hill climbing, A* ,AO* Algorithms, Problemreduction, Game Playing-Adversial search, Games, mini-max algorithm, optimal decisions in multiplayergames, Problem in Game playing, Alpha-Beta pruning, Evaluation functions
Unit III	**Knowledge representation**:Knowledge representation issues, predicate logic- logic programming, semantic nets- frames andinheritance, constraint propagation, representing knowledge using rules, rules based deduction systems.Reasoning under uncertainty, review of probability, Bayes probabilistic interferences and dempster shafertheory.
Unit IV	**Uncertainty:** First order logic. Inference in first order logic, propositional vs. first order inference, unification & lifts ,forward chaining, Backward chaining, Resolution, Learning from observationInductivelearning,Decision Trees,Explanation Based Learning,Statistical Learning methods ,Reinforcement Learning.
Unit V	**Learning & Expert System**: First order logic. Inference in first order logic, propositional vs. first order inference, unification & liftsforward chaining, Backward chaining, Resolution, Learning from observation Inductivelearning,Decision Trees,Explanation Based Learning,Statistical Learning methods ,Reinforcement Learning.

Text Books	
T1	Russell, S. and Norvig, P. 2015. Artificial Intelligence - A Modern Approach, 3rd edition, Prentice Hall
T2	J. Gabriel, Artificial Intelligence: Artificial Intelligence for Humans (Artificial Intelligence, Machine Learning), Create Space Independent Publishing Platform, First edition , 2016
Reference Books	
1	Introduction to Artificial Intelligence & Expert Systems, Dan W Patterson, PHI., 2010 2. S Kaushik, Artificial Intelligence, Cengage Learning, 1st ed.2011.
2	Ric, E., Knight, K and Shankar, B. 2009. Artificial Intelligence, 3rd edition, Tata McGraw Hill.
Useful Links	
1	https://nptel.ac.in/courses/106/105/106105077/
2	https://nptel.ac.in/courses/106/102/106102220/

	Course Outcomes	CL	Class Session
1	Evaluate Artificial Intelligence (AI) methods and describe their foundations.	2	9
2	Analysis of uninformed search & informed search algorithms on.	3	9
3	Demonstrate knowledge of reasoning and knowledge representation for solving real world problems	3	9
4	Classify certain and uncertain factor's AI problems.	4	9
5	Evaluate the concepts of Learning, Expert system and applications.	4	9

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Third Year (Semester-V) B.Tech. (CSE)

Course Code: BCS33507 (Principles of Distributed Systems)

Teaching Scheme	
Lectures	4Hrs/week
Tutorial	-
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 learn the principles, architectures, algorithms and programming models used in distributed systems.
2	To Analyze various distributed algorithms, such as logical clocks and leader election for synchronization.
3	To get knowledge in distributed naming and file systems, consistency, replication and fault tolerance and distributed shared memory.
4	To design and implement sample distributed systems.

Course Contents

Unit I	**Fundamentals of Distributed System:** Definition of a Distributed System, Goals of a Distributed System, Types of Distributed Systems, Basics of Operating System and Networking. **Basics of Architectures:** Architectures - Types of System Architectures, Self Management in Distributed System.
Unit II	**Processes and Communication:** Processes - Basics of Threads, Virtualization, Roles of Client and Server, Code Migration; Communication - Types of Communications, Remote Procedure Calls, Message-Oriented Communication, Stream-Oriented Communication, Multicasting.
Unit III	**Time and Global States:** Introduction, Clocks Events and Process States, Synchronizing Physical Clocks, Logical Time and Logical Clocks, Global States, Distributed Debugging. **Coordination and Agreement:** Introduction, Distributed Mutual Exclusion, Elections, Multicast Communication, Consensus and Related Problems.
Unit IV	**Distributed File Systems:** Introduction, File Service Architecture, Case Study 1: Sun Network File System, Case Study 2: The Andrew File System. **Name Services:** Introduction, Name Services and the Domain Name System, Directory Services, Case Study of the Global Name Services. **Distributed Shared Memory:** Introduction, Design and Implementation Issues, Sequential Consistency, Release Consistency, Other Consistency Models.
Unit V	**Consistency, Replication and Fault Tolerance:**-Introduction To Replication, DataCentric Consistency Models, Client-Centric Consistency Models, Replica Management, Consistency Protocols, Basics of Fault Tolerance, Process Resilience, Reliable ClientServer Communication, Reliable Group Communication, Distributed Commit, Recovery.

Text Books

1	Distributed Systems, Concepts and Design, George Coulouris, J Dollimore and Tim Kindberg, Pearson Education, Edition. 2009.

2	Ajay D. Kshemkalyani and MukeshSinghal, Distributed Computing: Principles, Algorithms and Systems, Cambridge University Press, 2008.
3	Sinha, P.K., 1998. Distributed operating systems: concepts and design. PHI Learning Pvt. Ltd.
Reference Books	
1	Distributed Systems, Principles and Paradigms, Andrew S. Tanenbaum, Maarten Van Steen, 2nd Edition, PHI.
2	Distributed Systems, An Algorithm Approach, Sukumar Ghosh, Chapman&Hall/CRC, Taylor & Fransis Group, 2007.
Useful Links	
1	https://archive.nptel.ac.in/courses/106/106/106106168/
2	https://onlinecourses.nptel.ac.in/noc21_cs87/preview

	Course Outcomes	CL	Class Session
1	Understand Fundamentals and architecture of Distributed System.	2	9
2	Understand Processes and Communication in Distributed Systems	2	9
3	Recognize synchronization and Coordination using logical clock in Distributed System	3	9
4	Analyze various Distributed File Systems, Name Services and Distributed Shared Memory.	4	9
5	Analyze various consistency and replication protocols and methods.	4	9

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Third Year (Semester-V) B.Tech. (CSE)

Course Code: BCS33508 (Design Pattern)

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

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

Course Objective:

1	To understand the fundamentals of design patterns, their types, and applications to solve design problems and improve software design.
2	To construct efficient object creation mechanisms using Creational Design Patterns.
3	To design software systems using Structural Design Patterns.
4	To design and implement interactive software systems using Behavioral Design Patterns and Architecture Patterns (MVC)
5	To apply design patterns to real-world applications, analyzing complexity and designing solutions, through a case study of a Document Editor.

Course Contents

Unit I	Introduction to Design Patterns and Observer Pattern. Basics of Design patterns, Description of design patterns, Catalog. Catalog and organization of catalog, design pattern to solve design problem , selection of design pattern, Use of design pattern
Unit II	**Creational Patterns:** Abstract Factory, Builder, Factory Method, Prototype, Singleton, Creational Patters
Unit III	**Structural Pattern:** Adapter, Bridge, Composite, Decorator, Façade, Flyweight, Proκy, Discussion of Structural Pattern
Unit IV	**Behavioral Pattern:** Chain of Responsibility, Command, Interpreter, Iterator, Mediator, Memento, Observer, State, Strategy, Template Method, Visitor, Discussion of Behavioral Pattern **Architecture Pattern:** MVC Pattern
Unit V	**A Case Study: Designing a Document Editor:** Design Problems, Document Structure, Formatting, Embellishing the User Interface, Supporting Multiple Lock-and-Feel Standards, Supporting Multiple Window Systems, User Operations, Spelling Checking, and Hyphenation **Complexity Analysis of Design Patterns:** Methods to analyze the complexity of design pattern

Text Books

T1	"Head First Design Patterns" by Eric Freeman and Elisabeth Freeman
T2	"Design Patterns Explained" by Shalloway and Trott

Reference Books

R1	"Introduction to Design Patterns in C++" by Alan Ezust and Paul Ersat

R2	Design Patterns: Elements of Reusable Object-Oriented Software" by Erich Gamma, Richard Helm, Ralph Johnson, and John Vlissides
Useful Links	
1	https://devbrite.io/design-patterns
2	https://www.domestika.org/en/blog/8013-the-pattern-library-the-home-of-free-design-patterns

Sr. no.	Course Outcomes	CL	Class Session
1	**Understand** the fundamentals of design patterns and their applications.	2	9
2	**Design and implement** efficient object creation mechanisms using Creational Design Patterns.	3	9
3	**Construct** flexible, scalable, and maintainable software systems using Structural Design Patterns	4	9
4	**Design and implement** interactive software systems using Behavioral Design Patterns and Architecture Patterns (MVC).	4	9
5	**Analyze** real-world problems and apply design patterns to design and develop efficient solutions.	6	9

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Third Year (Semester-V) B.Tech. (CSE)

Course Code: BCS33509 (Introduction to Data Science)

Teaching Scheme	
Lectures	4 Hrs/week
Tutorial	-
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 fundamentals of Basics of Data Science
2	To Summarize methods and structure used to organize a large amount of data.
3	To develop the ability to explore and summarize datasets using statistical techniques and visualization tools.
4	To introduce machine learning model development techniques and enable them to build and optimize predictive models.
5	To enable to assess model performance, fine-tune parameters, and deploy models for real-world applications while ensuring robustness and reliability.

Course Contents

Unit I	**Introduction to Data Science** Definition, Scope, and Applications of Data Science, Evolution of Data Science, Difference between Data Science, Machine Learning, and AI, Lifecycle of Data Science projects, Data Science Roles and Responsibilities, Data Privacy & Protection, Ethical Issues and Challenges in Data Science.
Unit II	**Getting started with raw data** The worlds of arrays with NumPy, creating an array, mathematical operation, indexing and slicing, the data structure of Pandas, series data frame and Panel, reading files, exploratory data analysis, Data preparation and preprocessing inserting and exploring data CSV, XLS, JSON.
Unit III	**Statistical Inference** Introduction to data analysis using python, dealing with missing values in python, exploratory data analysis, analysis of variance, correlation, correlation statistics, Various forms of distribution, one tailed and two tailed test, Z test Vs T tests, F distribution, chi square distribution, ANOVA
Unit IV	**Uncovering Machine learning** Introduction, different types of machine learning, linear regression, logistic regression, naïve bayes classifier, K-means clustering, K-nearest neighbors, hierarchical clustering, decision trees, support vector machines.

Unit V	**Making sense of data through advanced visualization** Controlling line properties of chart, creating multiple plots, Scatter plot, Line plot, bar plot, Histogram, Box plot, Pair plot, playing with text, styling your plot,3d plot of surface
Text Books	
T.1	Introduction to linear algebra-by Gilbert Strang
T.2	Applied statistics and probability for engineers–by Douglas Montgomery
T.3	Python for Data Analysis-by WMcKinney
Reference Books	
1	Raj, Pethuru, "Handbook of Research on Cloud Infrastructures for Big Data Analytics", IGI Global.
2	"A Hands on Introduction to Data Science", Chirag Shah, Cambridge University Press
Useful Links	
1	https://nptel.ac.in/courses/106106212
2	https://www.edx.org/learn/python/ibm-python-basics-for-data-science

Code	Course Outcomes	CL	Class Session
BCS3502.1	**Understand** various technique to for searching, Sorting and hashing	2	9
BCS3502.2	**Apply** Design and analyze different linear data structure techniques to solve real world problem	3	9
BCS3502.3	**Analyze** significance of dynamic memory management Techniques.	4	9
BCS3502.4	**Implement** non-linear data structure to find solutions for given engineering. Applications.	3	9
BCS3502.5	**Summarize** different categories of data Structures.	3	9

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