Tulsiramji Gaikwad - Patil College of Engineering and Technology

Wardha Road, Nagpur-441108

NAAC Accredited with A+ Grade

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

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

Fifth 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	5	PCC	DS	BDS33501	Design and Analysis of Algorithms	T	3	0	0	3	3	30	10	60	3
2	5	PCC	DS	BDS33502	Design and Analysis of Algorithms - Lab	P	0	0	2	2	1	25	-	25	-
3	5	PCC	DS	BDS33503	Data Mining and Data Warehouse	T	3	0	0	3	3	30	10	60	3
4	5	PCC	DS	BDS33504	Data Mining and Data Warehouse – Lab	P	0	0	2	2	1	25	-	25	-
5	5	PCC	DS	BDS33505	Computer Network	T	3	0	0	3	3	30	10	60	3
6	5	PEC	DS	BDS33506- 09	PEC–I	T	4	0	0	4	4	30	10	60	3
7	5	MDM	ECE	BEC33510	Digital System Design with HDL	T	4	0	0	4	4	30	10	60	3
8	5	OE		B$$335XX	OE - III	T	2	0	0	2	2	14	6	30	2
					TOTAL		**19**	**0**	**4**	**23**	**21**	**214**	**56**	**380**	**17**

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	-	11	4	4	2	-	-	-	-	-	-	-	-	-	-
Cumulative Sum	16/13	29	4	12	8	6	4	4	2	4	-	2	-	-	4

PROGRESSIVE TOTAL CREDITS: 21

Head of Department CSE - Data Science Tulsiramji Gaikwad-Patil College of Engineering and Tech... 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
Chairperson	Dean Academics	Vice Principal	Principal	Date of Release	Version

Applicable for A Y 2023-24 Onwards

OE List–

Open Elective				
Sr. no.		OE-I	OE-II	OE-III
1		Semester III	Semester IV	Semester V
	Course Code	BDS32307	BDS32407	BDS33510
	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**	**BDS33506**	**BDS33606**	**BDS33610**	**BDS34702**	**BDS34803**
		Network and Security	Cyber Law and Ethics	Cryptography	Computer Security	Cloud Security	Network Security Administration
2	Domain-2	**Course Code**	**BDS33507**	**BDS33607**	**BDS33611**	**BDS34703**	**BDS34804**
		AI ML	Artificial Intelligence	Machine Learning	Natural Language Processing	Neural Network	Deep Learning
3	Domain-3	**Course Code**	**BDS33508**	**BDS33608**	**BDS33612**	**BDS34704**	**BDS34805**
		IoT	TCP/IP	Mobile Computing	Ad-Hoc Sensor Networks	Internet of Things	Cloud Computing and IoT
4	Domain-4	**Course Code**	**BDS33509**	**BDS33609**	**BDS33613**	**BDS34705**	**BDS34806**
		Digital Healthcare	Introduction of Digital Healthcare	Medical Imaging Analysis with AI	Introduction to Internet of Medical Thing	Healthcare Data Management and Security	Mobile Health Applications

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

Semester	**Course Code**	**Course Name**
V	**BDS33501**	**Data Analysis and Algorithm**

Teaching Scheme		**Examination Scheme(Th)**		**Examination Scheme(P)**	
Theory(Th)	**3Hrs/Week**	**CT-I**	15	-	-
Practical(P)	-	**CT-II**	15	-	-
Total Credits	**03**	**CA**	10	-	-
Duration of ESE: 3Hrs		**ESE**	60	-	-
		Total Marks	**100**	-	-

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

CO1	**Analyze** recurrence relations for algorithms by using mathematical formulation and complexity analysis.
CO2	**Implement** algorithms for fundamental problem solving paradigms.
CO3	**Analyze** Dynamic Programming Paradigms to solve problems.
CO4	**Implement** efficient solutions for computational challenges.
CO5	**Execute** solution of NP class problems using algorithms.

Course Content

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; Substution method, Recursion tree method and Masters' Theorem. Principels of designing algorithms. Introduction to Fundamental Algorithmic Strategies.
Unit II	**Divide and Conquer-**Basic strategy, Strassen's matrix multiplication, Maximum subarray 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, travelling salesman problem, String Editing, Longest Common Subsequences problem,0/1 Knapsack Problem, Chained Matrix Multiplication.
Unit IV	**Backtracking:** General Method, applications- n-Queen problem, sum of subset problem, graph coloring, Hamiltonian cycles. **Branch and Bound:** General method, applications- Travelling salesman problem, 0/1 knapsack problem-LC Branch and Bound solution, FIFO Branch and Bound solution.
Unit V	**NP-Hard and NP-Complete Problems:** Non-deterministic algorithms, NP-Hard and NP-Complete classes, NP-Hard problems, Cook's Theorem.

Text Books

1	Design & Analysis of Computer Algorithms by Aho, Pearson Education. Horowitz, Sahani, Rajsekharam.
2	Computers and Intractability: A Guide to the Theory of NP-Completeness (Garey & Johnson).

3	Horowitz and sahani, Fundamentals of computer Algorithms, Galgotia.
Reference Books	
1	R.C.T. Lee,SS Tseng, R C Chang,Y T Tsai, Introduction to Designed Analysis of Algorithms, A Strategic approach,Tata McGraw Hill.
2	Algorithm Design: Foundations, Analysis and Internet examples, M.T.Goodrich and R. Tomassia,John Wiley and sons.
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc19_cs47/
2	https://nptel.ac.in/courses/106106131

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

Semester		Course Code		Course Name	
V		BDS33502		Data Analysis and Algorithm Lab	
Teaching Scheme		Examination Scheme(Th)		Examination Scheme(P)	
Theory(Th)	-	CT-I	-	-	-
Practical(P)	2 Hrs/week	CT-II	-	-	-
Total Credits	1 (Th)	CA	-	CA	25 Marks
Duration of ESE:		ESE	-	ESE	25 Marks
		Total Marks	-	Total Marks	50 Marks

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

CO1	**Analyze** the performance of sorting algorithms using time complexity and graphical evaluation.
CO2	**Apply** Divide and Conquer and Greedy strategies to solve algorithmic problems like matrix multiplication and Huffman coding.
CO3	**Implement** Dynamic Programming techniques to solve optimization problems such as shortest paths and the 0/1 Knapsack problem.
CO4	**Use** Backtracking techniques to solve decision problems such as the N-Queens and Subset Sum problem.
CO5	**Implement** the concepts of non-deterministic algorithms and verify NP-completeness through Cook's Theorem.

Sr.no	List of Experiments	COs
1	Sort a given set of elements using the quick sort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number element in the 1st to be sorted and plot a graph of the time taken versus n. The element can be read form a file or can be generated using the random number generator.	CO 1
2	Implement a merge sort algorithm to sort a given set of elements and determine the time required to sort the element.	CO 1
3	Implement algorithm for Strassen's matrix multiplication.	CO 2
4	Implement algorithm for Huffman coding.	CO 2
5	Implement a program of Floyd Warshall's Algorithm.	CO 3
6	Implement the 0/1 Knapsack problem using Dynamic Programming	CO 3
7	Find a subset of a given set S = {Sl, S2,.....,Sn} of n positive integers whose SUM is equal to a given positive integer d. For example, if S ={1,2, 5, 6, 8} and d= 9, there are two solutions {1,2,6}and {1,8}. Display a suitable message, if the given problem instance doesn't have a solution.	CO 4
8	Implement N Queen's problem using Back Tracking.	CO 4
9	Implement non – deterministic algorithms.	CO 5
10	Verify Cook's theorm.	CO 5

Text Books

1	Design & Analysis of Computer Algorithms by Aho, Pearson Education. Horowitz, Sahani, Rajsekharam.
2	Computers and Intractability: A Guide to the Theory of NP-Completeness (Garey & Johnson).
3	Horowitz and sahani, Fundamentals of computer Algorithms, Galgotia.
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2	Algorithm Design: Foundations, Analysis and Internet examples, M.T.Goodrich and R. Tomassia,John Wiley and sons.
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2	https://nptel.ac.in/courses/106106131

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

Semester	Course Code	Course Name
V	BDS33503	Data Mining and Data Warehouse

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

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

CO1	**Understand** data mining concepts, data types, and preprocessing techniques.
CO2	**Apply** clustering methods for data analysis and segmentation.
CO3	**Categorize** the scenario for applying different data mining technique.
CO4	**Describe** data warehouse architecture and development methods.
CO5	**Apply** planning and lifecycle concepts in data warehouse projects.

Course Content

Unit I	**Data Mining** – Kinds of data to be mined –Introduction – Applications - Major Issues in Data Mining – Data Objects and Attribute Types – Measuring Data similarity and dissimilarity - Data Cleaning –Data Integration - Data Reduction – Data Transformation – Data Discretization.
Unit II	**Clustering:** Introduction, Clustering, Cluster Analysis, Clustering Methods- K means, Hierarchical clustering, Agglomerative clustering, Divisive clustering, clustering and segmentation software.
Unit III	**Web Mining:** Introduction, Terminologies, Categories of Web Mining – Web Content Mining, Web Structure Mining, Web Usage Mining, Applications of Web Mining, and Agent based and Data base approaches, Web mining Software.
Unit IV	**Data Warehouse:** Introduction to Data Warehouse, Fundamentals Introduction to Data Warehouse, OLTP Systems; Differences between OLTP Systems and Data Warehouse: Characteristics of Data Warehouse; Functionality of Data Warehouse: Advantages, Applications: Top Down and Bottom Up, Development Methodology: Tools for Data warehouse development: Data Warehouse Types.
Unit V	**Planning and Requirements Introduction**: Planning Data Warehouse and Key Issues: Planning and Project Management in constructing Data warehouse; Data Warehouse Development Life Cycle: Kimball Lifecycle Diagram, Requirements Gathering Approaches: Team organization, Roles, and Responsibilities.

Text Books

1	K.P. Soman, Shyam Diwakar and V. Ajay, ―Insight into Data Mining Theory and Practice, Eastern Economy Edition, Prentice Hall of India, 2006.

2	Alex Berson and Stephen J.Smith, ―Data Warehousing, Data Mining & OLAP‖, Tata McGraw – Hill Edition, 35th Reprint 2016.
Reference Books	
1	Alex Berson and Stephen J.Smith, ―Data Warehousing, Data Mining & OLAP‖, Tata McGraw – Hill Edition, 35th Reprint 2016.
2	Ian H.Witten and Eibe Frank, ―Data Mining: Practical Machine Learning Tools and Techniques, Elsevier, Second Edition
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc21_cs06/preview
2	http://kcl.digimat.in/nptel/courses/video/110105148/L07.html

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

Semester	Course Code	Course Name
V	BDS33504	Data Mining and Data Warehouse Lab

Teaching Scheme		Examination Scheme(Th)		Examination Scheme(P)	
Theory(Th)	-	CT-I	-	-	-
Practical(P)	2 Hrs/week	CT-II	-	-	-
Total Credits	1(Pr)	CA	-	CA	25 Marks
Duration of ESE:		ESE	-	ESE	25 Marks
		Total Marks	-	Total Marks	50 Marks

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

CO1	**Install** the WEKA tool for data preprocessing and analysis.
CO2	**Create** ARFF files to represent structured datasets for mining tasks.
CO3	**Apply** preprocessing and OLAP operations for data summarization.
CO4	**Implement** classification and association algorithms in WEKA.
CO5	**Analyze** datasets using clustering techniques like K-means.

Sr.no	List of Experiments	COs
1	Installation of WEKA Tool.	CO 1
2	Creating new Arff File.	CO 1
3	Data Processing Techniques on Data set.	CO 2
4	Data cube construction – OLAP operations.	CO 2
5	Implementation of Apriori algorithm.	CO 3
6	Implementation of Decision Tree Induction.	CO 3
7	Market Basket Analysis using Apriori algorithm in Weka.	CO 4
8	Calculating Information gains measures.	CO 4
9	Classification of data using Bayesian approach.	CO 5
10	Implementation of K-means algorithm.	CO 5

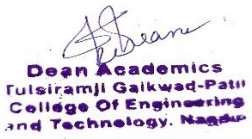
Text Books

1	K.P. Soman, Shyam Diwakar and V. Ajay, —Insight into Data Mining Theory and Practice, Eastern Economy Edition, Prentice Hall of India, 2006.
2	Alex Berson and Stephen J.Smith, —Data Warehousing, Data Mining & OLAP‖, Tata McGraw – Hill Edition, 35th Reprint 2016.

Reference Books

1	Alex Berson and Stephen J.Smith, —Data Warehousing, Data Mining & OLAP‖, Tata McGraw – Hill Edition, 35th Reprint 2016.
2	Ian H.Witten and Eibe Frank, —Data Mining: Practical Machine Learning Tools and Techniques, Elsevier, Second Edition

Useful Links	
1	https://onlinecourses.nptel.ac.in/noc21_cs06/preview
2	http://kcl.digimat.in/nptel/courses/video/110105148/L07.html



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

Semester	Course Code	Course Name
V	BDS33505	Computer Network

Teaching Scheme		Examination Scheme(Th)		Examination Scheme(P)	
Theory(Th)	3	CT-I	15	-	-
Practical(P)	0	CT-II	15	-	-
Total Credits	3	CA	10	-	-
Duration of ESE: 3Hrs		ESE	60	-	-
		Total Marks	100	-	-

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

CO1	**Understand** the basic concepts, applications, types of networks, and devices used in computer networking.
CO2	**Analyze** various network topologies and compare the OSI and TCP/IP layered architectures.
CO3	**Identify** the characteristics of transmission media, and wireless technologies.
CO4	**Explain** the functionalities of the Network and Transport layers, including addressing, switching techniques, and protocols
CO5	**Describe** the working of Application layer protocols and network security.

Course Content

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, Communication satellites, Recent Trends in Network Security.

Text Books

1	B. A. Forouzan – " Data Communications and Networking (3rd Ed)" - TMH
2	William Stallings, "Data and Computer Communications", PHI 6th Edition
3	A.S.,Wetherall, D.J.Tanenbaum ,"Computer networks", 5th edition, new Delhi , Pearson education

Reference Books

1	Andrew S. Tanenbaum, Nick Feamster, David J. Wetherall, "Computer Networks", Pearson, (6th Edition), 2021

2	James F. Kurose, Keith W. Ross, “Computer Networking: A Top-Down Approach”, Pearson, (8th Edition), 2020
Useful Links	
1	https://archive.nptel.ac.in/courses/106/105/106105183/
2	https://onlinecourses.nptel.ac.in/noc22_cs19/preview

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

Semester	**Course Code**	**Course Name**
V	**BDS33506**	**PEC – I (Cyber Law and Ethics)**

Teaching Scheme		**Examination Scheme(Th)**		**Examination Scheme(P)**	
Theory (Th)	4 Hrs./ Week	**CT-I**	15 Marks	-	-
Practical (P)	-	**CT-II**	15 Marks	-	-
Total Credits	**4**	**CA**	10 Marks	-	-
Duration of ESE: 3 Hrs		**ESE**	60 Marks	-	-
		Total Marks	**100 Marks**	-	-

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

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

CO1	**Understand** the scope, evolution, and regulatory framework of Cyber Law in India.
CO2	**Identify** and analyze various cybercrimes and security threats.
CO3	**Apply** legal frameworks and regulations to address cyber law issues.
CO4	**Evaluate** the ethical and social implications of cyber law.
CO5	**Create** awareness about cybersecurity best practices and legal compliance.

Course Content

Unit I	**Introduction to Cyber Law:** Define Cyber Law and its scope. Explain the need for Cyber Law. Discuss the history and evolution of Cyber Law. Compare and contrast Cyber Law with traditional law. Outline the key legal and regulatory framework-governing cyberspace in India (Information Technology Act, 2000 & amendments).
Unit II	**Cyber Crimes and Security Threats**: Define Cyber Crime and its types. Explain various types of cybercrimes: Hacking, Phishing, Identity Theft, Cyber Stalking, Online Fraud. Analyze the causes and consequences of cybercrimes. Discuss Intellectual Property Rights (IPR) issues in cyberspace. Evaluate the role of digital forensics in investigating cybercrimes. Identify common security threats: Malware, Ransomware, Denial of Service Attacks.
Unit III	**Legal Frameworks and Regulations**: Explain the Information Technology Act, 2000 and its key provisions. Discuss the amendments to the IT Act and their impact. Apply the relevant sections of the Indian Penal Code (IPC) to cybercrimes. Analyze the legal aspects of e-commerce and digital contracts. Evaluate the international perspectives on cyber law and treaties. Discuss Data Protection Laws and Privacy Regulations (e.g., GDPR, DPDP Bill).
Unit IV	**Ethical and Social Implications**: Discuss the ethical issues in cyberspace. Analyze the impact of cyber law on freedom of speech and expression. Evaluate the social implications of cybercrime and cyber warfare. Discuss the role of cyber law in promoting digital inclusion and accessibility. Create awareness about cyber ethics and responsible online behavior.
Unit V	**Cybersecurity and Compliance**: Explain the importance of cybersecurity. Discuss cybersecurity best practices and standards. Apply methods for risk assessment and management in cyberspace. Analyze the importance of digital signatures and encryption. Evaluate the legal requirements for data security and breach notification.

Text Books

1	**Cyber Law** by Pavan Duggal
2	**Information Technology Law and Practice** by Vakul Sharma

3	**Cyber Laws: Intellectual Property & E-Commerce Security** by Kumar K
Reference Books	
1	**The Information Technology Act, 2000** (Bare Act)
2	**Data Privacy Principles and Practice** by Roberto Garcia
3	**Computer Security: Principles and Practice** by William Stallings and Lawrie Brown
4	**Understanding Cyber Law** by Rodney D. Ryder
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc23_cs127/preview
2	https://onlinecourses.swayam2.ac.in/cec24_cs14/preview

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

Semester		**Course Code**		**Course Name**	
V		**BDS33507**		**PEC–I (Artificial Intelligence)**	
Teaching Scheme		**Examination Scheme(Th)**		**Examination Scheme(P)**	
Theory(Th)	4HRS/week	**CT-I**	15	-	-
Practical(P)	-	**CT-II**	15	-	-
Total Credits	**4**	**CA**	10	-	-
Duration of ESE: 3Hrs		**ESE**	60	-	-
		Total Marks	100	-	-

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

CO1	**Understand** core concepts of computer science and Python programming for AI.
CO2	**Apply** mathematical foundations essential for AI model development.
CO3	**Implement** machine-learning techniques for real-world problems.
CO4	**Develop** deep learning models using CNNs, RNNs, and Transformers.
CO5	**Explore** AI applications in NLP, vision, robotics, and ethical practices.

Course Content

Unit I	**Fundamentals of AI and Intelligent Problem Solving**: A Historical Perspective on AI, Problem Solving in AI, Problem formulation, State space representation, Search Algorithms (e.g., BFS, DFS, A*)Heuristics and Evaluation Functions, Knowledge Representation (KR), Propositional logic, Predicate logic, Forward chaining, backward chaining
Unit II	**Mathematics for AI**: Linear Algebra: Vectors, matrices, operations — used in neural networks, Probability & Statistics: Understanding data distributions, Bayes' Theorem, Calculus: Especially partial derivatives for optimization (e.g., gradient descent), Discrete Math: Logic, set theory, graph theory — useful in reasoning and search
Unit III	**Machine Learning**: Supervised Learning: Train with labeled data (e.g., classification, regression), Unsupervised Learning: Find patterns in unlabeled data (e.g., clustering), Reinforcement Learning: Learn by interacting with an environment, Neural Networks: Backbone of deep learning.
Unit IV	**Deep Learning and Neural Networks**: Image and speech recognition, Natural language processing, Self-driving cars, Game AI. **Neural Networks**: Structure of neural network, Types of neural network(Feedforward Neural Networks (FNN), Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs), Transformers (Modern Deep Learning),Tools & Libraries for Deep Learning
Unit V	**Intelligent Systems:** Natural Language Processing (NLP), tokenization, sentiment analysis, Computer Vision, Robotics and Automation, AI Ethics. Chatbots, speech recognition.

Text Books

1	Artificial Intelligence By Rich Elaine; Knight Kevin; Nair Shivashankar B. Mc Graw Hill.
2	Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, Pearson

Reference Books

1	A First Course In Machine Learning By Rogers, Sinmon Vikas Publication

2	Natural Language Processing And Information Retrieval Siddiqui Tanveer;Tiwary U.S. Oxford University Press
3	Artificial Intelligence By Rich,Elaine; Knight,Kevin; Nair,Shivashankar B. Mc Graw Hill
4	Artificial Intelligence And Expert Systems Patterson Dan W. Prentice Hall Of India.
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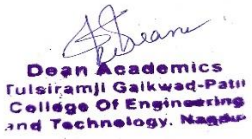
2	https://nptel.ac.in/courses/106105077
3	https://onlinecourses.nptel.ac.in/noc25_mg07/preview



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

Semester		**Course Code**		**Course Name**	
V		**BDS33508**		**PEC – I (TCP/IP)**	
Teaching Scheme		**Examination Scheme(Th)**		**Examination Scheme(P)**	
Theory(Th)	**4Hrs/Week**	**CT-I**	15	-	-
Practical(P)	0	**CT-II**	15	-	-
Total Credits	**04**	**CA**	10	-	-
Duration of ESE: 3Hrs		**ESE**	60	-	-
		Total Marks	**100**	-	-

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

CO1	**Understand** the architecture, protocols, and emerging technologies in modern networking, including SDN, NFV, and IoT networks.
CO2	**Apply** subnetting techniques, configure routing protocols, and administer IP networks using TCP/IP protocol suite.
CO3	**Analyze** TCP/IP transport layer services and mechanisms including connection control, congestion handling, and secure transport.
CO4	**Evaluate** multimedia communication protocols and implement secure, real-time multimedia transmission over IP networks.
CO5	**Demonstrate** understanding of IPv6 architecture, address management, security mechanisms, and transition techniques from IPv4.

Course Content

Unit I	**Introduction to Network Architecture and Technologies** Network architecture, Standards, TCP/IP Model Overview, Internetworking concept, Internet Backbones, NAPS, ISPs, RFCs and Internet Standards, Software-Defined Networking, Network Function Virtualization, Internet of Things (IoT) Networking
Unit II	**TCP/IP Protocol Suite and Network Administration** CIDR, Sub-netting and Super-netting, ARP, OSPF, DHCP, IP forwarding and routing algorithms, Computing paths, Mobile IP, ICMP, BGP, MPLS, DNS
Unit III	**TCP/IP Transport Layer Protocols and Services** TCP header, services, Connection establishment and termination, Interactive data flow, Bulk dataflow, TCP timers, Urgent Data processing, Congestion control, Extension headers, TCP/IP Security, Multipath TCP.
Unit IV	**TCP/IP Multimedia Networking and Security** Multimedia introduction, Digitizing audio & Video, Compression, Streaming, RTP, RTCP, Voiceover IP, Email Security, Internet Security, Multimedia over IP Networks, Quality of Service (QoS) for Multimedia, Content Delivery Networks, Secure Real-time Transport Protocol.
Unit V	**TCP/IP IPv6 Networking and IP Security**

	IP security protocol, IPv6 addresses, Packet format, Multicast, Anycast, ICMPv6, Interoperation between IPv4 and IPv6, QoS, Auto configuration, Secure Neighbor Discovery, IPSec Tunneling and Virtual Private Networks, Network Address Translation for IPv6
Text Books	
1	Internetworking With TCP/IP: Principles Protocols And Architecture/ D. E. Comer; 1st Vol.; Delhi: Pearson Education, 2008
2	TCP/IP Protocol Suite/Behrouz Aforouzan; New Delhi: Tata McGraw Hill, 2013
3	" High Performance TCP/IP Networking Concepts, Issues And Solutions/Hassan, Mahbub; New Delhi: Prentice Hall Of India, 2009
Reference Books	
1	Network Security and Cryptography, Bernard Menezes, Cengage Learning.
2	Information System Security, Nina Godbole, Wiley India, 2008.
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc22_cs19/preview
2	https://archive.nptel.ac.in/courses/106/105/106105183/

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

Semester	Course Code	Course Name
V	BDS33509	PEC-I (Introduction to Digital Healthcare)

Teaching Scheme		Examination Scheme(Th)		Examination Scheme(P)	
Theory(Th)	4Hrs/Week	CT-I	15	-	-
Practical(P)	-	CT-II	15	-	-
Total Credits	04	CA	10	-	-
Duration of ESE: 3Hrs		ESE	60	-	-
		Total Marks	100	-	-

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

CO1	**Understand** the core concepts of healthcare systems and the importance of digital transformation.
CO2	**Explain** the necessity of electronic health records (EHR) and their role in improving patient care.
CO3	**Identification** of key AI applications in healthcare and their impact.
CO4	**Understand** and analyze ethical, legal, and societal implications associated with the adoption of AI in healthcare.
CO5	**Apply** data analytics techniques to interpret healthcare data for clinical and operational decision-making.

Course Content

Unit I	**Introduction to Healthcare Informatics:** Overview of healthcare systems, Importance of healthcare informatics, Role of electronic health records (EHR), AI Basics for healthcare, Introduction to health vitals, Introduction to bio-medical signals, Significance of health vitals and biomedical signals, Introduction with basic bio-medical devices
Unit II	**Electronic Health Records (EHR) & Health Vitals:** Components of EHR systems, Functionalities of EHR systems, Benefits of EHR implementation, Challenges of EHR implementation, Case studies on successful EHR integration, Health vitals extraction process examples, Bio-medical signals capturing process examples
Unit III	**AI Applications in Healthcare :** Applications of AI in healthcare, Medical imaging analysis, Natural Language Processing in Healthcare, Predictive analytics for disease diagnosis and prognosis, Predictive analytics for disease diagnosis and prognosis-examples, Telemedicine, Remote patient monitoring
Unit IV	**Ethical and Legal Considerations:** Patient privacy and data security, Regulatory frameworks for healthcare AI, Ethical challenges in AI-driven healthcare decision-making
Unit V	**Healthcare Data Analytics and Decision Support:** Introduction to healthcare data types: clinical, operational, and financial data, Data preprocessing and cleaning techniques in healthcare, Use of descriptive, diagnostic, and predictive analytics in clinical settings, Visualization of healthcare trends using tools like Tableau or Power BI, Case studies: hospital readmission prediction, disease outbreak analysis, Role of analytics in hospital resource optimization and public health

Text Books

1	Stephan Kudyba. Healthcare Informatics: Improving Efficiency and Productivity. Boca Raton, FL: CRC Press, 2010.
2	Eric Topol. Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again. New York: Basic Books, 2019

Reference Books

1	Richard Gartee. Electronic Health Records: Understanding and Using Computerized Medical Records. Upper Saddle River, NJ: Pearson Prentice Hall, 2009
Useful Links	
1	https://elearn.nptel.ac.in/shop/nptel/fundamentals-of-cloud-services-for-healthcare/?v=c86ee0d9d7ed
2	https://www.coursera.org/learn/introduction-to-digital-health

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

Semester	Course Code	Course Name
V	BEC33510	Digital System Design with HDL

Teaching Scheme		Examination Scheme(Th)		Examination Scheme(P)	
Theory(Th)	4 Hours/ Week	CT-I	15 Marks	-	-
Practical(P)	-	CT-II	15 Marks	-	-
Total Credits	4	CA	10 Marks	-	-
Duration of ESE: 3Hrs		ESE	60 Marks	-	-
		Total Marks	100 Marks	-	-

Pre-Requisites: Basic knowledge of computer organization and architecture. Understanding of number systems and Boolean algebra. Familiarity with programming concepts (preferably Python or C).

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

CO1	**Understand** the fundamental components and syntax of VHDL including entities, architectures, data types, and process statements.
CO2	**Differentiate** various VHDL architecture styles such as data flow, behavioral, and structural modeling with timing control.
CO3	**Design** combinational and sequential logic circuits.
CO4	**Develop** finite state machines (FSMs) using different VHDL modeling techniques and understand state encoding methods.
CO5	**Apply** VHDL for designing and simulating digital systems on Programmable Gate Arrays (FPGAs) and Complex Programmable Logic Devices (CPLDs).

Course Content

Unit I	**Introduction to VHDL :** Library units, package, entity, architecture, configuration, Statements: declaration, concurrent, sequential, process, data types, operators, signal assignment, event scheduling, process statements, configuration statements, package declaration, package body, subprograms.
Unit II	**Types of Architecture:** Data flow, Behavioural, Structural, Delays: Inertial, Transport, Inertial, Simulation deltas, drivers, generic, block, design flow.
Unit III	**VHDL implementation of combinational logic circuits:** adders, subtractors, comparators, encoders, decoders. Sequential logic circuit : Flip flops, counters, shift registers.
Unit IV	**VHDL implementation:** VHDL implementation of Finite state machines (FSM). Registered and unregistered outputs, three ways of designing FSM, State vector encoding.
Unit V	Designing with Programmable Gate Arrays and Complex Programmable Logic Devices.

Text Books

1	John F.Warkerly,"Digital Design Principles and Practices", Pearson Education, Fifth Edition(2018).
2	Morris Mano, Michael D. Ciletti,"Digital Design",Pearson Education, Fifth Edition(2013).
3	R. P. Jain, "Modern Digital Electronics ",Tata Mc Graw Hill Education, Fourth Edition(2010).

Reference Books

1	Thomas L.Floyd, “Digital Fundamentals”, Pearson Prentice Hall, Eleventh Global Edition (2015).
2	Mandal, “Digital Electronics Principles and Applications” , Mc Graw Hill Education, First Edition (2010).
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc21_ee39/preview
2	https://onlinecourses.nptel.ac.in/noc24_cs61/preview

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

Semester	**Course Code**	**Course Name**
V	**BDS33510**	**OE - III (Software Engineering and Quality Assurance)**

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**	**CA**	6 Marks	-	-
Duration of ESE: 2 Hrs		**ESE**	30 Marks	-	-
		Total Marks	**50 Marks**	-	-

Pre-Requisites: Basic understanding of computers and their applications. Familiarity with logical thinking and problem solving. No prior knowledge of software engineering or programming required.

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

CO1	**Explain** the key concepts of software engineering, including the software development life cycle (SDLC) and process models.
CO2	**Apply** requirement analysis techniques to design software solutions for domain-specific problems.
CO3	**Analyze** software testing and quality assurance methods to ensure reliable and efficient software systems.

Course Content

Unit I	**Fundamentals of Software Engineering** (10 Hours): Introduction to software engineering: Definition, scope, and importance in interdisciplinary applications. Software Development Life Cycle (SDLC): Phases (requirements, design, implementation, testing, maintenance). Process models: Waterfall and Agile, their relevance to non-CSE domains. Tools for Agile: Introduction to Jira for sprint planning and task tracking. Case studies: Software in engineering (e.g., structural analysis tools for civil engineering, control systems for mechanical engineering). Ethical considerations: User privacy, ethical software design.
Unit II	**Requirement Analysis and Software Design** (10 Hours): Requirement engineering: Gathering and documenting functional and non-functional requirements. Tools and techniques: Flowcharts, use case diagrams, basic UML (Unified Modeling Language). Software design basics: Modularity, user interface design principles. Applications: Designing software for domain-specific problems (e.g., real-time monitoring in electronics, predictive maintenance in mechanical systems).
Unit III	**Software Testing and Quality Assurance** (10 Hours): Software testing: Objectives, types (unit, integration, system testing). Testing techniques: Black-box and white-box testing, test case design. Quality assurance: Definition, quality metrics, standards (e.g., ISO 9001). Tools for testing and QA: JUnit, Selenium, Bugzilla, Jira for issue tracking. Sustainable QA practices: Minimizing software defects, optimizing performance. Applications: QA for engineering software (e.g., reliability in IoT devices, data pipeline validation in data-driven systems).

Text Books

1	Roger S. Pressman, Software Engineering: A Practitioner's Approach, 8th Edition, McGraw Hill, 2019.

2	Ian Sommerville, Software Engineering, 10th Edition, Pearson Education, 2015.
3	Pankaj Jalote, An Integrated Approach to Software Engineering, 3rd Edition, Narosa Publishing House, 2011.
Reference Books	
1	K.K. Aggarwal and Yogesh Singh, Software Engineering, 3rd Edition, New Age International, 2008.
2	Rajib Mall, Fundamentals of Software Engineering, 5th Edition, PHI Learning, 2018.
3	Boris Beizer, Software Testing Techniques, 2nd Edition, Dreamtech Press, 2003.
4	Richard Fairley, Software Engineering Concepts, McGraw Hill, 2005.
Useful Links	
1	https://nptel.ac.in/courses/106101061
2	https://www.coursera.org/learn/software-engineering-fundamentals
3	https://www.edx.org/course/software-testing-and-quality-assurance
4	https://www.tutorialspoint.com/uml/
5	https://www.guru99.com/software-testing-introduction-importance.html

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