

30.1.1

**UNIVERSITY SCHOOL
OF
INFORMATION AND COMMUNICATION TECHNOLOGY**

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

PROGRAMME STRUCTURE

B.TECH. ARTIFICIAL INTELLIGENCE

2021-2025

30.01.01

08.09.23



**GAUTAM BUDDHA UNIVERSITY
GAUTAM BUDH NAGAR, GREATER NOIDA, UP, INDIA**

School of ICT
Gautam Buddha University
Greater Noida, (U.P.)

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SEMESTER I

S.No.	Course Code	Course Name	L	T	P	Credits	Types
1	MA101	Engineering Mathematics-I	3	1	0	4	GE1
2	PH102	Engineering Physics	3	1	0	4	GE2
3	CS101	Fundamentals of Computer Programming	3	1	0	4	CC1 / FC
4	CS105	Introduction of Artificial Intelligence	2	0	0	2	CC2 / FC
5	EC101	Basic Electronics Engineering	3	1	0	4	GE3 /FC
6	EN101	English Proficiency	2	0	0	2	OE1 / AECC
7	CE103	Engineering Graphics Lab	1	0	2	2	GE-L1
8	PH104	Engineering Physics Lab	0	0	2	1	GE-L2
9	CS181	Computer Programming Lab	0	0	2	1	CC-L1 / SEC
10	EC181	Basic Electronics Engineering Lab	0	0	2	1	GE-L3
11	GP	General Proficiency	Non Credit				
Total Hours and Credits			17	4	8	25	

SEMESTER II

S.No.	Course Code	Course Name	L	T	P	Credits	Types
1	MA102	Engineering Mathematics-II	3	1	0	4	GE4
2	AI102	Introduction to Python	2	0	0	2	CC3
3	EE102	Basic Electrical Engineering	3	1	0	4	GE5
4	ME101	Engineering Mechanics	3	1	0	4	GE6
5	ES101	Environmental Studies	3	1	0	4	OE2 / AECC
6	AI104	Data Structure and Algorithms	2	0	0	2	CC4
7	EE104	Basic Electrical Engineering Lab	0	0	2	1	CC-L2
8	AI182	Python Lab	0	0	2	1	OE-L1 / SEC
9	ME102	Workshop Practice	1	0	2	2	GE-L4
10	AI184	Data Structure and Algorithms Lab	0	0	2	1	CC-L3
11	GP	General Proficiency	Non Credit				
Total Hours and Credits			17	4	8	25	

SEMESTER III

S.No.	Course Code	Course Name	L	T	P	Credits	Types
1	AI201	Software Engineering	3	0	0	3	CC5
2	AI203	Intelligent Systems	3	0	0	3	CC6
3	AI205	Theory of Automata	3	0	0	3	CC7
4	AI207	Database Management Systems	3	0	0	3	CC8
5	AI209	Computer Vision	3	0	0	3	CC9
6	AI211	Introduction to R Programming	3	1	0	4	CC10 / SEC
7	AI281	Database Management Systems Lab	0	0	3	2	CC-L4
8	AI283	Computer Vision Lab	0	0	3	2	CC-L5
9	AI285	R Programming Lab	0	0	3	2	CC-L6 / SEC
10	GP	General Proficiency	Non Credit				
Total Hours and Credits			18	1	9	25	

SEMESTER IV

S.No.	Course Code	Course Name	L	T	P	Credits	Types
1	AI202	Machine Learning	3	1	0	4	CC11
2	AI204	Operating Systems	3	0	0	3	CC12
3	AI206	Computer Interfacing and Embedded Systems	3	0	0	3	CC13
4	AI208	Design and Analysis of Algorithms	3	0	0	3	CC14 / SEC
5	AI210	Quantum Computing	3	0	0	3	CC15
6	AI212	Computer Networks	3	0	0	3	CC16
7	AI282	Machine Learning using Python Lab	0	0	3	2	CC-L7 / SEC
8	AI284	Operating System Lab	0	0	3	2	CC-L8
9	AI286	MATLAB	0	0	3	2	CC-L9 / SEC
10	GP	General Proficiency	Non Credit				
Total Hours and Credits			18	1	9	25	

SEMESTER V

S.No.	Course Code	Course Name	L	T	P	Credits	Types
1	AI301	Big Data Analytics	3	0	0	3	CC17
2	AI303	Compiler Design	3	0	0	3	CC18
3	AI305	Deep Learning and Reinforcement Learning	3	0	0	3	CC19 / SEC
4	AI307	Operational Information Security Management and Biometric	3	1	0	4	CC20
5		Elective 1	3	0	0	3	E1 / DSE
6		Elective 2	3	0	0	3	E2 / DSE
7	AI381	Big Data Analytics Lab	0	0	3	2	CC-L10 / SEC
8	AI383	Compiler Design Lab	0	0	3	2	CC-L11
9	AI385	Deep Learning Lab using Python	0	0	3	2	CC-L12
10	GP	General Proficiency	Non Credit				
Total Hours and Credits			18	1	9	25	

SEMESTER VI

S.No.	Course Code	Course Name	L	T	P	Credits	Types
1	AI302	IoT and Its Applications	3	0	0	3	CC21
2	AI304	Expert Systems	3	0	0	3	CC22
3	AI306	Cloud Computing	3	0	0	3	CC23
4	AI308	Metaheuristics for Optimization	3	1	0	4	CC24
5		Elective 3	3	0	0	3	E3 / DSE
6		Elective 4	3	0	0	3	E4 / DSE
7	AI382	Internet of Things Lab	0	0	3	2	CC-L13
8	AI384	Expert Systems Lab	0	0	3	2	CC-L14 / SEC
9	AI386	Cloud Computing Lab	0	0	3	2	CC-L15
10	GP	General Proficiency	Non Credit				
Total Hours and Credits			18	1	9	25	

Industrial Training will be done by candidate individually after third year during the summer break and it will be of minimum 4 weeks. It will be evaluated as per University Examination in VII semester.

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SEMESTER VII

S.No.	Course Code	Course Name	L	T	P	Credits	Types
1	AI401	Parallel Processing and CUDA Programming	3	1	0	4	CC25
2	AI403	Computational Intelligence	3	0	0	3	CC26
3	AI405	Robotics and Drones	2	0	0	2	CC27
4	AI407	Natural Language Processing	3	0	0	3	CC28
5		Elective 5	3	0	0	3	E5 / DSE
6	AI481	Robotics and Drones Lab	0	0	3	2	CC-L16
7	AI491	Minor Project	0	0	6	3	IT1 / E
8	AI493	Industrial Training	0	0	10	5	MP1 / E
9	GP	General Proficiency	Non Credit				
Total Hours and Credits			14	1	19	25	

SEMESTER VIII

S.No.	Course Code	Course Name	L	T	P	Credits	Types
1	AI490	Seminar	0	0	3	2	S / E
2	AI492	Major Project	0	0	16	8	I / E
3	AI494	Internship	0	0	30	15	MP2 / E
4	GP	General Proficiency	Non Credit				
Total Hours and Credits			0	0	49	25	

GRAND TOTAL OF CREDITS = 200

In the **Seminar**, student need to study and present individually, on latest research paper of their specialized area and It will be evaluated as per University Examination Rules.

The **Internship** in Industry will be done by candidate individually during the 8th semester and it will be for a minimum of 4 (-6) months. It will be evaluated as per University Examination Rules.

Minor and Major Project will be in a group and It will be evaluated as per University Examination Rules.

USICT will provide a mentor/supervisor for industrial training, seminar, internship, minor and major projects.

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5/6

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ELECTIVES FROM DCSE

S.No.	Course Code	Course Name	L	T	P	Credits	Types
1	AI309	Computer Graphics	3	0	0	3	E1
2	AI311	Introduction to Brain and Neuroscience	3	0	0	3	E1
3	AI313	Stochastic Processes	3	0	0	3	E1
4	AI315	Computer Based Numerical & Statistical Techniques	3	0	0	3	E1
5	AI317	Sequence Models	3	0	0	3	E1
6	AI319	Bayesian Data Theory	3	0	0	3	E2
7	AI321	Speech Analysis and Systems	3	0	0	3	E2
8	AI323	Graph Theory	3	0	0	3	E2
9	AI325	Distributed Database	3	0	0	3	E2
10	AI327	Pattern Recognition	3	0	0	3	E2
11	AI329	Data Mining	3	0	0	3	E2
12	AI310	Biometric Security	3	0	0	3	E3
13	AI312	Gaming	3	0	0	3	E3
14	AI314	Knowledge Engineering	3	0	0	3	E3
15	AI316	Predictive Analysis	3	0	0	3	E3
16	AI318	Digital Fabrication	3	0	0	3	E3
17	AI320	AI Enabled Cyber Security	3	0	0	3	E4
18	AI322	Augmented and Virtual Reality	3	0	0	3	E4
19	AI324	Fuzzy logic	3	0	0	3	E4
20	AI326	Distributed Operating System	3	0	0	3	E4
21	AI328	Business Analytics	3	0	0	3	E4
22	AI409	Automation and Robotics	3	0	0	3	E5
23	AI411	Blockchain Technology using SALONA	3	0	0	3	E5
24	AI413	3D Printing	3	0	0	3	E5
25	AI415	Parallel Distributed Systems	3	0	0	3	E5
26	AI417	Time Series Analysis and Applications	3	0	0	3	E5
27	AI419	Data Science Basics and Visualization	3	0	0	3	E5

CC Core Course from USICT for Type of Course

GE General Elective from related discipline of other Deptt./School

GE L General Elective Lab from related discipline of other Deptt./School

OE Open Elective from other discipline of other Deptt./School

AECC Ability Enhancement Compulsary Course

DSE Discipline Specific Course

E Elective from USICT

CC-L Core Course Lab from USICT

IT1 Industrial Training

MP Minor / Major Project

S Seminar

I Internship

BLOCKCHAIN TECHNOLOGY			
Course Code:	AI411	Course Credits:	3
Course Category:	CC	Course (U / P)	U
Course Year (U / P):	4U	Course Semester (U / P):	7U
No. of Lectures + Tutorials (Hrs/Week):	03 +00	Mid Sem. Exam Hours:	1
Total No. of Lectures (L + T):	45 + 00	End Sem. Exam Hours:	3
COURSE OBJECTIVES			
1. To understand the technology behind blockchain			
2. Explain distributed Consensus, and Consensus in Bitcoin			
3. Discuss Permissioned Blockchain, and Hyperledger Fabric			
4. To comprehend the issues related to blockchain			
5. To study the real-world applications of blockchain			
COURSE OUTCOMES			
At the end of the course the students should be able to:			
1. Describe the basic concept of Blockchain, Crypto Primitives, Bitcoin Basics			
2. Identify the area in which they can apply permission or permission less blockchain.			
3. Apply Block chaining concept in various applications.			
4. Design and implement new ways of using blockchain for applications other than cryptocurrency			
5. Recognize the underlying technology of transactions, blocks, proof-of-work, and consensus building			

UNIT I

Introduction to Blockchain: What is Blockchain, Public Ledgers, Blockchain as Public Ledgers, Bitcoin, Blockchain 2.0, Smart Contracts, Block in a Blockchain, Transactions, Distributed Consensus, The Chain and the Longest Chain, Cryptocurrency to Blockchain 2.0, Permissioned Model of Blockchain

UNIT II

Basic Crypto Primitives: Cryptographic Hash Function, Properties of a hash function, Hash pointer and Merkle tree, Digital Signature, Public Key Cryptography, A basic cryptocurrency.

Bitcoin Basics: Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts, Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay.

UNIT III

Distributed Consensus: Why Consensus, Distributed consensus in open environments, Consensus in a Bitcoin network.

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B.Tech (Artificial Intelligence)

Batch: 2022-26

Consensus in Bitcoin: Bitcoin Consensus, Proof of Work (PoW) – basic introduction, Hashcash PoW, Bitcoin PoW, Attacks on PoW and the monopoly problem, Proof of Stake, Proof of Burn and Proof of Elapsed Time. The life of a Bitcoin Miner, Mining Difficulty, Mining Pool.

UNIT IV

Permissioned Blockchain: Permissioned model and use cases, Design issues for Permissioned blockchains, Execute contracts, State machine replication, Consensus models for permissioned blockchain, Distributed consensus in closed environment, Paxos, RAFT Consensus, Byzantine general problem. Blockchain Components and Concepts: Actors in a Blockchain, Components in Blockchain design, Ledger in Blockchain.

UNIT V

Hyperledger Fabric – Transaction Flow: Fabric Architecture, Transaction flow in Fabric.

Hyperledger Fabric Details: Ordering Services, Channels in Fabric, Fabric Peer and Certificate Authority.

Fabric – Membership and Identity Management: Organization and Consortium Network, Membership Service Provide, Transaction Signing.

Text Books

1. Nitin Gaur, Luc Desrosiers, Venkatraman Ramakrishna, Petr Novotny, Salman Baset, Anthony O'Dowd. Hands-On Blockchain with Hyperledger: Building decentralized applications with Hyperledger Fabric and Composer. Packt Publishing Ltd.
2. Bellaj Badr, Richard Horrocks, Xun (Brian) Wu. Blockchain By Example: A developer's guide to creating decentralized applications using Bitcoin, Ethereum, and Hyperledger. Packt Publishing Ltd, 2018.

Reference Books

1. Vikram Dhillon, David Metcalf, Max Hooper. Blockchain Enabled Applications: Understand the Blockchain Ecosystem and How to Make it Work for You. Apress.
2. Mayukh Mukhopadhyay Ethereum Smart Contract Development: Build blockchain-based decentralized applications using solidity. Packt Publishing Ltd

DESIGN AND ANALYSIS OF ALGORITHMS LAB			
Course Code:	AI286	Course Credits:	2
Course Category:	CC-P	Course (U / P)	U
Course Year (U / P):	2U	Course Semester (U / P):	4U
No. of Labs (Hrs/Week):	2(3hrs)	Mid Sem. Exam Hours:	
Total No. of Labs:	10	End Sem. Exam Hours:	3
COURSE OBJECTIVES			
1. Write sorting programs using Divide-and-Conquer techniques.			
2. Implement to find the minimum cost spanning tree and shortest path using different Greedy techniques			
3. Construct DFS, BFS programs and topological ordering using Decrease-and-Conquer technique			
4. Implement knapsack, travelling salesperson			
5. Design different searching & sorting techniques and finding the complexities.			
COURSE OUTCOMES			
At the end of the course the students should be able to:			
1. Demonstrate Quick sort and Merge sort and calculate the time required to sort the elements.			
2. Implement the topological ordering of vertices, travelling salesman problem and Knapsack problem			
3. Construct programs to check graph is connected or not using BFS and DFS methods			
4. Implement programs on divide and conquer, decrease and conquer			
5. Experiment finding the minimum cost of spanning tree using Prim's algorithms and shortest path using Dijkstra's algorithm			

PRACTICALS

(Note: Use any programming tools like C/Java/Python to execute.)

- Sort a given set of elements using the Quick sort method and also analyse it's runtime complexity for different inputs.
- Sort a given set of elements using merge sort method and also analyse it's runtime complexity for different inputs.
- Write a program to obtain the topological ordering of vertices in a given digraph.
- Implement travelling salesman problem and knapsack problem (0/1).
- Print all the nodes reachable from a given starting node in a digraph using BFS method.
- Check whether a given graph is connected or not using DFS method.
- Write a program to implement binary search using divide and conquer technique
- Write a program to implement insertion sort using decrease and conquer technique
- Find minimum cost spanning tree of a given undirected path using a Prim's algorithm.
From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.

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