ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)

M.TECH.-COMPUTER SCIENCE & ENGINEERING

(Effective for the batches admitted in 2025-26)

Semester I (First Year)

S. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T / CLC	P	C			
1	PC	25DPC5801	Advanced Data Structures and Algorithms	3	0	0	3	40	60	100
2	PC	25DPC5802	Distributed Operating Systems	3	0	0	3	40	60	100
3	PE	25DPE5801 25DPE5802 25DPE5803	**Program Elective-I** 1. Advanced Computer Architecture 2. Enterprise Cloud Concepts 3. Applied Machine Learning	3	0	0	3	40	60	100
4	PE	25DPE5804 25DPE5805 25DPE5806	**Program Elective-II** 1. Natural Language Processing 2. Smart Sensor Networks & IoT 3. Computing for Data Analytics	3	0	0	3	40	60	100
5	PC	25DPC5803	Advanced Data Structures and Algorithms Lab	0	0	4	2	40	60	100
6	PC	25DPC5804	Distributed Operating Systems Lab	0	0	4	2	40	60	100
7	MC	25DMC0110	Research Methodology and IPR	1	0	2	2	40	60	100
8	SE	25DSE5801	Full stack Development Using AI	0	1	2	2	40	60	100
9	AC	25DAC9901 25DAC2001 25DAC9902	**Audit Course – I** 1. English for Research Paper Writing 2. Disaster Management 3. Essence of Indian Traditional Knowledge	2	0	0	0	40	-	40
			Total	**15**	**01**	**12**	**20**	**360**	**480**	**840**

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M.TECH.-COMPUTER SCIENCE & ENGINEERING

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Semester II (First Year)

S. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T / CLC	P	C			
1	PC	25DPC5805	Advances in Software Engineering	3	0	0	3	40	60	100
2	PC	25DPC5806	Advanced Databases	3	0	0	3	40	60	100
3	PE	25DPE5807 25DPE5808 25DPE5809	**Program Elective – III** 1. Block Chain Technology 2. Advanced Computer Networks 3. Deep Learning and Applications	3	0	0	3	40	60	100
4	PE	25DPE5810 25DPE5811 25DPE5812	**Program Elective – IV** 1. Generative AI 2. Digital Forensics 3. Robotic Process Automation	3	0	0	3	40	60	100
5	PC	25DPC5807	Advances in Software Engineering Lab	0	0	4	2	40	60	100
6	PC	25DPC5808	Advanced Databases Lab	0	0	4	2	40	60	100
7	MC	25DMC5801	Quantum Technologies And Applications	2	0	0	2	40	60	100
8	PC	25DPC5809	Comprehensive Viva Voce	0	0	0	2	0	100	100
9	AC	25DAC9903 25DAC0101 25DAC5801 25DAC9001 25DAC9904	**Audit Course – II** 1. Sanskrit for Technical Knowledge 2. Business Ethics and Corporate Governance 3. System Modeling 4. Principles of Automation 5. Stress Management By Yoga	2	0	0	0	40	-	40
			Total	**16**	**0**	**08**	**20**	**320**	**520**	**840**

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Semester III (Second Year)

S. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T / CLC	P	C			
1	PE	25DPE5813 25DPE5814 25DPE5815	**Program Elective – V** 1. Software Defined Networks 2. Reinforcement Learning 3. Data Science	3	0	0	3	40	60	100
2	OE	25DOE5801	**Open Elective-I**	3	0	0	3	40	60	100
3	PR	25DPR5801	Dissertation Phase – I	0	0	20	10	100	00	100
4	PR	25DPR5802	Industry Internship	0	0	0	2	100	00	100
5	MC	25DMC5801	Co- Curricular Activities	0	0	0	1	-	-	-
			Total	**06**	**0**	**20**	**19**	**280**	**120**	**400**

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M.TECH.-COMPUTER SCIENCE & ENGINEERING

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Semester IV (Second Year)

S. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T / CLC	P	C			
1	PR	25DPR5803	Dissertation Phase – II	0	0	32	16	100	100	200
			Total	**0**	**0**	**32**	**16**	**100**	**100**	**200**

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M.TECH.-COMPUTER SCIENCE & ENGINEERING

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Semester I (First year)

S. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T / CLC	P	C			
1	PC	25DPC5801	Advanced Data Structures and Algorithms	3	0	0	3	40	60	100
2	PC	25DPC5802	Distributed Operating Systems	3	0	0	3	40	60	100
3	PE	25DPE5801 25DPE5802 25DPE5803	**Program Elective-I** 1. Advanced Computer Architecture 2. Enterprise Cloud Concepts 3. Applied Machine Learning	3	0	0	3	40	60	100
4	PE	25DPE5804 25DPE5805 25DPE5806	**Program Elective-II** 1. Natural Language Processing 2. Smart Sensor Networks &IoT 3. Computing for Data Analytics	3	0	0	3	40	60	100
5	PC	25DPC5803	Advanced Data Structures and Algorithms Lab	0	0	4	2	40	60	100
6	PC	25DPC5804	Distributed Operating Systems Lab	0	0	4	2	40	60	100
7	MC	25DMC0110	Research Methodology and IPR	1	0	2	2	40	60	100
8	SE	25DSE5801	Full stack Development Using AI	0	1	2	2	40	60	100
9	AC	25DAC9901 25DAC2001 25DAC9902	**Audit Course – I** 1. English for Research Paper Writing 2. Disaster Management 3. Essence of Indian Traditional Knowledge	2	0	0	0	40	-	40
			Total	**15**	**01**	**12**	**20**	**360**	**480**	**840**

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
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M.TECH.-COMPUTER SCIENCE & ENGINEERING

Course Code	Year & Sem	ADVANCED DATA STRUCTURES AND ALGORITHMS	L	T	P	C
25DPC5801	I-I		3	0	0	3

Pre-Requisites	DATA STRUCTURES

Course Objectives:

The course aims to:

- Introduce fundamental data structures including linked lists, stacks, queues, trees, graphs, dictionaries, and hashing techniques.
- Develop algorithmic skills for designing and analyzing searching, sorting, and traversal methods.
- Teach implementation of priority queues, binary search trees, and balanced trees (AVL, Red-Black, Splay, B-Trees).
- Enable students to select and apply appropriate data structures for solving computational problems efficiently.
- Foster understanding of the performance analysis and comparative evaluation of data structures and algorithms.

Course Outcomes (CO): Student will be able to

CO1	**Understand** the dynamic memory allocation to implement and manipulate linear data structures like linked lists, stacks, and queues.
CO2	**Analyze** the different sorting and searching techniques, to arrange data efficiently and compare their performance.
CO3	**Create** the dictionaries and hashing for efficient data storage and retrieval.
CO4	**Apply** the operations on trees and priority queues, including insertion, deletion, and traversal.
CO5	**Apply** the balanced search trees for efficient data access and storage.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	the Dynamic memory allocation		to implement and manipulate linear data structures like linked lists, stacks, and queues.	L2
CO2	Analyze	d the ifferent sorting and searching techniques		to arrange data efficiently and compare their performance.	L4
CO3	Create	the dictionaries and hashing		for efficient data storage and retrieval.	L6
CO4	Apply	the operations	on trees and priority queues, including insertion, deletion, and traversal.		L3
CO5	Apply	the balanced search trees		for efficient data access and storage.	L3

UNIT – I	**Introduction**	8 Hrs
Introduction to Data Structures, Singly Linked Lists, Doubly Linked Lists, Circular Lists-Algorithms. Stacks and Queues: Algorithm Implementation using Linked Lists.		
UNIT – II	**Searching and Sorting:**	9 Hrs
Linear and Binary, Search Methods, Sorting: -Basic sorting techniques, Radix Sort, Bucket Sort, Shell Sort Trees- Binary trees, Properties, Representation and Traversals, Expression Trees (Infix, prefix, postfix). Graphs-Basic Concepts, Storage structures and Traversals.		
UNIT – III	**Dictionaries and Hashing**	9 Hrs
Dictionaries: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries. Hashing: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing		
UNIT – IV	**Priority queues**	8 Hrs
Definition, ADT, Realizing a Priority Queue Using Heaps, Definition, Insertion, Deletion .Search Trees- Binary Search Trees, Definition, ADT, Implementation, Operations-Searching, Insertion, Deletion.		
UNIT – V	**Search Trees**	9 Hrs
AVL Trees, Definition, Height of AVL Tree, Operations-, Insertion, Deletion and Searching, Introduction to Red-Black and Splay Trees, B-Trees, Height of B-Tree, Insertion, Deletion and Searching, Comparison of Search Trees.		

Textbooks:

1. Data Structures: A Pseudo Code Approach, 2/e, Richard F.Gilberg, Behrouz A. Forouzon and Cengage
2. Data Structures, Algorithms and Applications in java, 2/e, SartajSahni, University Press

Reference Books:

1. Data Structures and Algorithm Analysis, 2/e, Mark Allen Weiss, Pearson.
2. Data Structures and Algorithms, 3/e, Adam Drozdek, Cengage
3. C and Data Structures: A Snap Shot Oriented Treatise Using Live Engineering Examples, N.B.Venkateswarulu, E.V.Prasad and S Chand & Co.

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3
CO1	1		-
CO2	3	3	2
CO3	3	3	3
CO4	2	2	2
CO5	2	2	2

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
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M.TECH.-COMPUTER SCIENCE & ENGINEERING

Course Code	Year & Sem	DISTRIBUTED OPERATING SYSTEMS	L	T	P	C
25DPC5802	I-I		3	0	0	3

Pre-Requisites	OPERATING SYSTEMS

Course Objectives: This course is aimed at enabling the students to

- Introduce the architectures, principles, and design issues of distributed, database, and multiprocessor operating systems.
- Develop an understanding of communication, synchronization, deadlock handling, and agreement protocols in distributed environments.
- Explain distributed resource management, shared memory, scheduling, and fault tolerance techniques.
- Provide knowledge of security and protection models, and cryptographic methods for secure distributed computing.
- Explore the structure and design issues of multiprocessor and database operating systems with concurrency control mechanisms.

Course Outcomes (CO): Student will be able to

CO1	**Understand** the concepts of Distributed architectures in operating systems.
CO2	**Analyze** the distributed deadlock algorithms and methods in Distributed systems.
CO3	**Apply** the concepts of distributed shared memory to perform scheduling and data recovery.
CO4	**Apply** the protection models and cryptographic algorithms on distributed systems for ensuring data security
CO5	**Analyze** the different multiprocessor operating system algorithms to Recover the data.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	the concepts of Distributed architectures in operating systems.			L2
CO2	**Analyze**	the distributed deadlock algorithms and methods in Distributed systems.			L4
CO3	**Apply**	the concepts of distributed shared memory		to perform scheduling and data recovery.	L3
CO4	**Apply**	the protection models and cryptographic algorithms	on distributed systems	for ensuring data security	L3
CO5	**Analyze**	the different multiprocessor operating system algorithms		to Recover the data.	L4

UNIT – I	Introduction to Distributed Systems	8 Hrs

Architectures of Distributed Systems, System Architecture types, issues in distributed operating systems, communication networks, communication primitives. Theoretical Foundations, inherent limitations of a distributed system, lamp ports, logical clocks, vector clocks, casual ordering of messages, global state, cuts of a distributed computation, termination detection. Distributed Mutual Exclusion, introduction, the classification of mutual exclusion and associated algorithms, a comparative performance analysis

UNIT – II	Distributed Systems Deadlock & algorithms	9 Hrs

Distributed Deadlock Detection, Introduction, deadlock handling strategies in distributed systems, issues in deadlock detection and resolution, control organizations for distributed deadlock detection, centralized and distributed deadlock detection algorithms, hierarchical deadlock detection algorithms. Agreement protocols, introduction-the system model, a classification of agreement problems, solutions to the Byzantine agreement problem, and applications of agreement algorithms. Distributed resource management: introduction-architecture, mechanism for building distributed file systems design issues, log structured file systems

UNIT – III	Distributed Shared memory, Database & Recovery	8 Hrs

Distributed shared memory, Architecture, algorithms for implementing DSM, memory coherence and protocols, design issues. Distributed Scheduling, introduction, issues in load distributing, components of a load distributing algorithm, stability, load distributing algorithm, performance comparison, selecting a suitable load sharing algorithm, requirements for load distributing, task migration and associated issues. Failure Recovery and Fault tolerance: introduction, basic concepts, classification of failures, backward and forward error recovery, backward error recovery, recovery in concurrent systems, consistent set of check points, synchronous and asynchronous check pointing and recovery, check pointing for distributed data base systems, recovery in replicated distributed databases

UNIT – IV	Protection, Security, Cryptography & Authentication	8 Hrs

Protection and security, preliminaries, the access matrix model and its implementations. -safetyin matrix model, advanced models of protection. Data security, cryptography: Model of cryptography, conventional cryptography modern cryptography, private key cryptography, data encryption standard public key cryptography, multiple encryptions, authentication in distributed systems

UNIT – V	Multiprocessor OS & Concurrency control	10 Hrs

Multiprocessor operating systems, basic multiprocessor system architectures, inter connection networks for multiprocessor systems, caching hypercube architecture. Multiprocessor Operating System, structures of multiprocessor operating system, operating system design issues, threads, process synchronization and scheduling.

Concurrency control model of database systems, the problem of concurrency control, serializability theory, distributed database systems, concurrency control algorithms, introduction, basic synchronization primitives, lock-based algorithms, time stamp-based algorithms, optimistic algorithms, concurrency control algorithms, data replication.

Textbooks:

1.Advanced concepts in operating systems :Distributed, Database and multi processor operating systems", Mukesh Singhal, Niranjan and Shivaratri, TMH, 2001

2. **Andrew S. Tanenbaum, Maarten Van Steen**, *Distributed Systems: Principles and Paradigms*, Pearson Education, 2nd Edition, 2006.

Reference Books:

1. **Andrew S. Tanenbaum, Maarten Van Steen**, *Distributed Systems: Principles and Paradigms*, Pearson Education, 2nd Edition, 2006.
2. **Silberschatz, Galvin, Gagne**, *Operating System Concepts*, Wiley, 9th Edition, 2018.
3. **M. Mitzenmacher, E. Upfal**, *Probability and Computing: Randomized Algorithms and Probabilistic Analysis*, Cambridge University Press, 2005.
4. **Alan Tucker**, *Applied Combinatorics*, John Wiley & Sons, 5th Edition, 2007.
5. **Nancy A. Lynch**, *Distributed Algorithms*, Morgan Kaufmann, 1996.
6. **George Coulouris, Jean Dollimore, Tim Kindberg, Gordon Blair**, *Distributed Systems: Concepts and Design*, Pearson, 5th Edition, 2011.

Online Learning Resources:

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3
CO1	1	1	1
CO2	3	2	2
CO3	3	2	2
CO4	3	2	2
CO5	3	2	2

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
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M.TECH.-COMPUTER SCIENCE & ENGINEERING

Course Code	Year & Sem	ADVANCED COMPUTER ARCHITECTURE (Program Elective I)	L	T	P	C
25DPE5801	I-I		3	0	0	3

Pre-Requisites	Computer Organization

Course Objectives:

- To impart the concepts and principles of parallel and advanced computer architectures.
- To develop the design techniques of Scalable and multithreaded Architectures.
- To apply the concepts and techniques of parallel and advanced computer architectures to design modern computer systems

Course Outcomes (CO): Student will be able to

CO1	**Understand** the concept of parallel computer models and program flow Mechanisms.
CO2	**Apply** the principles of scalability in parallel systems by using advanced processor technology.
CO3	**Analyze** the differentiate linear and non-linear Pipeline Processors for instruction level parallelism.
CO4	**Analyze** the multiprocessor system interconnects in the message-passing mechanisms.
CO5	**Apply** the principles of **v**ector processing and Internet of Drones (IoD) **.**

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	The concept of parallel computer models			L2
CO2	Apply	the principles of Scalable performance and scalability in parallel systems	by using advanced processor		L3
CO3	Analyze	the differentiate linear and non-linear Pipeline Processors			L4
CO4	Analyze	the **multiprocessor system interconnects**			L4
CO5	Apply	the v**ector processing principles**			L3

UNIT – I	**Micro Processors**	9 Hrs

Theory of Parallelism, Parallel computer models, The State of Computing, Multiprocessors and Multi computers, Multi vector and SIMD Computers, PRAM and VLSI models, Architectural development tracks, Program and network properties, Conditions of parallelism, Program partitioning and Scheduling, Program flow Mechanisms, System interconnect Architectures.

UNIT – II	**Parallel Processing**	9 Hrs

Principles of Scalable performance, Performance metrics and measures, Parallel Processing applications, Speed up performance laws, Scalability Analysis and Approaches, Hardware Technologies, Processes and Memory Hierarchy, Advanced Processor Technology, Superscalar and Vector Processors.

UNIT – III	**Pipeline Processors**	9 Hrs

Shared-Memory Organizations, Sequential and weak consistency models, Pipelining and superscalar techniques, Linear Pipeline Processors, Non-Linear Pipeline Processors, Instruction Pipeline design, Arithmetic pipeline design, superscalar pipeline design.

UNIT – IV	**Architecture of Microprocessors**	9 Hrs

Parallel and Scalable Architectures, Multiprocessors and Multi computers, Multiprocessor system interconnects, cache coherence and synchronization mechanism, Three Generations of Multi computers, Message-passing Mechanisms, Multi vector and SIMD computers.

UNIT – V	**Applications**	9 Hrs

Vector Processing Principles, Multi vector Multiprocessors, Compound Vector processing, SIMD computer Organizations, The connection machine CM-5.

Controller(ESC), GPS, IMU, Ultra sonic sensors; UAV Software –Arudpilot, Mission Planner, Internet of Drones(IoD)- Case study FlytBase.

Text Books:

Advanced Computer Architecture, Kai Hwang, 2nd Edition, Tata McGraw Hill Publishers.

Reference Books:

1. Computer Architecture, J.L. Hennessy and D.A. Patterson, 4th Edition, ELSEVIER.
2. Advanced Computer Architectures, S.G.Shiva, Special Indian edition, CRC, Taylor &Francis.
3. Introduction to High Performance Computing for Scientists and Engineers, G. Hager and G.Wellein, CRC Press, Taylor & Francis Group.
4. Advanced Computer Architecture, D. Sima, T. Fountain, P. Kacsuk, Pearson education.
5. Computer Architecture, B. Parhami, Oxford Univ. Press.

Mapping of course outcomes with program outcomes

CO	**PO1**	**PO2**	**PO3**
CO1	2	2	-
CO2	3	3	2
CO3	3	3	2
CO4	3	2	1
CO5	3	2	1

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
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Course Code	Year & Sem	Enterprise Cloud Concepts (Program Elective I)	L	T	P	C
25DPE5802	I-I		3	0	0	3

Pre-Requisites	Computer Networks
Course Objectives: Knowledge on significance of cloud computing and its fundamental concepts and models.	
Course Outcomes (CO): Student will be able to	
CO1	**Understand t**he fundamental concepts of cloud computing.
CO2	**Apply** the knowledge of cloud-enabling technologies for enterprise environments.
CO3	**Analyze** the cloud management and architectural mechanisms for effective resource utilization.
CO4	**Analyze** the transformation of traditional enterprises into smart and cloud-enabled enterprises.
CO5	**Apply** the strategies for transitioning to cloud-centric enterprises for ensuring business continuity and scalability.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	**t**he fundamental concepts of cloud computing			L2
CO2	**Apply**	the knowledge of cloud-enabling technologies		for enterprise environments	L3
CO3	**Analyze**	the cloud management and architectural mechanisms		for effective resource utilization.	L4
CO4	**Analyze**	the transformation of traditional enterprises into smart and cloud-enabled enterprises			L4
CO5	**Apply**	the strategies for transitioning to cloud-centric enterprises		for ensuring business continuity and scalability.	L3

UNIT – I	**9 Hrs**
Understanding Cloud Computing: Origins and influences, Basic Concepts and Terminology, Goals and Benefits, Risks and Challenges. Fundamental Concepts and Models: Roles and Boundaries, Cloud Characteristics, Cloud Delivery Models, Cloud Deployment Models.	
UNIT - II	9 Hrs
Cloud-Enabling Technology: Broadband Networks and Internet Architecture, Data Center Technology, Virtualization Technology CLOUD COMPUTING MECHANISMS: Cloud Infrastructure Mechanisms: Logical Network Perimeter, Virtual Server, Cloud Storage Device, Cloud Usage Monitor, Resource Replication	
UNIT - III	9 Hrs
Cloud Management Mechanisms: Remote Administration System, Resource Management System, SLA Management System, Billing Management System, Case Study Example Fundamental Cloud Architectures: Workload Distribution Architecture, Resource Pooling Architecture, Dynamic Scalability Architecture, Elastic Resource Capacity Architecture, Service Load Balancing Architecture, Cloud Bursting Architecture, Elastic Disk Provisioning Architecture, Redundant Storage Architecture, Case Study Example	
UNIT - IV	**9 Hrs**
Cloud-Enabled Smart Enterprises Introduction, Revisiting the Enterprise Journey, Service-Oriented Enterprises, Cloud Enterprises, Smart Enterprises, The Enabling Mechanisms of Smart Enterprises Cloud-Inspired Enterprise Transformations Introduction, The Cloud Scheme for Enterprise Success, Elucidating the Evolving Cloud Idea, Implications of the Cloud on Enterprise Strategy, Establishing a Cloud-Incorporated Business Strategy	
UNIT - V	**9 Hrs**
Transitioning to Cloud-Centric Enterprises The Tuning Methodology, Contract Management in the Cloud Cloud-Instigated IT Transformations Introduction, Explaining Cloud Infrastructures, A Briefing on Next-Generation Services, Service Infrastructures, Cloud Infrastructures, Cloud Infrastructure Solutions, Clouds for Business Continuity, The Relevance of Private Clouds, The Emergence of Enterprise Clouds	
Textbooks:	
1. Erl Thomas, Puttini Ricardo, Mahmood Zaigham, Cloud Computing: Concepts, Technology & Architecture 1st Edition 2. Pethuru Raj, Cloud Enterprise Architecture, CRC Press	

Reference Books:

1. James Bond, The Enterprise Cloud, O'Reilly Media, Inc
2. Dr. Kumar Saurabh, “Cloud Computing”, Wiley Publication.
3. Dimitris N. Chorafas, “Cloud Computing Strategies” CRC Press; 1 edition [ISBN: 1439834539],2010 4. Toby Velte, Anthony Velte, Robert Elsenpeter, “Cloud Computing, A Practical Approach” McGraw Hill Osborne Media; 1 edition [ISBN: 0071626948], 200
4. RajkumarBuyya, James Broberg, Andrzej M. Goscinski, “Cloud Computing: Principles and Paradigms”, Wiley Publication, 2011.
5. Tim Mather, SubraKumaraswamy, Shahed Latif, “Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance”, O’ReillyMediaInc, 2009

Correlation of COs with the POs & PSOs

COs	PO1	PO2	PO3
CO1	2	1	2
CO2	3	1	2
CO3	3	2	2
CO4	2	3	2
CO5	3	2	2

(*3: Highly Correlated, 2: Moderately Correlated, 1: Weakly Correlated)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
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Course Code	Year & Sem	Applied Machine Learning (Program Elective I)	L	T	P	C
25DPE5803	I-I		3	0	0	3

Pre-Requisites	Machine Learning

Course Objectives:

- To know the fundamental concepts of Machine Learning.
- To understand linear, distance based, and decision tree based models
- To explore tools and practices for Machine learning in Real world situation.
- To know the Artificial Neural Network and Reinforcement Learning.

Course Outcomes (CO): Student will be able to

CO1	**Analyze** the machine Learning concepts, and different learning paradigms applications.
CO2	**Understand** the advanced machine learning tasks and binary classification concepts.
CO3	**Apply** the decision tree learning concepts, linear models, and support vector machine methods.
CO4	**Analyze** the various distance-based and probabilistic machine learning models for real world scenarios.
CO5	**Analyze** the advanced topics in artificial neural networks and reinforcement learning techniques.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the machine Learning concepts, and different learning paradigms applications.			L4
CO2	Understand	the advanced machine learning tasks and binary classification concepts			L2
CO3	Apply	the decision tree learning concepts, linear models, and support vector machine methods.			L3
CO4	Analyze	the various distance-based and probabilistic machine learning models for real world scenarios.		for real world scenarios	L4
CO5	Analyze	the advanced topics in artificial neural networks and reinforcement learning techniques.			L4

UNIT – I		9Hrs
Introduction to Machine Learning: Introduction. Different types of learning, Examples of Machine Learning Applications Supervised Learning: Learning a Class from Examples, Probably Approximately Correct Learning, Learning multiple classes, Model selection and generalization Regression: Linear regression, Multiple Linear regression, Logistic Regression.		
UNIT – II		9 Hrs
The ingredients of machine learning: Tasks, Models, Features Binary classification and related tasks: Classification, Assessing classification performance, Visualizing classification performance Beyond binary classification: Multi-class classification, Regression, Unsupervised and descriptive learning		
UNIT – III		9 Hrs
Decision Tree learning – Introduction, Decision tree representation, Appropriate problems for decision tree learning, The basic decision tree learning algorithm, Inductive bias in decision tree, Issues in decision tree learning. Linear models: The least-squares method, Multivariate linear regression, The perceptron, Support vector machines, Soft margin SVM, Going beyond linearity with kernel methods.		
UNIT – IV		8 Hrs
Distance Based Models: Introduction, Neighbours and exemplars, Nearest Neighbours classification, K-Means algorithms, Clustering around medoids Probabilistic Models: Using Naïve Bayes Model for classification, Expectation Maximization, Gaussian Mixture models		

UNIT – V		9 Hrs
Artificial Neural Networks: Introduction, Neural network representation, appropriate problems for neural network learning, Multilayer networks and the back propagation, Advanced topics in Artificial Neural Networks Reinforcement Learning: Introduction, Learning tasks, Q-learning		
Textbooks:		
1. Machine Learning: The art and Science of algorithms that make sense of data, Peter Flach, Cambridge University Press, 2012 2. Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education		
Reference Books:		
1. AurélienGéron, Hands-On Machine Learning with Scikit-Learn, Keras, and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems 2nd Edition 2. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014 3. EthemAlpaydın, Introduction to machine learning, second edition, MIT press. 4. T. Hastie, R. Tibshirani and J. Friedman, "Elements of Statistical Learning", Springer Series, 2nd edition		

Mapping of course outcomes with program outcomes

CO	**PO1**	**PO2**	**PO3**
CO1	2	2	1
CO2	2	2	1
CO3	3	3	3
CO4	3	3	3
CO5	3	2	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
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M.TECH.-COMPUTER SCIENCE & ENGINEERING

Course Code	Year & Sem	NATURAL LANGUAGE PROCESSING (Program Elective-II)	L	T / CLC	P	C
25DPE5804	I-I		3	0	0	3

Course Outcomes:

Pre-Requisites	Theory of Computation

Course Objectives:

- Introduce the fundamental concepts of human language, linguistic structures, and their computational representation for Natural Language Processing.
- Develop knowledge of grammars, parsing strategies, semantic interpretation, and language modeling techniques for designing NLP systems.
- Explore advanced NLP applications such as machine translation, multilingual information retrieval, and cross-lingual language processing

Course Outcomes (CO): Student will be able to

CO1	**Understand** the fundamental concepts of Language and its roles in Natural Language Processing.
CO2	**Apply** the different grammar formalisms and parsing strategies for effective natural language processing.
CO3	**Analyze** the efficient parsing models for human language preferences and grammatical constraints.
CO4	**Evaluate** the statistical and neural language models for accurate language understanding and prediction.
CO5	**Analyze** the methods, and frameworks of Machine Translation and Anusaraka systems in bridging multilingual communication gaps.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	the fundamental concepts of Language and its roles in Natural Language Processing.			L2
CO2	**Apply**	different grammar formalisms and parsing strategies		for effective natural language processing.	L3
CO3	**Analyze**	efficient parsing models		for human language preferences and grammatical constraints.	L4
CO4	**Evaluate**	statistical and neural language models		for accurate language understanding and prediction.	L5
CO5	**Analyze**	The methods, and frameworks of Machine Translation and Anusaraka systems in bridging multilingual communication gaps.		.	L4

UNIT – I		9 Hrs
The Study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different Levels of Language Analysis, Representations and Understanding, Organization of Natural language Understanding Systems, Linguistic Background: An outline of English Syntax.		
UNIT - II		9Hrs
Grammars and Parsing- Top-Down and Bottom-Up Parsers, Transition Network Grammars, Feature Systems and Augmented Grammars, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks, Bayes Rule, Shannon game, Entropy and Cross Entropy.		
UNIT - III		9 Hrs
Grammars for Natural Language, Movement Phenomenon in Language, Handling questions in Context Free Grammars, Hold Mechanisms in ATNs, Gap Threading, Human Preferences in Parsing, Shift Reduce Parsers, Deterministic Parsers.		
UNIT - IV		9 Hrs
Semantic Interpretation: Semantic & Logical form, Word senses & ambiguity, The basic logical form language, Encoding ambiguity in the logical Form, Verbs & States in logical form, Thematic roles, Speech acts &embedded sentences, Defining semantics structure model theory. **Language Modelling:** Introduction, n-Gram Models, Language model Evaluation, Parameter Estimation, Language Model Adaption, Types of Language Models, Language-Specific Modelling Problems, Multilingual and Cross lingual Language Modelling.		
UNIT - V		9 Hrs
Machine Translation Survey: Introduction, Problems of Machine Translation, Is Machine Translation Possible, Brief History, Possible Approaches, Current Status. Anusaraka or Language Accessor: Background, Cutting the Gordian Knot, The Problem,		

Structure of Anusaraka System, User Interface, Linguistic Area, Giving up Agreement in Anusarsaka Output, Language Bridges.
Multilingual Information Retrieval: Introduction, Document Pre-processing, Monolingual Information Retrieval, CLIR, MLIR, Evaluation in Information Retrieval, Tools, Software and Resources.

Textbooks:

1. James Allen, Natural Language Understanding, 2nd Edition, 2003, Pearson Education.
2. Multilingual Natural Language Processing Applications: From Theory To Practice-Daniel M.Bikel and ImedZitouni, Pearson Publications.
3. Natural Language Processing, Apaninian perspective, AksharBharathi, Vineetchaitanya, Prentice–Hall of India.

Reference Books:

1. Charniack, Eugene, Statistical Language Learning, MIT Press, 1993.
2. Jurafsky,Dan and Martin, James, Speech and Language Processing, 2nd Edition, Prentice Hall, 2008.
3. Manning, Christopher and Henrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3
CO1	2	2	1
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	2	3

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
M.TECH.-COMPUTER SCIENCE & ENGINEERING

Course Code	Year & Sem	SMART SENSOR NETWORKS & IOT (Program Elective-II)	L	T	P	C
25DPE5805	I-I		3	0	0	3

Pre-Requisites	Computer Networks

Course Objectives:

- To provide an in-depth understanding of IoT concepts, applications, and research areas in domains such as smart cities, smart health, smart energy, and smart transportation.
- To analyzeIoT system architectures, design constraints, physical devices, communication protocols, and middleware for advanced implementation.
- To explore industrial and commercial IoT applications, including automation, sensor networks, and emerging trends like edge computing, cloud of things, and digital twins.

Course Outcomes (CO): Student will be able to

CO1	**Understand** the IoT-based smart environments in different domains using big data analytics, and IoT reference models.
CO2	**Analyze** the IoT reference architectures to perform different Design constraints.
CO3	**Apply** the practical knowledge of IoT devices to enable efficient and secure IoT system design.
CO4	**Apply** the IoT principles to industrial automation using SOCRADES and IMC-AESOP
CO5	**Analyze** the case studies in commercial building automation

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the IoT-based smart environments in different domains	using big data analytics, and IoT reference models.		L2
CO2	**Analyze**	the IoT reference architectures		to perform different Design constraints.	L4
CO3	**Apply**	the practical knowledge of IoT devices		to enable efficient and secure IoT system design.	L3
CO4	**Apply**	the IoT principles to industrial automation	using SOCRADES and IMC-AESOP		L3
CO5	**Analyze**	the case studies in commercial building automation			L5

UNIT – I	Introduction and Applications	8 Hrs

Introduction and Applications: smart transportation, smart cities, smart living, smart energy, smart health, and smart learning. Examples of research areas include for instance: Self-Adaptive Systems, Cyber Physical Systems, Systems of Systems, Software Architectures and Connectors, Software Interoperability, Big Data and Big Data Mining, Privacy and Security IoT Reference Architecture Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

UNIT – II	Real-World Design Constraints	9 Hrs

Real-World Design Constraints- Introduction, Technical Design constraints, hardware, Data representation and visualization, Interaction and remote control..

UNIT – III	IOT Physical Devices & Endpoints	8 Hrs

IOT Physical Devices & Endpoints: What is an IOT Device, Exemplary Device Board, Linux on Raspberry, Interface and Programming & IOT Device. Hardware Platforms and Energy Consumption, Operating Systems, Time Synchronization, Positioning and Localization, Medium Access Control, Topology and Coverage Control, **Routing:** Transport Protocols, Network Security, Middleware, Databases

UNIT – IV	Industrial Automation	8 Hrs

Industrial Automation-Service-oriented architecture-based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things, Commercial Building Automation-Introduction

UNIT – V	Case study	10 Hrs

Case study: phase one-commercial building automation today.
Case study: phase two commercial building automation in the future. Recent trends in sensor network and IOT architecture, Automation in Industrial aspect of IOT.

Textbooks:

1. Mandler, B., Barja, J., MitreCampista, M.E., Cagáová, D., Chaouchi, H., Zeadally, S., Badra, M., Giordano, S., Fazio, M., Somov, A., Vieriu, R.-L., Internet of Things. IoT Infrastructures, Springer International Publication
2. Internet of Things: A Hands-On Approach Paperback – 2015, by ArsheepBahga (Author), Vijay Madisetti (Author)
3. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things by Pearson Paperback – 16 Aug 2017 ,by Hanes David (Author), Salgueiro Gonzalo (Author), Grossetete Patrick (Author), Barton Rob (Author).

Reference Books:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, ― From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence‖, 1st Edition, Academic Press, 2014.
2. Arshdeep Bahga, Vijay Madisetti - Internet of Things: A Hands-On Approach, Universities Press, 2014.
3. The Internet of Things, Enabling technologies and use cases – Pethuru Raj, Anupama C. Raman, CRC Press.
4. Francis daCosta, ―Rethinking the Internet of Things: A Scalable Approach to Connecting Everything‖, 1st Edition, Apress Publications, 2013

Online Learning Resources:

1. https://www.arduino.cc/
2.https://www.raspberrypi.org/
3. https://nptel.ac.in/courses/106105166/5
4. https://nptel.ac.in/courses/108108098/4

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3
CO1	2	2	1
CO2	3	3	2
CO3	3	2	3
CO4	3	3	2
CO5	3	3	3

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
M.TECH.-COMPUTER SCIENCE & ENGINEERING

Course Code	Year & Sem	COMPUTING FOR DATA ANALYTICS (Program Elective-II)	L	T	P	C
25DPE5806	I-I		3	0	0	3

Pre-Requisites	Python

Course Objectives:

- Provide knowledge of the data analytics lifecycle, including business understanding, data science roles, and project deliverables.
- Develop a strong foundation in statistical methods, probability, and hypothesis testing for data-driven decision-making.
- Equip students with skills to apply predictive analytics, regression, time series forecasting, and experimental design techniques to real-world datasets.

Course Outcomes (CO): Student will be able to

CO1	**Understand** the data analytics lifecycle and responsibilities of data scientists in business analytics projects.
CO2	**Apply** the statistical techniques for measures of central data summarization and interpretation
CO3	**Analyze** the probability distributions by using modeling uncertain events.
CO4	**Analyze** the hypothesis testing & predictive analytics using various tests and multiple correlation methods.
CO5	**Apply** the forecasting models for analytical problem solving

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the data analytics lifecycle		scientists in business analytics projects.	L2
CO2	Apply	the statistical techniques such as measures of central tendency, variation	Using techniques for data summarization and interpretation		L3
CO3	Analyze	the Analyse probability distributions binomial, Poisson, normal		To exponential, gamma, etc , and in modelling uncertain events.	L4
CO4	Analyze	the Perform hypothesis testing and predictive analytics	using various tests and multiple correlation methods.		L4
CO5	Apply	the moving average, exponential smoothing, seasonal trends	Using forecasting models .		L3

UNIT – I	**DATA ANALYTICS LIFE CYCLE**	8 Hrs
Introduction to Big data Business Analytics - State of the practice in analytics role of data scientists - Key roles for successful analytic project - Main phases of life cycle - Developing core deliverables for stakeholders.		
UNIT – II	**STATISTICS**	10 Hrs
Sampling Techniques - Data classification, Tabulation, Frequency and Graphic representation - Measures of central value - Arithmetic mean, Geometric mean, Harmonic mean, Mode, Median, Quartiles, Deciles, Percentile - Measures of variation – Range, IQR, Quartile deviation, Mean deviation, standard deviation, coefficient variance, skewness, Moments & Kurtosis.		
UNIT – III	**PROBABILITY AND HYPOTHESIS TESTING**	8 Hrs
Random variable, distributions, joint probability function, marginal density function. Random vectors - Some special probability distribution - Binomial, Poison, Geometric, uniform, exponential, normal, gamma and Erlang - Normal distribution		
UNIT – IV	**PREDICTIVE ANALYTICS**	9 Hrs
Sampling distribution – Estimation - point, confidence - Test of significance, 1& 2 tailed test, uses of t-distribution, F-distribution, $\chi 2$ distribution - Predictive modeling and Analysis - Regression Analysis, Correlation analysis, Rank correlation coefficient, Multiple correlation. .		
UNIT – V	**TIME SERIES FORECASTING AND DESIGN OF EXPERIMENTS**	9 Hrs
Forecasting Models for Time series: MA, SES, TS with trend, season - Design of Experiments, one way classification, two-way classification, ANOVA, Latin square, Factorial Design.		

Textbooks:

1. Chris Eaton, Dirk Deroos, Tom Deutsch et al., ―Understanding Big Data, Mc Graw Hill, 2012.
2. Alberto Cordoba, ―Understanding the Predictive Analytics Lifecycle, Wiley, 2014.
3. Eric Siegel, Thomas H. Davenport, ―Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die, Wiley, 2013.

Reference Books:

1. James R Evans,―Business Analytics – Methods, Models and Decisions, Pearson 2013.
2. R. N. Prasad, Seema Acharya, ―Fundamentals of Business Analytics, Wiley, 2015.
3. S M Ross, ―Introduction to Probability and Statistics for Engineers and Scientists‖, Academic Foundation, 2011.
4. David Hand, HeikiMannila, Padhria Smyth, ―Principles of Data Mining, PHI 2013.
5. Spyros Makridakis, Steven C Wheelwright, Rob J Hyndman, ―Forecasting methods and applications Wiley 2013(Reprint).
6. David Hand, HeikkiMannila, Padhraic Smyth, ―Principles of Data mining, PHI 2013.

Online Learning Resources:

1. https://nptel.ac.in/courses/106105166/5
2. https://nptel.ac.in/courses/108108098/4

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3
CO1	2	2	1
CO2	3	3	2
CO3	3	3	3
CO4	3	3	1
CO5	3	3	2

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
M.TECH.-COMPUTER SCIENCE & ENGINEERING

Course Code	Year & Sem		L	T	P	C
25DPC5803	I-I	ADVANCED DATA STRUCTURES AND ALGORITHMS LAB	0	0	4	2

Pre-Requisites	DATA STRUCTURES AND ALGORITHMS

Course Objectives:

- To introduce students to the implementation of linear and non-linear data structures using linked representation.
- To provide practical knowledge on stack and queue operations and their applications in problem solving.
- To enable students to implement tree structures and perform operations like traversal, insertion, deletion, and balancing.
- To develop skills in implementing searching and sorting techniques to improve problem-solving efficiency.
- To expose students to advanced data structures such as AVL Trees, B-Trees, and Hashing for efficient storage and retrieval.
- To enhance the ability to design, test, and analyze algorithms for graph traversal and dictionary

Course Outcomes (CO): Student will be able to

CO1	**Apply** the linear linked lists to perform insertion, deletion, searching, and traversal.
CO2	**Create** the stack and queue using linked lists to solve expression processing problems
CO3	**Analyze** the tree and graph structures using recursive and iterative methods
CO4	**Analyze** the searching and sorting techniques for efficiency.
CO5	**Apply** the hashing techniques for efficient dictionary implementation and collision resolution.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Apply**	the linear linked lists to perform insertion, deletion, searching, and traversal.			L3
CO2	**Create**	the stack and queue using linked lists		to solve expression processing problems	L6
CO3	**Analyze**	the tree and graph structures using recursive and iterative methods			L4
CO4	**Analyze**	the searching and sorting techniques		for efficiency	L4
CO5	**Apply**	the hashing techniques		for efficient dictionary implementation and collision resolution.	L3

List of Topics:

Program 1:
Write a program to perform various operations on single linked list **(CO1)**

Program 2:
Write a program for the following **(CO1)**
a) Reverse a linked list
b) Sort the data in a linked list
c) Remove duplicates
d) Merge two linked lists

Program 3: Write a program to perform various operations on doubly linked list. **(CO1)**
Program 4: Write a program to perform various operations on circular linked list. **(CO1)**

Program 5: Write a program for performing various operations on stack using linked list. **(CO2)**

Program 6: Write a program for performing various operations on queue using linked list. **(CO2)**
Program 7: Write a program for the following using stack **(CO2)**
a) Infix to postfix conversion.
b) Expression evaluation.

Program 8: Write a program to implement various operations on Binary Search Tree Using Recursive and Non-Recursive methods. **(CO3)**

Program 9: Write a program to implement the following for a graph. a) BFS b) DFS **(CO3)**

Program 10: Write a program to implement various Sorting Techniques **(CO4)**

Program 11: Write a program to implement various Searching Techniques **(CO4)**

Program 12: Write a program to implement various operations on AVL trees. **(CO4)**

Program 13: Write a program to perform the following operations: **(CO5)**
a) Insertion into a B-tree
b) Searching in a B-tree

Program 14: Write a program to implement all the functions of Dictionary (ADT) using Hashing. **(CO5)**

Textbook:

Reference Books:

1. Ellis Horowitz, SartajSahni, and SanguthevarRajasekaran – Fundamentals of Computer Algorithms, Universities Press, 2008.
2. Mark Allen Weiss – Data Structures and Algorithm Analysis in C++ / Java, Pearson Education, 4th Edition, 2013.
3. Seymour Lipschutz – Data Structures with C, Schaum's Outline Series, McGraw Hill, 2011.
4. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein – Introduction to Algorithms, MIT Press, 3rd Edition, 2009.

Correlation of COs with the POs & PSOs

Course Outcomes Cos	PO1	PO2	PO3
CO1	3	2	2
CO2	3	3	3
CO3	3	3	3
CO4	3	2	3
CO5	3	2	3

(*3: Highly Correlated, 2: Moderately Correlated, 1: Weakly Correlated)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
M.TECH.-COMPUTER SCIENCE & ENGINEERING

Course Code	Year & Sem	DISTRIBUTED OPERATING SYSTEMS LAB	L	T	P	C
25DPC5804	I-I		0	0	4	2

Pre-Requisites	Operating Systems

Course Objectives:

- To provide hands-on experience in implementing synchronization, deadlock detection, and resource management algorithms in distributed and multiprocessor systems.
- To develop the ability to design and simulate mechanisms for fault tolerance, load balancing, task migration, and secure communication using cryptographic techniques.
- To enable students to apply concurrency control methods in distributed databases and critically analyze the performance of various distributed algorithms.

Course Outcomes (CO): Student will be able to

CO1	**Analyze** the Different Distributed Algorithms in Distributed Systems. .
CO2	**Analyze** the Different Distributed deadlock detection techniques.
CO3	**Apply** the memory models and scheduling algorithms in a distributed systems.
CO4	**Apply** the encryption and authentication mechanisms for Providing Security.
CO5	**Analyze** the Multiprocessor systems using different concurrency control Mechanisms.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Analyze**	the Different Distributed Algorithms		in Distributed Systems	L4
CO2	**Analyze**	the Different Distributed deadlock detection techniques.			L4
CO3	**Apply**	the memory models and scheduling algorithms in a distributed systems.			L3
CO4	**Apply**	the encryption and authentication mechanisms		for Providing Security	L3
CO5	**Analyze**	the Multiprocessor systems	using different concurrency control Mechanisms.		L4

List of Programs:

Unit I: Architectures & Synchronization (CO1)

1. Implementation of Lamport's Logical Clocks – Simulate logical clock updates in a distributed system.
2. Vector Clocks and Causal Ordering – Implement vector clocks and analyze message ordering.
3. Distributed Mutual Exclusion Algorithms – Implement Ricart-Agrawala and Maekawa's mutual exclusion algorithms.

Unit II: Deadlock Detection & Resource Management (CO2)

4. Simulation of Distributed Deadlock Detection Algorithms – Implement centralized and distributed deadlock

detection techniques.

5. Hierarchical Deadlock Detection – Implement a hierarchical approach to detecting deadlocks in a distributed system.

Unit III: Shared Memory, Scheduling & Fault Tolerance (CO3)

6. Implementation of Load Balancing Algorithms – Compare load balancing techniques (static and dynamic).
7. Task Migration Mechanism – Implement and analyze task migration in a distributed system.

Unit IV: Security & Cryptography (CO4)

8. Access Matrix Model Implementation – Simulate access control using an access matrix.
9. Implementation of Data Encryption Standard (DES) Algorithm – Encrypt and decrypt messages using DES.
10. Public Key Cryptography using RSA – Implement RSA encryption and authentication mechanisms.

Unit V: Multiprocessor & Database OS (CO5)

11. Process Synchronization in Multiprocessor Systems – Implement and analyze thread synchronization.
12. Concurrency Control using Lock-Based Algorithms – Implement two-phase locking protocol.
13. Timestamp-Based Concurrency Control – Develop a timestamp-based concurrency control mechanism.
14. Optimistic Concurrency Control Algorithm – Implement an optimistic concurrency control protocol.

References

1. MukeshSinghal and Niranjan G. Shivaratri – *Advanced Concepts in Operating Systems: Distributed, Database, and Multiprocessor Operating Systems*, McGraw Hill, 2001.
2. Andrew S. Tanenbaum and Maarten Van Steen – *Distributed Systems: Principles and Paradigms*, Pearson Education, 2nd Edition, 2007.
3. George Coulouris, Jean Dollimore, Tim Kindberg, and Gordon Blair – *Distributed Systems: Concepts and Design*, Pearson Education, 5th Edition, 2012.
4. Pradeep K. Sinha – *Distributed Operating Systems: Concepts and Design*, PHI Learning, 2008.

Online Learning Resources/Virtual Labs:

Correlation of COs with the POs & PSOs

Course Outcomes COs	**PO1**	**PO2**	**PO3**
CO1	3	2	2
CO2	3	3	3
CO3	3	3	3
CO4	3	2	3
CO5	3	2	3

(*3: Highly Correlated, 2: Moderately Correlated, 1: Weakly Correlated)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
M.TECH.-COMPUTER SCIENCE & ENGINEERING

Course Code	Year & Sem	Research Methodology and IPR (Mandatory Course)	L	T	P	C
25DMC0110	I-I		1	0	2	2

Pre-Requisites	-

Course Objectives:

- To understand the research design process and data collection methods.
- To develop skills in data analysis and reporting.
- To familiarize students with intellectual property rights (IPR) and patents.
- To apply research skills in real-world contexts.

Course Outcomes (CO): Student will be able to

CO1	**Understand** the various research approaches for different research goals to identify suitable methodologies.
CO2	**Analyze** the various sources and tools and technologies to collect the data
CO3	**Apply** the statistical methods for analyzing data and understand the guidelines for report writing.
CO4	**Analyze** the safeguarding of business secrets by using various types of Intellectual Property Rights
CO5	**Understand** the procedure for filling and grant of patent to protect the innovative ideas of the business

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the various research approaches for different research goals.		to identify suitable methodologies	L2
CO2	Analyse	the various sources and tools and technologies		to collect the data	L4
CO3	Apply Understand	the statistical methods for analysing data the guidelines for report writing			L3 L2
CO4	Analyse	the safeguarding of business secrets	by using various types of Intellectual Property Rights		L4
CO5	Understand	the procedure for filling and grant of patent		to protect the innovative ideas of the business	L2

UNIT – I	FUNDAMENTALS OF RESEARCH METHODOLOGY	8 Hrs

Overview of research process and design - Types of Research - Approaches to Research (Qualitative vs Quantitative) - Observation studies, Experiments and Surveys - Use of Secondary and exploratory data to answer the research question - Importance of Reasoning in Research and Research ethics - Documentation Styles (APA/IEEE etc.) - Plagiarism and its consequences

Learning Outcomes

- Recall key concepts of the research process, including different types and approaches to research, and the importance of ethics.
- Differentiate between qualitative and quantitative research approaches and the various uses of secondary data.
- Identify the core principles of research design and ethics, including plagiarism and documentation styles.
- Explain the significance of reasoning and ethical conduct in all stages of the research process.
- Apply knowledge of different documentation styles, such as APA and IEEE, to properly cite sources and avoid plagiarism.

UNIT – II	DATA COLLECTION AND SOURCES	10 Hrs

Importance of Data Collection - Types of Data - Data Collection Methods - Data Sources - primary, secondary and Big Data sources - Data Quality & Ethics - Tools and Technology for Data Collection

Learning Outcomes

- Identify different types of data and the various methods for collecting both primary and secondary data.
- Explain the importance of data quality and ethical considerations in data collection.

- Differentiate between primary, secondary, and Big Data sources.
- Describe the various tools and technologies used for effective data collection.

Analyze the ethical implications of data collection and ensure data quality in a research study.

UNIT – III	DATA ANALYSIS AND REPORTING	8 Hrs

Overview of Multivariate analysis - Experimental research, cause-effect relationship, and development of hypotheses- Measurement systems analysis, error propagation, and validity of experiments - Guidelines for writing abstracts, introductions, methodologies, results, and discussions - Writing Research Papers & proposals

Learning Outcomes

- Apply knowledge of multivariate analysis and experimental research to develop hypotheses and analyze data.
- Explain the process of measurement systems analysis and error propagation in experimental design.
- Formulate clear and concise abstracts, introductions, and methodologies for research papers.
- Write effective results and discussion sections based on data analysis.

Develop comprehensive research papers and proposals based on proper data analysis and reporting guidelines.

UNIT – IV	UNDERSTANDING INTELLECTUAL PROPERTY RIGHTS	9 Hrs

Intellectual Property – The concept of IPR, Evolution and development of concept of IPR, IPR development process, Trade secrets, utility Models, IPR & Bio diversity, Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.

Learning Outcomes

- Recall the fundamental concepts of Intellectual Property (IP) and its evolution.
- Describe the roles of organizations like **WIPO** and **WTO** in the establishment of IPR.
- Differentiate between various types of IPR, including trade secrets and trademarks.
- Explain the common rules and features of IPR agreements and the role of UNESCO.

Analyze the relationship between IPR and biodiversity, and its broader impact.

UNIT – V	**PATENTS**	9 Hrs

Patents – objectives and benefits of patent, Concept, features of patent, Inventive step, Specification - Types of patent application, process E-filling, Examination of patent, Grant of patent, Revocation, Equitable Assignments, Licenses, Licensing of related patents, patent agents, Registration of patent agents

Learning Outcomes

- Explain the objectives, benefits, and key features of a patent, including the concept of an inventive step.
- Differentiate between the various types of patent applications and the e-filing process.
- Describe the process of patent examination, grant, and revocation.
- Identify the roles of patent agents and the process for their registration.

Analyze the concepts of equitable assignments, licenses, and licensing of related patents.

Textbooks:

1.Stuart Melville and Wayne Goddard, *Research Methodology: An introduction for Science & Engineering students*, Juta and Company Ltd, 2004

2.Catherine J. Holland, *Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets*, Entrepreneur Press, 2007.

Reference Books:

1. Cooper Donald R, Schindler Pamela S and Sharma JK, "Business Research Methods", Tata McGraw Hill Education 11e (2012).
2. Ranjit Kumar , *Research Methodology: A Step-by-Step Guide for Beginners.* . David Hunt, Long Nguyen, Matthew Rodgers, "Patent searching: tools & techniques", Wiley, 2007.
3. Deborah E. Bouchoux , *Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, 6th Edition*, Cengage 2024.
4. Wayne C. Booth, Gregory G. Colomb, Joseph M. Williams, *The Craft of Research*, 5th Edition, University of Chicago Press, 2024
5. The Institute of Company Secretaries of India, Statutory body under an Act of parliament, "Professional Programme Intellectual Property Rights, Law and practice", September 2013.
6. Peter Elbow, *Writing With Power*, Oxford University Press, 1998.

Online Learning Resources:

- **Coursera / edX** – Research Methodology and Data Analysis courses
- **Springer Link & ScienceDirect** – Latest journals on research design and statistics
- **Google Scholar** – Free access to research papers
- **NCBI Bookshelf** – Open-access research methodology resources
- **Khan Academy (Statistics & Probability)** – For fundamentals of hypothesis testing, regression, and ANOVA.

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3
CO1	2		
CO2	3		
CO3	2	2	
CO4	3		
CO5	2		

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES: TIRUPATI (AUTONOMOUS)
M.TECH.-COMPUTER SCIENCE & ENGINEERING

Course Code	Year & Sem	FULL STACK DEVELOPMENT USING AI (Skill Enhancement Course)	L	T	P	C
25DSE5801	I-I		0	1	2	2

Course Outcomes:

After Studying the Course Student will able to

Pre-Requisites	Java Script

Course Objectives:

- Provide strong foundations in web development technologies (HTML, CSS, JavaScript, ES6).
- Introduce server-side programming with Node.js and Express.js for building scalable applications.
- Enable students to work with relational (MySQL) and non-relational (MongoDB) databases.
- Impart skills to design and develop interactive user interfaces using ReactJS.
- Enhance problem-solving abilities through full-stack web application development experiments.

Course Outcomes (CO): Student will be able to

CO1	**Apply** the HTML and CSS concepts to design structured and visually attractive web pages.
CO2	**Analyze** the JavaScript and ES6 features to create interactive and asynchronous client-side applications.
CO3	**Apply** the Node.js and Express.js to develop server applications handling HTTP requests efficiently.
CO4	**Analyze** the SQL and NoSQL databases to select suitable storage solutions for applications.
CO5	**Apply** the React components, state management, and conditional rendering to build dynamic user interfaces.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Apply**	the HTML and CSS concepts		to design structured and visually attractive web pages	L3
CO2	**Analyze**	the JavaScript and ES6 features		to create interactive and asynchronous client-side applications	L4
CO3	**Apply**	the Node.js and Express.js	in server-side development		L3
CO4	**Analyze**	the SQL and NoSQL databases		to select suitable storage solutions for applications	L4
CO5	**Apply**	the React components, state management, and conditional rendering	in frontend development		L3

List of Programs:

Module 1: Web Development Fundamentals

Fundamentals of Web Design, Webpage and Website, Web application HTML Typography, Images, Tables, Lists, Hyperlinks etc. CSS Syntax and usage, CSS Selectors, CSS on body, CSS on Text, CSS on Links, CSS on Tables, CSS on Lists, CSS on Forms, CSS on Images, CSS on DIV, W3.CSS Framework

List of Programs:

- **HTML & CSS Basics** – Create a personal portfolio webpage using HTML (headings, lists, tables, hyperlinks, forms) and style it with CSS selectors.
- **Responsive Layout** – Develop a responsive webpage using DIV, CSS box model, and W3.CSS framework.
- **Styled Components** – Design a webpage for a college event with images, tables, and styled navigation menu using CSS.

Module 2: JavaScript and ECMA Script 6

JavaScript Fundamentals - Grammar and types, Control flow and error handling - Loops, Function - Objects, Arrays, Promises - ES6 Let and const, Template literals - Arrow Function, Default parameter, Async Await.

List of Programs:

- **JavaScript Fundamentals** – Build a simple calculator app using functions, loops, and control flow.
- **Array & Object Manipulation** – Write a program using ES6 features (let/const, arrow functions, template literals) to manage student records.
- **Async Programming** – Create a webpage that fetches and displays random user data from a public API using Promises and Async/Await.
- AI-Powered Content Generator (HTML + CSS + JavaScript)

Module 3: Node.js

overview, Node.js - basics and setup - Node.js console, Node.js command utilities - Node.js modules, concepts - Node.js events, database access - Node.js with Express.js, Express.js Request/Response - Express.js Get, Express.js Post - Express.js Routing, Express.js Cookies - Express.js File Upload, Middleware - Express.js Scaffolding, Template

List of Programs:

- **Node.js Basics** – Write a Node.js script to create a local server and display "Hello World" in the browser.
- **Express.js Routing** – Build a REST API with Express.js that handles GET and POST requests for a student information system.
- **File Handling** – Develop a Node.js application to upload, read, and display a text/JSON file using Express middleware.
- AI-Enhanced Chatbot (Node.js + Express + AI API)

Module 4: MySQL and MongoDB

MySQL Concepts - Create, Read, Update, Delete Operation - SQL and NoSQL concepts - Create and manage MongoDB - Migration of data into MongoDB - MongoDB with NodeJS - Services offered by MongoDB

List of Programs:

- **MySQL CRUD** – Create a MySQL database for employee records and perform Create, Read, Update, Delete (CRUD) operations.
- **MongoDB CRUD with Node.js** – Build a Node.js application that connects to MongoDB and manages student data.
- **Migration Project** – Write a script to migrate data from MySQL to MongoDB and display it through a Node.js API.
- AI-Driven Database Analyzer (Node.js + MySQL/MongoDB + AI)

Module 5: React JS

ReactJS introduction and overview - ReactJS installation and environment setup - Introducing JSX, Rendering Elements - Components and Props - State and Lifecycle - Handling Events - Conditional Rendering - Lists and Keys, Forms - Lifting State Up

List of Programs:

- **React Components** – Build a React app to display a list of courses using functional components and props.
- **State & Events** – Create a counter and a form component in React using useState and event handling.
- **Conditional Rendering & Lists** – Develop a React to-do list application with add/delete functionality and conditional rendering of completed tasks.
- React AI Assistant (React + AI API)

Textbooks:

1. **Alex Banks, Eve Porcello** – *Learning React: Modern Patterns for Developing React Apps*, O'Reilly.
2. **StoyanStefanov** – *React Up & Running: Building Web Applications*, O'Reilly.
3. **Mario Casciaro, Luciano Mammino** – *Node.js Design Patterns*, Packt.
4. **Seyed M.M. Iravani** – *Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics*, O'Reilly.

Reference Books:

1. **Robin Wieruch** – *The Road to React*, Leanpub.
2. **Carl Rippon** – *React 18 Design Patterns and Best Practices*, Packt.
3. **KirupaChinnathambi** – *Learning React: A Hands-On Guide to Building Web Applications*, Addison-Wesley.
4. **Ethan Brown** – *Web Development with Node and Express: Leveraging the JavaScript Stack*, O'Reilly.
5. **Kristina Chodorow** – *MongoDB: The Definitive Guide*, O'Reilly.
6. **Ben Forta** – *SQL in 10 Minutes, Sams Teach Yourself*, Sams Publishing.

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3
CO1	3	2	1
CO2	3	3	1
CO3	3	3	1
CO4	3	3	1
CO5	3	3	1

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
M.TECH.-COMPUTER SCIENCE & ENGINEERING

Course Code	Year & Sem	(AUDIT COURSE-I)	L	T	P	C
25DAC9901	I-I	**English for Research Paper Writing**	2	0	0	0

Pre-Requisites	-

Course Objectives:

1. To equip students with the fundamentals of academic English for research paper writing.
2. To develop students' advanced reading skills for analyzing and evaluating research articles.
3. To refine students' grammar and language skills for clarity and precision in research writing.
4. To master the skills of revising, editing, and proofreading research papers.
5. To familiarize students with the role of technology and AI in research writing, including digital literacy and ethical considerations..

Course Outcomes (CO): Student will be able to

CO1	**Understand** the key language aspects and structural elements of academic writing in research papers.
CO2	**Apply** note-making techniques to organize information from academic and research texts.
CO3	**Apply** correct use of voice, subject–verb agreement, and modifiers to improve sentence accuracy
CO4	**Apply** editing strategies to improve clarity, coherence, structure, grammar, and spelling in academic writing
CO5	**Analyze** plagiarism, ethical issues, and fair-use practices using digital tools and awareness strategies.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	the Yoga foundations and benefits	—	—	L2
CO2	Apply	The key language aspects and structural elements of academic writing	in research papers		L2
CO3	Apply	Note-making techniques to organize information		From academic and research texts	L3
CO4	Apply	Correct use of voice, subject–verb agreement, and modifiers to improve sentence accuracy			L3
CO5	Analyze	Editing strategies to improve clarity, coherence, structure, grammar, and spelling	in academic writing		L4

UNIT – I	Fundamentals of Academic English	Lecture Hrs: 9
Academic English - MAP (Message-Audience-Purpose) - Language Proficiency for Writing - Key Language Aspects - Clarity and Precision - Objectivity - Formal Tone - Integrating References - Word order - Sentences and Paragraphs - Link Words for Cohesion - Avoiding Redundancy / Repetition - Breaking up long sentences - Structuring Paragraphs - Paraphrasing Skills – Framing Title and Sub-headings		
UNIT – II	Reading Skills for Researchers	Lecture Hrs:9
Reading Academic Texts - Critical Reading Strategies - Skimming and Scanning - Primary Research Article vs. Review Article - Reading an Abstract - Analyzing Research Articles - Identifying Arguments - Classifying Methodologies - Evaluating Findings - Making Notes		
UNIT - III	Grammar Refinement for Research Writing	Lecture Hrs:9
Advanced Punctuation Usage - Grammar for Clarity - Complex Sentence Structures - Active- Passive Voice - Subject-Verb Agreement - Proper Use of Modifiers - Avoiding Ambiguous Pronoun References - Verb Tense Consistency - Conditional Sentences		
UNIT - IV	Mastery in Refining Written Content/Editing Skills	Lecture Hrs:9
Effective Revisions - Restructuring Paragraph - Editing vs Proofreading, Editing for Clarity and Coherence - Rectifying Sentence Structure Issues - Proofreading for Grammatical Precision – Spellings - Tips for Correspondence with Editors - Critical and Creative Phases of Writing		
UNIT – V	Technology and Language for Research	Lecture Hrs:9
Digital Literacy and Critical Evaluation of Online Content - Technology and Role of AI in Research Writing – Assistance in Generating Citations and References - Plagiarism and Ethical Considerations – Tools and Awareness – Fair Practices		

Textbooks:

1. Bailey. S. A*cademic Writing: A Handbook for International Students.* London and New York: Routledge,2015.
2. Adrian Wallwork, *English for Writing Research Papers*, Springer New York Dordrecht Heidelberg London, 2011.

Reference Books:

1. Craswell, G. *Writing for Academic Success,* Sage Publications, 2004.
2. Peter Elbow, *Writing With Power, E-book*, Oxford University Press, 2007
3. Oshima, A. & Hogue, A. *Writing Academic English*, Addison-Wesley, New York, 2005
4. Swales, J. & C. Feak, Academic Writing for Graduate Students: Essential Skills
5. and Tasks. Michigan University Press, 2012.
6. 5.Goldbort R.*Writing for Science*, Yale University Press (available on Google Books), 2006
7. 6. Day R.*How to Write and Publish a Scientific Paper*, Cambridge University Press, 2006

Online References:

1. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-ge04/
2. https://onlinecourses.swayam2.ac.in/ntr24_ed15/preview
3. 3.. "Writing in the Sciences" – Stanford University (MOOC on Coursera) https://www.coursera.org/learn/sciwrite
4. Academic Phrasebank – University of Manchester
5. http://www.phrasebank.manchester.ac.uk
6. 5. OWL (Online Writing Lab) – Purdue University, https://owl.purdue.edu
7. *(Resources on APA/MLA formats, grammar, structure, paraphrasing)*
8. Zotero or Mendeley (Reference Management Tools) – Useful for managing citations and sources.

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3
CO1	3	3	
CO2	3	3	
CO3	2	3	
CO4	2	3	
CO5	2	3	

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
M.TECH.-COMPUTER SCIENCE & ENGINEERING

Course Code	Year & Sem	(AUDIT COURSE-I)	L	T	P	C
25DAC2001	I-I	**Disaster Management**	2	0	0	0

Pre-Requisites	-

Course Objectives:

1. To enable the students to understand the fundamental concepts of disasters, hazards, their factors, and significance with special reference to India.
2. To prepare them to classify and analyze different types of natural and man-made disasters, their causes, magnitude, and impacts.
3. To foster them develop understanding of disaster preparedness, monitoring systems, and the role of government, community, and media.
4. To equip them in learning risk assessment techniques, disaster risk reduction strategies, and the importance of global and national cooperation.
5. To foster their ability to think critically and respond to disasters and design effective mitigation measures (structural and non-structural) with a focus on emerging trends and Indian disaster management programs.

Course Outcomes (CO): Student will be able to

CO1	**Understand** the hazards and disasters, their classifications based on type and nature and their impacts on people
CO2	**Understand** the map disaster-prone areas in India and epidemiological consequences of disasters.
CO3	**Understand** the disaster preparedness through monitoring and risk evaluation
CO4	**Understand** the disaster risk, its reduction, assessment techniques, global cooperation and survival Strategies
CO5	**Understand** the disaster mitigation concepts, strategies, trends and related programs in India

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	**Understand**	Hazards and disasters, their Classifications		Based on type and nature and their impacts on people	L2
CO2	**Understand**	Map disaster-prone areas in India		Epidemiological consequences of disasters	L2
CO3	**Understand**	Disaster preparedness	Through monitoring and risk evaluation		L2
CO4	**Understand**	Disaster risk, its reduction, assessment techniques, global cooperation and survival strategies			L2
CO5	**Understand**	Disaster mitigation concepts, strategies, trends and related programs			L2

UNIT – I	**Introduction**	9 Hrs

Disaster - Definition, Factors and Significance - Difference Between Hazard and Disaster - Natural and Man-made Disasters - Difference, Nature, Types and Magnitude -
Disaster Prone Areas in India - Study of Seismic Zones - Areas Prone to Floods and Droughts, Landslides and Avalanches - Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami - Post-Disaster Diseases and Epidemics.

UNIT – II	**Repercussions of Disasters and Hazards**	9 Hrs

Economic Damage - Loss of Human and Animal Life - Destruction of Ecosystem - Natural Disasters - Earthquakes, Volcanism, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster - Nuclear Reactor Meltdown - Industrial Accidents - Oil Slick sand Spills - Outbreaks of Disease and Epidemics War and Conflicts

UNIT – III	**Disaster Preparedness and Management**	9 Hrs

Preparedness - Monitoring of Phenomena - Triggering a Disasteror Hazard - Evaluation of Risk-Application of Remote Sensing - Data from Meteorological and Other Agencies - Media Reports- Governmental and Community Preparedness

UNIT – IV	Risk Assessment	9 Hrs
Disaster Risk -Concept and Elements, Disaster Risk Reduction - Global and National Disaster Risk Situation -Techniques of Risk Assessment – Global Co-Operation in Risk Assessment and Warning - People's participation in Risk Assessment – Strategies for Survival		
UNIT – V	**Disaster Mitigation**	9 Hrs
Meaning, Concept and Strategies of Disaster Mitigation - EmergingTrends in Mitigation - Structural Mitigation and Non-Structural Mitigation - Programs of Disaster Mitigation in India		

Textbooks:

1. Gupta, H. K. *Disaster Management*. Universities Press, 2003
2. Singh, R. B. *Natural Hazards and Disaster Management*. Rawat Publications, 2006.

Reference Books:

1. Coppola, D. P. (2020). *Introduction to International Disaster Management* (4th ed.). Elsevier.
2. Shaw, R., & Izumi, T. (2022). *Science and Technology in Disaster Risk Reduction in Asia*. Springer.
3. Wisner, B., Gaillard, J. C., & Kelman, I. (2021). *Handbook of Hazards and Disaster Risk Reduction and Management* (2nd ed.). Routledge.
4. Saini, V. K. (2021). *Disaster Management in India: Policy, Issues and Perspectives*. Sage India.
5. Kelman, I. *Disaster by Choice: How Our Actions Turn Natural Hazards into Catastrophes,* Oxford University Press, 2022
6. Sahni, P. & Dhameja, A. *Disaster Mitigation: Experiences and Reflections*. Prentice Hall of India, 2004.

Online References:

- 1 **National Disaster Management Authority (NDMA), India**: https://ndma.gov.in – official guidelines, reports, and policy frameworks.
- **United Nations Office for Disaster Risk Reduction (UNDRR)**: https://www.undrr.org – Sendai Framework, global risk reduction strategies.
- **Global Disaster Alert and Coordination System (GDACS)**: https://www.gdacs.org – real-time disaster alerts.
- **World Health Organization (WHO)** – https://www.who.int/emergencies – disaster-related health guidelines.

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3
CO1	3	2	**2**
CO2	3	2	2
CO3	3	3	2
CO4	3	3	**2**
CO5	2	2	**2**

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
M.TECH.-COMPUTER SCIENCE & ENGINEERING

Course Code	Year & Sem	(AUDIT COURSE-I)	L	T	P	C
25DAC9902	I-I	**Essence of Indian Traditional Knowledge**	2	0	0	0

Pre-Requisites	-

Course Objectives:

1. To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the importance of roots of knowledge system.
2. To make them understand the need for protecting traditional knowledge and its significance in the global economy.
3. To make them understand the legal frame work and policies related to traditional knowledge protection.
4. To enable them to understand the relationship between traditional knowledge and intellectual property rights.
5. To make them explore the applications of traditional knowledge in different sectors, such as engineering, medicine, agriculture, and biotechnology.

Course Outcomes (CO): Student will be able to

CO1	**Understand** the concept of traditional knowledge, its nature, characteristics, and scope
CO2	**Understand** the need for protecting traditional knowledge and its significance in the global economy
CO3	**Analyze** the legal framework and policies related to traditional knowledge protection
CO4	**Apply** traditional knowledge in different sectors, such as engineering, medicine, agriculture, and biotechnology
CO5	**Analyze** the relationship between traditional knowledge and intellectual property rights, including patents and non-IPR mechanisms

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	The concept of traditional knowledge, its nature, characteristics, and scope			L2
CO2	Understand	The need for protecting traditional knowledge and its significance		In the global economy	L2
CO3	Analyze	The legal framework and policies	Related to traditional knowledge protection		L4
CO4	Apply	Traditional knowledge in different sectors	Such as engineering, medicine, agriculture, and biotechnology		L3
CO5	Analyze	the relationship between traditional knowledge and intellectual property rights, including patents and non-IPR mechanisms			L4

UNIT – I		9 Hrs
Introduction to traditional knowledge - Definition, Nature and characteristics, scope and importance - Kinds of traditional knowledge - Physical and social contexts in which traditional knowledge develop - Historical impact of social change on traditional knowledge systems - Indigenous Knowledge (IK) – Characteristics - traditional knowledge vis-à-vis indigenous knowledge -Traditional knowledge Vs western knowledge, traditional knowledge vis-à-vis formal knowledge		
UNIT – II		9 Hrs
Protection of traditional knowledge- Need for protecting traditional knowledge - Significance of TK Protection - Value of TK in global economy - Role of Government to harness TK.		
UNIT – III		9 Hrs
Legal frame work and TK - A)The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 - Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act) – B)The Biological Diversity Act 2002 and Rules 2004 - the protection of traditional knowledge bill, 2016 - Geographical Indicators Act 2003.		
UNIT – IV		9 Hrs
Traditional knowledge and Intellectual property - Systems of traditional knowledge protection - Legal concepts for the protection of traditional knowledge - Certain non-IPR mechanisms of traditional knowledge protection - Patents and traditional knowledge - Strategies to increase protection of traditional knowledge -Global legal FORA for increasing protection of Indian Traditional Knowledge.		

UNIT – V		9 Hrs

Traditional knowledge in different sectors - Traditional knowledge and Engineering - Traditional medicine system - TK and Biotechnology - TK in Agriculture - Traditional societies depend on it for their food and healthcare needs - Importance of conservation and sustainable development of environment - Management of biodiversity, Food security of the country and protection of TK

Textbooks:

1. Mahadevan, B., Bhat Vinayak Rajat, Nagendra Pavana R.N. *Introduction to Indian Knowledge System: Concepts and Applications*, PHI Learning Pvt.Ltd. Delhi, 2022.
2. 2.Basanta Kumar Mohanta and Vipin Kumar Singh,*Traditional Knowledge System and Technology in India*, PratibhaPrakashan 2012.

Reference Books:

1. Pride of India: A Glimpse into India's Scientific Heritage, Samskrita Bharati, New Delhi.
2. Kak, S.C. "On Astronomy in Ancient India", Indian Journal of History of Science, 22(3), 1987
3. Subbarayappa, B.V. and Sarma, K.V. *Indian Astronomy: A Source Book*, Nehru Centre, Mumbai, 1985.
4. Bag, A.K. *History of Technology in India*, Vol. I, Indian National Science Academy, New Delhi, 1997.
5. Acarya, P.K. *Indian Architecture*, Munshiram Manoharlal Publishers, New Delhi, 1996.
6. Banerjea, P. *Public Administration in Ancient India*, Macmillan, London, 1961.
7. Kapoor Kapil, Singh Avadhesh,*Indian Knowledge Systems Vol – I & II*, Indian Institute of Advanced Study, Shimla, H.P., 2022

Online References:

- https://www.youtube.com/watch?v=LZP1StpYEPM 2.http://nptel.ac.in/courses/121106003/

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3
CO1	1		
CO2	1		
CO3	2	3	
CO4	2		
CO5	3		

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)

M.TECH.-COMPUTER SCIENCE & ENGINEERING

(Effective for the batches admitted in 2025-26)

Semester II (First year)

S. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T / CLC	P	C			
1	PC	25DPC5805	Advances in Software Engineering	3	0	0	3	40	60	100
2	PC	25DPC5806	Advanced Databases	3	0	0	3	40	60	100
3	PE	25DPE5807 25DPE5808 25DPE5809	**Program Elective – III** 1. Block Chain Technology 2. Advanced Computer Networks 3. Deep Learning and Applications	3	0	0	3	40	60	100
4	PE	25DPE5810 25DPE5811 25DPE5812	**Program Elective – IV** 1. Generative AI 2. Digital Forensics 3. Robotic Process Automation	3	0	0	3	40	60	100
5	PC	25DPC5807	Advances in Software Engineering Lab	0	0	4	2	40	60	100
6	PC	25DPC5808	Advanced Databases Lab	0	0	4	2	40	60	100
7	MC	25DMC5801	Quantum Technologies And Applications	2	0	0	2	40	60	100
8	PC	25DPC5809	Comprehensive Viva Voce	0	0	0	2	0	100	100
9	AC	25DAC9903 25DAC0101 25DAC5801 25DAC9001 25DAC9904	**Audit Course – II** 1. Sanskrit for Technical Knowledge 2. Business Ethics and Corporate Governance 3. System Modeling 4. Principles of Automation 5. Stress Management By Yoga	2	0	0	0	40	-	40
			Total	**16**	**0**	**08**	**20**	**320**	**520**	**840**

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
M.TECH.-COMPUTER SCIENCE & ENGINEERING

Course Code	Year & Sem	Advances in Software Engineering	L	T	P	C
25DPC5805	I-II		3	0	0	3

Pre-Requisites	Software Engineering

Course Objectives:

1. Introduce fundamental software process models and project management practices.
2. Enable students to perform requirements engineering and UML-based system modeling.
3. Train students in designing software using advanced engineering paradigms such as OO, component, aspect, and reuse-oriented techniques.
4. Strengthen students' ability to evaluate software quality using reviews, testing strategies, and maintenance activities.
5. Expose students to advanced software engineering practices including SCM, DevOps, metrics, AI-driven engineering, cloud, and secure software development.

The course aims to:

Course Outcomes (CO): The Student will be able to

CO1	**Understand** major software process models & fundamental project management practices for software projects.
CO2	**Understand** requirements engineering tasks and UML techniques for complete system specifications.
CO3	**Apply** object-oriented, component, aspect, and reuse-oriented software design approaches effectively.
CO4	**Evaluate** software quality through structured reviews, systematic testing, and maintenance practices.
CO5	**Analyze** SCM, DevOps, metrics, and emerging software engineering practices for modern industry challenges.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	**Understand**	major software process models & fundamental project management practices for software projects			L2
CO2	**Understand**	requirements engineering tasks and UML techniques for complete system specifications			L2
CO3	**Apply**	object-oriented, component, aspect, and reuse-oriented software design approaches effectively			L3
CO4	**Evaluate**	software quality through structured reviews, systematic testing, and maintenance practices			L5
CO5	**Analyze**	SCM, DevOps, metrics, and emerging software engineering practices for modern industry challenges			L4

UNIT – I	**Software Process and Project Management**	8 Hrs
Software Engineering – A Layered Technology, Process Models: Waterfall, Incremental, Evolutionary, Spiral, Agile Development, Unified Process Framework. Software Project Management Concepts: Estimation, Scheduling, Risk Analysis, Process Improvement and Capability Maturity (CMMI, ISO Standards).		
UNIT – II	**Requirements Engineering and Modeling**	9 Hrs
Requirement Engineering Tasks: Inception, Elicitation, Elaboration, Negotiation, Specification, Validation. System Modeling with UML, Scenario-based, Flow-oriented, Behavioral and Class-based modelling, Design Concepts and Principles, Architectural Design – Styles and Patterns		
UNIT – III	**Advanced Design and Development Concepts**	9 Hrs
Component-level Design, Object-Oriented Design using UML, Design Patterns and Frameworks, Aspect-Oriented Software Engineering, Reuse-oriented Software Engineering.		
UNIT – IV	**Software Quality, Testing and Maintenance**	8 Hrs
Quality Concepts and Quality Assurance, Software Reviews, Formal Technical Reviews, Software Testing Strategies: Unit, Integration, System, Regression Testing, Black-box and White-box Testing, Software Maintenance and Reengineering.		
UNIT – V	**Advanced Topics and Emerging Trends**	9 Hrs
Software Configuration Management (SCM) and Version Control, Software Reliability and Safety Engineering, Agile Software Development and DevOps, Software Metrics and Measurement. Emerging Areas: AI in Software Engineering, Cloud-based SE, Secure Software Development.		

Textbooks:
1. Software Engineering A Practitioner's Approach, Roger S. Pressman, 9th Edition McGrawHill International Edition. 2. Fundamentals of Software Engineering, Rajib Mall, Fifth Edition, PHI.
Reference Books:
1. Software Engineering, Ian Sommerville, Tenth Edition, Pearson education. 2. Software Engineering : A Primer, Waman S Jawadekar, Tata McGraw-Hill, 2008 3. Software Engineering, A Precise Approach, Pankaj Jalote, Wiley India,2010. 4. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3
CO1	**2**	**3**	
CO2	**3**	**3**	**2**
CO3		**3**	**2**
CO4	**3**		**2**
CO5	**3**		**2**

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
M.TECH.-COMPUTER SCIENCE & ENGINEERING

Course Code	Year & Sem	Advanced Databases	L	T	P	C
25DPC5806	I-II		3	0	0	3

Pre-Requisites	Database Management Systems

Course Objectives:

1. Provide knowledge of distributed databases, object-based databases, and advanced database models.
2. Enable understanding of parallel architectures and distributed database transaction management.
3. Introduce data warehousing, data mining concepts, and analytical techniques.
4. Explain object-relational and object-oriented database features.
5. Familiarize students with XML databases and other advanced database applications

The course aims to:

Course Outcomes (CO): The Student will be able to

CO1	**Understand** the architecture of database systems, including parallel databases, their components, and functioning.
CO2	**Analyze** distributed transactions, commit protocols, and concurrency control in distributed databases.
CO3	**Understand** the principles, techniques, and practical applications of data warehousing and data mining processes.
CO4	**Analyze** the concepts and structures of object-based and object-relational databases in modern systems.
CO5	**Understand** XML databases and advanced models such as temporal, spatial, and multimedia databases.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	**Understand**	Understand the architecture of database systems		including parallel databases, their components, and their functioning.	L2
CO2	**Analyze**	Analyze distributed transactions, commit protocols, and concurrency control mechanisms.	In a distributed database		L4
CO3	**Understand**	Understand principles and applications of data warehousing and data mining.			L2
CO4	**Analyze**	Analyze concepts and structures of object-based and object-relational databases.	in modern systems		L4
CO5	**Understand**	Understand XML databases and advanced models such as temporal and spatial databases.			L2

UNIT – I		8 Hrs
Database System Architectures Centralized and Client –Server Architectures, Server System Architectures, Parallel Systems, Distributed Systems, Network Types Parallel Databases: Introduction, I/O Parallelism, Interquery Parallelism, Intra Query Parallelism, Intraoperation Parallelism, Interoperation Parallelism, Query Optimization, Design of Parallel Systems, Parallelism on Multicore Processors		
UNIT – II		9 Hrs
Distributed Databases Homogeneous and Heterogeneous Databases, Distributed Data Storage, Distributed Transactions, Commit Protocols, Concurrency Control in Distributed Databases, Availability, Distributed Query Processing, Heterogeneous Distributed Databases, Cloud-Based Databases, Directory Systems		
UNIT – III		9 Hrs
Data Warehousing and Mining Decision-Support Systems, Data Warehousing, Data Mining, Classification, Association Rules, Other Types of Associations, Clustering, Other Forms of Data Mining		
UNIT – IV		8 Hrs
Object-Based Databases Introduction, Complex Data Types, Structured Types and Inheritance in SQL, Table Inheritance, Array and Multiset Types in SQL, Object-Identity and Reference Types in SQL, Implementing O-R Features, Persistent Programming Languages, Object-Relational Mapping, Object-Oriented versus Object-Relational.		
UNIT – V		9 Hrs
Motivation, Structure of XML Data, XML Document Schema, Querying and Transformation, Application Program Interfaces to XML, Storage of XML Data, XML Applications Applications Advanced database models and applications: Active Database Concepts and Triggers, Temporal database concepts, Spatial database concepts, Multimedia database concepts, Deductive databases		

Textbooks:
1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan Database System Concepts, Sixth Edition
2. RamezElmasri, Shamkant B. Navathe, Database systems- Models, Languages, Design and Application Programming

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3
CO1	**2**	**2**	**-**
CO2	**3**	**2**	**-**
CO3	**2**	**1**	**1**
CO4	**2**	**2**	**1**
CO5	**1**	**2**	**1**

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
M.TECH.-COMPUTER SCIENCE & ENGINEERING

Course Code	Year & Sem		L	T	P	C
25DPE5807	I-II	**Blockchain Technology (Program Elective – III)**	3	0	0	3

Pre-Requisites	Basic knowledge of information security, cryptography, and computer networks.

Course Objectives:

1. Explain the fundamentals of blockchain technology, types of blockchain, and consensus mechanisms.
2. Understand public, private, and consortium blockchain frameworks and their architecture.
3. Study security issues, privacy challenges, and regulatory aspects of blockchain systems.
4. Explore smart contracts, decentralized application development, and blockchain platforms.
5. Apply blockchain concepts to real-world case studies using Python and Hyperledger Fabric.

The course aims to:

Course Outcomes (CO): The Student will be able to

CO1	**Understand** the fundamentals of blockchain, blockchain types, consensus mechanisms, and cryptocurrencies.
CO2	**Apply** the public blockchain systems and smart contract concepts for decentralized applications.
CO3	**Analyze** the private blockchain systems, consortium blockchains, Hyperledger, Ripple, Corda, and ICO mechanisms.
CO4	**Analyze** the blockchain security, privacy challenges, performance issues, and major industry applications.
CO5	**Apply** the blockchain-based solutions using suitable platforms for real-world blockchain application development.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	the Fundamentals of blockchain, blockchain types, consensus mechanisms, and cryptocurrencies			L2
CO2	Apply	Public blockchain systems and the smart contracts	Given a decentralized application		L3
CO3	Analyze	the Private blockchain systems, consortium models, Hyperledger, Ripple, Corda, ICO			L4
CO4	Analyze	the Blockchain security, privacy issues, performance challenges, industry use-cases			L4
CO5	Apply	the blockchain-based solutions	using suitable platforms for real-world blockchain application development.		L3

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UNIT – I		8 Hrs
Fundamentals of Blockchain: Introduction, Origin of Blockchain, Blockchain Solution, Components of Blockchain, Block in a Blockchain,The Technology and the Future. Blockchain Types and Consensus Mechanism: Introduction, Decentralization and Distribution, Types of Blockchain, Consensus Protocol. Cryptocurrency – Bitcoin, Altcoin and Token: Introduction, Bitcoin and the Cryptocurrency, Cryptocurrency Basics, Types of Cryptocurrencies, Cryptocurrency Usage.		
UNIT – II		9 Hrs
Public Blockchain System: Introduction, Public Blockchain, Popular Public Blockchains, The Bitcoin Blockchain, Ethereum Blockchain. Smart Contracts: Introduction, Smart Contract, Characteristics of a Smart Contract, Types of Smart Contracts, Types of Oracles, Smart Contracts in Ethereum, Smart Contracts in Industry.		
UNIT – III		9 Hrs
Private Blockchain System: Introduction, Key Characteristics of Private Blockchain, Why We Need Private Blockchain, Private Blockchain Examples, Private Blockchain and Open Source, E- commerce Site Example, Various Commands (Instructions) in E-commerce Blockchain, Smart Contract in Private Environment, State Machine, Different Algorithms of Permissioned Blockchain, Byzantine Fault, Multichain. Consortium Blockchain: Introduction, Key Characteristics of Consortium Blockchain, Why We Need Consortium Blockchain, Hyperledger Platform, Overview of Ripple, Overview of Corda. Initial Coin Offering: Introduction, Blockchain Fundraising Methods, Launching an ICO, Investing in an ICO, Pros and Cons of Initial Coin Offering, Successful Initial Coin Offerings, Evolution of ICO, ICO Platforms.		
UNIT – IV		8 Hrs

Security in Blockchain: Introduction, Security Aspects in Bitcoin, Security and Privacy Challenges of Blockchain in General, Performance and Scalability, Identity Management and Authentication, Regulatory Compliance and Assurance, Safeguarding Blockchain Smart Contract (DApp), Security Aspects in Hyperledger Fabric.
Applications of Blockchain: Introduction, Blockchain in Banking and Finance, Blockchain in Education, Blockchain in Energy, Blockchain in Healthcare, Blockchain in Real-estate, Blockchain In Supply Chain, The Blockchain and IoT. Limitations and Challenges of Blockchain.

UNIT – V		9 Hrs

Blockchain Case Studies: Case Study 1 – Retail, Case Study 2 – Banking and Financial Services, Case Study 3 – Healthcare, Case Study 4 – Energy and Utilities.
Blockchain Platform using Python: Introduction, Learn How to Use Python Online Editor, Basic Programming Using Python, Python Packages for Blockchain.
Blockchain platform using Hyperledger Fabric: Introduction, Components of Hyperledger Fabric Network, Chain codes from Developer.ibm.com, Blockchain Application Using Fabric Java SDK.

Textbooks:

1. "Blockchain Technology", Chandramouli Subramanian, Asha A.George, Abhilasj K A and MeenaKarthikeyan , Universities Press.

Reference Books:

1. Michael Juntao Yuan, Building Blockchain Apps, Pearson, India.
2. Blockchain Blueprint for Economy, Melanie Swan, SPD O'reilly.
3. Blockchain for Business, Jai Singh Arun, Jerry Cuomo, Nitin Gaur, Pearson.

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3
CO1	**2**	**2**	**-**
CO2	**2**	**3**	**-**
CO3	**3**	**2**	**1**
CO4	**3**	**2**	**1**
CO5	**3**	**3**	**1**

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
M.TECH.-COMPUTER SCIENCE & ENGINEERING

Course Code	Year & Sem	ADVANCED COMPUTER NETWORKS (Program Elective – III)	L	T	P	C
25DPE5808	I-II		3	0	0	3

Pre-Requisites	ADVANCED COMPUTER NETWORKS

Course Objectives:

1. To introduce fundamental data-link layer protocols such as Ethernet, Token Ring, and IEEE 802.11, and to provide understanding of wireless and mobile networking concepts including Mobile IP, WMNs, and routing mechanisms.
2. To provide knowledge of transport and application layer protocols, including TCP, UDP, congestion control, mobile transport protocols, and the principles of network applications in LAN and WAN environments.
3. To enable students to understand and implement application-layer services, such as HTTP, FTP, Email, DNS, P2P communication, and to develop basic socket programming skills using TCP and UDP.
4. To familiarize learners with wireless and mobile network technologies, including CDMA, Wi-Fi (802.11), cellular access technologies, and mobility management principles.
5. To develop the ability to understand multimedia networking technologies, including streaming video, VoIP, and protocols designed for real-time end-to-end communication.

Course Outcomes (CO): Student will be able to

CO1	**Understand** the holistic functioning and layered structure of computer networking fundamentals clearly.
CO2	**Understand** the network protocols and their practical applications in diverse real-world networking scenarios.
CO3	**Apply** the packet-forwarding concepts by designing and accurately simulating routing mechanisms in networks.
CO4	**Analyze** the wireless and mobile network architectures with detailed and efficient mobility-management concepts.
CO5	**Analyze** the multimedia networking protocols & real-time communication mechanisms for overall performance.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	the holistic functioning, layered structure of computer networking			L2
CO2	Understand	the computer network protocols and their applications			L2
CO3	Apply	the packet forwarding and routing		simulating routing mechanisms	L3
CO4	Analyze	the wireless and mobile network architectures with mobility-management concepts			L4
CO5	Analyze	the multimedia networking protocols		Evaluate performance	L4

UNIT – I		9 Hrs
Data-link protocols: Ethernet, Token Ring and Wireless (802.11). Wireless Networks and Mobile IP: Infrastructure of Wireless Networks, Wireless LAN Technologies, IEEE 802.11 Wireless Standard, Cellular Networks, Mobile IP, Wireless Mesh Networks (WMNs), Multiple access schemes Routing and Internetworking: Network–Layer Routing, Least-Cost-Path algorithms, Non-Least-Cost-Path algorithms, Intra-domain Routing Protocols, Inter-domain Routing Protocols, Congestion Control at Network Layer.		
UNIT – II		9 Hrs
Transport and Application Layer Protocols: Client-Server and Peer-To-Peer Application Communication, Protocols on the transport layer, reliable communication. Routing packets through a LAN and WAN. Transport Layer, Transmission Control Protocol (TCP), User Datagram Protocol (UDP), Mobile Transport Protocols, TCP Congestion Control. Principles of Network Applications.		
UNIT – III		9 Hrs
The Web and HTTP, File Transfer: FTP, Electronic Mail in the Internet, Domain Name System (DNS), P2P File Sharing, Socket Programming with TCP and UDP, building a Simple Web Server Creating simulated networks and passing packets through them using different routing techniques. Installing and using network monitoring tools..		
UNIT – IV		9 Hrs
Wireless and Mobile Networks: Introduction, Wireless links and Network Characteristics - CDMA, Wifi: 802.11 Wireless LANS, Cellular internet access, Mobility management: Principles		
UNIT – V		9 Hrs
Multimedia networking: Multimedia networking applications, streaming stored video, Voice-over-IP, Protocols for real-time conversational applications.		
Textbooks:		

1. Computer Networking: A Top-Down Approach, James F. Kuros and Keith W. Ross, Pearson, 6th Edition, 2012.
2. Computer Networks and Internets, Duglas E. Comer, 6th Edition, Pearson.

Reference Books:

1. A Practical Guide to Advanced Networking, Jeffrey S. Beasley and PiyasatNilkaew, Pearson, 3rd Edition, 2012
2. Computer Networks, Andrew S. Tanenbaum, David J. Wetherall, Prentice Hall.

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3
CO1	**2**	**2**	**-**
CO2	**2**	**3**	**-**
CO3	**3**	**2**	**1**
CO4	**3**	**2**	**1**
CO5	**3**	**3**	**1**

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
M.TECH.-COMPUTER SCIENCE & ENGINEERING

Course Code	Year & Sem	DEEP LEARNING AND APPLICATIONS (Program Elective – III)	L	T	P	C
25DPE5809	I-II		3	0	0	3

Pre-Requisites	DEEP LEARNING AND APPLICATIONS

Course Objectives:

1. To introduce fundamental deep learning concepts, including feed-forward neural networks, gradient descent, backpropagation, vanishing gradients, and modern training heuristics such as ReLU, regularization, dropout, and accelerated optimization techniques.
2. To provide an in-depth understanding of advanced neural architectures, including CNNs, RNNs (LSTM, GRU), encoder–decoder models, autoencoders, VAEs, GANs, and memory-based models.
3. To enable students to apply deep learning methods to computer vision tasks, including image segmentation, object detection, caption generation, attention models, and GAN-based image generation.
4. To develop the ability to apply deep learning techniques to NLP tasks, including word embeddings (CBOW, Skip-gram, GloVe), semantic similarity, and vector-space models of language
5. To equip learners with the skills to perform advanced NLP tasks, such as analogy reasoning, named entity recognition, sentiment analysis using RNNs/Recursive Networks, sentence classification with CNNs, and dialogue generation using LSTMs.

Course Outcomes (CO): Student will be able to

CO1	**Understand** the deep learning algorithms, neural networks, activation functions, and layered processing.
CO2	**Understand** the convolutional and recurrent networks, training strategies, optimization methods, and interfaces.
CO3	**Apply** the deep learning techniques, feature extraction, image recognition, and visual understanding.
CO4	**Analyze** the deep learning architectures, sequence models, attention mechanisms, and NLP applications.
CO5	**Analyze** the deep learning models, performance metrics, deployment strategies, and AI solutions.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Remember	the deep learning algorithms, neural networks			L1
CO2	Understand	the CNNs, RNNs			L2
CO3	Apply	the deep learning techniques, feature extraction, image recognition, and visual understanding		Implements techniques correctly	L3
CO4	Analyze	the deep learning architectures, sequence models, NLP			L4
CO5	Analyze	the DL models, performance metrics, deployment strategies			L4

UNIT – I		9 Hrs
Introduction: Feed forward Neural networks, Gradient descent and the back-propagation algorithm, Unit saturation, the vanishing gradient problem, and ways to mitigate it. RelU Heuristics for avoiding bad local minima, Heuristics for faster training, Nestors accelerated gradient descent, Regularization, Dropout		
UNIT – II		9 Hrs
Convolutional Neural Networks: Architectures, convolution/pooling layers, Recurrent Neural Networks: LSTM, GRU, Encoder Decoder architectures. Deep Unsupervised Learning: Auto encoders, Variational Auto-encoders, Adversarial Generative Networks, Auto-encoder and DBM Attention and memory models, Dynamic Memory Models		
UNIT – III		9 Hrs
Applications of Deep Learning to Computer Vision: Image segmentation, object detection, automatic image captioning, Image generation with Generative adversarial networks, video to text with LSTM models, Attention Models for computer vision tasks		
UNIT – IV		9 Hrs
Applications of Deep Learning to NLP: Introduction to NLP and Vector Space Model of Semantics, Word Vector Representations: Continuous Skip-Gram Model, Continuous Bag-of-Words model (CBOW), Glove, Evaluations and Applications in word similarity.		
UNIT – V		9 Hrs
Analogy reasoning: Named Entity Recognition, Opinion Mining using Recurrent Neural Networks: Parsing and Sentiment Analysis using Recursive Neural Networks: Sentence Classification using Convolutional Neural Networks, Dialogue Generation with LSTMs		

Textbooks:

1. Deep Learning by Ian Goodfellow, YoshuaBengio and Aaron Courville, MIT Press.
2. The Elements of Statistical Learning by T. Hastie, R. Tibshirani, and J. Friedman, Springer.

3. Probabilistic Graphical Models. Koller, and N. Friedman, MIT Press.

Reference Books:

1. Bishop, C, M., Pattern Recognition and Machine Learning, Springer, 2006.
2. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
3. Golub, G.,H., and Van Loan, C.,F., Matrix Computations, JHU Press,2013.
4. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

Online References:

1. http://www.deeplearning.net
2. https://www.deeplearningbook.org/
3. https://developers.google.com/machine-learning/crash-course/ml-intro
4. www.cs.toronto.edu/~fritz/absps/imagenet.pdf
5. http://neuralnetworksanddeeplearning.com/

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3
CO1	3	2	-
CO2	2	2	-
CO3	2	2	-
CO4	3	2	1
CO5	3	3	1

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
M.TECH.-COMPUTER SCIENCE & ENGINEERING

Course Code	Year & Sem	GENERATIVE AI (Program Elective – IV)	L	T	P	C
25DPE5810	I-II		3	0	0	3

Pre-Requisites	GENERATIVE AI

Course Objectives:

1. To introduce the foundational concepts of Artificial Intelligence and Generative Models, including ANN structures, mathematical foundations, and the evolution of AI, ML, NLP, and DL.
2. To provide an in-depth understanding of advanced neural architectures such as VAEs, GANs, Transformers, LSTMs, and pre-training/transfer learning strategies for generative modeling.
3. To develop the ability to work with Large Language Models (LLMs) including GPT and BERT; to learn prompt engineering, fine-tuning, and applying LLMs for real-world tasks like chatbots and text generation.
4. To enable students to understand and apply Multi-Agent Systems (MAS) for generative applications using frameworks such as AutoGen, CrewAI, and HuggingGPT in domains like art, healthcare, and creative automation.
5. To equip learners with the skills to use frameworks and multimodal generative AI technologies, including LangChain, RAG, embeddings, vector databases, multimodal generation (text, code, image, video), and to analyze ethical, legal, and societal implications of Generative AI.

Course Outcomes (CO): Student will be able to

CO1	**Understand** the AI foundations, generative models, advanced neural architectures, and key theoretical concepts.
CO2	**Apply** the generative AI techniques to develop solutions for text, image, video, and multimodal tasks effectively.
CO3	**Apply** the fine-tuning, adaptation, and optimization of Large Language Models for specific real-world applications.
CO4	**Analyze** the ethical, social, legal implications of generative AI deployments, and propose mitigation strategies.
CO5	**Apply** multimodal generative AI applications using frameworks like LangChain, RAG & vector databases practically.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	the AI foundations, generative models, advanced neural architectures, key theoretical concepts			L2
CO2	Apply	the Generative AI techniques	To develop solutions for text, image, video, and multimodal tasks effectively		L3
CO3	Apply	the fine-tuning, adaptation, optimization of Large Language Models	For specific real-world applications		L3
CO4	Analyze	the ethical, social, legal implications of generative AI deployments		Proposes valid mitigation strategies	L4
CO5	Apply	the multimodal generative AI applications using frameworks like LangChain, RAG & vector databases	Practically		L3

UNIT – I	Foundations of AI and Generative Models	9 Hrs

Introduction and historical evolution to Artificial Intelligence (AI), Machine Learning (ML), Natural Language Processing (NLP)and Deep Learning (DL), Structure of Artificial Neural Networks (ANNs), Mathematical and computational foundations of generative modeling, Overview of generative models and their applications across various domains; Importance of Generative AI in modern applications, Transfer learning and in advancing Generative AI.

UNIT – II	Advanced Neural Architectures for Generative AI	9 Hrs

VariationalAutoencoders (VAEs): principles and applications, Generative Adversarial Networks (GANs): architecture and working principles; Transformer architecture and attention mechanisms (in detail); Long Short-Term Memory Networks (LSTMs) and the limitations of traditional RNNs/LSTMs, Advanced Transformer architectures and techniques, Pre-training and transfer learning strategies for generative models.

UNIT – III	Large Language Models and Prompt Engineering	9 Hrs

Overview of Large Language Models (LLMs), GPT architecture, variants, and working principles, Prétraining and fine-tuning GPT models for applications (e.g., chatbots, text generation), Case study: GPT-based customer support chatbot, BERT architecture, pre-training objectives, and fine-tuning, Prompt Engineering: Designing effective prompts, controlling model behavior, and improving output quality, Fine-tuning language models for creative writing and chatbot development.

UNIT – IV	Multi-Agent Systems and Generative AI Applications	9 Hrs

Introduction to Multi-Agent Systems (MAS),Types of agents: reactive, deliberative, hybrid, and learning agents, Multi-agent collaboration and orchestration for generative tasks, Use cases: autonomous research assistants, cooperative creative generation, distributed problem-solving, Frameworks and tools: AutoGen, CrewAI, Hugging GPT for LLM-powered multi-agent systems, Generative AI applications: Art, Creativity, Image/Video generation, Music composition, Healthcare, Finance, Real-world case studies and deployment challenges

UNIT – V		9 Hrs

Frameworks, Multimodal Applications, and Ethics LangChain framework: components and LLM application development, Retrieval-Augmented Generation (RAG), Embeddings, Indexing networks, and Vector databases, Generative AI across modalities: Text, Code, Image, and Video generation, Image and Video generation using GANs and VAEs, Multimodal Generative AI: integration and training strategies, Ethical considerations: bias, fairness, trust, and responsible AI deployment, Social and legal implications of Generative AI, Risk mitigation strategies and real-world ethical case studies

Textbooks:

1. AltafRehmani, Generative AI for Everyone: Understanding the Essentials and Applications of This Breakthrough Technology.
2. Charu C. Aggarwal, Neural Networks and Deep Learning: A Textbook. Joseph Babcock, Raghav Bali, Generative AI with Python and TensorFlow 2, 2024.

Reference Books:

1. Josh Kalin, Generative Adversarial Networks Cookbook.
2. Jesse Sprinter, Generative AI in Software Development: Beyond the Limitations of Traditional Coding, 2024.

Online References:

1.Fabian Gloeckle et al., Better & Faster Large Language Models via Multi-token Prediction, arXiv:2404.19737v1, 2024.Vaswani et al., Attention Is All You Need, NeurIPS 2017.

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3
CO1	3	2	-
CO2	2	3	-
CO3	3	3	2
CO4	2	3	2
CO5	3	2	2

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
M.TECH.-COMPUTER SCIENCE & ENGINEERING

Course Code	Year & Sem	DIGITAL FORENSICS (Program Elective – IV)	L	T	P	C
25DPE5811	I-II		3	0	0	3

Pre-Requisites	DIGITAL FORENSICS

Course Objectives:

1. To provide foundational knowledge of digital forensics science, including computer forensics, cyber criminalistics, and investigative processes.
2. To familiarize students with cybercrime scene analysis, including methods for search and seizure of electronic evidence and required court documents.
3. To develop the ability to manage and present digital evidence by understanding the forensic mindset, workload of law enforcement, and legal principles such as probable cause.
4. To equip students with skills to conduct computer and network forensic investigations, including case preparation, investigation procedures, and preservation of network data.
5. To introduce students to mobile forensics techniques, tools, and legal aspects of digital forensics, including IT Act 2000 and its amendments, and recent trends in electronic evidence handling.

The course aims to:

Course Outcomes (CO): Student will be able to

CO1	**Understand** the relevant legislation, IT Acts, and codes of ethics related to digital forensics.
CO2	**Understand** the computer forensics processes, digital detective methods, and various forensic policies and procedures.
CO3	**Analyze** the e-discovery procedures, digital evidence guidelines, forensic tools, and investigation environments.
CO4	**Apply** the techniques of email forensics, web forensics, and network forensics to extract and analyze digital evidence.
CO5	**Apply** the mobile forensics techniques, tools & legal procedures to acquire, analyze & present mobile digital evidence.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	Relevant legislation, IT Acts, and codes of ethics related to digital forensics			L2
CO2	Understand	Computer forensics processes, digital detective methods, and various forensic policies and procedure			L2
CO3	Analyze	E-discovery procedures, digital evidence guidelines, forensic tools, and investigation environments			L4
CO4	Apply	Techniques of email forensics, web forensics, and network forensics	To extract and analyze digital evidence		L3
CO5	Apply	mobile forensics techniques, tools, and legal procedures	To acquire, analyze & present mobile digital evidence		L3

UNIT – I		9 Hrs
Digital Forensics Science: Forensics science, computer forensics, and digital forensics. Computer Crime: Criminalistics as it relates to the investigative process, analysis of cyber criminalistics area, holistic approach to cyber-forensics		
UNIT – II		9 Hrs
Cyber Crime Scene Analysis: Discuss the various court orders etc., methods to search and seizure electronic evidence, retrieved and un-retrieved communications, Discuss the importance of understanding what court documents would be required for a criminal investigation.		
UNIT – III		9 Hrs
Evidence Management & Presentation: Create and manage shared folders using operating system, importance of the forensic mindset, define the workload of law enforcement, Explain what the normal case would look like, Define who should be notified of a crime, parts of gathering evidence, Define and apply probable cause.		
UNIT – IV		9 Hrs
Computer Forensics: Prepare a case, Begin an investigation, Understand computer forensics workstations and software, Conduct an investigation, Complete a case, Critique a case, Network Forensics: open-source security tools for network forensic analysis, requirements for preservation of network data		
UNIT – V		9 Hrs
Mobile Forensics: mobile forensics techniques, mobile forensics tools. Legal Aspects of Digital Forensics: IT Act 2000, amendment of IT Act 2008. Recent trends in mobile forensic technique and methods to search and seizure electronic evidence		

Textbooks:

1. John Sammons, The Basics of Digital Forensics, Elsevier
2. John Vacca, Computer Forensics: Computer Crime Scene Investigation, Laxmi Publications

Reference Books:

1. William Oettinger, Learn Computer Forensics: A beginner's guide to searching, analyzing, and securing digital evidence, Packt Publishing; 1st edition (30 April 2020), ISBN : 1838648178.
2. Thomas J. Holt, Adam M. Bossler, Kathryn C. Seigfried-Spellar, Cybercrime and Digital Forensics: An Introduction, Routledge.

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3
CO1	2	3	1
CO2	2	2	1
CO3	3	2	2
CO4	3	2	2
CO5	3	2	2

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
M.TECH.-COMPUTER SCIENCE & ENGINEERING

Course Code	Year & Sem	ROBOTIC PROCESS AUTOMATION (Program Elective – IV)	L	T	P	C
25DPE5812	I-II		3	0	0	3

Pre-Requisites	ROBOTIC PROCESS AUTOMATION

Course Objectives:

1. To introduce the fundamentals of Robotic Process Automation (RPA) and enable students to understand RPA concepts, use cases, and features of Automation Anywhere Enterprise Platform.
2. To provide knowledge of Web Control Room and Client operations, including dashboards, task/activity monitoring, bot management, device handling, audit logs, and administrative features.
3. To develop the ability to manage devices, workloads, credentials, and APIs involved in enterprise-grade automation solutions.
4. To equip students with skills to create and manage bots using recorders, task editors, variables, loops, Excel/database commands, and other core automation components.
5. To enable students to work with advanced RPA commands and tools, including PDF, FTP, PGP, Object Cloning, Error Handling, Workflow Designer, and Report Designer for end-to-end automation processes.

Course Outcomes (CO): Student will be able to

CO1	**Understand** the RPA, its various applications, benefits, and overall basic implementation processes.
CO2	**Understand** the components, architecture, and detailed functions of Web Control Room and Client.
CO3	**Analyze** the handling and management of devices, queues, workloads, and automated scheduling in RPA.
CO4	**Apply** the use of Bot Creators, Web Recorders, Task Editors, and advanced development tools.
CO5	**Create** the RPA tools and frameworks to build, test, deploy, and manage comprehensive workflows.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	**Understand**	Robotic Process Automation, its various applications, benefits, and overall basic implementation process in enterprises			L2
CO2	**Understand**	Components, architecture, and detailed functions of the Web Control Room and Client in RPA environments			L2
CO3	**Analyze**	Handling and management of various devices, queues, workloads, and automated scheduling in RPA			L4
CO4	**Apply**	Use of Bot Creators, Web Recorders, Task Editors, and advanced automation development tools			L3
CO5	**Create**	RPA tools and frameworks	to build, test, deploy, and manage comprehensive workflows		L5

UNIT – I		9 Hrs
Introduction to Robotic Process Automation & Bot Creation Introduction to RPA and Use cases – Automation Anywhere Enterprise Platform – Advanced features and capabilities – Ways to create Bots		
UNIT – II		9 Hrs
Web Control Room and Client Introduction - Features Panel - Dashboard (Home, Bots, Devices, Audit, Workload, Insights) - Features Panel – Activity (View Tasks in Progress and Scheduled Tasks) - Bots (View Bots Uploaded and Credentials)		
UNIT – III		9 Hrs
Devices (View Development and Runtime Clients and Device Pools) - Workload (Queues and SLA Calculator) - Audit Log (View Activities Logged which are associated with Web CR) - Administration (Configure Settings, Users, Roles, License and Migration) - Demo of Exposed API's – Conclusion – Client introduction and Conclusion.		
UNIT – IV		9 Hrs
Bot Creator Introduction – Recorders – Smart Recorders – Web Recorders – Screen Recorders - Task Editor – Variables - Command Library – Loop Command – Excel Command – Database Command - String Operation Command - XML Command		
UNIT – V		9 Hrs
Terminal Emulator Command - PDF Integration Command - FTP Command - PGP Command - Object Cloning Command - Error Handling Command - Manage Windows Control Command - Workflow Designer - Report Designer		

Textbooks:
1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath: Create Software robots. with the leading RPA tool – UiPath Kindle Edition.
Reference Books:
1.Robotic Process Automation A Complete Guide - 2020 Edition Kindle Edition.

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3
CO1	**2**	**1**	
CO2	**3**	**2**	
CO3	**3**	**2**	**1**
CO4	**2**	**3**	**1**
CO5	**3**	**3**	**2**

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
M.TECH.-COMPUTER SCIENCE & ENGINEERING

Course Code	Year & Sem	Advances in Software Engineering Lab	L	T	P	C
25DPC5807	I-II		0	0	4	2

Pre-Requisites	Software Engineering

Course Objectives:

1. To familiarize students with various software process models and project management practices for planning and managing software development.
2. To enable students to gather, document, and model software requirements using industry-standard requirement engineering and UML techniques.
3. To develop students' ability to design modular, reusable, and maintainable software systems using object-oriented and component-based approaches.
4. To provide hands-on experience in applying software testing, maintenance, and reengineering strategies to ensure software quality and continuous improvement.
5. To train students in the use of modern software engineering tools, DevOps practices, and software analytics to improve development efficiency and quality assurance.

Course Outcomes (CO): Student will be able to

CO1	**Analyze** the software process models & project management techniques to plan & manage software development effectively.
CO2	**Analyze** the requirements elicitation, documentation, and UML modeling techniques for software systems.
CO3	**Analyze** the software testing strategies, techniques & reengineering practices to ensure overall software quality
CO4	**Apply** the software testing, maintenance, and reengineering practices for overall quality.
CO5	**Apply** the modern tools like version control, DevOps, metrics, and Artificial intelligence - based analysis.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	**Analyze**	software process models and project management techniques	To plan & manage software development	Implements planning and management effectively	L4
CO2	**Analyze**	Requirements elicitation, documentation, and UML modeling techniques	For software systems		L4
CO3	**Analyze**	Software testing strategies, techniques & reengineering practices	To ensure overall software quality	reengineering	L4
CO4	**Apply**	Software testing, maintenance, and reengineering practices	For overall quality		L3
CO5	**Apply**	Modern tools like version control, DevOps, metrics, and Artificial Intelligence-based analysis			L3

List of Programs:

Program 1: Comparative Study of Process Models (CO1)
Implement a simple project using Waterfall and Incremental models; compare effort, defects, and time taken.
Program 2: Agile Development Simulation (CO1)
Develop a small software system using Scrum methodology with sprints, product backlog, sprint backlog, and daily scrums.
Program 3: Project Estimation and Scheduling (CO3)
Perform Function Point Analysis (FPA) or Use Case Points (UCP) to estimate size and effort, then prepare a Gantt chart and PERT chart.
Program 4: Risk Analysis in Software Projects (CO4)
Conduct risk identification, qualitative/quantitative assessment, and develop a risk mitigation plan for a given case study.
Program 5: Requirement Elicitation and SRS Document (CO4)
Conduct requirement gathering for a mini-project and prepare a Software Requirement Specification (SRS) document.
Program 6: UML Modeling (Scenario-based & Structural) (CO3)
Create Use Case diagrams, Activity diagrams, and Sequence diagrams for a given problem domain.
Program 7: UML Modeling (Class &Behavioral) (CO2)
Create Class diagrams, State machine diagrams, and Component diagrams to represent system architecture.
Program 8: Object-Oriented Design Using UML(CO2)
Design a software module using OO principles (encapsulation, inheritance, polymorphism) and illustrate with UML diagrams.
Program 9: Design Patterns Implementation (CO4)

Implement at least three design patterns (e.g., Singleton, Factory, Observer) in Java/Python.

Program 10: Reuse-Oriented Software Engineering (CO5)

Use existing open-source libraries/frameworks to develop a component-based application (e.g., web app using Django/Flask).

Program 11: Black-box and White-box Testing(CO3)

Perform equivalence partitioning and boundary value analysis (black-box) and basis path testing (white-box) for a given program.

Program 12: Software Maintenance and Reengineering(CO4)

Take an existing open-source project (small module), analyze it, and perform refactoring/reengineering for improvement.

Program 13: Version Control and DevOps Pipeline (CO5)

Use Git & GitHub/GitLab for version control and demonstrate CI/CD pipeline setup with Jenkins/GitHub Actions.

Program 14: Software Metrics and AI in SE (CO5)

Compute software metrics (complexity, coupling, cohesion) for a given project and explore an AI tool (e.g., GitHub Copilot, SonarQube) for software quality analysis.

Textbooks:

1. Software Engineering A Practitioner's Approach, Roger S. Pressman, 9th Edition McGrawHill International Edition.
2. Fundamentals of Software Engineering, Rajib Mall, Fifth Edition, PHI.

Reference Books:

1. Software Engineering, Ian Sommerville, Tenth Edition, Pearson education.
2. Software Engineering: A Primer, Waman S Jawadekar, Tata McGraw-Hill, 2008
3. Software Engineering, A Precise Approach, Pankaj Jalote, Wiley India,2010.
4. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3
CO1	3	2	-
CO2	3	3	-
CO3	3	3	1
CO4	2	3	1
CO5	2	3	1

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
M.TECH.-COMPUTER SCIENCE & ENGINEERING

Course Code	Year & Sem	Advanced Databases Lab	L	T	P	C
25DPC5808	I-II		0	0	4	2

Pre-Requisites	Database Management Systems

Course Objectives:

1. introduce students to the architecture and execution models of parallel and distributed database systems for high-performance data processing.
2. To enable students to understand and analyze transaction management and concurrency control mechanisms in distributed databases.
3. To provide practical exposure to data warehousing and mining techniques for analytical processing and pattern discovery.
4. To develop the ability to work with object-based databases, including type inheritance and advanced database design aspects.
5. To train students in handling semi-structured data through XML-based models, XQuery, and SQL/XML transformations for effective data exchange and integration.

Course Outcomes (CO): Student will be able to

CO1	**Understand** the database system architectures, layered structures, and parallel database concepts.
CO2	**Analyze** the transactions, commit protocols, and concurrency control in distributed databases effectively.
CO3	**Understand** the importance, principles, and practical applications of data warehousing and data mining processes.
CO4	**Apply** the concepts, structures, and functionalities of object-based databases accurately.
CO5	**Apply** the semi-structured data representations using XML/XQuery and SQL/XML for advanced modeling & integration.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	**Understand**	Database system architectures, layered structures, and parallel databases concepts		Explains architecture and parallel database concepts	L2
CO2	**Analyze**	Transactions, commit protocols, and concurrency control in distributed databases effectively			L4
CO3	**Understand**	Importance, principles, and practical applications of data warehousing and data mining processes		data warehousing and mining	L2
CO4	**Apply**	concepts, structures, and functionalities of object-based databases accurately		Of object-based database structures accurately.	L3
CO5	**Apply**	Semi-structured data representations using XML/XQuery and SQL/XML for advanced data modeling and integration practically	For advanced data modeling and integration		L3

List of Programs:

1. Write a program to implement RDBMS - Cursors, Triggers **(CO2)**
2. Write a Program to implement Range Partitioning sort. **(CO2)**
3. Write a program to implement parallel hash join **(CO1)**
4. Write a program to implement parallel nested join loop **(CO1)**
5. Write a program to implement parallelize duplicate elimination by partitioning the tuples **(CO3)**
6. Perform data fragmentation of distributed data(Horizontal, Vertical, Hybrid fragmentation) **(CO3)**
7. Implement deadlock detection in distributed databases **(CO4)**
8. Implement Semi Join algorithm. **(CO3)**
9. DataCube Implementation - Aggregation **(CO3)**
10. Perform data Integration - Extraction, Transformation, Loading **(CO3)**
11. Implement any one classifier **(CO4)**
12. Implement vector space models for Text corpus **(CO4)**
13. Demonstrate type inheritance, table inheritance in object based databases **(CO4)**
14. Write queries in XQueries on DTD **(CO5)**
15. Write queries in SQL/XML to convert University data - XML Schema **(CO5)**

Textbooks:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan Database System Concepts, Sixth Edition
2. RamezElmasri, Shamkant B. Navathe, Database systems- Models, Languages, Design and Application Programming.

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3
CO1	3	2	1
CO2	3	3	1
CO3	2	3	1
CO4	2	3	1
CO5	2	3	1

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
M.TECH.-COMPUTER SCIENCE & ENGINEERING

Course Code	Year & Sem	Quantum Technologies And Applications (Mandatory Course)	L	T	P	C
25DMC5801	I-II		2	0	0	2

Pre-Requisites	-

Course Objectives:

1. provide foundational understanding of the transition from classical to quantum physics and the nature of quantum states.
2. To introduce students to qubits, quantum systems, and their conceptual and philosophical importance.
3. To enable students to analyze quantum computer requirements, hardware platforms, software roles, and technological challenges.
4. To examine quantum information, communication, and computing theories and evaluate their future potential.
5. To familiarize students with quantum applications, current industry use cases, challenges, and opportunities across domains.

Course Outcomes (CO): Student will be able to

CO1	**Understand** the transition from classical physics to quantum physics, quantum states, superposition, and key principles.
CO2	**Understand** qubits, quantum systems, entanglement, and their philosophical and theoretical significance.
CO3	**Analyze** quantum computer requirements, system fragility, hardware platforms, software components, and operational challenges.
CO4	**Analyze** quantum information processing, quantum communication, quantum computing principles & future potential.
CO5	**Apply** quantum computing applications, industry use cases, emerging challenges, and practical opportunities.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	**Understand**	Transition from classical to quantum physics and quantum states			L2
CO2	**Understand**	Qubits, quantum systems, and their significance		Explains qubits and quantum system significance	L2
CO3	**Analyze**	Quantum computer requirements, fragility, hardware platforms, and software roles			L4
CO4	**Analyze**	Quantum information, communication, computing, and future potential		Assesses information and computing potential correctly	L4
CO5	**Apply**	Quantum applications, industry cases, challenges, and opportunities			L3

UNIT – I	**Introduction to Quantum Theory and Technologies**	9 Hrs

The transition from classical to quantum physics, Fundamental principles explained conceptually: Superposition, Entanglement, Uncertainty Principle, Wave-particle duality, Classical vs Quantum mechanics – theoretical comparison,Quantum states and measurement: nature of observation,Overview of quantum systems: electrons, photons, atoms,The concept of quantization: discrete energy levels,Why quantum? Strategic, scientific, and technological significance,A snapshot of quantum technologies: Computing, Communication, and Sensing,National and global quantum missions: India's Quantum Mission, EU, USA, China

UNIT – II	**Theoretical Structure of Quantum Information Systems**	9 Hrs

What is a qubit? Conceptual understanding using spin and polarization, Comparison: classical bits vs quantum bits, Quantum systems: trapped ions, superconducting circuits, photons (non-engineering view),Quantum coherence and decoherence – intuitive explanation, Theoretical concepts: Hilbert spaces, quantum states, operators – only interpreted in abstract,The role of entanglement and non-locality in systems, Quantum information vs classical information: principles and differences,Philosophical implications: randomness, determinism, and observer role

UNIT – III	**Building a Quantum Computer – Theoretical Challenges and Requirements**	9 Hrs

What is required to build a quantum computer (conceptual overview)?,Fragility of quantum systems: decoherence, noise, and control, Conditions for a functional quantum system: Isolation, Error management, Scalability, Stability, Theoretical barriers: Why maintaining entanglement is difficult,Error correction as a theoretical necessity, Quantum hardware platforms (brief conceptual comparison),Superconducting circuits, Trapped ions, Photonics, Visionvs reality: what's working and what remains elusive,The role of quantum software in managing theoretical complexities

UNIT – IV	**Quantum Communication and Computing – Theoretical Perspective**	9 Hrs

Quantum vs Classical Information, Basics of Quantum Communication, Quantum Key Distribution (QKD),Role of Entanglement in Communication,The Idea of the Quantum Internet – Secure Global Networking,Introduction to Quantum Computing,Quantum Parallelism (Many States at Once),Classical vs Quantum Gates, Challenges: Decoherence and Error

Correction,Real-World Importance and Future Potential

UNIT – V	Applications, Use Cases, and the Quantum Future	9 Hrs

Real-world application domains: Healthcare (drug discovery),Material science, Logistics and optimization, Quantum sensing and precision timing, Industrial case studies: IBM, Google, Microsoft, PsiQuantum,Ethical, societal, and policy considerations, Challenges to adoption: cost, skills, standardization,Emerging careers in quantum: roles, skillsets, and preparation pathways,Educational and research landscape – India's opportunity in the global quantum race

Textbooks:

1. Michael A. Nielsen, Isaac L. Chuang, Quantum Computation and Quantum Information, Cambridge University Press, 10th Anniversary Edition, 2010.
2. Eleanor Rieffel and Wolfgang Polak, Quantum Computing: A Gentle Introduction, MIT Press, 2011.
3. Chris Bernhardt, Quantum Computing for Everyone, MIT Press, 2019.

Reference Books:

1. David McMahon, Quantum Computing Explained, Wiley, 2008.
2. Phillip Kaye, Raymond Laflamme, Michele Mosca, An Introduction to Quantum Computing, Oxford University Press, 2007.
3. Scott Aaronson, Quantum Computing Since Democritus, Cambridge University Press, 2013.
4. Alastair I.M. Rae, Quantum Physics: A Beginner's Guide, Oneworld Publications, Revised Edition, 2005.
5. Eleanor G. Rieffel, Wolfgang H. Polak, Quantum Computing: A Gentle Introduction, MIT Press, 2011.
6. Leonard Susskind, Art Friedman, Quantum Mechanics: The Theoretical Minimum, Basic Books, 2014.
7. Bruce Rosenblum, Fred Kuttner, Quantum Enigma: Physics Encounters Consciousness, Oxford University Press, 2nd Edition, 2011.
8. GiulianoBenenti, GiulioCasati, GiulianoStrini, Principles of Quantum Computation and Information, Volume I: Basic Concepts, World Scientific Publishing, 2004.
9. K.B. Whaley et al., Quantum Technologies and Industrial Applications: European Roadmap and Strategy Document, Quantum Flagship, European Commission, 2020.
10. Department of Science & Technology (DST), Government of India, National Mission on Quantum Technologies & Applications – Official Reports and Whitepapers, MeitY/DST Publications, 2020 onward.

Online Learning Resources:

• IBM Quantum Experience and Qiskit Tutorials
• Coursera – Quantum Mechanics and Quantum Computation by UC Berkeley
• edX – The Quantum Internet and Quantum Computers
• YouTube – Quantum Computing for the Determined by Michael Nielsen
• Qiskit Textbook – IBM Quantum

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3
CO1	3	2	-
CO2	3	2	-
CO3	3	3	-
CO4	2	3	-
CO5	2	3	-

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
M.TECH.-COMPUTER SCIENCE & ENGINEERING

Course Code	Year & Sem	(AUDIT COURSE-II)	L	T	P	C
25DAC9903	I-II	**Sanskrit for Technical Knowledge**	2	0	0	0

Pre-Requisites	ROBOTIC PROCESS AUTOMATION

Course Objectives:

1. Enable students to understand and interpret technical Sanskrit literature relevant to research and academic writing.
2. Develop the ability to differentiate research paper formats and apply correct citation techniques.
3. Build critical evaluation skills for reviewing technical and scientific documents in a structured manner.
4. Promote ethical research practices by avoiding plagiarism and enhancing academic writing skills.
5. Equip students with the capability to prepare and publish an original research paper in reputed journals and conferences.

Course Outcomes (CO): Student will be able to

CO1	**Understand** the nuances and structure of research paper writing using Sanskrit technical literature.
CO2	**Apply** the research paper formats and correct citation styles as per academic standards.
CO3	**Analyze** the research papers and articles scientifically using critical review techniques.
CO4	**Apply** the plagiarism and **develop** scholarly writing skills for presenting research outcomes ethically.
CO5	**Create** a complete research paper and **demonstrate** the knowledge of identifying appropriate journals/conferences for publication.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	**Understand**	The nuances and structure of technical research paper writing	—	—	**L2**
CO2	**Apply**	The Research paper formats and apply correct citation styles	—	—	**L3**
CO3	**Analyze**	The Research papers and scientific articles using critical review techniques	—	Evaluates credibility, methodology, and conclusion	**L4**
CO4	**Apply**	The Scholarly writing skills while preventing plagiarism	Given academic writing and research documentation tasks	Produces plagiarism-free structured technical writing	**L3**
CO5	**Create**	A complete research paper and choose suitable publication venues	Given journal/conference publication guidelines	Submits a complete research paper ready for publication	**L6**

UNIT – I		9 Hrs
Academic Writing: Meaning & Definition of a research paper– Purpose of a research paper – Scope – Benefits, Limitations – outcomes.		
UNIT – II		9 Hrs
Research Paper Format: Title – Abstract – Introduction – Discussion – Findings, Conclusion– Style of Indentation – Font size/Font types – Indexing – Citation of sources.		
UNIT – III		9 Hrs
Research Methodology: Methods (Qualitative – Quantitative) Review of Literature. Criticizing, Paraphrasing & Plagiarism.		
UNIT – IV		9 Hrs
Process of Writing a research paper: Choosing a topic - Thesis Statement – Outline – Organizing notes - Language of Research – Word order, Paragraphs – Writing first draft –Revising/Editing - The final draft and proof reading.		
UNIT – V		9 Hrs
Research Paper Publication: Reputed Journals – National/International – ISSN No, No. of volumes, Scopus Index/UGC Journals – Free publications - Paid Journal publications –Advantages/Benefits Presentation Skills: Developing Persuasive Presentations, Structure of Presentation, Presentation Slides, Presentation Delivery, role of the audience, what to search and cite, how to establish credibility		

Textbooks:

1. C. R Kothari, Gaurav, Garg, ―Research Methodology Methods and Techniques‖, 4/e, New Age International Publishers.

Reference Books:

1. Day R, ―How to Write and Publish a Scientific Paper", Cambridge University Press, 2006
2. MLA Hand book for writers of Research Papers‖, 7/e, East West Press Pvt. Ltd, New Delhi
3. Lauri Rozakis, Schaum's, ―Quick Guide to Writing Great Research Papers", Tata McGraw Hills Pvt. Ltd, New Delhi.

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3
CO1	2	1	-
CO2	2	-	-
CO3	1	3	2
CO4	2	3	2
CO5	1	2	3

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
M.TECH.-COMPUTER SCIENCE & ENGINEERING

Course Code	Year & Sem	(AUDIT COURSE-II)	L	T	P	C
25DAC0101	I-II	**Business Ethics and Corporate Governance**	2	0	0	0

Pre-Requisites	-

Course Objectives:

1. Provide conceptual understanding of business ethics, values, and professional responsibility.
2. Develop awareness of ethical conduct and decision-making in corporate environments.
3. Introduce the functional domains and applications of ethics in business operations.
4. Build foundational knowledge of corporate governance mechanisms and stakeholder roles.
5. Explore corporate sector ethical theories, best practices, and real-world applications.

Course Outcomes (CO): Student will be able to

CO1	**Understand** the fundamental concepts of business ethics and values in professional practice.
CO2	**Analyze** ethical behavior and practices followed in corporate organizations.
CO3	**Analyze** functional areas of business ethics and their relevance in organizational decision making.
CO4	**Understand** the structure, mechanisms, and principles of corporate governance.
CO5	**Evaluate** theories and practices adopted by corporate sectors for responsible and ethical operations.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	Concepts of business ethics and values	—	—	**L2**
CO2	Analyze	Ethical behavior and practices in corporate organizations	Given case studies or workplace ethical dilemmas	Recommends appropriate ethical behavior	**L4**
CO3	Analyze	Functional areas of business ethics and their relevance	—	Correctly identifies and categorizes ethical functional areas	**L4**
CO4	Understand	Structure, mechanisms, and principles of corporate governance	—	—	**L2**
CO5	Evaluate	Ethical theories and corporate sector practices	Given corporate practices or strategies	Critically evaluates suitability and ethical impact	**L5**

UNIT – I		9 Hrs
Introduction – Concepts of ethics – Importance, Ethics and morality, Ethics and law, Ethics and ethos, Business Ethics – Meaning, scope, and benefits, Ethical theories, Values and its relevance in Management, role of Ethics in Business and Indian Value system, Various approaches to ethics- Indian examples.		
UNIT – II		9 Hrs
Ethical Corporate Behaviour- stages of ethical behaviour, Ethical leadership with examples, Ethical Decision Making, Work ethics: nature and scope, Ethical issues at the workplace, Ethics and cultural issues, Environmental Ethics, Ethical dilemma, ethical displacement.		
UNIT – III		9 Hrs
Ethics in Functional Areas: Operations, Marketing, Finance, HR & Information Technology, Recent challenges in ethics, Ethics in different countries.		
UNIT – IV		9 Hrs
Corporate Governance – concepts, relevance and importance – emergence of corporate governance in 21st century – Corporate Governance initiatives in India and abroad. Corporate Governance failures with examples, General ethical issues and the court verdicts in the domain of business ethics, obligation to stakeholders.		
UNIT – V		9 Hrs
Theories of corporate governance – models – social audit – Ethical Issues-Corruption, – whistle blowing-competition-privacy-trade secrets, corporate governance in public sector undertakings and banks, Harassment & Discrimination.		

Textbooks:

1.Manisha Paliwal – Business Ethics – New Age International

Reference Books:

1.Joseph Petrick, John F Quinn – Management Ethics: Integrity at work – Sage Publishers
2.Sherlekar – Ethics in Management – Himalaya

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3
CO1	2	3	-
CO2	2	3	-
CO3	2	3	1
CO4	1	3	1
CO5	2	3	2

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
M.TECH.-COMPUTER SCIENCE & ENGINEERING

Course Code	Year & Sem	(AUDIT COURSE-II)	L	T	P	C
25DAC5801	I-II	**System Modeling**	2	0	0	**0**

Pre-Requisites	-

Course Objectives:

1. Provide knowledge on system modeling, simulation tools, and model development life cycle.
2. Develop understanding of statistical models, random number generation, and input modelling.
3. Train students to evaluate system performance using analytical and simulation-based approaches.
4. Enable selection of appropriate models, tools, and performance indicators for real-world systems.
5. Build analytical skills for modeling complex dynamic systems for research and industry applications.

Course Outcomes (CO): Student will be able to

CO1	**Analyze** the system requirements and select appropriate simulation tools for modeling.
CO2	**Apply** the various statistical models used in system modeling and simulation.
CO3	**Analyze** the techniques for generating random numbers and evaluate their suitability for simulation.
CO4	**Evaluate** the methods for selecting input models based on system characteristics and data patterns.
CO5	**Analyze** the system performance measures and estimation techniques to determine model efficiency.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Analyze	System requirements and simulation tool selection	Given a system specification	Selects the most appropriate simulation tool	**L4**
CO2	Apply	Statistical models for system modeling	—	Correctly distinguishes among various statistical models	**L3**
CO3	Analyze	Random number generation techniques	Given simulation data or technique list	Explains the method and evaluates its suitability	**L4**
CO4	Evaluate	Input model selection methods	Given dataset or system characteristics	Chooses the optimal input model based on evaluation	**L5**
CO5	Analyze	Performance measures and estimation techniques	After simulation experiment	Determines system performance accurately	**L4**

UNIT – I		9 Hrs
When simulation is the appropriate tool. Advantages and disadvantages of Simulation; Areas of application, Systems and system environment; Components of a system; Discrete and continuous systems, Model of a system; Types of Models, Discrete-Event System Simulation, Steps of a simulation study.		
UNIT – II		9 Hrs
Review of terminology and concepts, Useful statistical models, Discrete distributions. Continuous distributions, Poisson process, Empirical distributions. (basic idea only)		
UNIT – III		9 Hrs
Properties of random numbers; Generation of pseudorandom numbers, Techniques for generating random numbers, Tests for Random Numbers		
UNIT – IV		9 Hrs
Data Collection; Identifying the distribution with data,Parameter estimation, Goodness of Fit Tests, Fitting a non-stationary Poisson process, Selecting input models without data, Multivariate and Time-Series input models.		
UNIT – V		9 Hrs
. Measures of performance and their estimation, Output analysis for terminating simulations, Output analysis for steady-state simulations, Verification, calibration and validation		

Textbooks:

1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol: Discrete-Event System Simulation, 5th Edition, Pearson Education, 2010.

Reference Books:

1. Lawrence M. Leemis, Stephen K. Park: Discrete – Event Simulation: A First Course, Pearson Education, 2006.
2. Averill M. Law: Simulation Modeling and Analysis, 4 th Edition, Tata McGraw-Hill, 2007
3. System Modelling and Response by Ernest O. Doebelin
4. Averill M Law, "Simulation Modeling and Analysis",McGraw-Hill Inc,2007 Geoffrey Gorden, "System Simulation",Prentice Hall of India,1992.

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3
CO1	3	1	-
CO2	3	1	-
CO3	3	1	-
CO4	3	1	1
CO5	3	2	1

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
M.TECH.-COMPUTER SCIENCE & ENGINEERING

Course Code	Year & Sem	(AUDIT COURSE-II)	L	T	P	C
25DAC9001	I-II	**Principles of Automation**	2	0	0	0

Pre-Requisites	-

Course Objectives:

1. Introduce automation concepts, sensor systems, actuators, and signal conditioning.
2. Provide knowledge of industrial robots, numerical control, and controller fundamentals.
3. Train students to design signal conditioning and automation control schemes.
4. Develop analytical ability to select appropriate automation components for real-world applications.
5. Enable students to integrate sensors, actuators, controllers, and logic programming in automation systems.

Course Outcomes (CO): Student will be able to

CO1	**Analyze** the sensor systems and select an appropriate sensor based on application constraints.
CO2	**Apply** the signal conditioning schemes based on application requirements.
CO3	**Evaluate** the actuator characteristics and choose a suitable actuator for industrial applications.
CO4	**Apply** the industrial robots and numerical control concepts in the context of automation.
CO5	**Create** the automation schemes using controllers and ladder logic programming.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Analyze	the Sensor systems and their selection based on constraints	Given an industrial application description	Selects the most suitable sensor based on evaluation of constraints	**L4**
CO2	Apply	the Signal conditioning schemes	Given application requirements or a block diagram	Designs an effective signal conditioning system	**L3**
CO3	Evaluate	the Actuator systems and their characteristics	Given performance requirements or industrial task	Selects the optimal actuator based on evaluation	**L5**
CO4	Apply	the Industrial robots and numerical control concepts	—	—	**L3**
CO5	Create	the Automation schemes using controllers and ladder logic	Given control requirements or functional specification	Develops a functioning automation ladder logic program	**L6**

UNIT – I	**Introduction to Industrial Automation**	9 Hrs
Basic Elements of an Automated System, Levels of Automation, Hardware components for Automation: Sensors, classification, Static and dynamic behaviour of sensors. Basic working principle of different sensors: Proximity sensors, Temperature sensors, flow sensors, Pressure sensors, Force sensors.Position sensors		
UNIT – II	**Signal conditioning**	9 Hrs
Need for signal conditioning, Types of signal conditioning. Signal conditioning using operational amplifier-Amplifier (Inverting and Non-inverting) and Filter circuits (Basic concepts). Design of first order low pass filter. Signal conditioning for data acquisition systems, anti-aliasing filters, Analog–Digital Conversions, Analog-to-Digital Converters (ADC)-Steps in analog-to-digital conversion, Successive Approximation Method, Digital-to-Analog Converters (DAC)- Steps in digital to analog conversion, Zero-order and first order data hold circuits		
UNIT – III	**Actuators**	9 Hrs
Types of actuators- mechanical, electrical, pneumatic and hydraulic actuators. (Basic working principle), Mechanical systems for motion conversion, transmission systems, Solenoids, Electric and stepper motors control.		
UNIT – IV	**Robotics and Automated Manufacturing Systems**	9 Hrs
Robot Anatomy and Related Attributes: Joints and Links, Common Robot Configurations, Joint Drive Systems, Sensors in Robotics (Basic concepts), Robot Control Systems, Applications of Industrial Robots- Material handling, Fundamentals of Numerical control (NC) Technology.		
UNIT – V	**Discrete Control and Programmable Logic Controllers**	9 Hrs
Discrete Process Control: Logic and Sequence control, Ladder Logic Diagrams, Programmable Logic Controllers: Components of the PLC, PLC Operating Cycle, Programming the PLC (Basic concepts only), Introduction to Distributed control system (DCS) and Supervisory Control and Data Acquisition Systems (SCADA)		

Reference Books:

1. Mikell Groover, Automation, Production Systems, and Computer-Integrated Manufacturing, 5th Edition, Pearson, 2019.
2. Yoram Koren, "Computer Control of Manufacturing Systems",TataMcGraw Hill Edition2005.
3. S. R. Deb; Sankha Deb. Robotics Technology and Flexible Automation, Second Edition McGraw-Hill Education: New York, 2010.
4. W. Bolton, "Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering" - PrenticeHall- 2013 - 5th Edition.
5. Doebelin, E.O. and Manic, D.N., "Measurement Systems: Applications and Design", 7th Edition, McGraw Hill, 2019.
6. Krishna Kant, Computer Based Industrial Control-, EEE-PHI,2nd edition,2010.
7. Nathan Ida, Sensors, Actuators, and Their Interfaces- A multidisciplinary introduction, 2nd Edition, IET Digital Library, 2020.
8. Salivahanan, S., and VS Kanchana Bhaaskaran. Linear integrated circuits. McGraw-Hill Education, 2nd edition, 2014.
9. Petruzella, Frank D. Programmable logic controllers. Tata McGraw-Hill Education,2005
10. Chapman and Hall, "Standard Handbook of Industrial Automation", Onsidine DM C & Onsidine GDC", NJ, 1986

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3
CO1	3	1	1
CO2	3	1	-
CO3	3	1	1
CO4	2	1	2
CO5	3	1	2

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
M.TECH.-COMPUTER SCIENCE & ENGINEERING

Course Code	Year & Sem	(AUDIT COURSE-II)	L	T	P	C
25DAC9904	I-II	**Stress Management By Yoga**	2	0	0	0

Pre-Requisites	-

Course Objectives:

6. Introduce the foundations and benefits of yoga for physical and mental well-being.
7. Improve physical fitness, flexibility, and endurance through yogic techniques.
8. Promote calmness, focus, and mindfulness for emotional stability.
9. Reduce stress, anxiety, and tension using Asanas, Pranayama, and meditation practices.
10. Encourage a healthy lifestyle that enhances personal productivity and professional efficiency.

Course Outcomes (CO): Student will be able to

CO1	**Understand** the importance of yoga and its benefits for physical and mental wellness.
CO2	**Apply** the physical strength and flexibility through regular yogic practices.
CO3	**Apply** the relaxation and concentration techniques to improve mental focus.
CO4	**Apply** the yogic Asanas and breathing techniques to relieve physical and mental stress.
CO5	**Analyze** the work performance and efficiency through stress-free lifestyle habits learned via yoga.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	the Yoga foundations and benefits	—	—	**L2**
CO2	Apply	the Physical strength and flexibility	Given guided yogic exercises	Demonstrates improved strength and flexibility	**L3**
CO3	Apply	the Relaxation and concentration techniques	During meditation or guided sessions	Performs techniques with improved mental focus	**L3**
CO4	Apply	the Asanas and breathing techniques for stress relief	Given instructions or stress-relief routines	Applies techniques to relieve physical and mental tension	**L3**
CO5	Analyze	the Work performance and efficiency through yoga-based lifestyle	After regular practice over a period	Shows improved productivity and reduced stress levels	**L4**

UNIT – I		9 Hrs
Meaning and definition of Yoga - Historical perspective of Yoga - Principles of Astanga Yoga by Patanjali.		
UNIT – II		9 Hrs
Meaning and definition of Stress - Types of stress - Eustress and Distress. Anticipatory Anxiety and Intense Anxiety and depression. Meaning of Management- Stress Management.		
UNIT – III		9 Hrs
Concept of Stress according to Yoga - Stress assessment methods - Role of Asana, Pranayama and Meditation in the management of stress.		
UNIT – IV		9 Hrs
Asanas- (5 Asanas in each posture) - Warm up - Standing Asanas – Sitting Asanas - Prone Asanas - Supine asanas - Surya Namaskar.		
UNIT – V		9 Hrs
Pranayama- Anulom and Vilom Pranayama - Nadishudhi Pranayama – Kapalabhati-Pranayama - Bhramari Pranayama - Nadanusandhana Pranayama. Meditation techniques: Om Meditation - Cyclic meditation : Instant Relaxation technique (QRT), Quick Relaxation Technique (QRT), Deep Relaxation Technique (DRT).		

Textbooks:

3. Yogic Asanas for Group Training - Part-I‖: Janardhan Swami Yogabhyasi Mandal,Nagpur

Reference Books:

8. ajayoga or Conquering the Internal Nature‖ by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata
9. Nagendra H.R nad Nagaratna R, ―Yoga Perspective in Stress Management‖,Bangalore, Swami Vivekananda Yoga Prakashan

Online References:
1 https://onlinecourses.nptel.ac.in/noc16_ge04/preview
2 https://freevideolectures.com/course/3539/indian-philosophy/11

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3
CO1	1	3	-
CO2	1	3	1
CO3	1	3	1
CO4	1	3	1
CO5	2	3	1

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)