

**Puducherry Technological University,
Puducherry –605014**
(A Technological University of Government of Puducherry)



**Curriculum and Syllabi
for
B.Tech (INFORMATION TECHNOLOGY)
(Effective from Academic year 2024-25)**

**(Subject to the Approval of the Fifth Academic Council meeting of
Puducherry Technological University)**

CURRICULUM AND SYLLABUS

The Curriculum of B.Tech. (Information Technology) is designed to fulfil the Program Educational Objectives (PEO) and the Program Outcomes (PO) listed below.

PROGRAM EDUCATIONAL OBJECTIVES (PEO)

PEO1	Core Competence: To provide students with Core Competence in fundamental knowledge necessary to formulate, analyse and solve problems in IT discipline.
PEO2	Industry compliance: To engrant ability in creativity and design of information technology and impart knowledge and skills to analyse, design, test, and implement various software as well as hardware applications.
PEO3	Professionalism: To inculcate in students to maintain high professionalism and ethical standards, to work as part of teams on multidisciplinary projects and diverse professional environments, and relate engineering issues to the society, global economy, and emerging technologies
PEO4	Entrepreneurial skills: To produce graduates with technical, communication and leadership skills in professional environment or as entrepreneurs with social responsibility and human values in multicultural and multidisciplinary environments.
PEO5	Continuous Learning: To motivate students to pursue higher education in engineering or other professional fields

PROGRAM OUTCOMES (PO)

PO1	Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
PO2	Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
PO3	Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
PO4	Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modeling, analysis & interpretation of data to provide valid conclusions. (WK8)
PO5	Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modeling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6	The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7)
PO7	Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
PO8	Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
PO9	Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.
PO10	Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
PO11	Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

PROGRAM SPECIFIC OUTCOMES (PSO)

PSO1	Emerging Technologies and Innovations: Graduates will be equipped to adopt and integrate emerging technologies in IT to solve real-world problems.
PSO2	Professionalism and Ethical Practices: Graduates will be able to practice IT in a professional, ethical, and socially responsible manner, contributing to the betterment of society through technological innovation and problem-solving

Distribution of credits among the subjects grouped under various categories:

Courses are grouped under various categories and the credits to be earned in each category of courses are as follows:

Sl. No.	Category	Credits	Course Category Code (CCC)
1	Basic science courses	20	BSC
2	Engineering science courses	6	ESC
3	Professional core courses	94	PCC
4	Professional elective courses	12	PEC
5	Ancillary Stream Courses	12	ANC
6	Ability enhancement courses	10	AEC
7	Skill enhancement courses	6	SEC
8	Value added courses	4	VAC
	Total	164	

Semester-wise Courses and Credits

Semester I

Group-II (CS1, CS2, IT1, EE1, EI1, CE1, CE2)

Course Code	Course	CCC	Periods			Credits
			L	T	P	
	3 weeks compulsory Induction Program					
MAUC101	Mathematics I	BSC	3	1		4
ITUC101	Information Technology Essentials	PCC	3	1		4
CYUC101	Chemistry	BSC	3			3
CSUC101	Programming for Problem Solving	ESC	2			2
HSUA101	English for Communication	AEC	2			2
GEUS102	Basic Engineering Skills Laboratory - II	SEC	1		4	3
GEUV102	Essence of Indian Traditional Knowledge	VAC	1			1
CYUC102	Chemistry Laboratory	BSC			2	1
CSUC102	Computer Programming Laboratory	ESC			2	1
Total			15	2	8	
					25	21

CCC - Course Category Code, L-Lecture, T – Tutorial, P – Practical

Semester II

Group-II (CS1, CS2, IT1, EE1, EI1, CE1, CE2)

Course Code	Course	CCC	Periods			Credits
			L	T	P	
MAUC102	Mathematics II	BSC	3	1		4
ITUC102	Digital System Design	PCC	3	1		4
PHUC101	Physics	BSC	3			3
MEUC101	Engineering Graphics	ESC	1		4	3
HSUA102	Professional English	AEC	2			2
GEUS102	Basic Engineering Skills Laboratory - I	SEC	1		4	3
GEUV101	NSS, Yoga and Health	VAC			2	1
PHUC102	Physics Laboratory	BSC			2	1
Total			13	2	12	
					27	21

Exit Option for the students who opt to exit after completion of first year of B.Tech Programme and have secured a minimum of 42 credits will be awarded a UG certificate in a discipline if, in addition they complete one vocational course of 4 credits during the summer vacation of the first year

Semester III

Course Code	Course	CCC	Periods			Credits
			L	T	P	
ITUC103	Data structures	PCC	3	1		4
ITUC104	Object Oriented Programming using C++ and Java	PCC	3			3
ITUC105	Operating Systems	PCC	3			3
ITUC106	Computer Architecture	PCC	3	1		4
HSUA103	Entrepreneurship	AEC	2			2
GEUV104	Universal Human values	VAC	1			1
ITUC107	Data structures Lab	PCC			3	1.5
ITUC108	Object Oriented Programming Lab (C++ and Java)	PCC			3	1.5
ITUC109	Operating Systems Lab	PCC			3	1.5
Total			15	2	9	-
					26	21.5

Semester IV

Course Code	Course	CCC	Periods			Credits
			L	T	P	
MAUC107	Mathematics for Computing	PCC	3	1		4
ITUC110	Design and Analysis of Algorithms	PCC	3			3
ITUC111	Computer Networks	PCC	3	1		4
ITUC112	Information Coding Techniques	PCC	3			3
HSUA104/ HSUA106	Design Thinking/Foreign language	AEC	2			2
GEUV103	Environmental Education	VAC	1			1
ITUC113	Design and Analysis of Algorithms Lab	PCC			3	1.5
ITUC114	Computer Networks Lab	PCC			3	1.5
ITUC115	Python programming Lab	PCC			3	1.5
Total			15	2	9	
					26	21.5

Course Code	Course	CCC	Periods			Credits
			L	T	P	
	Ancillary stream course1	ANC	3			3
ITUH101	Foundations of Data Science	HNC	3	1		4

Exit Option for the students who opt to exit after completion of first year of B. Tech Programme and have secured a minimum of 87 credits will be awarded a UG Diploma in a discipline if, in addition they complete one vocational course of 4 credits during the summer vacation of the second year.

Semester V

Course Code	Course	CCC	Periods			Credits
			L	T	P	
ITUC116	Software Engineering	PCC	3		2	4
ITUC117	Database Management Systems	PCC	3			3
ITUC118	Web Essentials	PCC	3			3
HSUA105	Industrial Economics and Management	AEC	2			2
ITUEXXX	Professional Elective1	PEC	3	1		4
ITUC119	Mobile Application Development Lab	PCC			3	1.5
ITUC120	Database Management Systems Lab	PCC			3	1.5
ITUC121	Web Essentials Lab	PCC			3	1.5
Total			14	1	11	
Total			26		20.5	

Course Code	Course	CCC	Periods			Credits
			L	T	P	
	Ancillary stream course2	ANC	3			3
ITUH102	Data Engineering Principles	HNC	3	1		4

Semester VI

Course Code	Course	CCC	Periods			Credits
			L	T	P	
ITUC122	Data Mining and Data Warehousing	PCC	3			3
ITUC123	Information security	PCC	3			3
ITUC124	Artificial Intelligence and Machine Learning	PCC	3			3
ITUEXXX	Professional Elective2	PEC	3	1		4
ITUC125	Data Mining and Data Analytics Lab	PCC			3	1.5
ITUC126	Artificial Intelligence and Machine Learning Lab	PCC			3	1.5
ITUC127	Data visualization Lab	PCC			3	1.5
ITUC128	Internship	PCC				2
Total			12	1	9	
Total			22		19.5	

Course Code	Course	CCC	Periods			Credits
			L	T	P	
	Ancillary stream course3	ANC	3			3
ITUH103	Multi-biometrics	HNC	3	1		4

Exit Option for the students who opt to exit after completion of third year of B. Tech Programme and have secured a minimum of 132 credits will be awarded a B.Sc. (Engg.) in a discipline.

Semester VII

Course Code	Course	CCC	Periods			Credits
			L	T	P	
ITUC129	Full Stack Web Development	PCC	3			3
ITUC130	Deep Learning	PCC	3			3
ITUC131	Automata and Compiler Design	PCC	3		2	4
ITUEXXX	Professional Elective3	PEC	3	1		4
ITUC132	Mini project	PCC			4	2
ITUC133	Full Stack Web Development Lab	PCC			4	2
ITUC134	Comprehensive viva	PCC				1
Total			12	1	10	
					23	19

CourseCode	Course	CCC	Periods			Credits
			L	T	P	
	Ancillary stream course4	ANC	3			3
ITUH104	Software Defined Networks	HNC	3	1		4

Semester VIII

CourseCode	Course	CCC	Periods			Credits
			L	T	P	
ITUC135	Project work	PCC			16	8
Total						8

Course Code	Course	CCC	Periods			Credits
			L	T	P	
ITUH105	Seminar	HNC				2

List of Professional Elective Courses

Professional Elective	Coursecode	Course	Semester
Professional Elective I	ITUE101	Internet of Things	V
	ITUE102	Object Oriented Analysis and Design	
	ITUE103	Business Intelligence	
	ITUE104	Soft computing	
	ITUE105	Wireless Networking and Mobile Communication	
Professional Elective II	ITUE106	Cloud Computing	VI
	ITUE107	DevOps	
	ITUE108	IT operations and Management	
	ITUE109	UI & UX Design	
	ITUE110	Privacy and Security in Online Social Media	
Professional Elective III	ITUE111	Ethical hacking	VII
	ITUE112	Generative AI	
	ITUE113	Big Data Analytics	
	ITUE114	Cognitive Science	
	ITUE115	Block chain Technologies	

Ancillary stream Elective course

Ancillary stream title: Data Science (for Other Department students)	
Course code	Course Name
ITUN101	Data structures and Algorithms
ITUN102	Database systems
ITUN103	Applied Data science using Python
ITUN104	Introduction to Machine Learning

Ancillary stream title: Information Technology Essentials (for Other Department students)	
Course code	Course Name
ITUN101	Data Structures and Algorithms
ITUN105	Java and Internet Programming
ITUN106	IoT and Python programming
ITUN107	Web Design and Development

Ancillary stream title: Inter Departmental Electives (Business Analytics)	
Course code	Course Name
ITUI101	Digital Marketing
ITUI102	Business Process
ITUI103	Social Network Analysis
ITUI104	Industry 4.O with Industrial IoT

SYLLABI FORMAT

Department: IT		Programme: B.Tech												
Semester : III		CourseCategoryCode:PCC				SemesterExamType: TY								
Course Code	Course Name	Periods/Week			Credit		MaximumMarks							
		L	T	P	C	CA	SE	TM						
ITUC103	Data Structures	3	1	-	4	40	60	100						
Prerequisite:	CSUC101 – Programming for problem solving													
Course Outcome	CO1	Learn the data representation of linear and nonlinear data structures and their associated operations												
	CO2	Design Linear data structures and their operations using array based or non-array based methods												
	CO3	Design Nonlinear data structures, traversals and their operations using alternate methods												
	CO4	Employ suitable data structure to solve known and unknown applications												
UNIT-I	Stacks and Queues			Periods:12										
Stack and its operations – Representation - LIFO – Push and Pop - Applications of Stacks –infix expression to postfix expression conversion – postfix expression evaluation –algorithms. Queue and its operations – Representation – FIFO – Types of queues - Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues, Algorithms – Applications of queues – De-queues - Multi stacks and multi queues							CO1	CO2						
							CO3	CO4						
UNIT-II	Linked Lists			Periods:12										
Singly linked lists, Representation methods, operations - Traversing, Searching, Insertion into, Deletion from, Linked representation of Stack and Queue, Header nodes, Doubly linked list –representation methods, operations, Circular Linked Lists: all operations and their algorithms – multi lists – Sparse matrix using linked lists							CO1	CO2						
							CO3	CO4						
UNIT-III	Trees			Periods:12										
Tree Terminologies – General Tree - Binary Tree – Representation – traversal methods – Conversion of general tree to binary tree, Threaded Binary Tree, Binary Search Tree, AVL Tree – algorithms for insertion and deletion of nodes - Expression trees – Game trees – decision trees – disjoint sets							CO1	CO3						
							CO2	CO4						
UNIT-IV	Graphs			Periods:12										
Graph Terminologies - Representations - Graph Traversal methods – Bi-connectivity - Connected Components -Spanning Trees –prim's algorithm and kruskal's algorithm - Transitive Closure - Shortest Path Algorithms –Dijkstra Algorithm-Floyd-Warshall Algorithm- Activity Networks -Topological Sorting -Critical Paths.							CO1	CO3						
							CO2	CO4						
UNIT-V	Advanced structures			Periods:12										
m-way search trees - B-tree – B+ Trees –Tries –Search, Insertion and Deletion Hash Table – Hashing function – open addressing – chaining – Rehashing Priority Queues(Heaps)– Binary heap – d-Heaps – Leftist Heaps – Binomial Heaps							CO1	CO3						
							CO2	CO4						
Lecture Periods:45		Tutorial Periods:15	Practical Periods:			Total Periods:60								
Reference Books:														
<ol style="list-style-type: none"> Sharika.T.R, WillsonJoseph.C and Reshma.M.R, A guide to data structures and algorithms, Notion Press, 2024 Narasimha Karumanchi, Data Structures and Algorithms made easy, Careermonk Publications, 2023 Ritika Mehra, Data structures using C, Pearson Education, 2021 E.Horowitz, S.Sahni and S. Anderson, Fundamentals of Data structures in C, Second Edition, Universities Press, 2018. Ellis Horowitz, Sartaj Sahni, "Fundamentals of Data Structures", Illustrated Edition, Galgotia Publications, Second Edition, 2008. Reema T hareja, "Data Structures using C", Oxford University Press, 2011. C.A.V.Pai, "Data Structures and Algorithms, Concepts, Techniques and Applications", McGraw Hill Education, First edition, 2017. 														

CO-PO/PSO MAPPING

CO/ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PS01	PS02
CO1	2	1		2							2	2	2
CO2	2	2		2							2	2	2
CO3	2	2		2							2	2	2
CO4	2	1		2							3	2	2

Department : IT		Programme :B.Tech.													
Semester : III		CourseCategory Code: PCC				Semester Exam Type: TY									
Course Code	Course Name	Periods / Week		Credit		Maximum Marks									
		L	T	P	C	CA	SE	TM							
ITUC104	Object Oriented Programming using C++ and Java	3	-	-	3	40	60	100							
Prerequisite:	CSUC101 – Programming for problem solving														
Course Outcome	CO1	Understands the basic Concepts of OOPs (C++)													
	CO2	Implements object oriented programs in C++													
	CO3	Understands the basics of Java													
	CO4	Learns Inheritance and Polymorphism, Packages, Interfaces(Java)													
	CO5	Learns Inheritance and Polymorphism, Packages, Interfaces and JDBC (Java)													
UNIT-I	Basics of Object Oriented Programming							Periods: 9							
Object Oriented Programming - Concepts – Objects – Classes – Methods - Messages –Abstraction - Encapsulation – Inheritance – Abstract Classes – Polymorphism. Introduction To C++ – Classes – Access Specifies – Function and Data Members –Function Overloading – Friend Functions – Static Members – Objects – Pointers and Objects – Constant Object–Nested Class – Local Classes								CO1							
UNIT-II	Constructors and Overloading, Exception Handling, Inheritance and Polymorphism							Periods: 9							
Constructors – Default Constructor – Parameterized Constructors – Constructor with Dynamic Allocation – Copy Constructor – Destructors – Operator Overloading – Overloading through Friend Functions – Exception Handling – Try-Catch-Throw Paradigm – Exception Specification – Terminate and Unexpected Functions – Uncaught Exception - Inheritance – Public, Private, and Protected Derivations – Multiple Inheritance – Virtual Base Class - Virtual Functions – Pure Virtual Functions								CO1, CO2							
UNIT-III	Basics of Java							Periods: 9							
Creation of Java, importance of Java to internet, byte code, Java buzzwords, data types, declaring variables, dynamic initialization, scope and life time of variables, arrays, operators, control statements, type conversion and casting, compiling and running of simple Java program. Concepts of classes and objects, class fundamentals Declaring objects, assigning object reference variables, introducing methods, constructors, usage of static with data and methods, usage of final with data, access control, this key word, overloading methods and constructors, parameter passing - call by value, nested classes and inner classes, exploring the String class.								CO3							
UNIT-IV	Inheritance and Polymorphism, Packages, Interfaces (Java)							Periods: 9							
Basic concepts, member access rules, usage of super key word, forms of inheritance, method overriding, abstract classes, dynamic method dispatch, using final with inheritance, the Object class. Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages, differences between classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces.								CO1, CO4							
UNIT-V	Exception Handling, Threads, Applets (Java)							Periods: 9							
Concepts of Exception handling, types of exceptions, usage of try, catch, throw, throws and finally Keywords, Built-in exceptions, creating own exception sub classes, Concepts of Multithreading, differences between process and thread, thread life cycle ,creating multiple threads using Thread class, Runnable interface, Synchronization, thread priorities, inter thread communication, daemon threads, deadlocks, thread groups.								CO5							
JDBC Connectivity: Getting Started sets up a basic database development environment - Processing SQL Statements with JDBC: Establishing a Connection, Connecting with DataSource Objects, Handling SQL Exceptions, Setting Up Tables, Retrieving and Modifying Values from Result Sets , Using Prepared Statement and Transaction															
Lecture Periods: 45	Tutorial Periods:	Practical Periods:			Total Periods:45										

Reference Books:

1. Object Oriented Programming with C++, 8th Edition, E. Balagurusamy Paperback – Big Book, 24 September 2020
2. Programming with Java, 7th Edition E. Balagurusamy, Paperback, 12 November 2023
3. S. B. Lippman, JoseeLajoie, “Barbara E. Moo, “C++ Primer”, Sixth Edition, Pearson Education,2012.
4. B. Stroustrup, “The C++ Programming Language”, Sixth Edition, Pearson Education, 2014.
5. D. S. Malik, “C++ Programming: From Problem Analysis to Program Design”, Eighth Edition2017.
6. The Complete Reference Java J2SE 13th Edition, Herbert Schildt, TMH Publishing Company Ltd,NewDelhi, 2025.

CO-PO/PSO MAPPING

CO/PO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PS01	PS02
CO1	2	2	2	3							1	3	2
CO2	2	3	3	3							1	3	1
CO3	2	2	2	3							2	2	3
CO4	2	2	2	3							2	2	2
CO5	2	2	2	3							2	2	2

Score: 3 – High; 2 – Medium; 1 – Low

Department:IT		Programme: B.Tech						
Semester :III		CourseCategoryCode:PCC				SemesterExamType: TY		
Course Code	Course Name	Periods/Week			Credit		MaximumMarks	
		L	T	P	C	CA	SE	TM
ITUC105	Operating Systems	3	-	-	3	40	60	100
Prerequisite:	-							
Course Outcome	CO1	Explain with thorough understanding, the concept of operating systems and the functions of process, memory, disk and file management systems of an OS						
	CO2	Apply various CPU scheduling algorithms and compare them						
	CO3	Apply process synchronization mechanisms, deadlock prevention, detection, and recovery schemes						
	CO4	Apply different memory management schemes and disk management schemes						
	CO5	Analyze the functionalities of file systems and virtual machines concepts of different operating systems						
UNIT-I	Operating Systems Overview				Periods: 9			
Introduction to operating systems – Computer system organization, architecture – Operating system operations – Resource management –security and protection – Distributed systems – Computing Environments–Open-sourceoperatingsystems–OSservices–Useroperating-systeminterface–System calls– System services–OS structure–OS generation–System Boot								CO1
UNIT-II	Process Management				Periods: 9			
Process concept, scheduling – Operations on processes – Inter-process communication – Examples – Multicore Programming–Multi threading models–Thread Libraries–Threading issues–OS examples CPU Scheduling: Basic concepts – Scheduling criteria – Scheduling algorithms – Thread scheduling – Multiple processor scheduling – Real Time CPU Scheduling - Operating system examples – Algorithm Evaluation.								CO1,CO2
UNIT-III	Process Synchronization				Periods: 9			
The critical section problem–Peterson’s solution –Synchronization hardware–Mutex Locks–Semaphores – Monitors -- Classic problems of synchronization – Critical regions – Deadlocks – System model – Deadlock characterization – Methods for handling deadlocks – Deadlock Prevention – Deadlock Avoidance – Deadlock detection – Recovery from deadlock.								CO1, CO3
UNIT-IV	Memory And Storage Management				Periods: 9			
Main Memory - Swapping - Contiguous Memory Allocation – Paging - Structure of the Page Table - Segmentation, Segmentation with paging; Virtual Memory - Demand Paging – Copy on Write - Page Replacement - Allocation of Frames –Thrashing. Mass Storage system – Disk Structure - Disk Scheduling and Management- I/O Systems – I/O Hardware, Application I/O interface, Kernel I/O subsystem.								CO1,CO4
UNIT-V	File System And Virtual Machines				Periods: 9			
File-System Interface - File concept - Access methods - Directory Structure - Directory organization - File system mounting - File Sharing and Protection; File System Implementation - File System Structure - Directory implementation - Allocation Methods - Free Space Management; Virtual Machines – History, Benefits and Features, Building Blocks, Types of Virtual Machines and their Implementations, Virtualization and Operating-System Components; Case Study: Linux OS.								CO1, CO5
Lecture Periods: 45		Tutorial Periods: -		Practical Periods: -		Total Periods: 45		
Reference Books:								

1. Andrew S. Tannenbaum, Modern Operating Systems, 5th Edition, Pearson, 2024.
2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 10th Edition, John Wiley and Sons Inc., 2018.
3. William Stallings, "Operating Systems Internals and Design Principles", Pearson Education, Ninth Edition, 2021.
4. Dhananjay M. Dhamdhere, "Operating System Concept Based Approach" McGrawHill Publication, Third Edition, 2017.
5. George Coulouris, Jean Dollimore and Tim Kindberg, "Distributed Systems Concepts and Design", Pearson Education, Fifth Edition, 2021.
6. Rajiv Chopra, "Operating Systems: - A Practical Approach", Fourth Edition, S Chand and Company, 2023.

CO-PO/PSO MAPPING

CO/ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10	PO 11	PSO1	PSO2
CO1	2	2	-	1	-	-	-	-	-	-	-	2	-
CO2	2	3	1	3	-	-	-	-	-	-	1	2	1
CO3	2	3	1	3	-	-	-	-	-	-	1	2	1
CO4	1	3	1	3	-	-	-	-	-	-	1	2	1
CO5	2	2	1	2	-	-	-	-	-	-	1	2	1

Score: 3 – High; 2 – Medium; 1 – Low

Department: IT		Programme: B.Tech.													
Semester :III			CourseCategoryCode: PCC			SemesterExamType: TY									
Course Code	Course Name	Periods/Week			Credit		MaximumMarks								
		L	T	P	C	CA	SE	TM							
ITUC106	Computer Architecture	3	1	-	4	40	60	100							
Prerequisite:	-														
Course Outcome	CO1	Understand the basic components of Processor, Memory and I/O Units.													
	CO2	Understand Parallel processor and multicore Processor architectures.													
	CO3	Analyse the operations of various processor architectures.													
	CO4	Analyse the operations of various memory and I/O devices.													
	CO5	Apply the technologies in the processor, memory and I/O architectures													
UNIT-I	Introduction				Periods: 12										
Basic concepts and computer evolution – top-level view of computer function and interconnection – number systems – computer arithmetic.					CO1										
UNIT-II	Processor Organization				Periods: 12										
Processor Structure and Function – Reduced Instruction Set Computers – Instruction-level parallelism and superscalar processors – Control unit operation and microprogrammed control.					CO2										
UNIT-III	Memory Organization				Periods: 12										
Memory hierarchy: Principle of locality – characteristics of memory systems – memory hierarchy – performance modelling on a multilevel memory hierarchy – Cache memory: Principles – elements of Cache design – Intel x86 Cache organization – IBM z13 cache organization – Cache performance models – Internal memory: Semiconductor Main memory – Error correction – DDR DRAM – EDRAM – Flash memory – Nonvolatile Solid-state memory technologies – External Memory: Magnetic Disk – Raid – Solid State Drives – Optical Memory – Magnetic Tape.					CO3										
UNIT-IV	Input/Output Organization				Periods: 12										
External Devices – I/O Modules – Programmed I/O – Interrupt-Driven I/O – Direct Memory Access – Direct Cache Access – I/O Channels and Processors – External Interconnection Standards – IBM z13 I/O Structure .					CO4										
UNIT-V	Parallel Processing and Multicore Computers				Periods: 12										
Parallel Processing: Multiple processors Organization – symmetric multiprocessors – Cache coherence and the MESI protocol – Multithreading and Chip multiprocessors – Clusters – Nonuniform Memory Access.					CO5										
Multicore Computers: Multicore organization – heterogeneous multicore organization – Intel Core i7-5960X – arm Cortex-A15 MP Core – IBM Z13 Mainframe.															
Lecture Periods: 45		TutorialPeriods: 15		PracticalPeriods: -		TotalPeriods: 60									
ReferenceBooks:															
1. William Stallings, Computer Organization and Architecture, Prentice-Hall of India, Pvt. Ltd., Eleventh edition, 2021. 2. M. Morris Mano, Computer System Architecture, Prentice-Hall of India, Pvt. Ltd., Revised Third edition, 2017. 3. Kai Hwang and NagrshJotwani, Advanced Computer Architecture, McGraw-Hill, 2020. 4. Carl Hamacher, Zvonko G. Vranesic and Safwat G. Zaky, Computer Organization, McGraw-Hill, 2021. 5. John P. Hayes, Computer Architecture and Organisation, McGraw Hill, 1998. 6. John L. Hennessy and David A Patterson, Computer Architecture-A quantitative approach, Morgan Kaufmann, 2020.															

CO-PO / PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	2	-	-	-	-	-	-	-	-	2	1
CO2	2	1	2	-	-	-	-	-	-	-	-	2	1
CO3	2	2	2	-	-	-	-	-	-	-	-	2	1
CO4	2	2	2	2	2	-	-	-	-	-	2	2	2
CO5	2	2	2	2	2	-	-	-	-	-	2	2	2

Score: 3 – High; 2 – Medium; 1 – Low

Department : HSS			Programme: B.Tech.																
Semester : III			Course Category Code: AEC				Semester Exam Type:												
Course Code	Course Name	Periods / Week			Credit	Maximum Marks													
		L	T	P	C	CA	SE	TM											
HSUA103	Entrepreneurship	2	-	-	2	40	60	100											
Prerequisite:																			
Course Outcome	CO1	Understand entrepreneurial mindset, problem identification, customer segmentation, and value proposition development.																	
	CO2	Develop and validate business models, test solutions, and create a Minimum Viable Product (MVP) through iterative feedback.																	
	CO3	Analyze financial planning, revenue models, pricing strategies, and investor expectations for startup funding.																	
	CO4	Apply sales, branding, digital marketing, automation, and teamwork strategies to successfully launch and scale a venture.																	
UNIT-I	Problem Identification and Customer Discovery				Periods: 6														
Entrepreneurial mindset – Identifying business opportunities – Effectuation principles – Design Thinking for problem-solving – Consumer segmentation and customer persona – Value Proposition Canvas (VPC) – Unique Value Proposition (UVP) – Market research techniques – Emerging trends: AI in market research.								CO1											
UNIT-II	Business Model and Lean Startup				Periods: 6														
Types of business models – Lean Canvas vs. Business Model Canvas – Competitor analysis – Blue Ocean Strategy – Building and testing Minimum Viable Product (MVP) – Build-Measure-Learn feedback loop – Digital Prototyping tools – Rapid Experimentation – Agile startup methodology.								CO1, CO2											
UNIT-III	Revenue Models, Costing, and Financial Planning				Periods: 6														
Revenue models: Subscription, Freemium, and Pay-per-use – Unit economics: Cost structures and pricing strategies – Funding sources: Bootstrapping, Crowdfunding, Venture Capital – Investor expectations and funding rounds – Pitching to investors – Financial forecasting and break-even analysis – Government startup incentives.								CO2, CO3											
UNIT-IV	Digital Marketing and Sales Strategies				Periods: 6														
Brand positioning and storytelling – Social media marketing and digital presence – SEO, SEM, and paid advertising – Data-driven marketing strategies – Sales funnels – Unique Sales Proposition (USP) – B2B vs. B2C sales – CRM tools for customer engagement – Customer retention strategies.								CO3, CO4											
UNIT-V	Team Building, Compliance, and Scaling				Periods: 6														
Building and managing startup teams – Remote collaboration tools – Business registration and legal compliance – Intellectual Property Rights (IPR) for startups – Growth hacking and automation – Scaling strategies: Expansion and franchising – Emerging trends: AI in entrepreneurship, blockchain applications – Exit strategies: Mergers, acquisitions, IPOs.								CO5											
Lecture Periods: 30		Tutorial Periods:		Practical Periods:			Total Periods: 30												
Reference Books:																			
<ol style="list-style-type: none"> Eric Ries, The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses by Crown Business, 1st Edition (2011). Alexander Osterwalder & Yves Pigneur, Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers, Wiley, 1st Edition (2010). Ash Maurya, Running Lean: Iterate from Plan A to a Plan That Works, O'Reilly Media, 2nd Edition (2019). Steve Blank and Bob Dorf, The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company, K&S Ranch, 1st Edition (2012). 																			

CO-PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	3	2	1	3	2	2	2	2	1	1
CO2	3	3	3	2	3	2	2	3	3	2	2
CO3	1	2	3	3	2	1	1	2	3	3	2
CO4	2	2	2	3	2	2	2	3	3	2	2

Score: 3 – High; 2 – Medium; 1 – Low

Department : HSS			Programme: B.Tech.														
Semester : IV				Course Category Code: VAC			Semester Exam Type:										
Course Code	Course Name:			Periods / Week		Credit	Maximum Marks										
GEUV104	Universal Human Values			L	T	P	C	CA	SE								
Prerequisite:	-																
Course Outcome	CO1	Develop a Holistic Understanding of Value Education															
	CO2	Foster Personal and Social Harmony															
	CO3	Enhance Awareness of Universal Co-existence															
	CO4	Apply Ethical and Humanistic Principles in Professional and Personal Life															
Module--I	Introduction to Value Education					Periods: 3											
	Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations								CO1								
Module-II	Harmony in the Human Being					Periods: 3											
	Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health								CO2								
Module-III	Harmony in the Family and Society					Periods: 3											
	Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order								CO2								
Module-IV	Harmony in the Nature/Existence :					Periods: 3											
	Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence								CO3								
Module-V	Implications of the Holistic Understanding					Periods: 3											
	A Look at Professional Ethics : (3 hours) Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models- Typical Case Studies, Strategies for Transition towards Value-based Life and Profession								CO4								
Lecture Periods: 15	Tutorial Periods: 0	Practical Periods:0			Total Periods: 15												
Reference Books:																	
<ol style="list-style-type: none"> 1. Student Induction Program Handbook v2 by AICTE NCC-IP sub-committee: Dr. Rajneesh Arora, Chairman NCC-IP, Dr. Shishir Gaur, Convener NCC-IP, Dr. Ruchir Gupta, Member NCC-IP. 2. a foundation course in R R Gaur R Asthana G P Bagaria HUMAN VALUES and professional ethics , R R Gaur R Asthana G P Bagaria 3. Understanding Human Being, Nature and Existence Comprehensively By UHV Team (https://uhv.org.in/uhev) 4. Teachers' Manual for A Foundation Course in Human Values and Professional Ethics RR Gaur, R Asthana, GP Bagaria 																	

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	2	3	3	2	2	2	3
CO2	2	2	2	2	2	3	3	3	3	2	3
CO3	3	2	2	2	2	3	3	2	2	2	3
CO4	3	2	2	2	3	3	3	2	2	3	3

Score: 3 – High; 2 – Medium; 1 – Low

Department: IT				Programme: B.Tech																		
Semester : III				CourseCategoryCode: PCC				SemesterExamType: LB														
Course Code	Course Name			Periods/Week			Credit		MaximumMarks													
				L	T	P	C	CA	SE	TM												
ITUC107	Data Structures Lab			-	-	3	1.5	40	60	100												
Prerequisite:	-																					
Course Outcome	CO1	Learn to implement linear and non-linear data structures as abstract data type using appropriate data declaration and associated operations																				
	CO2	Implement data structures using alternate methods for known applications																				
	CO3	Experiment suitable data structures in problem solving and real time applications																				
Choice of 10-12 experiments from the following																						
1.	Stack operations using arrays / linked lists											CO1										
2.	Queue operations using arrays / linked lists											CO2										
3.	Conversion of Infix expression to postfix expression using stack											CO3										
4.	Postfix expression evaluation using stack																					
5.	Implementation of circular queue / priority queue / deque																					
6.	Singly linked list operations using arrays / pointers																					
7.	Doubly linked list operations using arrays / pointers																					
8.	Polynomial addition using linked list																					
9.	Implementation of binary tree using array / pointers											CO1										
10.	Binary tree traversal algorithms											CO2										
11.	Implementation of graphs(directed / undirected) using adjacency matrix / adjacency list											CO3										
12.	Graph traversal algorithms																					
13.	Binary search tree implementation and search operation																					
14.	Hashing functions and collision resolution techniques																					
15.	Solving algorithmic problems on coding platforms like Hacker Rank																					
LecturePeriods:	TutorialPeriods:			PracticalPeriods:45				TotalPeriods:45														
ReferenceBooks:																						
1. ReemaThareja, "Data Structures using C", Oxford University Press, 2011. 2. Data Structures Lab manual, Department of IT, PTU, 2024.																						

CO-PO / PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	2							1	3	2
CO2	3	2	1	2							1	3	2
CO3	2	1	1	1							1	3	2

Score: 3 – High; 2 – Medium; 1 – Low

Department :IT				Programme :B.Tech.							
Semester : III				Course Category Code: PCC				Semester Exam Type: LB			
Course Code	Course	Periods / Week			Credit		Maximum Marks				
		L	T	P	C	CA	SE	TM			
ITUC108	Object Oriented Programming Lab (C++ and Java)	-	-	3	1.5	40	60	100			
Prerequisite											
		CO1	Learn the Basics of C++ and Java								
		CO2	Implement the Programming features of C++ and Java								
		CO3	Implement Advanced C++ Programming and Java								
LIST OF EXPERIMENTS											
C++ Programs											
1. Implement Programs to demonstrate the use of Classes, Objects, Constructor and Destructor, Control Structures, Arrays and Pointers.											
2. Implement Programs to demonstrate the use of different types of overloading and type casting.											
3. Implement Programs to demonstrate the use of Virtual Base Classes, Pure Virtual Function and various types of Inheritance.											
4. Implement Programs to demonstrate the use of different types of Polymorphism											
5. Implement Programs to demonstrate the use of Exception Handling											
Java Programs											
6. Implement Programs to demonstrate the use of Packages											
7. Implement Programs to demonstrate the use of Interfaces											
8. Implement Programs to demonstrate the use of Event Handling (if necessary)											
9. Implement Programs to demonstrate the use of Thread Handling											
10. Programs to implement JDBC connection.											
11. Solving programming problems on coding platforms like Hacker Rank											

Lecture Periods: **Tutorial Periods:** **Practical Periods: 45** **Total Periods: 45**

Reference Books:

1. Object Oriented Programming with C++, 8th Edition, E. Balagurusamy Paperback – Big Book, 24 September 2020
2. Programming with Java, 7th Edition E. Balagurusamy, Paperback, 12 November 2023
3. S. B. Lippman, JoseeLajoie, “Barbara E. Moo, “C++ Primer”, Sixth Edition, Pearson Education, 2012.
4. B. Stroustrup, “The C++ Programming Language”, Sixth Edition, Pearson Education, 2014.
5. The Complete Reference Java J2SE 13th Edition, Herbert Schildt, TMH Publishing Company Ltd, New Delhi, 2025.

CO-PO/PSO MAPPING

CO/PO	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2
CO1	2	2	2	3							1	3	2
CO2	2	3	3	3							1	3	1
CO3	2	2	2	3							2	2	3
CO4	2	2	2	3							2	2	2

Department: IT				Programme: B.Tech.							
Semester : III				CourseCategoryCode: PCC				SemesterExamType: LB			
Course Code	Course Name			Periods/Week			Credit	MaximumMarks			
				L	T	P	C	CA	SE	TM	
ITUC109	Operating System Lab			-	-	3	1.5	40	60	100	
Prerequisite	-										
Course Outcome	CO1	Demonstrate the use of system calls using Shell script and C									
	CO2	Implement processor, memory, storage management solutions using Shell script and C									
	CO3	Compare and contrast the existing Scheduling algorithms									
	CO4	Implement the process synchronization algorithms and file systems									
<p>1. Study of basic Unix/Linux commands.</p> <p>2. Shell Programming Programs using the following system calls of Unix / Linux operating system: fork,exec, getpid, exit, wait, close ,stat, opendir, readdir Programs using the I/O system calls of UNIX operating system (open,read,write,etc)</p> <p>3. Implementation of scheduling algorithms (CPU and Disk)</p> <p>4. Implementation of synchronization problems using Semaphore</p> <p>5. Implementation of basic memory management schemes</p> <p>6. Implementation of virtual memory management schemes</p> <p>7. Implementation of file systems</p>											CO1
<p>1. Andrew S. Tannenbaum, "Modern Operating Systems", 5th Edition, Pearson, 2024</p> <p>2. Rajiv Chopra, "Operating Systems: - A Practical Approach", Fourth Edition, S Chand and Company, 2023</p> <p>3. Stephen G Kochan, Patrick Wood, "Shell Programming in Unix, Linux and OS X", Pearson Education, Fourth Edition, 2016</p> <p>4. William Stallings, "Operating Systems Internals and Design Principles", Pearson Education, Ninth Edition, 2021</p> <p>5. Charles Crowley, Operating System –A Design-Oriented Approach, Mc Graw Hill, 2017</p>											CO1
Lecture Periods: -	Tutorial Periods: -		Practical Periods: 45			Total Periods: 45					
Reference Books											

CO-PO/PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2
CO1	2	-	-	1	-	-	-	-	-	-	-	2	2
CO2	3	3	2	3	-	-	-	-	-	-	2	1	1
CO3	2	3	2	3	-	-	-	-	-	-	2	1	1
CO4	1	3	1	1	-	-	-	-	-	-	2	1	1

Score: 3 – High; 2 – Medium; 1 – Low

Department : Mathematics		Programme : B. Tech															
Semester: IV		Course Category Code: BSC				Exam Type:TY											
Course Code	Course Name	Hours / Week			Credit	Maximum Marks											
		L	T	P	C	CA	SE	TM									
MAUC107	Mathematics For Computing	3	1	0	4	40	60	100									
Prerequisite	--																
Course Outcome:	CO1	Construct sample spaces of random experiments and discuss the discrete distributions and continuous distributions															
	CO2	Classify the random process and relate the appropriate queueing model to solve practical problems															
	CO3	Develop the knowledge of logical connectivity, compound propositions and formal symbols of propositional logic															
	CO4	Analyze the validity of logical arguments by making use of derivation process.															
	CO5	Develop the concept of Predicate calculus.															
UNIT – I	Probability and Distributions						Hours: 12										
Random Variables and their event spaces - Probability mass function, Distribution functions, Special discrete distributions: Bernoulli, Binomial, Poisson, Geometric distributions, Negative Binomial - Characteristic function. Reliability, Failure density and Hazard function - Some important Continuous distributions: Exponential, Hypo exponential, Erlang, Gamma, Hyper exponential, Weibull, Gaussian, Uniform and Pareto distributions							CO1										
UNIT – II	Stochastic Processes and Queueing Models						Hours: 12										
Stochastic Processes: Definition, Classification of Stochastic Processes - Poisson process, Markov Process, Markov Chain. The Birth and Death process: M/M/1, M/M/c, M/M/1/N, M/M/c/N (c < N), M/M/c/c, M/M/ ∞ models only - derivation of mean number of customer in the system, queue and waiting time - Simple applications.							CO1, CO 2										
UNIT – III	Mathematical Logic						Hours: 12										
Connectives, Statement formulae, well-formed formulae-Tautologies. Equivalence of Statement formulae, Duality law-Tautological implications- Functionally complete set of connectives-NAND and NOR connectives							CO3										
UNIT – IV	Normal Forms and Inference Theory						Hours: 12										
Principal conjunctive and disjunctive normal forms-Inference calculus-validity of conclusion using truth table-Rules of inference - Derivation process - Conditional proof - Indirect method of proof - Derivation of validity of conclusion by these methods.							CO3, CO4										
UNIT – V	Predicate Calculus						Hours: 12										
Predicate calculus: Predicates, The statement function, variables and quantifiers-Predicate formulas-symbolizing the statement. Inference theory of the predicate calculus-Rules of specification and generalization-Derivation of conclusion using the rules of inference theory.							CO3, CO4, CO5										
Total contact Hours: 45		Total Tutorials: 15		Total Practical Classes:		Total Hours:60											
Reference Books:																	
<ol style="list-style-type: none"> 1. J.P.Tremblay and R.Manohar, Discrete Mathematical Structures with applications to Computer science, Tata McGraw-Hill Publishing company pvt. Ltd., New Delhi, 2002. 2. Kishore S. Trivedi, Probability and Statistics with Reliability, Queueing and Computer Science Applications, John Wiley & Sons Inc. Second Edition, 2016. 3. T. Veerarajan, Probability and Statistics, Random Processes and Queueing Theory" McGraw-Hill 																	

4. D.Gross and C.M.Harris, Fundamentals of Queuing Theory, Wiley Students Edition, Third Edition, 2008.
5. J.Medhi, Stochastic models in Queuing Theory, Academic Press, Second Edition, 2002.

CO-PO/PSO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02
CO1	3	2	-	2	-	-	-	-	-	-	-	3	-
CO2	3	3	-	2	-	-	-	-	-	-	-	3	-
CO3	3	3	-	2	-	-	-	-	-	-	-	3	-
CO4	3	3	-	2	-	-	-	-	-	-	-	3	-
CO5	3	3	-	2	-	-	-	-	-	-	-	3	-

Score: 3 – High; 2 – Medium; 1 – Low

Department: IT		Programme: B.Tech															
Semester :IV	CourseCategoryCode:PCC SemesterExamType: TY																
Course Code	Course Name	Periods/Week			Credit	MaximumMarks											
		L	T	P	C	CA	SE	TM									
ITUC110	Design and Analysis of Algorithms	3	-	-	3	40	60	100									
Prerequisite:	ITUC103 Data structures																
Course Outcome	CO1	Recognize problems solvable by divide and conquer technique and apply															
	CO2	Demonstrate solving problems using greedy and dynamic programming techniques															
	CO3	Use backtracking and branch and bound techniques to solve classic problems															
	CO4	Experiment suitable techniques to solve a given problem instance and analyze its performance through time complexity															
UNIT-I	Algorithm Analysis and Divide and Conquer technique	Periods:9															
Introduction: Algorithm – characteristics – Time and space complexities - best, worst and average case analysis – the order of – asymptotic notations – big Oh, Omega and Theta notations - solving recurrences							CO1 CO4										
Divide and Conquer technique: Introduction – DANDC general method - Binary Search - finding maximum and minimum - merge sort – improved merge sort – quick sort – Strassen's matrix multiplication.																	
UNIT-II	Greedy Technique	Periods:9															
Greedy Method: General Method – Knapsack Problem – MinimumSpanning Tree Algorithms – Single Source Shortest Path distance Algorithm – Job Scheduling - Optimal Storage on Tapes - Optimal Merge Patterns.							CO2 CO4										
UNIT-III	Dynamic Programming Technique	Periods:9															
Dynamic Programming: Introduction - Principle of optimality – Multi-Stage Graphs – forward approach – backward approach - All Pairs Shortest Paths Algorithm – single source shortest paths with general weights algorithm - 0/1 Knapsack – Travelling Salesman Problem – Chained Matrix Multiplication.							CO2 CO4										
UNIT-IV	Backtracking Method	Periods:9															
Backtracking: The General Method – 8-Queens Problem – Sum of Subsets – Graph Colouring – Hamiltonian Cycles –Knapsack Problem.							CO3 CO4										
UNIT-V	Branch and Bound Technique	Periods: 9															
Branch and Bound: Least Cost (LC) Search – The 15-Puzzle Problem – Control Abstractions For LC-Search – Bounding – FIFO Branch and-Bound –LC branch and bound - 0/1 Knapsack Problem – FIFO branch and bound solution - Travelling Salesman Problem – LCBB solution.							CO3 CO4										
LecturePeriods:45	Tutorial Periods:-	Practical Periods:-				Total Periods:45											
ReferenceBooks:																	
<ol style="list-style-type: none"> 1. S.Sridhar, Design and analysis of algorithms, Oxford university press, 2nd edition, 2023 2. SuchismitaMaiti, Mr. Suman Kumar Bhattacharyya, Mr. AnirbanBhar, Design And Analysis Of Algorithm A Beginner's Guide, Orange Books Publication, 2024 3. Michael T. Goodrich and Roberto Tamassia Design and Analysis of Algorithms, An Indian Adaptation, Wiley Publication, 2021 4. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Pearson Education, 2009. 5. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, —Introduction to Algorithms, MIT Press, England, 2009 6. Ellis Horowitz, SartajSahni and SanguthevarRajasekaran, —Fundamentals of Computer Algorithms, Second Edition, Universities Press, 2011. 7. Gilles Brassard and Paul Bratley, Fundamentals of Algorithmics, Theory and Practice PHI, 2010. 																	

CO-PO / PSO MAPPING

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02
CO1	3	2	1	1							1	2	2
CO2	3	2	1	1							1	2	2
CO3	3	2	1	1							1	2	2
CO4	3	2	1	2							1	2	2

Score: 3 – High; 2 – Medium; 1 – Low

Department: IT		Programme: B.Tech								
Semester : IV		CourseCategoryCode:PCC			SemesterExamType: TY					
Course Code	Course Name	Periods/Week			Credit	MaximumMarks				
		L	T	P	C	CA	SE	TM		
ITUC111	Computer Networks	3	1	-	4	40	60	100		
Prerequisite:										
Course Outcome	CO1	Describe the functions of each layer in OSI and TCP/IP model, network connecting devices, transmission media used to communicate over the network								
	CO2	Discuss the various application layer protocols (HTTP, SMTP, FTP and DNS) used to communicate with servers and other applications								
	CO3	Demonstrate the transport layer protocols and client-server programming model for reliable communications using end-to-end solution								
	CO4	Examine the efficiency of various congestion control mechanism to improve quality of service of networking application								
	CO5	Design the topological and routing strategies for an IP based networking infrastructure								
UNIT-I	Need for Networking	Periods:12								
Computer Networks and the Internet: Service Description –The Network Edge: Access Networks– Physical Media. The Network Core: Packet Switching, circuit switching and A Network of Networks. - Delay, loss and throughput in Packet switched Networks – Protocol Layers and their models - History of Computer Networking and the Internet							CO1			
UNIT-II	Application Layer	Periods:12							C01, C02	
Principles of Network Applications – The Web and HTTP – Electronic Mail in the Internet– DNS – Peer to Peer Applications – Video streaming and content distribution Networks - Socket Programming: Socket programming with TCP and UDP.										
UNIT-III	Transport Layer	Periods:12							C03	
Transport Layer Services– Multiplexing and De-multiplexing – Connectionless Transport: UDP – Principles of Reliable Data Transfer – Go-Back-N and Selective Repeat. Connection-Oriented Transport: TCP – TCP connection– Segment Structure – RTT estimation – Flow Control – Connection Management – Principles of Congestion Control – The causes and cost of congestion – Approaches to congestion control - TCP congestion control.										
UNIT-IV	Network Layer	Periods:12								
Overview of Network Layer: Data plane: What's inside a router – The Internet Protocol : IPV4 datagram format – Ipv4 addressing- Network Address Translation- IPv6. Network Layer: Control plane – Routing algorithms: Link State routing – Distance Vector Routing – Intra AS routing in the Internet: OSPF – Routing among the ISPs: BGP – Internet Control Message Protocols – Network Management and SNMP.							C04, C05			
UNIT-V	Data Link Layer and LANs	Periods: 12								
Link Layer Services – Framing - Error correction and detection – Multiple Access Links and Protocols – Switched Local Area Networks – Link-Layer Addressing and ARP – Ethernet – Link layer switches – Virtual Local Area Networks (VLANs) - Data centre Networking - WiFi: IEEE 802.11 Wireless LANs.							C01			
Lecture Periods: 45		Tutorial Periods:-15		Practical Periods: -			Total Periods:60			

Reference Books:

1. James F.Kurose, KeithW.Ross, "Computer Networking, A Top-Down Approach Featuring the Internet", Eighth Edition, Pearson Education, 2022.
2. William Stallings, "Data and Computer Communications", Tenth Edition, Pearson Education, 2017.
3. Behrouz A Forouzan, Firouz Mosharraf "Computer Networks: A Top down Approach" Fifth Edition, McGraw Hill, 2023.
4. LarryL.Peterson,Bruce S.Davie, "Computer Networks: A Systems Approach", Sixth Edition, Morgan Kaufmann Publishers Inc.,2020.

CO-PO/PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2										2	3	
CO2	2	2										3	2
CO3	2	2										2	1
CO4	2	2	2									2	2
CO5	2	2	2								1	3	2

Score: 3 – High; 2 – Medium; 1 – Low

Department: IT				Programme: B.Tech																		
Semester :IV				CourseCategoryCode: PCC				Semester ExamType: TY														
Course Code	Course Name				Periods/Week			Credit	Maximum Marks													
ITUC112	Information Coding Techniques				L	T	P	C	CA	SE	TM											
Prerequisite:								3	40	60	100											
Course Outcome	CO1	Learn the fundamentals of information and representation of text, image, audio and video.																				
	CO2	Understand the basic data and source coding algorithms for multimedia data.																				
	CO3	Compare various ITU/MPEG coding standards for different data.																				
	CO4	Apply the efficient source coding algorithms in multimedia coding standards.																				
UNIT-I	Introduction				Periods: 9																	
Information – Entropy - Properties of information and Entropy- Relation between information and probability- Mutual and Self-Information - Coding theory- Code Efficiency and Redundancy-Shannon's theorem – Construction of basic codes.										CO1												
UNIT-II	Text Coding				Periods: 9																	
Shannon and Fano coding - Huffman coding– Arithmetic coding - Predictive coding - Run-length Encoding - Ziv-Lempel Coding – Predictive Coding – File Formats: text, audio, image and video file formats.										CO1, CO2												
UNIT-III	Audio Coding				Periods: 9																	
Audio Coding: types – Linear Predictive Coding (LPC) – Code Excited LPC – Perceptual Coding - MPEG Audio Coding.										CO1, CO2												
UNIT-IV	Image Coding				Periods: 9																	
Image Coding: Image representation – Transformation: DCT – DWT – Quantization: Scalar - Vector – Image Coding Standards: JBIG, JPEG and JPEG 2000.										CO3, CO4												
UNIT-V	Video Coding				Periods: 9																	
Video Coding: Motion Estimation and Compensation – Types of Frames – Encoding and Decoding of Frames – Video Coding Standards: H.261, H.263, MPEG-1, MPEG-2, MPEG-4, H.264/AVC, H.265/HEVC, Internet Video Coding.										CO3, CO4												
Lecture Periods: 45			Tutorial Periods: -			Practical Periods: -			Total Periods: 45													
Reference Books:																						
1. Ze-Nian Li, Mark S. Drew and Jiang Chuan Liu, Fundamentals of Multimedia, Springer Edition, 2021. 2. Monica Borda, Fundamentals in Information Theory and Coding, Springer, 2020. 3. Ranjan Bose, Information theory, coding and cryptography, Tata McGraw Hill, 2018. 4. K.R. Rao and J.J. Hwang, "Techniques and Standards for Image, Video and Audio Coding, Prentice Hall, 2020. 5. Yun Q. Shi and Huifang Sun, Image and Video compression for Multimedia Engineering, CRC Press, third edition, 2019.																						

CO-PO / PSO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	2	-	-	-	-	-	-	-	-	2	1
CO2	2	1	2	-	-	-	-	-	-	-	-	2	1
CO3	2	2	2	-	-	-	-	-	-	-	-	2	1
CO4	2	2	2	2	2	-	-	-	-	-	2	2	2

Score: 3 – High; 2 – Medium; 1 – Low

Department : HSS		Programme: B.Tech.															
Semester : IV		Course Category Code: AEC				Semester Exam Type: TY											
Course Code	Course Name	Periods / Week			Credit	Maximum Marks											
		L	T	P	C	CA	SE	TM									
HSUA104	Design Thinking	2			2	40	60	100									
Prerequisite:																	
Course Outcome	CO1	Apply Design Thinking to solve engineering problems															
	CO2	Generate creative solutions for real-world problems using brainstorming and other idea-generation techniques															
	CO3	Build and test prototypes to validate design ideas and improve them based on user feedback.															
	CO4	Work in teams and communicate ideas effectively through presentations, reports, and discussions.															
UNIT-I	Introduction to Design Thinking			Periods: 6													
Understanding the Need for Design Thinking in Engineering - Five-Stage Process: Empathize, Define, Ideate, Prototype, Test - Case Studies: How Engineering Innovations Used Design Thinking - Mindset Shift: From Problem-Solving to Human-Centered Design							CO1, CO4										
Team Exercise: Identify a real-world engineering problem and discuss how Design Thinking can be applied.																	
UNIT-II	Empathize			Periods: 6													
Importance of User Research in Engineering Solutions - Techniques: Interviews, Observations, Surveys, Empathy Mapping - Engineering Constraints vs. User-Centric Needs - Role of Emotional Intelligence in Product Development							CO1, CO2										
Team Exercise: Conduct field research (interview users or observe a process) and create an Empathy Map for an engineering challenge.																	
UNIT-III	Define & Ideate			Periods: 6													
Problem Definition Techniques: How to Frame the Right Problem - Creating Point of View (POV) Statements - Brainstorming & Idea Generation Techniques: SCAMPER, Reverse Thinking, Mind Mapping - Evaluating and Selecting Feasible Engineering Solutions							CO2, CO4										
Team Exercise: Define a problem statement and conduct a Brainstorming Workshop to generate innovative solutions.																	
UNIT-IV	Prototyping			Periods: 6													
Importance of Rapid Prototyping in Engineering - Types of Prototypes: Paper, Digital, Physical Models, Simulation - Tools & Technologies: 3D Printing, CAD, Arduino, Low-Code Development - Iteration & Refinement – Learning from Failures. Team Exercise: Develop a low-fidelity prototype of an engineering solution and present it to peers for feedback.							CO3, CO4										
UNIT-V	Testing, Iteration & Implementation			Periods: 6													
Methods of Testing: Usability Testing, A/B Testing, Stress Testing - Gathering Feedback: Stakeholder & User Insights - Iteration Strategies: Continuous Improvement & Agile Thinking - Real-World Engineering Applications of Design Thinking							CO3, CO4										
Team Exercise: Conduct a user test on the prototype, refine it based on feedback, and present the final solution in a showcase session.																	
Lecture Periods: 30		Tutorial Periods:		Practical Periods:		Total Periods: 30											
Reference Books:																	
<ol style="list-style-type: none"> Michael Lewrick, Patrick Link, and Larry Leifer, <i>The Design Thinking Toolbox: A Guide to Mastering the Most Popular and Valuable Innovation Methods</i>, Wiley, 1st Edition, 2020. Teun den Dekker, <i>Design Thinking</i>, NoordhoffUitgeversbv, International Edition, 2020 Angèle M. Beausoleil, <i>Business Design Thinking and Doing</i>, Palgrave Macmillan Imprint, Springer, 2022 SoniPavan, <i>Design your Thinking</i>, Penguin Random House India Publishing, 2020 E Balagurusamy, <i>Design Thinking</i>, McGraw Hill; First Edition, 2024 																	

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	2	2	2	1	2	1	2	3
CO2	3	3	3	2	2	2	-	2	3	2	3
CO3	3	2	3	3	3	2	1	3	2	3	3
CO4	-	-	3	2	-	2	3	3	3	3	2

Score: 3 – High; 2 – Medium; 1 – Low

Department :HSS		Programme: B.Tech.																	
Semester : IV		Course Category Code: AEC				Semester Exam Type: TY													
Course Code	Course Name	Periods / Week			Credit	Maximum Marks													
		L	T	P	C	CA	SE	TM											
HSUA106	Foreign Language - FRENCH	2	-	-	2	40	60	100											
Prerequisite:																			
Course Outcome	CO1	To acquire the basics of the French language																	
	CO2	To apply the acquired basics of the language in expressing oneself																	
	CO3	To develop basic conversation skills																	
	CO4	To communicate their student life in the University context																	
	CO5	To equip the students to communicate within technical contexts																	
UNIT-I	Introduction To French And Basics				Periods: 6														
French alphabets and pronunciation – Greetings and Introductions (Bonjourçava?) – Numbers, days of the week, months, seasons – Classroom expressions and instructions – Articles (Definite and Indefinite) – Basic sentence structure (Subject – Verb Agreement)								CO 1											
UNIT-II	Personal Identity and Expressions				Periods: 6														
Introducing oneself and others (Je me présente.....) – Nationalities and Professions – Describing people (Physical appearance and Personality) – Possessive adjectives (mon, ma, mes...) – Gender and number agreement of adjectives								CO 2											
UNIT-III	Daily Life and Routines				Periods: 6														
Talking about daily activities and schedules (Je melève à 7 heures...) – Telling the time and discussing time tables – Common verbs in the present tense (ER, IR, RE verbs) – Reflexive verbs (Se lever, s'habiller...)								CO3											
UNIT-IV	Directions and University Life				Periods: 6														
Asking for and giving directions (Oùest....? A gauche, A droite...) – Describing locations (Près de, loin de....) - Talking about University courses and subjects (J'éudiell'ingénierie...) - Prepositions of place (sur, sous, devant....) – Using Il y a and C'est for descriptions								CO4											
UNIT-V	Future Plans, Basic Technical Presentations and Technical and Engineering Contexts				Periods: 6														
Talking about future career goals (Je veuxdeveniringénieur....) Using future proche for near future plans- Vocabulary related to Engineering disciplines – Talking about machines and materials (Acier, moteur, circuit....) – Giving simple presentations on technical topics – Introduction to passive voice (La machine estréparée...)								CO5											
Lecture Periods: 30		Tutorial Periods: -		Practical Periods:-			Total Periods: 30												
Reference Books:																			
1. Nouvelle Generations A1, Luca Giachino, Carla Baracoo, Didier FLE, 2020, Paris 2. Tech French – French for Science and Technology, Ingrid Le Gargasson, SharivaNaik et Claire Chaize, Goyal Publishers, 1 April 2011. 3. Écho – Méthode de Français, A1 ,Girardet, Pecheur, CLE International,2013. 4. ÉchoCahier personnel d'apprentissage, A1, Girardet, Pecheur, CLE International, 2013.																			

CO-PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1								3	3		3
CO2								3	3		3
CO3								3	3		3
CO4								3	3		3
CO5								3	3		3

Score: 3 – High; 2 – Medium; 1 – Low

Department : HSS		Programme: B.Tech.													
Semester : IV		Course Category Code: VAC				Semester Exam Type: -									
Course Code	Course Name		Periods / Week			Credit	Maximum Marks								
			L	T	P	C	CA	SE	TM						
GEUV103	Environmental Education		1	-	-	1	100	-	100						
Prerequisite:	-														
Course Outcome	CO1	Recall the concept of environment ecology and Education.													
	CO2	Summarise the effect of population explosion, degradation of environment and global problem due to the anthropogenic activities.													
	CO3	Justify the need of pollution control and sustainable development for future.													
UNIT-I	Introduction to Environmental Education				Periods: 5										
Concept, scope and importance of Environmental Education - Objectives of Environmental Education - Concept of an Ecosystem: Structure and functions, Types of ecosystem (aquatic and terrestrial) - Biodiversity: Levels, values, threats and conservation - Natural resources: Renewable and Non-renewable resources.								CO1							
UNIT-II	Environmental degradation and impact				Periods: 5										
Human population growth and its impact on environment - Deforestation: Causes and effects due to expansion of agriculture, firewood, mining and building of new habitats - Pollution: Definition, different types of Pollution - Air and water pollution: Causes and effect on environment - Climate change, Global warming, Ozone layer depletion and impacts on human communities.								CO2							
UNIT-III	Conservation of environment				Periods: 5										
Control measures for various types of Pollution: use of renewable and alternate source of energy - Environmental laws: Environmental Protection Act (1986), Water Act (1974), Air Act (1981) - International agreements: Montreal and Kyoto Protocol, Paris Agreement - Concept of sustainable development and SDGs - Role of government, NGOs and individual in environmental conservation.								CO3							
Lecture Periods: 15		Tutorial Periods:		Practical Periods:		Total Periods:									
Reference Books:															
1. Singh, J.S., Singh, S.P. and Gupta, S.R., 2014. "Ecology, Environmental Science and Conservation", S. Chand Publishing, New Delhi. 2. Sharma, P. D., 2011. "Ecology and Environment", Rastogi Publications. 3. ErachBharucha, 2010. "Text Book of Environmental Studies", University Grants Commission, Universities Press (India) Pvt.Ltd., Hyderabad.															

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1					3	1				1
CO2	1					3	1				1
CO3					1	3	2	1			2

Score: 3 – High; 2 – Medium; 1 – Low

Department: IT				Programme: B.Tech																				
Semester :IV				CourseCategoryCode: PCC				Semester ExamType: LB																
Course Code	Course Name			Periods/Week			Credit		Maximum Marks															
				L	T	P	C	CA	SE	TM														
ITUC113	Design and Analysis of Algorithms Lab			-	-	3	1.5	40	60	100														
Prerequisite:	-																							
Course Outcome	CO1	Apply and explain when an algorithmic design situation calls for divide-and-conquer, greedy, dynamic programming, Backtracking and Branch and bound techniques for classic problems							Apply															
	CO2	Implement alternate algorithmic methods for known and unknown applications							Apply															
	CO3	Experiment suitable algorithmic methods in real time applications and analyze the performance							Analyze															
Choice of 10-12 experiments covering all FIVE methods																								
1. Binary search and finding minimum & maximum using DANDC method 2. Quick sort algorithm 3. Merge sort algorithm and Improved merge sort algorithm 4. Strassen's Matrix multiplication using DANDC method 5. General Knapsack problem solution using Greedy method 6. Prim's algorithm to find minimum spanning tree of a graph 7. Kruskal's algorithm to find minimum spanning tree of a given graph 8. Dijkstra's algorithm to find shortest path distance from a source to all destination 9. All pairs shortest path distance algorithm using dynamic programming method 10. 0/1 knapsack problem solution using dynamic programming method 11. Travelling salesman problem solution using dynamic programming method 12. N queen's problem solution using backtracking method 13. Sum of subsets problem solution using backtracking method 14. Graph Coloring problem solution using backtracking method 15. Hamiltonian Cycle problem solution using backtracking method 16. Branch and bound algorithm for 8 puzzle problem 17. Branch and bound algorithm for 0/1 knapsack problem 18. Solving algorithmic problems on coding platforms like HackerRank.																								
LecturePeriods:		TutorialPeriods:		PracticalPeriods:45				TotalPeriods: 45																
ReferenceBooks:																								
1. DeepshikhaAgarwal, A Practical Guide to Analysis and Design of Algorithms, Notion Press Media Pvt Ltd, 2021 2. Books for the language choice (C / C++ / Java) for coding the algorithms. 3. Design and Analysis of Algorithms Lab manual, Department of IT, PTU, 2024.																								

CO-PO / PSO Mapping

CO/ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2
CO1	3	2	1	1							1	3	2
CO2	3	2	1	2							2	3	2
CO3	3	2	1	2							2	3	2

Score: 3 – High; 2 – Medium; 1 – Low

Department: IT		Programme: B.Tech														
Semester : IV		CourseCategoryCode: PCC				SemesterExamType: LB										
CourseCode	Course Name		Periods/Week			Credit	MaximumMarks:100									
	L	T	P	C	CA	SE	TM									
ITUC114	Computer Networks Lab		-	-	3	1.5	40	60	100							
Prerequisite:	Programming knowledge on C/C++/Java/Python															
Course Outcome	CO1	Implement TCP and UDP sockets for various network application such as client-server chat, file transfer, real-time multimedia transmission														
	CO2	Implement sliding window protocols and RMI to provide reliable data delivery between nodes														
	CO3	Analyse the performance of TCP and UDP using the simulation tool														
S.No	Experiments								CO							
1.	Use the commands ipconfig, route, hostname, arp, netstat, nslookup, nbtstat, netdiag, ping, and traceroute to understand the networking configuration of the computer that the student is working on															
2.	Implementation of Client Server Communication Using TCP a. Chat b. File transfer c. Concurrent server								CO1							
2.	Applications using UDP Sockets like a. DNS b. chat								CO1							
4	Write programs simulating ARP and RARP protocols								CO1							
5	Implementation of Sliding Window ProtocolS: a. Stop and Wait Protocol b. Go Back 'N' Protocol c. Selective Repeat ARQ Protocol								CO2							
6	Write a program to implement RPC (Remote Procedure Call) a. Arithmetic calculator b. Factorial of a number								CO2							
7	Create a socket for HTTP for web page upload and download								CO1							
8	Message passing using Message Window - Broadcasting								CO1							
9	Message passing using Group Window - Multicasting								CO1							
10	Simulate Distance Vector/ Link State Routing algorithm.								CO3							
11	Packet Capture and Analysis : Study of frame format of IP, TCP and UDP datagrams and Traffic analysis using wireshark								CO3							
Software:																
1. C / C++ / Java / Python / Equivalent Compiler 2. Network simulator like NS2 / NS3 / Wireshark/ Equivalent																
LecturePeriods:	TutorialPeriods:-	PracticalPeriods: 45				TotalPeriods:45										
ReferenceBooks:																
1. Harold, Elliotte Rusty. Java network programming. " O'Reilly Media, Inc.", 2004. 2. Dr. M.O. FaruqueSarker, Sam Washington, "Learning Python Network Programming", Packet Publisher, O'Reilly, June 2015. 3. https://www.w3schools.in/python-tutorial/network-programming 4. Cisco Packet Tracer /C, Java /Wireshark Tool																

CO-PO/PSO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	1								3	3	1
CO2	2	2	1	2								2	2
CO3	2	2	2	2					3		1	3	2

Score: 3 – High; 2 – Medium; 1 – Low

Department: IT				Programme:B.Tech.																	
Semester :IV				CourseCategoryCode:PCC				Semester ExamType:LB													
Course Code	Course Name			Periods/Week		Credit		Maximum Marks													
				L	T	P	C	CA	SE	TM											
ITUC115	Python Programming Laboratory			-	-	3	1.5	40	60	100											
Prerequisite	-																				
Course Outcome	CO1	Develop and execute simple Python programs.																			
	CO2	Decompose a Python program into functions																			
	CO3	Represent compound data using Python data structures																			
	CO4	Apply Python features in developing software applications																			
<p>1. Python programming using simple statements and expressions. CO1</p> <p>2. Scientific problems using Conditionals and Iterative loops. CO2</p> <p>3. Implementing real-time/technical applications using Lists, Tuples. CO4</p> <p>4. Implementing real-time/technical applications using Sets, Dictionaries. CO4</p> <p>5. Implementing programs using Functions. CO2</p> <p>6. Implementing programs using Strings. CO3</p> <p>7. Implementing programs using written modules and Python Standard Libraries. CO3</p> <p>8. Implementing real-time/technical applications using File handling. CO3, CO4</p> <p>9. Implementing real-time/technical applications using Exception handling. CO3, CO4</p> <p>10. Developing a game activity using Py game like bouncing ball, car race etc. CO2, CO3</p> <p style="text-align: right;">CO4</p>																					
Lecture Periods: -		Tutorial Periods: -		Practical eriods: 45			Total Periods: 45														
Reference Books																					
<ol style="list-style-type: none"> Rob Mastrodomenico, "The Python Book", Wiley, 2022. MartinC.Brown, Python: The Complete Reference, Fourth edition, McGrawHill, USA,2018. Ashok Namdev Kamthane and Amit Ashok Kamthane, Programming and problem solving with python, McGraw Hill, USA, 2018. ReemaThareja, Python programming using problem solving approach, Oxford University Press, India, 2017. JohnV.Guttag, Introduction to Computation and Programming using Python", The MITPress, 2016. RobertSedgewick, KevinWayne, RobertDondero "Introduction to Programming in Python: An Interdisciplinary Approach", Pearson India., 2016. 																					

CO-PO/PSO MAPPING

CO/ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	2	2	2	2	-	-	-	-	-	-	-	2	-
CO2	2	2	2	2	-	-	-	-	-	-	-	2	-
CO3	2	2	1	2	-	-	-	-	-	-	-	2	-
CO4	2	3	3	3	-	-	-	-	-	-	-	2	-

Department: IT		Programme: B.Tech.										
Semester	: V	CourseCategoryCode: PCC				SemesterExamType: TY						
Course code	Course Name	Periods/Week			Credit	Maximum Marks						
		L	T	P	C	CA	SE	TM				
ITUC116	Software Engineering	3	-	2	4	40	60	100				
Prerequisite	ITUC103 – Data structures											
Course Outcome	CO1	Remember and Understand basic definitions, concepts and all Software Engineering Lifecycle Models.										
	CO2	Apply Software Engineering Lifecycle Models for real-Time Projects.										
	CO3	Create requirement gathering report with DFD/ER/Use Case appropriate for chosen real-time projects.										
	CO4	Decompose with WBS to achieve modular design specification and create SDS Report.										
	CO5	Evaluate with software metrics for cost estimation and time schedule for chosen real-time projects.										
UNIT-I	Introduction to Software Engineering				Periods:9							
The Software Engineering Discipline – Evolution and Impact – Software Development Life Cycle –General V Model -Software Project versus Software Product.												
Software Life Cycle Models: Classic Water fall model–Iterative Life cycle model–Incremental Model, RAD Model, Prototyping model–Types of Prototype-Spiral model– WIN-WIN Spiral–Introduction to Agile, What is Agility?, Agile Process, Extreme Programming (XP), Agility and the cost of change.								CO1				
UNIT-II	Software Requirement Gathering				Periods:9							
Understanding Requirements: Requirements Engineering, Establishing the ground work form Brainstroming, identifying stakeholders, feasabilty study, requirements gathering for Data Flow Diagrams (DFDs), Entity-Relationship (ER) diagrams and Use Cases Model using Rational Rose Tool.												
Software Cost Estimation: Cost Estimation with activity chart and critical path method- COCOMO-I and COCOMO-II Model.								CO2, CO3				
UNIT-III	Software Design Specification				Periods:9							
Design Process – Characteristics of a Good Software Design –High Level Architectural Design- Decomposition Techniques with Work Break down Structure, Coupling and Cohesion –Types of Coupling and Cohesion, Approaches to Software Design for Structured DFD, Object Oriented ER and embedded Use case.								CO2, CO3				
UNIT-IV	Coding and Testing				Periods:9							
Coding – Testing –Error, bug , fault and failure, Verification and Validation testing–White Box testing – Unit Testing –Test Coverage Criteria Based On Data Flow Path Mechanisms–Cyclomatic Complexity – Regression Testing– smoke Testing- Integration testing –acceptance testing, along with functional testing - Structure Oriented Testing versus Object Oriented Testing -Black Box testing –BVA– System Testing.								CO3, CO4				
UNIT-V	Software Project Management and Quality Control				Periods:9							
Software Reliability – Software Quality – ISO 9000 – SEI CMM – Six Sigma. Measures and Measurements – Software Metric-ZIPF's Law – Software Cost Estimation – Function Point Models–COCOMO Model–Delphi Method–Scheduling–Software reverse engineering– RiskManagement–Software maintenance process.								CO5				
Lecture Periods:45		Tutorial Periods:		Practical Periods:15		TotalPeriods:60						

References Books

1. Erik W. Larson , Clifford F. Gray and Rohit Joshi , "Project Management: The Managerial Process", 8th McGraw Hill Edition ISBN-13978-9354602078 October 2021.
2. Mall Rajib, Fundamentals of Software Engineering, PHI, 2014
3. Jalote Pankaj, Software Engineering: A Precise Approach, Wiley India, 2010
4. Pressman, Software Engineering Practitioner's Approach, McGraw Hill Education, 2012
5. Vliet V Hans, Software Engineering: Principles and Practice, John Wiley & Sons Ltd.2008

Kjk2

Software Engineering Practical**Exercises**

1. Identify appropriate model for given domain-Case study on Importance of agile in real-time system.	Practical hours:6	CO1
2. Prepare SRS report in IEEE format for the given domain with DFD/ER/Use Case. Documenting and validating completeness and accuracy Eliciting Requirements	Practical hours:6	CO2, CO3
3. Prepare SDS report in IEEE format with WBS incorporating minimum three Modules for the given domain.	Practical hours:6	CO2, CO3
4. Apply all Test case generation for real-time Mini Projects.	Practical hours:6	CO3, CO4
5. Apply software standards for small real-time projects.	Practical hours:6	CO5

CO-PO/PSO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	2	0	1	0	0	0	0	0	1	1	3	3
CO2	2	3	0	2	0	0	0	0	2	3	2	2	3
CO3	1	3	2	1	1	2	2	0	2	3	2	1	3
CO4	2	3	2	1	3	3	1	3	3	3	3	1	3
CO5	2	3	0	0	1	3	3	3	2	3	3	1	1

Department:IT		Programme:B.Tech													
Semester : V		CourseCategoryCode:PCC				SemesterExamType: TY									
Course Code	Course Name		Periods/Week		Credit	MaximumMarks									
			L	T	P	C	CA	SE	TM						
ITUC117	Data Base Management Systems		3	-	-	3	40	60	100						
Prerequisite:	ITUC103-Data Structures														
Course Outcome	CO1	Understand basics of DBMS with its Architecture													
	CO2	Create ER diagram with various Key Constraints													
	CO3	Apply various query Techniques and normalization techniques in real time database application													
	CO4	Apply concurrency control & recovery mechanism for database problems													
	CO5	Create Multidimensional DB for mini Project and Understand concepts of Distributed ,Parallel Database and Data Warehouse													
UNIT-I	Introduction To Databases						Periods:9								
Purpose of Database System – Data Versus Information –What is database system, purpose of database system, view of data, relational databases, Database System Architecture– Types of Architectures (Single-Tier Architecture, Two-Tier Architecture, Three-Tier Architecture)								CO1							
UNIT-II	Relational Database Design and SQL						Periods:9								
Relational Database Design: – Entity-Relationship model – E-R Diagrams – Enhanced-ER Model – ER-to-Relational Mapping – Introduction to relational databases – Relational Model – Keys – – SQL Queries with creation of Tables with attributes and its types including key constraints Data types- Key Constraints (primary key, foreign key, etc.) Basic SQL syntax (SELECT, FROM, WHERE, INSERT, UPDATE, DELETE)								CO2, CO3							
UNIT-III	Relational Algebra and Functional Dependencies						Periods:12								
Relational Algebra: Select Operation (or σ), Project Operation (or π), Union Operation (or ∪), Set Different Operation (or −), Cartesian Product Operation (or ×)’ Rename Operation (or ρ) -Data manipulation -Data definition (DDL) -Data retrieval (DQL), JOIN Operation, SET Operation- PL/SQL, Trigger and cursor . Functional Dependencies – Normalization -First, Second, Third Normal Forms – Dependency Preservation – Boyce-Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form								CO2, CO3							
UNIT-IV	Transaction and File Organization and Indexing						Periods:8								
Transaction Concepts – ACID Properties – Schedules – Serializability – Concurrency Control – Need for Concurrency – Locking mechanisms and Protocols – Two Phase Locking – Deadlock – Save Points – Roll back – SQL Facilities for Concurrency and Recovery.								CO3, CO4							
File Organization and Indexing: Sequential, indexed, and hashed files- RAID- Indexing and Hashing – B+ tree Index Files – B tree Index Files															
UNIT-V	Advanced database						Periods: 7								
Distributed Databases: Heterogeneous and Homogenous Database, Distributed Database Architecture - Introduction to Parallel Databases. Introduction to Data Warehouse: Definition – Multidimensional Data Model – Data Cube – Dimension Modelling– OLAP Versus OLTP Operations.								CO1, CO5							
Lecture Periods:45	Tutorial Periods:	Practical Periods:-				Total Periods:45									
Reference Books															
1. Ramez Elmasri and Shamkant B. Navathe, Fundamentals of Database Systems, Pearson, Seventh Edition, Global Edition, 2016															
2. A. Silberschatz, H. Korth, S. Sudarshan, Database System Concepts, Seventh Edition, McGraw-Hill, 2019.															
3. Vlad Vlasceanu, Wendy A. Neu, Andy Oram, Sam Alapati, An Introduction to Cloud Databases, O'Reilly Media, Inc., 2019															
4. Alex Berson and Stephen J. Smith, Data Warehousing, Data Mining and OLAP, Tata McGraw-Hill, 2004. Reprint 2014															

CO-PO/PSO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	1	1	3	3
CO2	2	3	-	-	-	-	-	-	2	3	2	2	3
CO3	2	3	3	-	1	3	2	-	2	3	2	2	3
CO4	2	3	3	-	3	3	1	3	3	3	3	3	2
CO5	2	3	1	-	2	3	3	3	3	3	3	2	3

Score: 3 – High; 2 – Medium; 1 – Low

Department: IT		Programme: B.Tech.(IT)													
Semester : V		Course Category Code: PCC					Semester Exam Type: TY								
Course Code	Course Name	Periods/Week			Credit	Maximum Marks									
		L	T	P	C	CA	SE	TM							
ITUC118	Web Essentials	3	-	-	3	40	60	100							
Prerequisite	ITUC111 - Computer Networks														
Course Outcome	CO1	Discuss the concepts of internet protocols, web browsers and servers.													
	CO2	Demonstrate Scripting languages.													
	CO3	Organize XML documents including ActiveX controls.													
	CO4	Use Multimedia on web design for E-commerce.													
	CO5	Experiment Ajax programming in web services.													
UNIT-I	Introduction			Periods:09											
		Introduction to Internet Principles and Components: History of the Internet and WorldWideWeb-HTML-protocols-HTTP,SMTP,POP3,MIME,IMAP.DomainNameServer,WebBrowsers and Web Servers, Dynamic HTML.													
UNIT-II	Scripting Languages			Periods:09											
		Client Side and Server Side Programming: Introduction to Java Scripts and VB Scripts– Object Based Scripting for the Web. Programming with JQuery– Structures – Functions – Arrays – Objects, Regular Expression in JavaScript. Java Server Pages – Session and Application management – Session Tracking and Cookies–Access database from JSP.													
UNIT-III	XML, PHP and Servlets			Periods:09											
		XML and ActiveX: Well-formed XML documents - XML markup-working with elements and attributes –Creating valid documents - XML objects and DOM. Servlets: Installing Servlets, The Servlet Life Cycle, Servlet API, Cookies, Database Connectivity, Servlet Chaining. PHP – Working principle of PHP – Variables and Constants – Operators – Flow Control and Looping – Arrays – Strings – Functions – File Handling – File Uploading – Email Basics – Email with attachments – PHP and HTML – Simple PHP scripts – Databases with PHP.													
UNIT-IV	Electronic Commerce			Periods:09											
		Multimedia and Web Application: Multimedia in Web design, Audio and video speech synthesis and recognition - Electronic Commerce – E-Marketing - Case studies: Amazon, Flipcart – Online Transactions- Online Payments and Security. Search and Design: Working of Search Engines – Search Engine Optimization (SEO) – Search Interfaces.													
UNIT-V	Web Services and Ajax			Periods:09											
		Web Services: Introduction to Web Services, UDDI, SOAP, WSDL, Web Service Architecture, Developing and deploying web services. Ajax–Improving webpage performance using Ajax, Programming in Ajax.													
Lecture Periods:45		Tutorial Periods:-		Practical Periods:-		Total Periods:45									
Reference Books:															
<ol style="list-style-type: none"> 1. N.P.Gopalan and J.Akilandeswari, “Web Technology: A Developer’s Perspective”, Second Edition,Prentice-Hall of India,2014. 2. Steven Holzner , “PHP – The Complete Reference”,McGraw-Hill, Jan 2020. 3. Robin Nixon, “Learning PHP, MySQL, JavaScript, CSS & HTML5: A Step-by-Step Guide to Creating Dynamic Websites”, 7th Edition, O’Reilly Publishers, Jan 2025. 4. Deitel and Deitel, Goldberg,“Internet and World Wide Web–How to Program”, Fifth Edition, Pearson Education Asia,2011. 5. Eric Newcomer, “Understanding Web Services: XML, WSDL, SOAP and UDDI”, Addison-Wesley, 2007. 															

CO-PO/PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	2	-	2	-	-	0	-	-	1	2	1
CO2	2	-	2	-	3	-	-	0	-	-	2	2	2
CO3	2	-	1	-	3	-	-	1	-	-	3	3	2
CO4	2	-	2	-	2	-	-	3	-	-	3	2	2
CO5	3	-	3	-	3	-	-	3	-	-	3	3	3

Department: HSS		Programme: B.Tech.													
Semester : V	CourseCategoryCode: AEC				SemesterExamType: TY										
Course Code	Course Name	Periods/ Week			Credit	MaximumMarks									
		L	T	P	C	CA	SE	TM							
HSUA105	Industrial Economics and Management	2	-	-	2	40	60	100							
Pre-requisite	Nil														
Course Outcome	CO1	Demonstrate economic theories, revenue and cost concepts and set of analytical techniques applied to a variety of economic (and non-economic) and financial management issues.													
	CO2	Implement various management techniques based on the needs													
	CO3	Apply financial planning and Interpret company's income statements and balance sheets to ascertain the financial position of a company.													
	CO4	Apply production planning, project scheduling and financial analysis to economic investment and project management problems.													
	CO5	Understand fundamental marketing concepts, apply them to real-world scenarios, and develop effective marketing strategies.													
UNIT-I	Micro and Macro Economics and its Applications						Periods:6								
Nature and Scope of Economic science – Micro Economics: Economic decisions and Technical decisions, Demand and Supply concepts, Market Equilibrium, Elasticity of Demand, Various concepts of Cost– Break Even Analysis – Market structure. Macro Economics: Measures of National Income–Inflation–Business Cycle.								CO1							
UNIT-II	Management Techniques						Periods:6								
Introduction to Management –Functions of Management –F.W.Taylor's Scientific Management– Henry Fayol's Principles of Management. Forms of Business Organization, and Types of(Ownership)of a firm.								CO2							
UNIT-III	Industrial Finance						Periods:6								
Need for Finance–Types of finance–Sources of finance. Final Accounts – Preparation of Trading, Profit and loss Account and Balance Sheet.								CO3							
UNIT-IV	Production Management						Periods:6								
Types of Production system – Production Planning and control: Planning, Routing, Scheduling, Inspection and Dispatches. Concepts of Productivity–Measurement of Productivity.								CO4							
UNIT-V	Marketing Management						Periods:6								
Core Concepts of Marketing – Marketing Vs Selling–Channels of Distribution–Promotion Vs. Advertising–Market Research Vs Marketing research.								CO5							
Lecture Periods: 30	Tutorial Periods:–	Practical Periods:–			TotalPeriods: 30										
Reference Books															
1. Varshney Maheswari, Managerial Economics, SChand&Co, NewDelhi, 2011. 2. Dutt & Sundaram, Indian Economy, SChand&Co,NewDelhi,2015. 3. Pandeyl. M, Elements of Financial Management Wiley Eastern Ltd, NewDelhi,2015. 4. H.L. Ahuja, Macro Economics for Business and Management, SChand&CompanyLtd, 2011. 5. O.PKhanna, Industrial Engineering and Management, Dhanpat RaiandSons,2009. 6. Philip BKotler, Marketing Management, MacMillan, NewYork, 2011.															

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1		1				3					2
CO2										3	2
CO3		1								3	2
CO4										3	2
CO5										3	2

Score: 3 – High; 2 – Medium; 1 – Low

Department: IT						Programme: B.Tech																		
Semester: V						Course Category Code: PCC				Semester Exam Type: LB														
Course Code	Course Name				Periods / Week			Credit		Maximum Marks														
					L	T	P			CA	SE	TM												
ITUC119	Mobile Application Development Lab		-	-	3		1.5	40	60	100														
Prerequisites	ITUC105 - Operating Systems																							
Course Outcome	CO1	Install and configure Android application development tools.																						
	CO2	Design and develop user Interfaces for the Android platform.																						
	CO3	Apply Java programming concepts to Android application development.																						
	CO4	Analyze business trends impacting mobile applications.																						
	CO5	Implementation of mobile applications to real-world problems.																						
1. Develop an application that uses GUI components, Font and Colors.											CO1, CO2													
2. Develop an application that uses Layout Managers and event listeners.																								
3. Write an application that draws basic graphical primitives on the screen.											CO2													
4. Develop an application that makes use of databases.																								
5. Develop an application that makes use of Notification Manager.																								
6. Implement an application that uses Multi-threading.											CO3, CO4													
7. Develop a native application that uses GPS location information.																								
8. Implement an application that writes data to the SD card.											CO4													
9. Implement an application that creates an alert upon receiving a message.																								
10. Write a mobile application that makes use of RSS feed.											CO5													
11. Develop a mobile application to send an email.																								
12. Develop a Mobile application for simple needs (Mini-Project)																								
Lecture Periods: -			Tutorial Periods: -			Practical Periods: 45			Total Periods: 45															
Reference Books																								
1. Jerome DiMarzio, "Beginning Android Programming with Android Studio", 4th Edition, WroxPrInc, 2016.																								
2. Dawn Griffiths, David Griffiths, "Head First Android Development: A Brain-Friendly Guide", 2017.																								
3. Neil Smyth , "Android Studio 3.0 Development Essentials: Android", 8 th Edition, 2017.																								
4. Pradeep Kothari, "Android Application Development (With Kitkat Support)", Black Book 2014.																								
5. https://www.stannesct.ac.in/cms/staff/qbank/CSE/Lab_Manual-converted.pdf																								
6. https://www.google.co.in/books/edition/Head_First_Android_Development																								
7. http://repo.darmajaya.ac.id/5623/1/AndroidStudioEssentials.pdf																								
8. https://developer.android.com/guide																								
9. https://en.wikipedia.org/wiki/Android_10																								
10. https://aws.amazon.com/mobile/mobile-application-development/																								
11. https://en.wikipedia.org/wiki/Mobile_app_development																								

CO-PO/PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	2	1	3	-	3	2	-	-	2	2	2
CO2	2	2	2	2	3	-	3	2	-	-	2	2	2
CO3	2	3	1	1	3	-	3	2	-	-	2	3	2
CO4	2	2	2	2	2	-	3	2	-	-	3	2	2
CO5	3	2	3	2	3	-	3	3	-	-	3	3	3

Score: 3 – High; 2 – Medium; 1 – Low

Department : IT		Programme: B.Tech.																						
Semester : V		Course Category Code: PCC Semester Exam Type: LB																						
Course Code	Course Name		Periods / Week			Credit		Maximum Marks																
	L	T	P	C	CA	SE	TM																	
ITUC120	Database Management Systems Lab		-	-	3	1.5	40	60	100															
Prerequisite	Nil																							
Course Outcome	CO1	Understand the basic concepts database and its design principles																						
	CO2	Formulate solutions to a broad range of query and data update problems using SQL																						
	CO3	Master in SQL queries using advanced operators and concepts																						
	CO4	Formulate Programming solutions for various queries using PL-SQL																						
	CO5	Apply SQL query language with ODBC Connectivity for real time application																						
1. Study of Database Concepts: Relational model – table – operations on tables – Schema- ER Diagram												CO1												
2. Study of SQL: Primitive Data Types – User Defined Data Types – create, alter, drop, select, insert, delete, update, commit, rollback, save point, grant, revoke - Built-in Functions – Integrity Constraint – Authorization – Transactions.												CO2												
3. AdvancedQuery Types: Set Operators- Union, Intersection, Difference, Cartesian product, and Divide Operations – Sub Queries – Join Queries – Nested Queries –Recursive Queries.												CO3												
4. Study of Procedural Query Language: Blocks, Exception Handling, Functions, Procedures, Cursors, Triggers, Packages.												CO4												
5. Design and develop Mini Project with Existing and advancement for real time Application with ODBC Connectivity: a. Library Information System b. Hospital Management System c. Students' Information System d. Employee Information System. e. Real time Projects Like University Result processing system, Currency Conversion System etc												CO1, CO2, CO3, CO4, CO5												
Lecture Periods: -	Tutorial Periods: -		Practical Periods: 45			Total Periods: 45																		
Reference Books																								
1. Abraham Silberschatz, Henry F. Korth and S.Sudarshan, Database System Concepts, Sixth Edition, McGraw-Hill International Inc., 2011. 2. https://www.tutorialspoint.com/ 3. https://www.w3schools.com/																								

CO-PO/PSO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	0	-	0	0	-	0	0	1	1	3	3
CO2	2	3	0	-	0	0	-	0	2	3	3	2	3
CO3	2	3	3	-	1	3	2	0	2	3	2	2	3
CO4	2	3	3	-	3	3	1	3	3	3	3	3	2
CO5	2	3	1	-	2	3	3	3	3	3	3	2	3

Score: 3 – High; 2 – Medium; 1 – Low

Department: IT					Programme: B.Tech																			
Semester : V					Course Category Code: PCC				Semester Exam Type: LB															
Course Code	Course Name				Periods/Week			Credit	Maximum Marks															
ITUC121	Web Essentials Lab				L	T	P	C	CA	SE	TM													
Prerequisite	ITUC111 - Computer Networks																							
Course Outcome	CO1	Implement HTML file creation using file formatting, CSS.																						
	CO2	Use scripting languages for linking and embedding documents.																						
	CO3	Demonstrate the configuration of web servers. Use JSP for data accessing and session tracking.																						
	CO4	Experiment client-side and server-side scripting.																						
	CO5	Develop web applications (mini-project).																						
1. Creation of HTML Files with CSS 2. Working with Client Side Scripting 2.1 VBScript 2.2 JavaScript 3. Configuration of web servers 3.1 Apache Web Server 3.2 Internet Information Server(IIS) 4. Working with ActiveX Controls in web documents											CO1,CO2,CO4													
5. Experiments in Java Server Pages 5.1 Data Access Programming (using ADO) 5.2 Session and Application objects											CO3													
6. Working with other Server Side Scripting 6.1 Active Server Pages 6.2 Java Servlets 6.3 PHP											CO3,CO4													
7. Experiments in Ajax Programming 8. Developing Web Services 9. Developing any E-commerce application (Mini-Project)											CO4,CO5													
Lecture Periods: -			Tutorial Periods: -			Practical Periods: 45			Total Periods: 45															
Reference Books																								
1. N.P.Gopalan and J.Akilandeswari, "Web Technology: A Developer's Perspective", Second Edition, Prentice-Hall of India, 2014. 2. Steven Holzner , "PHP – The Complete Reference", McGraw-Hill, Jan 2020. 3. Robin Nixon, "Learning PHP, MySQL, JavaScript, CSS & HTML5: A Step-by-Step Guide to Creating Dynamic Websites", 7 th Edition, O'Reilly Publishers, Jan 2025. 4. Deitel and Deitel, Goldberg,"Internet and World Wide Web–How to Program", Fifth Edition, Pearson Education Asia, 2011. 5. Eric Newcomer, "Understanding Web Services: XML, WSDL, SOAP and UDDI", Addison-Wesley, 2007. 6. https://books.google.co.in/books/about/WEBTECHNOLOGY.html																								

CO-PO/PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	-	2	-	2	-	-	0	-	-	1	2	1
CO2	2	-	2	-	3	-	-	0	-	-	2	2	2
CO3	2	-	1	-	3	-	-	1	-	-	3	3	2
CO4	2	-	2	-	2	-	-	3	-	-	3	2	2
CO5	3	-	3	-	3	-	-	3	-	-	3	3	3

Score: 3 – High; 2 – Medium; 1 – Low

Department: IT		Programme:B.Tech.(IT)														
Semester :VI			CourseCategoryCode:PEC			SemesterExamType: TY										
Course Code	Course Name	Periods/Week			Credit	MaximumMarks										
		L	T	P	C	CA	SE	TM								
ITUC122	Data Mining and Data Warehousing	3	-	-	3	40	60	100								
Prerequisite	ITUC120 Data Base Management Systems															
Course Outcome	CO1	Understand Data Mining and Data Warehousing Architecture, concepts and techniques.														
	CO2	Analyse Multidimensional Data with OLAP Technology														
	CO3	Apply appropriate data mining techniques for respective Domain														
	CO4	Apply Data Warehouse Architecture with OLAP for real-time Project.														
	CO5	Create with Cloud simulator for pattern recognition and prediction.														
UNIT-I	Introduction to Data Mining			Periods:9												
Definition of data mining - data mining vs query tools – machine learning – taxonomy of data mining tasks–steps in data mining process–overview of data mining techniques							CO1									
UNIT-II	Data Warehousing			Periods:9												
Definition – Multidimensional Data Model – Data Cube – Dimension Modelling– OLAP Operations – Data Warehouse Architecture – Data Mart– Meta Data – Types of Meta Data							CO2									
UNIT-III	Data cleaning and Pre-Processing			Periods:9												
Data Cleaning – Pre-Processing techniques, Data Integration and Transformation –Data Reduction – Discretization and Concept Hierarchy Generation –Generalization –Summarization							CO2, CO3									
UNIT-IV	Association Rule and Classification			Periods:9												
Association Rule – Mining Multi-Dimensional data from Transactional Database and Relational Database. Classification – Decision Tree Induction – Bayesian Classification – Prediction –Back Propagation							CO3, CO4									
UNIT-V	Cluster analysis			Periods:9												
Cluster Analysis – K-Means Algorithm, Advantages and disadvantages of K-Means clustering, Types of Clustering-Hierarchical Method – Partitioning methods- Density Based Method – Outlier Analysis.							CO4, CO5									
Advanced topics: Web Mining-Difference between data mining and Web Mining – Web Content Mining – Web Structure Mining and Usage Mining. Applications : Case studies in Data Mining and web mining applications																
Lecture Periods:45	Tutorial Periods:	Practical Periods:-	TotalPeriods:45													
Reference Books																
<ol style="list-style-type: none"> Mr. Prolay Biswas , Mrs. Frenisha Digaswala ,Mrs. Arpita Vaidya, Mr. Rahul Sharma, "Introduction to Data Mining: DM-ISBN-13 979-8893220841 Notion Press , 2024 Paulraj Ponnaiah, Data Warehousing Fundamentals: A Comprehensive Guide for IT Professionals, Wiley Publishers, 2001. Jiawei Han, MichelineKamber, Data Mining: Concepts and Techniques, Morgan Kaufman Publishers, 2011. Usama M.Fayyad, Gregory Piatetsky Shapiro, Padhraic Smyth, Ramasamy Uthurusamy, Advances in Knowledge Discover and Data Mining, The M.I.T.Press, 2012. Ralph Kimball, Margy Ross, The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modelling, John Wiley and Sons Inc., 3rd edition 2019. Ken Yale, Robert Nisbet, Gary D. Miner, "Handbook of Statistical Analysis and Data Mining 																

Applications" Second Edition , Elsevier 2017

7. Daniel T. Larose John Wiley & Sons, Hoboken, Discovering Knowledge in Data: An Introduction to Data mining, New Jersey, 2005.
8. Hand, Mannila and Smyth, Principles of Data Mining, Prentice Hall of India, New Delhi, 2009.
9. Sean Kelly, Data warehousing in action, John wiley& sons, reprint 2008.
10. Sam Anahory, Dennis Murrary, Data warehousing in the real world: A practical guide to build decision support System, Addition Wesley, Fourth Impression 2009.

CO-PO/PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	0	1	0	0	1	0	0	1	1	3	3
CO2	2	3	0	2	0	0	1	0	2	3	2	2	3
CO3	2	3	3	1	1	3	2	0	2	3	2	2	3
CO4	2	3	3	1	3	3	0	3	3	3	3	3	2
CO5	2	3	1	1	2	3	3	3	3	3	3	2	3

Score: 3 – High; 2 – Medium; 1 – Low

Department: IT		Programme:B.Tech													
Semester :VI	CourseCategoryCode:PCC							SemesterExamType:TY							
Course Code	Course Name	Periods/Week			Credit	MaximumMarks									
		L	T	P	C	CA	SE	TM							
ITUC123	Information Security	3	-	-	3	40	60	100							
Prerequisite	ITUC111 - Computer Networks														
Course Outcome	On successful completion of this course, the students will be able to:														
	CO1	Describe OSI security architecture and legal, ethical and professional issues in security.													
	CO2	Identify risks and appropriate security models.													
	CO3	Implement security technologies including encryption standards.													
	CO4	Experiment cryptographic techniques for message authentication.													
	CO5	Apply biometric and cyber security effectively for real-time applications.													
UNIT-I	Introduction							Periods:9							
Security Trends, OSI security architecture, Security attacks, security services, security mechanisms,-Security System Development Life cycle–Legal, Ethical and Professional issues.								CO1							
UNIT-II	Security Analysis and Design							Periods:9							
Risk Management – Identifying and Assessing Risk – Assessing and Controlling Risk. Blueprint for Security-Information Security Policy-Standards and Practices–ISO17799/BS7799–NIST Models –VISA International Security Model – Design of Security Architecture.								CO1 CO2							
UNIT-III	Physical Design and Encryption Techniques							Periods:9							
Security Technology–Intruders, Malicious software, Firewalls, Scanning and Analysis tools, Content filters. Encryption Techniques – Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Steganography, Block Cipher Principles, The Data Encryption Standard.								CO2 CO3							
UNIT-IV	Public-Key Encryption And Hash Functions							Periods:9							
Advanced Encryption standard, Principles of public-key cryptosystem, Key management, Message Authentication and Hash functions, Digital Signatures and Authentication Protocols.								CO3,CO4							
UNIT-V	Biometric and Cyber security							Periods:9							
Biometrics: Definition–Types of Biometrics–Multibiometrics–Fusion methods–Applications. Cyber Security: Introduction to Cyber security –Reasons of cyber crime, Damage to the organizations, Cyber security Components – Zero day attacks, Types of network attacks, Application security, Data security.								CO5							
LecturePeriods:45	TutorialPeriods:	Practical Periods:-			TotalPeriods:45										
Reference Books:															
1. Michael E. Whitman and Herbert J. Mattord, "Principles of Information Security", Sixth Edition, Vikas Publishing House, New Delhi, 2018. 2. William Stallings, Cryptography and Network Security, Principles and Practices", Seventh Edition, Pearson Education, 2017. 3. Anand Shinde, "Introduction to Cyber Security: Guide to the World of Cyber Security", Notion Press, 1 st Edition, 2021, ISBN-13: 978-1637816424 4. John D. Woodward (Jr.), Nicholas M. Orlans, Peter T. Higgins, "Biometrics", McGraw-hill, 2003. 5. https://almuhammadi.com/sultan/sec_books/Whitman.pdf 6. https://notionpress.com/in/read/introduction-to-cyber-security/															

CO-PO/PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	0	2	-	2	2	3	2	-	-	2	2	2
CO2	2	2	2	-	3	2	3	2	-	-	2	2	2
CO3	2	3	2	-	2	2	3	2	-	-	2	3	3
CO4	2	2	2	-	3	2	3	2	-	-	3	2	2
CO5	3	3	3	-	3	3	3	3	-	-	3	3	3

Score: 3 – High; 2 – Medium; 1 – Low

Department:IT		Programme:B.Tech.													
Semester :VI	CourseCategory Code:PCC				SemesterExamType: TY										
Course Code	Course Name	Periods/Week			Credit	MaximumMarks									
		L	T	P	C	CA	SE	TM							
ITUC124	Artificial Intelligence and Machine Learning	3		-	3	40	60	100							
Prerequisite	ITUC103 Data structures ITUC110 Design and Analysis of Algorithms														
Course Outcome	CO1	Understand the search techniques.													
	CO2	Able to design different Knowledge Representation schemes for typical AI problems.													
	CO3	Apply AI techniques in developing real world applications.													
	CO4	Identify applications suitable for different types of machine learning with suitable justification													
	CO5	Design and make modifications to existing machine learning algorithms to suit an individual application													
UNIT-I	Intelligent Agents and Search Techniques				Periods:9										
Overview of AI, Problem space-Heuristic search Algorithms. –uninformed search algorithms- informed search algorithms – search algorithms for games- constraint satisfaction problem – means and ends analysis–Intelligent agents: Agents and environment – structure of agents and its functions								CO1, CO3							
UNIT-II	Knowledge representation				Periods:9										
Knowledge Representation Issues – Approaches for Knowledge Representation: Simple Relational Knowledge – Inherited Knowledge – Semantic Nets – Frames – Semantic Web – Ontology- Expert System								CO2, CO3							
UNIT-III	Meta Heuristics				Periods:9										
Genetic Algorithm – Ant Colony Optimization Algorithm Tabu search – Adversarial search – game tree- Minmax game playing algorithm - Adding alpha-beta cutoff.								CO3							
UNIT-IV	Machine learning -Supervised Learning				Periods:9										
Machine Learning – Types of Machine Learning -Supervised Learning- Linear Regression- Logistic Regression-Decision Trees-Support Vector Machines (SVM)-k-Nearest Neighbours (k-NN)- Naive Bayes- Ensemble Learning-Random Forest-Boosting Algorithms								CO4, CO5							
UNIT-V	Unsupervised and Reinforcement Learning				Periods:9										
Clustering -k-means- hierarchical- dimensionality reduction (PCA)- Association Rule- Apriori algorithm- Reinforcement Learning-Model-Based Methods-Model-Free Methods-Policy-based Methods								CO4, CO5							
Lecture Periods:45		Tutorial Periods:		Practical Periods:-		TotalPeriods:45									
Reference Books:															
1. R. Panneerselvam, "Artificial Intelligence", Vijay Nicole Imprints Private Limited, 2024. 2. Elaine Rich, Kevin Knight, Shivashankar B. Nair, "Artificial Intelligence - A Modern Approach", Third Edition, McGraw Hill Education, 2017. 3. Stuart J. Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson Education, IV edition, 2022. 4. S.Sridhar and M.vijayalakshmi, "Machine Learning", Oxford University Press, I edition, 2021 5. Hui Jiang, "Machine Learning Fundamentals: A Concise Introduction", Cambridge University Press, 2021.															

CO-PO /PSO MAPPING

CO/ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PS01	PS02
CO1	2	3	3	3	2						3	2	2
CO2	3	3	3	3	2						3	2	2
CO3	3	3	3	3	3						3	3	3
CO4	3	3	3	3	3						3	3	3
CO5	3	3	3	3	3						3	3	3

Score: 3 – High; 2 – Medium; 1 – Low

Department: IT		Programme:B.Tech.													
Semester	:VI	CourseCategory Code:PCC					SemesterExamType: LB								
Course Code	Course Name	Periods / Week			Credit	Maximum Marks									
		L	T	P	C	CA	SE	TM							
ITUC125	Data mining and Data Analytics Lab	-	-	3	1.5	40	60	100							
Prerequisite	ITUC117 -Database Management Systems														
Course Outcome	CO1	Understand the basic concepts of Multidimensional data to apply practically													
	CO2	Apply cleaning and pre processing tools & techniques.													
	CO3	Apply Data mining techniques like Association Rule mining, Classification, clustering for appropriate domain.													
	CO4	Simulate with cloud for various heterogeneous real time data													
	CO5	Apply prediction and preventive measures for real time application													
1. Implement the following Multidimensional data model <ul style="list-style-type: none"> • Star Schema • Snowflake Schema • Fact Constellation 2. With online UCI Repository Dataset or any dataset do case study for ALL stages of KDD															
3. Perform Data Preprocessing using Weka															
4. Implement Apriori Algorithm															
5. Implement Classification Algorithm <ul style="list-style-type: none"> • Decision Tree Induction • KNN • Perform Classification using Weka 															
6. Implement Clustering Algorithm <ul style="list-style-type: none"> • K –Means. • K - Median 															
7. Design and develop Real Time Datamining using R Programming Mini Project															
Lecture Periods: -		Tutorial Periods: -		Practical Periods: 45		Total Periods: 45									
Reference Books															

- | |
|--|
| 1. https://www.geeksforgeeks.org/data-mining-in-r/ |
| 2. https://www.rdatamining.com/ |
| 3. https://www.rdatamining.com/ |
| 4. https://www.tutorialspoint.com/ |
| 5. https://www.w3schools.com/ |

CO-PO /PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	1	1	3	3
CO2	2	3	-	-	-	-	-	-	2	3	3	2	3
CO3	2	3	3	-	1	3	2	-	2	3	2	2	3
CO4	2	3	3	-	3	3	1	3	3	3	3	3	2
CO5	2	3	1	-	2	3	3	3	3	3	3	2	3

Department: IT		Programme:B.Tech.							
Semester :VI		SubjectCategory:PCC				SemesterExamType:LB			
Course Code	Course Name	Periods / Week				Credit		MaximumMarks	
		L	T	P	C	CA	SE	TM	
ITUC126	Artificial Intelligence and Machine Learning Lab	-	-	3	1.5	40	60	100	
Prerequisite									
Course Outcome	CO1	Apply heuristic concepts to design efficient algorithms using Python.							
	CO2	Implement game playing algorithms in python and learn to handle the conditions technically. Single Player – Win / Lose Condition; Two Player – Win / Opponent Win Condition.							
	CO3	Develop an Expert System for Medical Diagnosis using Python.							
	CO4	Understand various Machine Learning algorithms and the way to evaluate performance of the Machine Learning algorithms.							
	CO5	Apply Machine Learning to learn, predict and classify the real-world problems in the Supervised Learning paradigms as well as discover the Unsupervised Learning paradigms of Machine Learning							
To develop following programs in Python									
1. Implement Breadth First Search(for 8 puzzle problem)									
2. Implement Depth First Search(for Water Jug problem)									
3. Implement A*algorithm									
4. To implement AO*Algorithms									
5. Implement Single Player Game(Using Heuristic Function)									
6. Implement Two Player Game(Using Heuristic Function)									
7. To implement constraint satisfaction technique									
8. Develop an Expert system for Medical diagnosis.									
9. Write a Python program to implement Simple Linear Regression and plot the graph.									
10. Write a program to demonstrate the working of the decision tree based ID3 algorithm by considering a dataset									
11. Consider a dataset; use Random Forest to predict the output class. Vary the number of trees as follows and compare the results:									
i. 20									
ii. 50									
iii. 100									
iv. 200									
v. 500									
12. Build KNN Classification model for a given dataset. Vary the number of k values as follows and compare the results:									
i. 1									
ii. 3									
iii. 5									
iv. 7									
v. 11									
13. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.									
14. Implement Support Vector Machine for a dataset and compare the accuracy by applying the following kernel functions:									
i. Linear									
ii. Polynomial									
iii. RBF									
15. Write a python program to implement K-Means clustering Algorithm. Vary the									

number of k values as follows and compare the results:

- i. 1
- ii. 3
- iii. 5

Lecture Periods:-	Tutorial Periods:-	Practical Periods:45	Total Periods:45
RREFERENCE S			
<ol style="list-style-type: none"> 1. Ashok Choppadandi, Jagbir Kaur , Pradeep Kumar Chenchala, " Artificial intelligence machine learning data science engineering - usage and challenges", 1st edition, Vinsa Publisher 2024 2. Elaine Rich, Kevin Knight, Shivashankar B. Nair, "Artificial Intelligence - A Modern Approach", Third Edition, McGraw Hill Education, 2017. 3. Stuart J. Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson Education, IV edition,2022. 4. S.Sridhar and M.vijayalakshmi, "Machine Learning", Oxford University Press, I edition, 2021 5. https://zitniklab.hms.harvard.edu/software/ 6. https://www.ml.informatik.tu-darmstadt.de/ 7. https://ai.engineering.columbia.edu/ai-vs-machine-learning/ 			

CO-PO/PSO MAPPING

CO/ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PS01	PS02
CO1	3	3	3	3	3	2			3		3	2	2
CO2	3	3	3	3	3	2			3		3	2	2
CO3	3	3	3	3	3	3			3		3	3	3
CO4	3	3	3	3	3	3			3		3	3	3
CO5	3	3	3	3	3	3			3		3	3	3

Score: 3 – High; 2 – Medium; 1 – Low

Department: IT		Programme:B.Tech.							
Semester :VI			CourseCategoryCode:PCC			SemesterExamType:LB			
Course Code	Course Name		Periods/Week		Credit	Maximum Marks 100			
	L	T	P	C	CA	SE	TM		
ITUC127	Data Visualization Lab		-	-	3	1.5	40	60	100
Prerequisite	-								
Course Outcome	CO1	Understand the fundamentals of Tableau and Power BI including interfaces, Terminologies and basic functionalities							
	CO2	Connect and import data from various sources, to create basic charts and graphs demonstrating proficiency in data integration using Tableau and Power BI							
	CO3	Develop the solution for the given real-world problem							
	CO4	Analyse the results and produce substantial written documentation							
1. Getting Started	Tableau Workspace, Tableau terminologies, basic functionalities.							CO1	
2. Connecting to Data Source	Connecting to Database, Different types of Tableau Joins.							CO2	
3. Creating a View	formatting charts, adding filters, creating calculated fields and defining parameters.							CO4	
4. Introducing Power BI	Components and the flow of work. PowerBI Desktop Interface the Report has Five main areas.							CO1, CO2	
5. Querying Data from CSV	Query Editor, Connecting the data from the Excel Source, Clean, Transform the data.							CO3	
6. Creating Reports & Visualizations	Different types of charts, Formatting charts with Title, Colors.							CO3	
7. Dashboards	Filters in Power BI, Formatting dashboards.							CO3, CO4	
8. Analysis of revenue in sales dataset:	i) Create a choropleth map (fill the map) to spot the special trends to show the state which has the highest revenue. ii) Create a line chart to show the revenue based on the month of the year. iii) Create a bin of size 10 for the age measure to create a new dimension to show the revenue. iv) Create a donut chart view to show the percentage of revenue per region by creating zero access in the calculated field. v) Create a butterfly chart by reversing the bar chart to compare female & male revenue based on product category. vi) Create a calculated field to show the average revenue per state& display profitable & non-profitable state. vii) Build a dashboard.							CO3, CO4	
9. Analysis of GDP dataset:	i) Visualize the countries data given in the data set with respect to attitude and longitude along with country name using symbol maps. ii) Create a bar graph to compare GDP of Belgium between 2006-2026. iii) Using piechart, visualize the GDP of India, Nepal, Romania, South Asia, Singapore by the year 2010. iv) Visualize the countries Bhutan & Costa Rica competing in terms of GDP. v) Create a scatter plot or circle views of GDP of Mexico, Algeria, Fiji, Estonia from 2004 to 2006. vi) Build an interactive dashboard							CO2, CO3 CO4	

<p>10-. Analysis of HR Dataset:</p> <ul style="list-style-type: none"> i) Create KPI to show employee count, attrition count, attrition rate, attrition count, active employees, and average age. ii) Create a Lollipop Chart to show the attrition rate based on gender category. iii) Create a pie chart to show the attrition percentage based on Department Category-Drag department into colours and change automatic to pie. Entire view, Drag attrition count to angle. Label attrition count, change to percent, add total also, edit label. iv) Create a bar chart to display the number of employees by Age group v) Create a highlight able to show the Job Satisfaction Rating for each job role based on employee count. vi) Create a horizontal bar chart to show the attrition count for each Education field Education field wise attrition -drag education field to rows, sum attrition count to col, vii) Create multiple donut charts to show the Attrition Rate by Gender for different Age group. 	CO3,CO4		
<p>11. Analysis of Amazon Prime Dataset:</p> <ul style="list-style-type: none"> i) Create a Donut chart to show the percentage of movie and tv shows ii) Create a area chart to shows by release year and type iii) Create a horizontal bar chart to show Top10 game iv) Create a map to display total shows by country v) Create a text sheet to show the description of any movie/movies. Build an interactive Dashboard. 	CO3,CO4		
LecturePeriods: -	TutorialPeriods: -	PracticalPeriods: 45	TotalPeriods: 45
ReferenceBooks			
<ol style="list-style-type: none"> 1. Visualization Analysis & Design by Tamara Munzner (2014) 2. Interactive Data Visualization for the Web by Scott Murray 2nd Edition (2017) 3. Practical Tableau: 100 Tips, Tutorials, and Strategies from a Tableau Zen Master, Ryan Sleeper, O'Reilly Publications, 2018 4. Dr. Arpana Chaturvedi, Prof. Praveen Malik, Mastering Data Visualization with Tableau, BPB Publications, India, 2024. 5. Nisal Mihiranga, "Power Bi Data Modeling Build Interactive Visualizations, Learn Dax, Power Query, and Develop Bi Model", BPB Publications, India, 2022. 			

CO-PO/PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2	2	1	-	-	-	3	-	-	2	-
CO2	2	2	2	2	1	-	-	-	3	-	-	2	-
CO3	2	2	1	2	2	-	-	-	3	-	-	2	-
CO4	2	3	3	3	2	-	-	-	3	-	-	2	-

Score: 3 – High; 2 – Medium; 1 – Low

Department :IT		Programme: B.Tech.							
Semester : VI	Course Category Code: PCC							Semester Exam Type: -	
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
ITUC128	Internship					2	100		100
Prerequisite:	-								
Course Outcome: Periods / Week	CO1	Apply theoretical knowledge gained during coursework to real-world projects and tasks.							
	CO2	Develop soft skills such as communication, teamwork, problem-solving, and time management.							
	CO3	Demonstrate proficiency in relevant industry technologies or platforms.							
	CO4	Handle the demands and challenges of a professional setting							
	CO5	Prepare reports and deliver presentations effectively on internship work.							
The student is required to undergo 'internship' in industry / research laboratory / higher learning institution for a period of at least 4 weeks in a maximum of 2 spells during vacations. Each spell of internship shall be for a period of not less than 2 weeks. The main purpose of internship is to enhance the general professional outlook and capability of the student to advance his chances of improving the career opportunities. The student should get prior approval from the Head of the Department before undertaking the internship and submit a detailed report after completion for the purpose of assessment. A departmental committee shall evaluate the performance of the students.								CO1, CO2, CO3, CO4, CO5	

CO-PO/PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	3	1							1	
CO2												1	2
CO3	2	3	2	2	3							2	2
CO4						2	1	3	1	1		2	2
CO5									2	2	3		3

Score: 3 – High; 2 – Medium; 1 – Low

Department: IT		Programme: B.Tech													
Semester :VII		CourseCategoryCode:PCC				SemesterExamType: TY									
ITUC129	Full Stack Web Development	Periods/Week				Credit		MaximumMarks 100							
		L	T	P	C	CA	SE	TM							
		3			3	40	60	100							
Prerequisite:	ITUC118-Web essentials ITUC117-Database management system ITUC111-Computer networks														
Course Outcome	CO1	Understand the various stacks available for web application development													
	CO2	Implement interactive web application design using React JS													
	CO3	Build simple web applications using AngularJS framework.													
	CO4	Understand the basic concepts of Node.js & Express.js Framework.													
	CO5	Familiarize with the different back-end design using MySQL, MongoDB													
UNIT-I	Basics of Full Stack				Periods:9										
Understanding the Basic Web Development Framework -User -Browser –Webserver -Backend Services – MVC Architecture -Understanding the different stacks –The role of Express –Angular –Node –Mongo DB – React								CO1							
UNIT-II	React JS Framework				Periods:9										
Basic React applications – React Components – React State – Express REST APIs – Modularization and Web pack – Routing with React Router – Server-side rendering								CO1,CO2							
UNIT-III	Angular JS Framework				Periods:9										
Overview of JavaScript frameworks: MEAN stack frameworks - Introduction to Angular JS - Binding and Expression – Directives – Controllers – Filters – Modules – Services – Scopes – Tables & forms – AngularJS DOM – Animations – Simple application.								CO1,CO3							
UNIT-IV	Express JS andNode JS Framework				Periods:9										
Introduction to Node.js – Node.js Architecture - NPM(Node Packaging Manager) -Installing NPM module - Creating and locating modules - Creating a simple HTTP server - Overview of Express.js framework – Simple Express application – Routing – MVC in Express – middleware – templates – Error handling – Debugging – using process managers								CO1, CO4							
UNIT-V	MongoDB Framework				Periods:9										
Introduction to MySQL with Node.js– Basic DDL & DML Operations, NoSQL Database -Basic CRUD Operations – Indexing –Aggregation -Data Modelling concepts - Connecting MongoDB using Mongoose								CO1,CO5							
Lecture Periods:45	Tutorial Periods:0	Practical Periods:0			Total Periods:45										
ReferenceBooks:															
<ol style="list-style-type: none"> 1. Brad Dayley, Brendan Dayley, Caleb Dayley, “Node.js, MongoDB and Angular Web Development”, Addison-Wesley, Second Edition, 2018 2. Vasan Subramanian, “Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node”, Apress, 2nd Edition, 2019. 3. Chris Northwood, “The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer”, Apress; 1st edition, 2018. 4. KirupaChinnathambi, “Learning React: A Hands-On Guide to Building Web Applications Using React and Redux”, Addison-Wesley Professional, 2nd edition, 2018 5. Martin Krause, “The Complete Developer Master the Full Stack with TypeScript, React, Next.js, MongoDB, and Docker”, No Starch Press,2024. 															

CO-PO/PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2	----	3	-	-	-	-	-	3	3	-
CO2	2	3	3	2	3	-	-	-	-	-	3	3	-
CO3	2	3	3	--	3	-	-	-	-	-	3	3	-
CO4	2	3	3	3	3	-	-	-	-	-	3	3	-
CO5	2	3	3	1	3	-	-	-	-	-	3	3	-

Score: 3 – High; 2 – Medium; 1 – Low

Department: IT		Programme: B.Tech.															
Semester : VII		CourseCategoryCode: PCC				SemesterExamType: TY											
Course Code	Course Name	Periods/Week			Credit	MaximumMarks											
		L	T	P	C	CA	SE	TM									
ITUC130	Deep Learning	3	-	-	3	40	60	100									
Prerequisite:	ITUC125 – Artificial Intelligence and Machine Learning																
Course Outcome	CO1	Learn the basics of deep learning architectures - remember															
	CO2	Understand the basic layers of deep learning architectures, GAN and auto encoders - understand															
	CO3	Understand the working of convolutional, recurrent and reinforcement learning - understand															
	CO4	Compare various deep learning architectures with discrete and continuous data sets. - analyse															
	CO5	Apply various deep learning algorithms in multi-disciplinary fields - apply															
UNIT-I	Introduction to Deep Learning				Periods: 9												
Overview: tensors – input layer – output layer – deep learning layer survey: fully-connected layer – activation functions – dropout – batch normalization – convolution – pooling layers – recurrent layers – utility layers – layer and symbol summary - building a deep learner.							CO1										
UNIT-II	Convolutional Neural Networks (CNN)				Periods: 9												
Introduction – depth – sum of scaled values – weighted sharing – local receptive field – kernel; convolution – filters – hierarchies of filters – padding – stride; high-dimensional convolution – filters with multiple channels – striding for hierarchies – 1D convolution – 1x1 convolution – convolution layer – transposed convolution – CNN Architectures: LeNet, AlexNet, VGG16, GoogLenet, ResNet, DenseNet.							CO3, CO4										
UNIT-III	Recurrent Neural Networks (RNN)				Periods: 9												
Introduction – state - structure of an RNN Cell – organizing inputs – training an RNN – Long Short Term Memory – RNN structures – Deep RNN – Bidirectional RNN – Deep Bidirectional RNN. Autoencoders: introduction – the simplest autoencoder – convolutional autoencoders – de-noising – variational autoencoders.							CO2, CO3, CO4										
UNIT-IV	Reinforcement Learning (RL)				Periods: 9												
Introduction - Structure of RL - Immediate rewards – delayed rewards – Exploration – Exploitation – Markov Decision Process – Model based / free learning – Q learning; structure of RL – flippers – Lousy learning – Quality learning – SARSA – applications; Generative Adversarial Networks (GAN): Metaphor – Implementing GANs – Deep Convolutional GANs.							CO2, CO3, CO4										
UNIT-V	Recent trends in Deep learning				Periods: 9												
Review of NLP models – Vision Transformers – Self-Supervised Learning - Large Language Models – Gen AI – Explainable AI - Applications: ChatGPT – Meta AI – Copilot – Deepseek - Speech recognition - Visual object recognition – Face detection – Pedestrian detection – Drug detection – Deep genomics – Handwritten Digit Recognition – Object Recognition in Photographs – Predict sentiment from movie reviews – Sequence classification of movie reviews – Text generation.							CO5										
Lecture Periods: 45		Tutorial Periods: -		Practical Periods: -		Total Periods: 45											
Reference Books:																	
<ol style="list-style-type: none"> 1. Jeeva Jose, Introduction to Machine Learning, Khanna Book Publishing Company, 2020. 2. Aston Zhang, Zachary C. Lipton, Mu Li and Alexander J. Smola, Dive into Deep Learning, Open Source Book, 2020. 3. Vivienne Sze, Yu-Hsin Chen, Tien-Ju Yang and Joel S. Emer, “Efficient Processing of Deep Neural Networks”, Morgan and Claypool, California, 2020. 4. Francois Chollet, Deep Learning with Python, 2nd edition, Manning Publications, Shelter Island, 2021. 5. Andrew Glassner, Deep Learning: From Basics to Practice, Volume 2, The Imaginary Institute, Seattle, WA, 2018. 6. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2017. 7. Richard Sutton and Andrew Barto, Reinforcement Learning: An Introduction, 2nd edition, MIT Press, 2015. 																	

CO-PO / PSO MAPPING

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	2	-	-	-	-	-	-	-	-	2	1
CO2	2	1	2	-	-	-	-	-	-	-	-	2	1
CO3	2	2	2	-	-	-	-	-	-	-	-	2	1
CO4	2	2	2	2	2	-	-	-	-	-	2	2	2
CO5	2	2	2	2	2	-	-	-	-	-	2	2	2

Score: 3 – High; 2 – Medium; 1 – Low

Department : IT		Programme: B. Tech.						
Semester	: VII	Course Category Code: PCC				Semester Exam Type: TY		
Course Code	Course Name	Periods / Week		Credit	Maximum Marks			
		L	T	P	C	CA	SE	TM
ITUC131	Automata and Compiler Design	3		2	4	40	60	100
Prerequisite								
Course Outcome	CO1	Employ finite state machines and Turing Machines to solve problems in computing and classify machines by their power to recognize languages.						
	CO2	Construct parse trees and Push down automata for CFG and able to minimize and find equivalence of automata						
	CO3	Ability to implement semantic rules into a parser that performs attribution while parsing and apply error detection and correction methods.						
	CO4	Apply the code optimization techniques to improve the space and time complexity of programs while programming						
	CO5	Ability to design a compiler for a concise programming language.						
UNIT-I	Introduction to Automata	Periods: 9						
Introduction to Finite Automata- Deterministic and Non-Deterministic Finite Automata, Finite Automata with ϵ -moves – two-way finite automata, minimization of finite automata, Finite automata and regular expressions, Arden's theorem, construction of Finite automata equivalent to regular expression, Equivalence of two finite automata, Pumping lemma for regular languages, Applications of pumping lemma, Closure properties of Regular Languages.							CO1	
UNIT-II	Context Free Grammars	Periods: 9						
Context free grammars and languages, Derivation trees, Leftmost and rightmost derivation of strings and Sentential forms, Ambiguity, left recursion and left factoring in context free grammars, Minimization of context free grammars, Normal forms for context free grammars, Chomsky normal form, Greibach normal form, Pumping Lemma for Context free Languages, Closure and decision properties of context free languages.							CO2	
UNIT-III	Pushdown Automata & Turing Machine	Periods: 9						
Pushdown Automata: Introduction to Pushdown automata, Acceptance of context free languages, Acceptance by final state and acceptance by empty state and its equivalence, Equivalence of context free grammars and pushdown automata. Turing Machine: Introduction to Turing Machine, Design of Turing machines, Types of Turingmachines							CO1, CO2	
UNIT-IV	Introduction To Compiler	Periods: 9						
Overview of Compilers- Phases of a Compiler. Lexical Analysis: The Role of Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens, A language for specifying Lexical Analyzers(LEX).Syntax Analysis: The role of the Parser, First and Follow, Predictive Parsing, LR Parsers-SLR, Canonical LR, LALR, Parser Generator(YACC).							CO3, CO5	
UNIT-V	Syntax-Directed Translation& Intermediate Code Generation	Periods: 9						
Syntax-Directed Translation: Syntax-Directed Definition, S-Attributed SDD, L-Attributed SDD, Translation Schemes.Intermediate Code Generation: Intermediate Languages- Graphical Representations, Three address code, Implementations							CO4, CO5	
Lab Exercises:							Periods: 30	
<ol style="list-style-type: none"> 1. Write a C Program to Scan and Count the number of characters, words, and lines in a file. 2. Write a C Program to implement NFAs that recognize identifiers, constants, and operators of the mini language 								

3. Design a lexical analyzer for the given language. The lexical analyzer should ignore redundant spaces, tabs and new lines, comments etc.	CO3, CO4, CO5
4. Implement the lexical analyzer using JLex, flex or other lexical analyzer generating tools.	
5. Implementation of SLR Parser	
6. Design Predictive Parser for the given language	
7. Implementation of Recursive Descent Parser	
Lecture Periods: 45	Tutorial Periods:
Practical Periods: 30	Total Periods: 75
Reference Books:	
1. ArunAnoop M , "Automata Theory and Computability", Shanlax Publications, Edition: I, 2024	
2. Peter Linz, " An introduction to Formal Languages and Automata", 6th Edition, Jones &Bartlett, 2016	
3. V.Raghavan, "Principles of Compiler Design",1stEdition,McGrawHillEducation,2017	
4. Hopcroft H.E. and Ullman J.D, ".Introduction to Automata Theory Languages and Computation", , Pearson Education, 2009.	
5. A.V Aho and J D Ullman, "Principles of Compiler Design", Pearson Education.2002	

CO-PO/PSO MAPPING

CO/ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2
CO1	3	2	3	3	3						2	3	2
CO2	3	2	3	3	3						2	3	3
CO3	2	3	3	3	3						2	3	3
CO4	3	2	3	3	3						2	2	2
CO5	2	2	3	3	3						2	2	2

Score: 3 – High; 2 – Medium; 1 – Low

Department : IT		Programme: B.Tech.						
Semester : VII		Course Category Code: PCC					Semester Exam Type: -	
Course Code	Course Name		Periods / Week			Credit	Maximum Marks	
	L	T	P	C	CA	SE	TM	
ITUC132	Mini Project				4	2	100	100
Prerequisite:								
Course Outcome: At the end of the course the student will be able to	CO1	Carry out literature survey, understand state of art techniques.						
	CO2	Identify and apply appropriate tools to solve a problem.						
	CO3	Transform knowledge into an algorithmic/experimental process.						
	CO4	Prepare and present reports on the project work.						
The objective of this course is to enable the students to carry out the mini-project in a group. The topic shall be chosen in consultation with the Faculty coordinators. Each group of students is expected to make a detailed review of the literature, formulate the problem, carry out the mini project and prepare a report on the work done. The mini project can be a small project work or it can be a part of the work planned for the main project. The students should present the results of the work in the review committee meetings. A departmental committee shall evaluate the performance of the students.								CO1, CO2, CO3, CO4

CO-PO/PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	1	1	2	2	3	3	3	3	3	2
CO2	3	2	1	1	1	2	2	3	3	3	3	3	2
CO3	3	2	1	1	1	2	2	3	3	3	3	3	2
CO4	3	2	1	1	1	2	2	3	3	3	3	3	2
CO5	3	2	1	1	1	2	2	3	3	3	3	3	2

Score: 3 – High; 2 – Medium; 1 – Low

Department :IT		Programme: B.Tech.																					
Semester : VII		Course Category Code: PCC							Semester Exam Type: LB														
Course Code	Course Name	Periods / Week				Credit		Maximum Marks 100															
		L	T	P		C		CA	SE		TM												
ITUC133	Full Stack Web Development Lab				4	2		40	60		100												
Prerequisite:																							
Course Outcome	CO1	Design flexible and responsive Web applications using Node JS, React, Express and Angular.																					
	CO2	Perform CRUD operations with MongoDB on huge amount of data.																					
	CO3	Develop real time applications using react components.																					
	CO4	Use various full stack modules to handle http requests and responses.																					
Design Full stack responsive Web applications using Node JS, React, Express and Angular with MongoDB in the back end for any of the following domains.																							
<ul style="list-style-type: none"> i. Personal Profile ii. Food Delivery iii. E-commerce Website iv. Inventory management system v. Microblogging platform, similar to Twitter, where users can post content that is visible to their followers. vi. Dashboard for Project management vii. Online survey and report generation viii. 																							
Lecture Periods:		Tutorial Periods: -		Practical Periods:60			Total Periods: 60																
Reference Books:																							
<ol style="list-style-type: none"> 1. Vasan Subramanian, 'Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React', and Node, 2nd Edition, A Press,2019. 2. Brad Dayley, Brendan Dayley, Caleb Dayley., 'Node.js, MongoDB and Angular Web Development', 2nd Edition, Addison-Wesley, 2019. 3. Mark Tielens Thomas, 'React in Action', 1st Edition, Manning Publications.2018. 																							

CO-PO/PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2	-	3	-	-	-	-	-	-	2	2
CO2	2	2	3	-	3	-	-	-	-	-	-	2	2
CO3	2	3	3	-	3	-	-	-	-	-	-	2	2
CO4	2	3	3	-	3	-	-	-	-	-	-	2	2

Score: 3 – High; 2 – Medium; 1 – Low

Department : Information Technology				Programme: B. Tech.						
Semester : VII				SubjectCategory: PCC				SemesterExamType:-		
Course Code	Course Name			Periods / Week		Credit	Maximum Marks			
				L	T	P	C	CA	SE	TM
ITUC134	Comprehensive Viva		-	-	-	-	1	100	-	100
Prerequisite	-									
Course Outcome	CO1	Recall and Refresh fundamental concepts learnt in different subjects.								
	CO2	To get familiar with the placement tests conducted for the campus recruitment								
	CO3	To Enhance interview facing skills.								
	CO4	To become competent in competitive examinations.								
Comprehensive viva is an oral examination conducted to evaluate the critical thinking, analytical abilities, and how well a student can discuss and apply concepts learned throughout their studies. A committee comprising of five faculty members will conduct the comprehensive viva examination and evaluate the students. Experts from the industry may also be included in this committee. The Head of the Department shall constitute this committee										CO1, CO2, CO3, CO4
Lecture Periods: -		Tutorial Periods: -		Practical Periods: 45			Total Periods: 45			

CO-PO/PSO MAPPING

CO/PO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2
CO1	2	2	3	2								2	
CO2	2	2										2	
CO3	2											2	2
CO4	3	2										2	3

Score: 3 – High; 2 – Medium; 1 – Low

Department: IT		Programme:B.Tech.																			
Semester	:VIII	SubjectCategory: PCC							SemesterExamType: PR												
Course Code	Course Name		Hours /Week				Credit		MaximumMarks												
ITUC135	Project Work		L	T	P		C		CA	SE	TM										
Prerequisite																					
Course Outcome	CO1	Identify and formulate an IT related solutions for an engineering problem																			
	CO2	Analyze and review research literature related to the problem																			
	CO3	Apply mathematical knowledge for design a solution for the problem																			
	CO4	Implement IT enabled solutions																			
	CO5	Communicate, demonstrate and document the work as a member and leader in a team																			
The project group is required to do the following																					
<ul style="list-style-type: none"> • Literature Survey, • Problem formulation • Forming a methodology of arriving at the solution of the problem. • Documentation of each step • Master a programming language or software tool used for implementation • Test the project and compare it with benchmark standards • Prepare Project Report • Develop Presentation skills • Develop ability to work in a Group 																					
Rigorous review by the committee will be carried out in the process to ascertain whether the work qualifies as a suitable project at the graduate level. Each team is expected to present their work at national/International conferences or at the students' technical symposiums. Team that has come out with novel contribution will be encouraged to publish their work in any referred journals.																					
Lecture Periods:-			Tutorial Periods:-			PracticalPeriods:230			TotalPeriods:230												

CO-PO/PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	1	1	2	2	3	3	3	3	3	2
CO2	3	2	1	1	1	2	2	3	3	3	3	3	2
CO3	3	2	1	1	1	2	2	3	3	3	3	3	2
CO4	3	2	1	1	1	2	2	3	3	3	3	3	2
CO5	3	2	1	1	1	2	2	3	3	3	3	3	2

Score: 3 – High; 2 – Medium; 1 – Low

PROFESSIONAL ELECTIVE COURSES

Department:IT		Programme: B.Tech								
Semester :V		CourseCategoryCode:PEC				SemesterExamType: TY				
CourseCode	CourseName	Periods/Week			Credit		MaximumMarks			
		L	T	P	C	CA	SE	TM		
ITUE101	Internet of Things	3	1	-	4	40	60	100		
Prerequisite: Computer Networks										
Course Outcome	CO1	Describe the IoT architecture, infrastructure and constraints of Internet of Things								
	CO2	Explore the design methodologies for various IoT applications								
	CO3	Apply the IoT protocols for local and global connectivity								
	CO4	Explore the principles of data analytics and cloud in the context of IoT								
	CO5	Design and develop simple IoT Systems using Arduino and Raspberry Pi.								
UNIT-I	Introduction to Internet of Things				Periods:12					
Introduction to Internet of Things: Definition and Characteristics of IoT, Physical Design of IoT –Logical design of IoT - IoT enabling Technologies – IoT Levels and Deployment Templates. Domain Specific IoTs: Home Automation – Cities.-IoT& M2M: M2M – Difference between M2M &IoT – Software defined networks & Network function virtualization for IoT -							CO1			
UNIT-II	IoT system Management and IoT platforms Design Methodology				Periods:12					
IoT System Management with NETCONF-YANG – SNMP – Network Operator Requirements – IoT Systems Management with NETCONFIG-YANG - IoT design Methodology – IoT physical Devices &Endpoints: Introduction to Arduino and Raspberry Pi – Installation, Interfaces (serial, SPI, I2C)-Raspberry Pi Interfaces – Programming Raspberry Pi with python – Other IoT devices.							CO2,C05			
UNIT-III	IoT Network and Application Layer Protocols				Periods:12					
IoT Access Technologies: IEEE 802.15.4. IP as IoT network layer – Adoption or adaption of IP – Need for optimization – Optimizing IP for IoT. IoT Application Transport Methods: Non-Application Layer – SCADA — Web Based Protocols – IoT Application Layer Protocols: CoAP and MQTT.							C01,C03			
UNIT-IV	IoT Physical Servers & Cloud offerings				Periods:12					
Introduction to Cloud storage models and Communication APIs – WAMP – AutoBahn for IoT – Xively cloud for IoT – Python web application Framework – Django – Designing a RESTful Web API – Amazon Web services for IoT – Skynet IoT Messaging Platform, Case Studies illustrating IoT Design: Home Automation – Agriculture.							CO4,C05			
UNIT-V	Data Analytics for IoT				Periods: 12					
Data Analytics for IoT - Apache Hadoop – Using Hadoop MapReduce for Batch Data analysis – Apache Oozie – Apache Spark – Apache Storm – Using Apache Storm for Real-time Data Analysis							CO4			
Lecture Periods: 45		Tutorial Periods:15		Practical Periods: -		TotalPeriods:60				
ReferenceBooks:										

1. Arshdeep Bahga and Vijay Madisetti, "Internet of Things – A Hands-on Approach", 1st Edition, University Press, 2015.
2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things", Cisco Press, 2017.
3. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", 1st Edition, CRC Press, 2012.
4. Madhusanka Liyanage, An Braeken, Pradeep Kumar, Mika Ylianttila, "IoT Security: Advances in Authentication", Wiley Publications, 2020.

CO-PO/PSO MAPPING

CO/PO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2
CO1	2	2	2								1	1	
CO2	2	2	3	2	3						1	1	3
CO3	2	3	2	2							2	1	3
CO4	2	2	2	2	3						2	3	3
CO5	2	2	3	2	3						2	3	3

Score: 3 – High; 2 – Medium; 1 – Low

Department:IT		Programme: B.Tech											
Semester :V		CourseCategoryCode:PEC			SemesterExamType: TY								
CourseCode	CourseName	Periods/Week			Credit	MaximumMarks							
		L	T	P	C	CA	TM						
ITUE102	Object Oriented Analysis and Design	3	1	-	4	40	100						
Prerequisite:	ITUC104 – Object oriented programming using C++ and Java												
Course Outcome	CO1	Learn the processes in object oriented system development and its life cycle											
	CO2	Use various modelling techniques to do Object oriented analysis for applications											
	CO3	Employ object oriented design approach for applications											
	CO4	Develop Object oriented systems using UML for the given requirements											
UNIT-I	Introduction to Unified Approach				Periods:12								
Overview of Object Oriented System Development: Introduction – Object Oriented System Development Methodology – Overview of Unified Approach – Object Basics – Systems Development Life Cycle-Unified Approach.						CO1							
UNIT-II	OMT and Booch Methodology				Periods:12								
Methodology and Modelling: Introduction –Rumbaugh et al.'s Object Modelling Technique - Booch Methodology – Jacobson et al. Methodologies – Patterns –Framework – Unified approach – Unified Modelling Language.						CO1	CO2						
UNIT-III	Object Oriented Analysis				Periods:12								
Object Oriented analysis: Use Case Driven Object Oriented Analysis Object Oriented Analysis: Classification Noun Phrase Approach – Common Class Patterns Approach – Object Relationship analysis.						CO1	CO2						
UNIT-IV	Object Oriented Design				Periods:12								
Object Oriented Design: Object Oriented Design Process – Object Oriented Design Axioms – Corollaries – Designing Classes: Defining Attributes and methods –Object Store and Access layer – Designing the View Layer Classes.						CO1	CO3						
UNIT-V	Applications				Periods:12								
Applications: Data Acquisition: Weather Monitoring Station – Frameworks: Foundation Class library – Client/Server Computing: Inventory Tracking.						CO1, CO2	CO3, CO4						
Lecture Periods: 45		Tutorial Periods:-15		Practical Periods:-		Total Periods: 60							
Reference Books:													
<ol style="list-style-type: none"> 1. Brahma Dathan and Sarnath Ramnath, Object-Oriented Analysis, Design and Implementation: An Integrated Approach, Universities Press, Third edition, 2024 2. A. Mummoorthy, A. Saraswathi, D. Rajagopal and E. Pavithra, Object oriented analysis and design, Notion press, 2021 3. Ali Bahrami, "Object oriented systems development using the unified modelling language", Tata McGraw Hill, 1st Edition 2008. 4. Grady Booch, "Object Oriented Analysis and Design with Applications", Pearson Education, Inc, Second Edition, 2008. 5. John Deacon, "Object Oriented Analysis and Design", Addison Wesley, 1st Edition, 2005. 6. Pinson L. and Wiener R., "Application of Object Oriented Programming", Addison Wesley Publishing Company, 1990. 7. Taylor D., "Object Oriented Information Systems", John Wiley and Sons, 1992. 													

CO-PO / PSO MAPPING

CO / PO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2
CO1	3	1		1								2	1
CO2	3	3	1	1							1	2	1
CO3	3	1	2	2							1	2	1
CO4	3		1	2							1	2	1

Score: 3 – High; 2 – Medium; 1 – Low

Department: IT		Programme: B.Tech												
Semester : V		CourseCategoryCode: PEC				SemesterExamType: TY								
Course Code	Course Name	Periods/Week			Credit		MaximumMarks							
		L	T	P	C	CA	SE	TM						
ITUE103	Business Intelligence	3	1	-	4	40	60	100						
Prerequisite:	-													
Course Outcome	CO1	Understand Business Intelligence Components												
	CO2	Recognize the importance of Data Integration												
	CO3	Model the data in different dimensions												
	CO4	Forecast trends of data												
	CO5	Provide insights from data												
UNIT-I	Business Intelligence and Its Components			Periods:12										
Introduction to OLTP and OLAP (MOLAP, ROLAP, HOLAP), Business Intelligence Definitions and Concepts, Business Intelligence Framework-Data Warehousing Concepts and Its Role in Business Intelligence; Business Intelligence Infrastructure Components - Business Intelligence Process, Business Intelligence Technology, Business Intelligence Roles and Responsibilities, Business Applications of Business Intelligence, Business Intelligence Best Practices								CO1						
UNIT-II	Basics of Data Integration (Extraction Transformation Loading)				Periods:12									
Concepts of Data Integration , Needs and Advantages of using Data Integration , Introduction to Common Data Integration Approaches ; Meta Data – Types and Sources , Introduction to Data Quality , Data Profiling Concepts and Applications, Introduction to ETL								CO2						
UNIT-III	Multi-Dimensional Data Modelling			Periods:12										
Data Modelling Basics-Types of Data Model-Data Modelling Techniques-Fact Table-Dimension Table-Dimensional Models-Dimensional Modelling Lifecycle and Design- Creating Cubes using Microsoft Excel. Introduction to Business Metrics -Fact-Based Decision Making and KPIs-KPIs Applications								CO1,CO3						
UNIT-IV	Prediction Models for Business Intelligence			Periods:12										
Simple Linear Regression Model – Least Squares Method – Multiple Regression Model – Multiple Regression using Excel – Time Series Analysis: Time Series Patterns – Forecast Accuracy – Moving averages and Exponential Smoothing – Regression Analysis for Forecasting: Linear Trend Projection – Seasonality – Seasonality without Trend – Seasonality with Trend.								CO2,CO4						
UNIT-V	Basics of Enterprise Reporting			Periods: 12										
A Typical Enterprise, Malcolm Bridge – Quality Performance Framework, Reporting Perspectives – Report Standardization and Best Practices - Balanced Scorecard, Enterprise Dashboard, Balanced Scorecard vs. Enterprise Dashboard- Funnel Analysis, Enterprise Reporting using MS Access / MS Excel								CO5						
LecturePeriods: 45		TutorialPeriods:15	PracticalPeriods:			TotalPeriods:60								
ReferenceBooks:														
<ol style="list-style-type: none"> 1. RN Prasad and Seema Acharya, "Fundamentals of Business Analytics", Wiley India, 2016. 2. The book "Essentials of Business Analytics," published by Cengage Learning in 2016, is authored by Jeffrey D. Camm, James J. Cochran, Michael J. Fry, Jeffrey W. Ohlmann, David R. Anderson, Dennis J. Sweeney, and Thomas A. Williams. 3. James R. Evans, "Business Analytics", 3rd edition, Pearson, 2019. 4. David Loshin , "Business Intelligence", Second Edition ,Elsevier Science and Technology,2012. 														

CO-PO/PSO MAPPING

CO/ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PS01	PS02
CO1	3	2	2	2	2							3	2
CO2	3	3	3	2								3	1
CO3	3	3	1	1	1							3	2
CO4	3	2	2									3	2
CO5	2				1							3	1

Score: 3 – High; 2 – Medium; 1 – Low

Department: IT		Programme:B.Tech															
Semester : V	CourseCategory Code:PEC SemesterExamType: TY																
Course Code	Course Name		Periods/Week		Credit	MaximumMarks											
			L	T	P	C	CA	SE									
ITUE104	Soft Computing		3	1		4	40	60									
Prerequisite	-																
Course Outcome	CO1	Identify and describe soft computing techniques and their roles in building intelligent machines.															
	CO2	Recognize the feasibility of applying a soft computing methodology for a particular problem															
	CO3	Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.															
	CO4	Apply genetic algorithms to optimization problems															
	CO5	Design neural networks for pattern classification and regression problems.															
UNIT-I	Fuzzy Computing				Periods:12												
Basic Concepts of Fuzzy Logic – Fuzzy Sets and Crisp Sets – Fuzzy Set Theory and Operations – Properties of Fuzzy Sets – Fuzzy and Crisp Relations – Fuzzy to Crisp Conversion – Membership Functions – Interference in Fuzzy Logic – Fuzzy If-Then Rules, Fuzzy-Implications and Fuzzy Algorithms – Fuzzifications and Defuzzifications – Fuzzy Controller – Industrial Applications.							CO1, CO3										
UNIT-II	Fundamentals of Neural Networks				Periods:12												
Neuron, Nerve Structure and Synapse – Artificial Neuron and its Model – Activation Functions – Neural Network Architecture: Single Layer and Multilayer Feed Forward Networks, Recurrent Networks – Various Learning Techniques: Perception and Convergence Rule, Auto-Associative and Hetero-Associative Memory.							CO2, CO5										
UNIT-III	Back Propagation Networks				Periods:12												
Back Propagation Networks Architecture: Perceptron Model, Solution, Single Layer Artificial Neural Network, Multilayer Perception Model – Back Propagation Learning Methods – Effect of Learning Rule Co-Efficient – Factors Affecting Back Propagation Training – Applications							CO2, CO5										
UNIT-IV	Competitive Neural Networks				Periods:12												
Kohonen's Self Organizing Map – SOM Architecture, learning procedure – Application; Learning Vector Quantization, Learning by LVQ – Adaptive Resonance Theory – Learning procedure – Applications							CO2, CO5										
UNIT-V	Genetic Algorithm				Periods:12												
Basic Concepts – Working Principle – Procedures of GA – Flow Chart of GA – Genetic Representation: (Encoding) Initialization and Selection – Genetic Operators: Mutation, Generational Cycle – Applications.							CO4										
LecturePeriods:45		TutorialPeriods:15		PracticalPeriods:-		TotalPeriods:60											
ReferenceBooks:																	
<ol style="list-style-type: none"> Samir Roy , "Introduction To Soft Computing: Neuro-Fuzzy And Genetic Algorithms", Pearson, 2022 SarojKaushik, SunitaTiwari , "Soft Computing- Fundamentals, Techniques and Applications", Wiley 1st Edition 2018 S. N. Sivanandam and S. N. Deepa, "Principles of Soft Computing",Wiley Publisher, 3rd edition, 2016. Timothy Ross, "Fuzzy Logic with Engineering Applications", Wiley Publications, 2016. Satish Kumar, Neural Networks: A Classroom Approach, McGraw Hill Education, 2nd edition, 2017 																	

CO-PO/PSO MAPPING

CO/PO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2
CO1	2	2	3	3	3						3	2	2
CO2	2	2	3	3	3						3	2	2
CO3	3	3	3	3	3						3	3	3
CO4	3	3	3	3	3						3	3	3
CO5	3	3	3	3	3						3	3	3

Score: 3 – High; 2 – Medium; 1 – Low

Department: IT		Programme: B.Tech							
Semester :V			Course Category Code: PEC			Semester ExamType: TY			
Course Code	Course Name		Periods/Week			Credit	Maximum Marks		
ITUE105	Wireless Networking and Mobile Communication		L	T	P	C	CA	SE	TM
Prerequisite:	ITUC11 Computer Networks								
Course Outcome	CO1	Learn new trends in mobile/wireless communications networks and multiple radio access techniques							
	CO2	Describe the functionality of Mobile IP and Transport Layer							
	CO3	Interpret and explain 5G architecture, its components and functional criteria.							
	CO4	Analyze various protocols of all layers for mobile and ad hoc wireless communication networks							
	CO5	Understand the major concepts involved in wireless wide-area networks and its architecture.							
UNIT-I	Introduction				Periods:12				
Wireless Comes of Age -The Global Cellular Network -The Mobile Device Revolution- Future Trends-The Trouble With Wireless. Wireless LAN Technology: IEEE 802 Architecture - IEEE 802.11 Architecture and Services- IEEE 802.11 Medium Access Control- IEEE 802.11 Physical Layer - Gigabit Wi-Fi - Other IEEE 802.11 Standards- IEEE 802.11 Wireless LAN Security.								CO1	
UNIT-II	Wireless Mobile Networks and Applications				Periods:12				
Cellular Wireless Networks: Principles of Cellular Networks- First-Generation Analog ` - Second-Generation TDMA - Second-Generation CDMA - Third-Generation Systems. Fourth Generation Systems and LTE- Advanced: Purpose, Motivation, and Approach to 4G - LTE Architecture. Long Range Communications: Satellite Parameters and Configurations - Satellite Capacity Allocation - Satellite Applications - Fixed Broadband Wireless Access - WiMAX/IEEE 802.16								CO1,C05	
UNIT-IV	5 G Networks				Periods:12				
Historical background-Rationale of 5G – 5G architecture:Introduction - NFV and SDN - Basics about RAN architecture- High-level requirements- Functional architecture and 5G flexibility Functional split criteria-alternatives-Functional optimization- Integration of LTE and new air interface- Enhanced Multi-RAT coordination features- Physical architecture and 5G deployment								C03	
UNIT-V	Mobile Network and Trasport Layer				Periods:12				
Mobile IP- Goals and requirements, Entities, IP packet delivery, Agent Discovery, Registration, Tunneling and Encapsulation, Optimizations, Reverse Tunneling, IP micro-mobility support- DHCP -Traditional TCP- Congestion Control, Slow start, Fast retransmit/fast recovery, Implications of mobility, Classical TCP- Indirect TCP, snooping TCP, Mobile TCP, Transmission/time out freezing and advancements								C02,C04	
UNIT-V	Mobile Ad hoc Networks				Periods: 12				
Bluetooth: User scenarios- Architecture-Radio layer- Baseband layer - Link manager protocol- L2CAP – Security- Profiles- IEEE 802.15– ZigBee. Routing protocols: Destination sequence distance vector- Dynamic source routing - Alternative metrics-Overview ad-hoc routing protocols.								CO4,C05	
Lecture Periods: 45		Tutorial Periods:15		Practical Periods: -		Total Periods:60			
ReferenceBooks:									

1. Cory Beard, William Stallings, "Wireless Communications Networks and Systems" Pearson Education, 2016
2. Schiller J., "Mobile Communication", 2nd Edition, Pearson Education, New Delhi, 2014
3. AfifOsseiran, Jose F. Monserrat, Patrick Marsch, "5G Mobile and Wireless Communications Technology", 1st Edition, Cambridge University Press, 2016
4. Raj Kamal, "Mobile Computing", 3rd edition, Oxford University PressInc. New Delhi, 2019.
5. Asoke K Talukder,HasanAhmed,Roopa R Yavagal, "Mobile Computing Technology, applications and Service Creation", 2nd Edition , McGraw Hill Education Private Ltd,2018.
6. William Stallings, "Wireless Communications and Networks" 2nd Edition, Pearson Education,2005

CO-PO/PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	-									3	2	
CO2	2	1										2	
CO3	2	-										2	2
CO4	2	2	2	2								3	2
CO5	2	2	2	2							2	3	2

Department: IT Semester : VI		Programme: B.Tech CourseCategoryCode: PEC SemesterExamType: TY													
ITUE106	Cloud Computing	Periods/Week			Credit		MaximumMarks 100								
		L	T	P	C	CA	SE	TM							
		3	1		4	40	60	100							
Prerequisite:	ITUC105-Operating systems, ITUC118- Web essentials ITUC11- computer networks														
Course Outcome	CO1	Understand the architecture and underlying principles of cloud computing.													
	CO2	Explain and apply need, types and tools of Virtualization for cloud.													
	CO3	Analyze Inter cloud resources management cloud storage services and their providers Assess security services and standards for cloud computing.													
	CO4	Analyze security, standards and applications of cloud technologies.													
	CO5	Create the various types of cloud services.													
UNIT-I	Introduction			Periods:12											
Introduction to Cloud Computing –Definition of Cloud –Evolution of Cloud Computing –Underlying Principles of Parallel and Distributed Computing –Cloud Characteristics –Elasticity in Cloud –On-demand Provisioning.					CO1										
UNIT-II	Cloud Enabling Technologies			Periods:12											
Service Oriented Architecture – RESTful Systems – Web Services – Publish- Subscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices – Virtualization Support and Disaster Recovery.					CO1,CO2										
UNIT-III	Cloud Architecture, Services and Storage			Periods:12											
Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds - IaaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3.					CO1, CO3										
UNIT-IV	Resource Management and Security in Cloud			Periods:12											
Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges – Software-as-a-Service – Security – Security Governance – Virtual Machine Security – IAM – Security Standards.					CO3, CO4, CO5										
UNIT-V	Cloud Technologies and Advancements			Periods:12											
Hadoop – MapReduce – Virtual Box -- Google App Engine – Programming Environment for Google App Engine – Open Stack – Federation in the Cloud – Four Levels of Federation – Federated Services and Applications – Future of Federation.					CO3, CO5										
Lecture Periods:45		Tutorial Periods:15		Practical Periods: -		Total Periods:60									
Reference Books:															
<ol style="list-style-type: none"> 1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012 2. Ritting house, John W., and James F. Ransome, "Cloud Computing: Implementation, Management and Security", CRC Press, 2017. 3. RajkumarBuyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering Cloud Computing", Tata McGraw Hill, 2013. 4. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing -A Practical Approach", Tata McGraw Hill, 2009. 5. Douglas Comer, "The Cloud Computing Book: The Future of Computing Explained", Chapman and Hall/CRC, 2023. 6. MehlMahrishi Kamal Kant Hiran, RuchiDoshi, Dr.FagbolaTemitayo, "Cloud Computing", BPB Publications, First Edition,2019. 															

CO-PO/PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2	----	3	-	-	-	-	-	3	3	-
CO2	2	3	3	2	3	-	-	-	-	-	3	3	-
CO3	2	3	3	2	3	-	-	-	-	-	3	3	-
CO4	2	3	3	2	3	-	-	-	-	-	3	3	-
CO5	2	3	3	3	3	-	-	-	-	-	3	3	-

Score: 3 – High; 2 – Medium; 1 – Low

Department: IT	Programme: B.Tech		
Semester :VI	CourseCategoryCode: PEC	SemesterExamType: TY	
Course Code	Course Name	Periods/Week	Credit
		L T P	C CA SE TM
ITUE107	DEVOPS	3 1 -	4 40 60 100
Prerequisite:			
Course Outcome	CO1	Understand different actions performed through Version control tools like Git	
	CO2	Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven &Gradle	
	CO3	Ability to Perform Automated Continuous Deployment	
	CO4	Ability to do configuration management using Ansible	
	CO5	Understand to leverage Cloud-based DevOps tools using Azure DevOps	
UNIT-I	Introduction to DevOps, SDLC, and Agile methodology	Periods: 12	
Definition of DevOps –The need for DevOps – Key concepts and principles of DevOps – Overview of SDLC – Phases of SDLC (Planning,Analysis,Design,Development,Testing,Deployment,Maintenance) – Overview of Agile methodology – Agile principles and values – Agile practices (Scrum, Kanban, Lean) – Role of DevOps in SDLC – Continuous Integration and Continuous Deployment (CI/CD) – Virtualization vs containerization-Overview of virtualization technologies (VMware,VirtualBox) - Setting up version control with Git and creating a simple Git repository.			CO1
UNIT-II	Compile and Build using Maven and Gradle	Periods:12	
Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases(compile build, test, package) Maven Profiles, Maven repositories(local, central, global),Maven plugins, Maven create and build Artificats, Dependency management, Installation of Gradle, Understand build using Gradle			CO1, CO5
UNIT-IV	Continuous Integration using Jenkins	Periods:12	
Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace			C03
UNIT-V	Configuration Management using Ansible	Periods:12	
Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in Ansible			C02, C04
UNIT-V	Building Devops Pipelines using Azure	Periods: 12	
Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure-pipelines.yaml file			CO4, CO5
Lecture Periods: 45	Tutorial Periods:15	Practical Periods: -	Total Periods:60
Reference Books:			

1. Roberto Vormittag, "A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises", Second Edition, Kindle Edition, 2016.
2. Jason Cannon, "Linux for Beginners: An Introduction to the Linux Operating System and Command Line", Kindle Edition, 2014
3. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans", First Edition, 2015.
4. David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps", Second Edition, 2016.
5. MariotTsitoara, "Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer", Second Edition, 2019
6. <https://www.jenkins.io/user-handbook.pdf>
7. <https://maven.apache.org/guides/getting-started/>

CO-PO/PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2									3	2	
CO2	3	2										2	
CO3	3	2										2	2
CO4	2	2	2	2								3	2
CO5	2	2	2	2							2	3	2

Department: IT		Programme: B.Tech													
Semester : VI	CourseCategoryCode: PEC				SemesterExamType: TY										
Course Code	Course Name	Periods/Week			Credit	MaximumMarks									
		L	T	P	C	CA	SE	TM							
ITUE108	IT Operations and Management	3	1	-	4	40	60	100							
Prerequisite:															
Course Outcome	CO1	Explain the essential roles of the system administrator in administrating IT Infrastructure													
	CO2	Use appropriate shell commands to manage users, files and devices in the Linux system													
	CO3	Make use of bash scripting to implement system administration tasks.													
	CO4	Configure and monitor various server roles such as DNS server, Web server and Mail server on windows server.													
	CO5	Implement group policy settings and manage resources using Active Directory in Windows Server													
UNIT-I	System Administration	Periods:12													
System Administration basics – Essential Duties and Roles of a system administrator – Datacenter – Overview – Data center Infrastructure Management					CO1										
UNIT-II	Linux Administration	Periods:12													
Linux Administration – Boot Process – System daemons: init and systemd – GRUB Configurations and Commands – Rootly powers – Access Control – File privileges – User Management – Process control – File System – Types, mounting, fsck, repair, User and group quotas - Network File system – Logs – Cron jobs - Linux Troubleshooting					CO1,C05										
UNIT-IV	Scripting for Administration	Periods:12													
Scripting for Administration – Bash scripting: Redirections and Pipelines - Arithmetic operations – functions – Command Line arguments – Control Flow – Loops.					C03										
UNIT-V	Windows Administration	Periods:12													
Windows Administration – Server Roles and Features - User accounts – Group Policy - Active directory- Network policies- Remote access- Managing File services					C02,C04										
UNIT-V	Server Administration	Periods: 12													
Server Configuration and Monitoring – Web Server – Mail Server – DNS server — Configuration and Management on Linux and Windows.Evolving arenas for System Admins – Devops – pipelining CI and CD, MLOps, Serverless Infrastructure.					CO4,CO5										
Lecture Periods: 45	Tutorial Periods:15	Practical Periods: -			Total Periods:60										
ReferenceBooks:															
<ol style="list-style-type: none"> 1. Evi Nemeth, Garth Snyder, Trent R. Hein, Ben whaley, Dan Mackin, Unix and Linux System Administration Handbook, Pearson Education, Fifth Edition, 2018. 2. Windows Server Management - https://learn.microsoft.com/en-us/windows-server/administration/manage-windows-server. 3. Linux commands and Bash Scripting - https://linuxhint.com/ 4. Windows Server Administration https://en.wikiversity.org/wiki/Windows_Server_Administration Course Contents and Lecture Schedule 															

CO-PO/PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2									3	2	
CO2	3	2										2	
CO3	3	-										2	2
CO4	2	2	2	2								3	2
CO5	2	2	2	2							2	3	2

Department: IT Semester : VI		Programme: B.Tech Course CategoryCode: PEC SemesterExamType: TY													
ITUE109	UI &UX Design		Periods/Week		Credit		MaximumMarks 100								
		L	T	P	C	CA	SE	TM							
		3		1	4	40	60	100							
Prerequisite:	ITUC118 -web essentials														
Course Outcome	CO1	Explain design thinking concept													
	CO2	Interpret user requirements													
	CO3	Select appropriate visual design for given problem													
	CO4	Create interactions using design tool.													
	CO5	Create innovative design prototype for given applications.													
UNIT-I	Design Thinking Fundamentals				Periods:12										
Introduction to Design thinking – Concept, Purpose, 5 stages of design thinking – Empathize, Define, Ideate, Prototype, Test . Introduction to User Interface / User Experience (UI/UX) – Definition of Design with respect to digital media, User Interface, User experience, Difference between UI and UX. History of UX. Need of UI and UX.								CO1, CO2							
UNIT-II	User Requirements and its Analysis				Periods:12										
Introduction to research and analysis tool (freeware) such as FigJam. User requirements – Definition, Types of user research - Qualitative research, Quantitative research. Tools to collect user requirements – personal observation, interviews, questionnaire, User/ Expert reviews. User requirement analysis - Understanding target audience and client requirements, Competitive analysis, Affinity mapping, Defining User Persona.								CO1,CO2, CO3							
UNIT-III	User Interface Design				Periods:12										
Storyboarding, User journey mapping - Gestalt principles of design - Aesthetics in UI design - Using Light, Colour and Contrast Effectively in UI Design: Introduction to any freeware design tool such as Figma: Visual Communication Design - effective visual communication for graphical user interface								CO3,CO4							
UNIT-IV	User Experience Design Tool				Periods:12										
Introduction to User Experience design -UX design open source tool such as - Figma features – Navigations, interactions, Buttons Creating Library Gamification, micro-animation Creating visual identity of the project – design system, design theme								CO3,CO4,CO5							
UNIT-V	Prototyping and Testing				Periods:12										
Introduction to Wireframing - Purpose of wireframing, Types – low fidelity, medium fidelity, high fidelity Basics of sketching, Creating low fidelity wireframes, medium fidelity and high fidelity in FigmaBasic considerations in wireframing – device, size, behavior, interaction- Elements used in wireframing – visual design, high fidelity elements - Prototyping and Testing.								CO3,CO4,CO5							
LecturePeriods:45	Tutorial Periods:15	Practical Periods: -			Total Periods:60										
ReferenceBooks:															
<ol style="list-style-type: none"> 1. Jesse James Garrett, " The Elements of User Experience: User-Centred Design for the Web and Beyond ", New Riders Publishing, 2022. 2. Falk Uebelnickel, Li Jiang, Walter Brenner, Britta Pukall, Therese Naef, "Design Thinking: The Handbook", World Scientific Publishing Co Pte Ltd, 2020. 3. Fabio Staiano, "Designing and Prototyping Interfaces with Figma", Packt Publishing Ltd, 2020. 4. Kilian Langenfeld, " Design Thinking for Beginners", Personal Growth Hackers, 2019. 															

CO-PO/PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3	3	2	3	-	-	-	-	-	1		3
CO2	2	3	3	2	3	-	-	-	-	-	1		3
CO3	2	3	3	2	3	-	-	-	-	-	1		3
CO4	2	3	3	2	3	-	-	-	-	-	1		3
CO5	2	3	3	3	3	-	-	-	-	-	1		3

Score: 3 – High; 2 – Medium; 1 – Low

Department: IT		Programme: B.Tech													
Semester : VI		Course Category Code: PEC													
Course Code	Course Name	Periods/Week			Credit		Maximum Marks								
		L	T	P	C		CA	SE	TM						
ITUE110	Privacy and Security in Online Social Media	3	1	-	4		40	60	100						
Prerequisite															
Course Outcome	On successful completion of this course, the students will be able to:														
	CO1	Understand the concept of online social networks.													
	CO2	Develop and manage trust related issues.													
	CO3	Analyze approaches to control information sharing in online social networks.													
	CO4	Apply knowledge of identity management.													
	CO5	Analyze various privacy issues associated with popular social media.													
UNIT-I	Introduction							Periods:12							
Introduction to Social Networks, From offline to Online Communities, Evolution of OSNs, Analysis and Properties, Security Issues, Trust Management, Controlled Information Sharing, Identity and Access Management, Data Collection from Social Media, Challenges, Opportunities, and Pitfalls in Online Social Networks, APIs.								CO1							
UNIT-II	Trust Management							Periods:12							
Trust and Policies, Trust and Reputation Systems, Trust in Online Social, Trust Properties, Trust Components, Social Trust and Capital, Trust Evaluation Models, Trust Credibility and Reputations in Social Systems; Online social media and Policing, Information Privacy Disclosure, Revelation and its Effects in OSM and OSNs; Phishing in OSM & Identifying Fraudulent Entities in OSNs.								CO2							
UNIT-III	Controlled Information Sharing							Periods:12							
Access Control Models, Access Control in Online Social Networks, Relationship-Based Access Control, Privacy Settings in Commercial Online Social Networks, Existing Access Control Approaches.								CO2,CO3							
UNIT-IV	Identity Management							Periods:12							
Identity Management, Digital Identity, Identity Management Models: From Identity 1.0 to Identity 2.0, Identity Management in Online Social Networks, Identity as Self-Presentation, Identity Thefts, Open Security Issues in Online Social Networks.								CO3,CO4							
UNIT-V	Case Study							Periods:12							
Privacy and Security Issues associated with Various Social Media such as Facebook, Instagram, Twitter, LinkedIn etc.								CO5							
Lecture Periods:45		Tutorial Periods:-15		Practical Periods:-		Total Periods:60									
Reference Books:															
1. Barbara Carminati, Elena Ferrari, Marco Viviani, "Security and Trust in Online Social Networks", Morgan & Claypool Publishers, Dec 2013.															
2. Simone Fischer-Hübner, FarzanehKaregar, "The Curious Case of Usable Privacy -Challenges, Solutions, and Prospects", Springer, 2024, ISBN 978-3-031-54158-2, https://doi.org/10.1007/978-3-031-54158-2 .															
3. YanivAltshuler, Yuval Elovici, Armin B. Cremers, NadavAharony, Alex Pentland, "Security and Privacy in Social Networks", Springer, 2013.															
4. Richard Chbeir, Bechara Al Bouna, "Security and Privacy Preserving in Social Networks", Lecture Notes in Social Networks, Springer, 2013.															
5. Michael Cross, "Social Media Security: Leveraging Social Networking While Mitigating Risk", SYNGRESS, Elsevier, 2014.															
6. https://link.springer.com/chapter/10.1007/978-3-031-61463-7_14?fromPaywallRec=true															
7. https://www.scribd.com/document/668768820/Privacy-And-Security-In-Online-Social-Media															
8. https://www.himt.ac.in/assets/pdf/syllabus/MCA%204th%20sem.pdf															

CO-PO/PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	0	2	-	2	2	3	2	-	-	2	2	2
CO2	2	2	2	-	3	2	3	2	-	-	2	2	2
CO3	2	3	2	-	2	2	3	2	-	-	2	3	3
CO4	2	2	2	-	3	2	3	2	-	-	3	2	2
CO5	3	3	3	-	3	3	3	3	-	-	3	3	3

Score: 3 – High; 2 – Medium; 1 – Low

Department: IT		Programme: B.Tech.										
Semester : VII		Course Category Code: PEC				Semester Exam Type: TY						
Course Code	Course Name	Periods/Week			Credit		Maximum Marks					
		L	T	P	C	CA	SE	TM				
ITUE111	Ethical Hacking	3	1	-	4	40	60	100				
Prerequisite: ITUC111-Computer Networks												
Course Outcome	CO1	Explain the terminologies associated with Penetration testing, vulnerability assessment and various information security standards										
	CO2	Use network scanning, enumeration and foot printing for gathering information about host, network and people related to an organization, search engines, web servers, DNS and social networking sites.										
	CO3	Provide security solutions for protection against evading of firewalls and Intrusion Detection Systems										
	CO4	Deploy measures for protecting computer systems against password cracking, key loggers, Spywares and Root kits										
	CO5	Use appropriate tools and techniques to identify various vulnerabilities in system, network, web server & websites and perform web application testing for prevention against OWASP application risks.										
UNIT-I	Introduction to Ethical Hacking and Information Security Laws & Standards				Periods:15							
Ethical Hacking Introduction: Scope and Limitations of Ethical Hacking, Types of Penetration, Phases of Penetration Testing, Security Testing Methodology, Comparing Security Audit, Vulnerability Assessment, and Penetration Testing, Case Studies							CO1 CO5					
Information Security Laws and Standards: Payment Card Industry Data Security Standard (PCI-DSS), ISO/IEC 27001:2013, Health Insurance Portability and Accountability Act (HIPAA), Sarbanes Oxley Act (SOX), The Digital Millennium Copyright Act (DMCA), Federal Information Security Management Act (FISMA)												
UNIT-II	Foot printing and Scanning Networks				Periods:10							
Foot printing: Foot printing through Search Engines and Web Services, Social Networking Sites, Website Footprinting, Email Footprinting, Network Footprinting, Foot printing through Social Engineering							CO1 CO2 CO5					
Scanning Networks: Check for live systems and live ports, Scanning beyond IDS, Banner Grabbing, Scan for vulnerability, Scanning Pen Testing												
UNIT-III	System Hacking				Periods:10							
Cracking Passwords, Types of Password Attacks, Sniffing and Spoofing, Escalating Privileges, Key loggers and Anti Key loggers, Spywares and Anti Spywares, Rootkits and Anti Rootkits							CO1 CO4 CO5					
UNIT-IV	Web Hacking				Periods:15							
Web Server Hacking, Web Server Attacks, Web Server Password Cracking, Web Server Penetration Testing, Injection Flaws, Broken Authentication, XML External Entity (XXE), Broken Access Control, Cross-Site Scripting (XSS) Attacks, Insecure Deserialization, Using components with known vulnerabilities, Insufficient Logging and Monitoring							CO1 CO5					
UNIT-V	IDS and Firewall Evasion Techniques				Periods: 10							
IDS Evasion Techniques: Insertion Attack, Evasion, Denial-of-Service Attack (DoS), Session Splicing, Unicode Evasion, Fragmentation Attack							CO1 CO3					
Firewall Evasion Techniques: IP Address Spoofing, Bypass a Firewall, Tunnelling Method, Protection against Firewall Evasion							CO5					
Lecture Periods: 45		Tutorial Periods:15		Practical Periods: -		Total Periods:60						
Reference Books:												

- | | |
|----|--|
| 1. | Robert S. Wilson, Michael T. Simpson, Nicholas Antill, Hands-On Ethical Hacking and Network Defence, Cengage Learning, Inc, 2022 |
| 2. | EC-Council iary morrison, Ethical hacking: A Comprehensive Beginner's to Learn and Master Ethical Hacking, Create Space Independent Publishing Platform 2018 |
| 3. | RafayBaloch, Ethical Hacking and Penetration Testing Guide , CRC Press, 2015 |
| 4. | Patrick Engebretson,The Basics of Hacking and Penetration Testing,Elsevier, 2013. |

CO-PO/PSO MAPPING

CO/PO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2
CO1	2	-	-	-	-	-	2	-	-	-	1	2	2
CO2	-	-	-	2	3	-	2	-	-	-	2	2	2
CO3	1	1	2	2	2	-	3	-	-	-	2	2	2
CO4	2	-	-	2	2	-	3	-	-	-	2	2	2
CO5	-	-	-	2	3	-	3	-	-	-	2	2	2

Score: 3 – High; 2 – Medium; 1 – Low

Department : IT		Programme : B.Tech							
Semester : VII		Subject Category: PEC				Semester Exam Type: TY			
Course Code	Course Name	Hours / Week			Credit	Maximum Marks			
		L	T	P	C	CA	SE	TM	
ITUE112	Generative AI	3	1		4	40	60	100	
Prerequisite:	ITUC126 – Artificial Intelligence and Machine Learning ITUC115- Python Programming								
Outcome:	CO1	Understand the fundamental principles, evolution, and scope of Generative AI							
	CO2	Apply LLMs and prompt engineering for text generation and intelligent assistance							
	CO3	Explore multimodal generation tools for images, video, and audio content							
	CO4	Integrate AI tools and APIs into automated workflows for real-world applications							
	CO5	Analyze ethical, societal, and legal challenges of generative systems							
UNIT-I	Introduction							Periods: 12	
Overview of Generative AI and traditional AI- History and evolution: Rule-based systems to generative models- High-level model categories: LLMs, diffusion models, audio generators Applications in engineering, media, healthcare, education, and business-Fundamentals of prompt engineering								CO1	
UNIT-II	Text Generation and Language Tools							Periods: 12	
Introduction to LLMs (GPT, Claude, Gemini, Mistral – conceptual only)- Transformer and Large Language Model (LLM) -Intermediate prompt engineering techniques: role-based, zero/few-shot Learning Applications: content generation, summarization, chatbot's, assistants- Tools: ChatGPT, Jasper, Notion AI, GrammarlyGO Hands-on: Build a chatbot using prompt flows								CO2, CO3	
UNIT-III	Image, Video & Audio Generation							Periods: 12	
Introduction to image generation tools: DALL-E, Mid journey, Generative Adversarial Networks (GAN) for image generation-Auto Encoders-Stable Diffusion- Text-to-video models: Runway ML, Sora -Music and audio generation: Eleven Labs, Suno, Music Gen- Prompt crafting for visual styles and control- Hands-on: Generate theme-based media content - Customizing LLM for own data								CO2, CO3	
UNIT-IV	APIs and AI Automation							Periods: 12	
Working with APIs: OpenAI, Hugging Face Inference API, Replicate- No-code/low-code platforms: Zapier, Canva AI, Microsoft Copilot- Use cases: content pipelines, document creation, coding assistants -GPTs and custom assistants: use, creation, deployment -Hands-on: Automate a multi-modal content workflow								CO3, CO4	
UNIT-V	Ethics, Bias and Future of Generative AI							Periods: 12	
Bias in training data and model behavior-Deep fakes, misinformation, and ethical use of generated content-Copyright, plagiarism, and AI content ownership-Emerging trends: open-source LLMs, multimodal AI, regulatory frameworks-Case study: Deep fake misuse & detection tools								CO4, CO5	
Total contact Hours: 45		Total Tutorials: 15			Total Practical Classes:-		Total Hours: 60		
Reference Books:									

1. Karthikeyan Sabesan, Sivagamisundari , Nilip Dutta, “ Generative AI for Everyone: Deep learning, NLP, and LLMs for creative and practical applications”, BPB Publications 2025
2. Altaf Rehmani, “Generative AI for everyone”, Bluerose Publishers Pvt. Ltd.2024
3. Martin Musiol, “Generative Ai: Navigating the Course to the Artificial General Intelligence Future”, John Wiley & Sons Inc; 1st edition 2024
4. Tanmoy Chakraborty, “Introduction to Large Language Models Generative AI for Text”, Wiley Publisher 2024
5. Yattish Ramhorry, “Building Intelligent Applications with Generative AI: Explore the potential of AI for next gen applications”, BPB Publications 2024
6. Hunaidkhan Pathan, Nayankumar Gajjar, “Mastering LLM Applications with LangChain and Hugging Face: Practical insights into LLM deployment and use cases” , BPB Publications 2024

CO-PO/PSO MAPPING

CO/PO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PS01	PS02
CO1	3	2	1	2	2						3	2	2
CO2	3	3	2	2	3						3	2	2
CO3	3	3	3	3	3						3	3	3
CO4	3	3	3	3	3						3	3	3
CO5	3	3	3	3	3						3	3	3

Department:IT		Programme:B.Tech.(IT)												
Semester : VII			CourseCategoryCode:PEC				SemesterExamType: TY							
CourseCode	CourseName	Periods/Week				Credit	MaximumMarks							
		L	T	P	C	CA	SE	TM						
ITUE113	Big Data Analytics	3	1		4	40	60	100						
Prerequisite	Database Management System													
Course Outcome	CO1	Understand the need for Big Data in Evolving Era												
	CO2	Analyse HDFS components with its Applications												
	CO3	Apply Hadoop Map reduce technique in real-time projects.												
	CO4	Design and implement real time dynamic Big Data Analytic Projects.												
	CO5	Implement with latest frame work tools for predictive and preventive measures.												
UNIT-I	Introduction To Big Data Architecture				Periods:12									
Introduction : Evolution of Big Data, definition of big data, Big Data and its Importance– Four V's of Big Data–Drivers for Big Data– Data Storage and Analysis - Characteristics of Big Data - Typical Analytical Architecture – Requirement for new analytical architecture – Challenges in Big Data Analytics – BigData Analytics Applications								CO1						
UNIT-II	Processing Big Data				Periods:12									
Coexistence of Big Data and Data Warehouse , Mapping Data to Programming Framework- Connecting and Extracting Data from Storage - Transforming Data for Processing - Subdividing Data in Preparation for Hadoop Map Reduce								CO1, CO2						
NoSQL: Types of No SQL Databases, advantages of NoSQL, SQL vs NoSQL														
UNIT-III	Hadoop Map Reduce				Periods:12									
Hadoop: Introduction to map reduce programming, mapper, reducer, Features of Hadoop, Creating Components of Hadoop Map Reduce Jobs–Executing Hadoop Map Reduce Jobs - Monitoring Progress of Job Flows –The Building Blocks of Hadoop Map Reduce- Hadoop1 vs Hadoop2- Key advantages of Hadoop.								CO2, CO3						
Map Reduce Programming: I/O formats, Map side join, Reduce Side Join, Secondary sorting, Pipelining Map Reduce jobs-Hadoop’s Parallel World														
UNIT-IV	Advanced Database for Big Data				Periods:12									
Installing and Running Pig–Comparison with Databases–Installing and Running Hive– Hive SQL – Tables – Querying Data –Oracle Big Data- Postgre SQL , Pig- Apache Cassandra, alongside cloud-based solutions like Amazon Redshift and Google Big Query								CO3, CO4						
Scripting language: Handling Big Data using Pig, Streaming- HIVE SQL														
UNIT-V	Big Data Case study with latest Tools				Periods:12									
Real-Time Sentiment Analysis for social media big data: Build a real-time sentiment analysis system to fetch tweets dynamically.								CO5						
Distributed Web Scraping with Python: Develop a distributed web scraping system that can scrape large amounts of data from multiple websites using Python and multiprocessing or asyncio for parallelism.														
Clustering Large Dataset using K-means and Python: Implement a clustering algorithm (like K-means , K-Median) to segment a large dataset into clusters with Scikit - Apache Cassandra - Amazon Redshift and Google BigQuery for any latest Domain														
Lecture Periods: 45	Tutorial Periods: 15	Practical Periods:-	Total Periods:60											
Reference Books														
1. Chandramouli Subramanian, Ash A George, C R Rene Robin, D Doreen Hephzibah Miriam, J Jasmine Christina Magdalene, “ Big Data Analytics” University Press Private Limited, 2024														
2. Arvind Sathi, “Big Data Analytics: Disruptive Technologies for Changing the Game”, IBM Corporation MC Press, Edition 2013ISBN: 978-1-58347-380-1														
3. Ms. Namrata Bhatt , Ms. Nikita Verma, Ms. Jagriti Singh Thakur& Ms. Garima Jain ,“BIG DATA ANALYTICS FOR BEGINNERS ”Chenour Publishing House, January 2024														
4. DeyNilanjan , “Big Data Analytics for Intelligent Healthcare Management (Advances in ubiquitous sensing														

applications for healthcare) ISBN 13: **9780128181461**, Academic Press . 2019

5. Mike Frampton, "Mastering Apache Spark", Packt Publishing, 2015.
6. TomWhite, "Hadoop:TheDefinitiveGuide",O'Reilly,4thEdition,2015.
7. Nick Pentreath, Machine Learning with Spark, PacktPublishing,2015.
8. Mohammed Guller, Big Data Analytics with Spark, Apress,2015
9. Donald Miner, Adam Shook, "Map Reduce Design Pattern", O'Reilly, 2012
10. <https://cloud.google.com/bigquery/docs/migration/redshift-overview>
11. <https://neontri.com/blog/apache-cassandra-use-cases>

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	3	1	3	3	0	1	0	1	2	2	2	2
CO2	3	3	2	3	3	0	2	3	3	3	3	3	3
CO3	3	3	3	3	3	2	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	2	3	3	3	3	3	3	3	3	3	3

Department : IT		Programme : B.Tech															
Semester : VII		Subject Category: PEC				SemesterExamType: TY											
Course Code	Course Name	Hours / Week			Credit	Maximum Marks											
		L	T	P	C	CA	SE	TM									
ITUE114	Cognitive Science	3	1		4	40	60	100									
Prerequisite:	ITUE104 -Soft Computing																
Outcome:	CO1	Understand the underlying theory behind cognition.															
	CO2	Connect to the cognition elements computationally															
	CO3	Develop a cognitive inference model.															
	CO4	Develop a cognitive learning model.															
	CO5	Explore the recent trends in cognitive computing.															
UNIT-I	Philosophy, Psychology and Neuroscience			Hours: 12													
Philosophy: Mental-physical Relation – From Materialism to Mental Science – Detour before the naturalistic turn – The Philosophy of Science – The Mind in Cognitive Science – Logic and the Sciences of the Mind – Psychology: Place of Psychology within Cognitive Science – Science of Information Processing – Neurosciences: Cognitive Neuroscience – Perception – Decision – Learning and Memory – Language Understanding and Processing.							CO1										
UNIT-II	Computational Intelligence			Hours: 12													
Machines and Cognition – Artificial Intelligence – Architectures of Cognition – Knowledge Based Systems – Logical Representation and Reasoning – Logical Decision Making – Decision making under Uncertainty – Learning – Language – Vision – Robotics							CO2, CO3										
UNIT-III	Probabilistic Programming Language			Hours: 12													
WebPPL Language – Syntax – Using JavaScript Libraries – Manipulating probability types and distributions – Finding Inference – Exploring random computation – Coroutines: Functions that receive continuations – Enumeration – Other basic computation.							CO2, CO3										
UNIT-IV	Implementing the Inference Models of Cognition			Hours: 12													
Generative Models – Conditioning – Causal and statistical dependence – Conditional dependence – Data Analysis – Algorithms for Inference							CO3, CO4										
UNIT-V	Implementing the Learning Models of Cognition			Hours: 12													
Learning as Conditional Inference – Learning with a Language of Thought – Hierarchical Models – Occam’s Razor – Learning (Deep) Continuous Functions – Mixture Models.							CO4, CO5										
Total contact Hours: 45		Total Tutorials: 15		Total Practical Classes:-		Total Hours: 60											
Reference Books:																	
<ol style="list-style-type: none"> 1. José Luis Bermúdez, "Cognitive Science: An Introduction to the Science of the Mind", Cambridge University Press, 2020 2. Robert A. Wilson, Frank C. Keil, "The MIT Encyclopedia of the Cognitive Sciences", The MIT Press, 1999. 3. Noah D. Goodman, Andreas Stuhlmuller, "The Design and Implementation of Probabilistic Programming Languages", Electronic version of book, https://dippl.org/. 4. Noah D. Goodman, Joshua B. Tenenbaum, The ProbMods Contributors, "Probabilistic Models of Cognition", Second Edition, 2016, https://probmods.org/. 																	

CO-PO/PSO MAPPING

CO/PO	PO1	PO 2	PO 3	PO4	PO 5	PO6	PO7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	2	1	2	2						3	2	2
CO2	3	3	2	2	3						3	2	2
CO3	3	3	3	3	3						3	3	3
CO4	3	3	3	3	3						3	3	3
CO5	3	3	3	3	3						3	3	3

Score: 3 – High; 2 – Medium; 1 – Low

Department:IT		Programme: B.Tech															
Semester :VII		CourseCategoryCode:PEC			SemesterExamType: TY												
Course Code	Course Name	Periods/Week			Credit		MaximumMarks										
		L	T	P	C	CA	SE	TM									
ITUE115	Block chain Technologies	3	1	-	4	40	60	100									
Prerequisite:	Data Structures, DAA, Computer Networks, DBMS																
Course Outcome	CO1	Understand the significance of blocks, proof-of-work, and consensus building in blockchain.															
	CO2	Demonstrate the functional/operational aspects of trading and mining using crypto currencies.															
	CO3	Apply smart contracts to code business logic in Solidity															
	CO4	Develop decentralized applications for web 3.0 using Ethereum block chain															
	CO5	Analyze the impact and challenges in Blockchain implementation in various domains like finance, Health care etc.															
UNIT-I	Introduction to Block chain and Cryptographic Primitives					Periods: 10											
Block chain Technology -Architecture, Transactions and Blocks,P2PSystems,Types of Block chain, Applications of Collison- resistant hash functions –SHA256,Digitalsignature - ECDSA, Public key cryptosystems for Authentication, zero-knowledge proof systems							CO1										
UNIT-II	Bitcoin Operation					Periods: 15											
Transactions in Bitcoin, Distributed Consensus atomic broadcast, Byzantine fault-tolerant consensus methods, Merkle Patricia Tree, Anonymity, Mining Mechanism – Proof of Work, Energy efficiency, Reward, Chain Policy, 51% Attack, Life of Blockchain application, Crypto currency as application of blockchain technology							CO1	CO2									
UNIT-III	Ethereum					Periods: 15											
Introduction to Ethereum, Consensus Mechanisms, Meta Mask Setup, Ethereum Accounts, Transactions, Receiving Ethers.Develop Smart Contracts using Solidity – Data types, looping and branching constructs, Function modifiers, Access Specifies, Inheritance and Polymorphism in smart contracts – Creating Crypto currencies and Non-Fungible Tokens							CO3	CO4									
UNIT-IV	Hyperledger					Periods: 10											
Permissioned and Private Block chains, Hyper ledger and its components Hyper ledger Fabric – Transactions life cycle, Deploying a chain code in test network							CO1										
UNIT-V	Blockchain–Use cases					Periods: 10											
Financial Services- KYC and Anti money Laundering, Trade finance, Cross-border Payments, Healthcare, Digital Rights Management, Identity Management, Tax Payment and Land Registry Records, Supply Chain							CO5										
LecturePeriods: 45		TutorialPeriods: 15		PracticalPeriods: -		TotalPeriods: 60											
ReferenceBooks:																	
<ol style="list-style-type: none"> 1. Imran Bashir, "Mastering Blockchain Inner Workings of Blockchain, from Cryptography and Decentralized Identities, to DeFi, NFTs and Web3", Fourth Edition, Packet Publishing, 2023 2. Lorne Lantz, Daniel Cawrey" Mastering Blockchain: Unlocking the Power of Crypto currencies, Smart Contracts, and Decentralized Applications", O'Reilly, 2020 3. Kumar Saurabh, Ashutosh Saxena, "Blockchain Technology Concepts and Applications", Wiley, 2020 4. Elad Elrom, "The Blockchain Developer: A Practical Guide for Designing, Implementing, Publishing, Testing, and 																	

Securing Distributed Blockchain-based Projects”, A press, 2019

5. Andreas Antonopoulos, “Mastering Bitcoin: Programming the open blockchain”, O'Reilly, Second Edition, 2021.
6. Melanie Swan, “Blockchain—Blueprint for New Economy”, O'Reilly, Second Edition, 2017
7. S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, “Blockchain Technology: Cryptocurrency and Applications”, Oxford University Press, 2019.

CO-PO/PSO MAPPING

CO/PO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2
CO1	3	1	-	-	-	-	1	-	-	-	-	2	2
CO2	2	-	-	2	2	-	1	-	-	-	-	2	2
CO3	3	-	-	-	-	-	2	-	-	-	-	2	2
CO4	2	3	3	3	2	-	2	-	-	-	-	2	2
CO5	2	3	1	1	2	-	2	-	-	-	-	2	2

Score: 3 – High; 2 – Medium; 1 – Low

HONORS COURSES

Department: IT		Programme: B.Tech								
Semester :IV		CourseCategoryCode:HNC				SemesterExamType: TY				
CourseCode	CourseName	Periods/Week			Credit		MaximumMarks			
		L	T	P	C	CA	SE	TM		
ITUH101	Foundations of Data Science	3	1	-	4	40	60	100		
Prerequisite:										
Course Outcome	CO1	Describe the need for data science and data preparation process								
	CO2	Develop Python programs for data preprocessing								
	CO3	Apply statistical techniques to analyze data and interpret various statistical inference								
	CO4	Demonstrate the techniques for handling large volume of data								
	CO5	Understand the data visualization techniques								
UNIT-I	Introduction To Data Science			Periods:12						
Introduction: Need for data science – Benefits and uses –Facets of data – Big data ecosystem – Data science process: Retrieving data – Cleansing, integrating, and transforming data – Data analysis – Build the models – Presenting findings and building application							C01			
UNIT-II	Data Preprocessing			Periods:12						
Introduction to Python; Fundamental Python Libraries for Data Scientists: Numpy – Scipy – Scikit Learn – Pandas – Matplotlib; IDE; Data manipulation: Reading and selection – Filtering missing data – Sorting – Grouping – Ranking and plotting; Data Manipulation with Pandas; Sample programs to pre-process and visualize data.							C02			
UNIT-III	Data Analysis			Periods:12						
Descriptive Statistics: Introduction – Data Preparation – Data summarization – Data distribution – Outlier Treatment – Measuring asymmetry – Continuous Distribution; Estimation: Mean – Variance – Sampling – Covariance – Correlation. Statstical Inference: Introduction – Frequentist Approach – Measuring the Variability in Estimates: Point estimates – Confidence intervals; Hypothesis Testing: Using confidence intervals – Using p-values.							C01,C03			
UNIT-IV	Handling Large data			Periods:12						
Handling large data on a single computer: General techniques for handling large volume of data, General programming tips for dealing with large data sets, Case study: Predicting malicious URLs, Building a recommender system inside a database.							C01, C04			
UNIT-V	Graph database and Data visualization			Periods: 12						
Introducing connected data and graph databases- Introducing Neo4j: a graph database - Connected data example: a recipe recommendation engine. Data visualization to the end user: Data visualization options- Crossfilter, the JavaScript MapReduce library- Creating an interactive dashboard with dc.js - Dashboard development tools.							C05			
LecturePeriods: 45		TutorialPeriods:15		PracticalPeriods: -		TotalPeriods:60				
ReferenceBooks:										

1. Davy Cielen, Arno D B Meysman, Mohamed Ali, "Introducing Data Science – Big data, Machine Learning, and more using Python tools", Manning Publications Co, 2016.
2. Laura Igual, Santi Segua, "Introduction to Data Science – A Python Approach to Concepts, Techniques and Applications", Springer Nature, 2017
3. Rachel Schutt, Cathy O'Neil, "Doing Data Science", O'Reilly Media, 2016
4. Dr. B. Srikanth, Dr.Swarajya Lakshmi V, Dr.Papineni Syed Khasim, "Fundamentals of Data Science" , Walnut Publications, 2022.

CO-PO/PSO MAPPING

CO/PO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PS01	PS02
CO1	2	2	2								3	3	
CO2	2	2	2									3	2
CO3	2		2									2	1
CO4	2	2	2	2								2	2
CO5	2	2	3	2							2	3	2

Score: 3 – High; 2 – Medium; 1 – Low

Department:IT		Programme: B.Tech							
Semester : V		CourseCategoryCode:HNC				SemesterExamType: TY			
ITUH102	Data Engineering Principles	Periods/Week			Credit		MaximumMarks 100		
		L	T	P	C	CA	SE	TM	
		3	1		4	40	60	100	
Prerequisite:	ITUC104 -Object Oriented Programming using C++and Java								
CourseOutcome	CO1	Describe a concise overview of the entire data engineering landscape							
	CO2	Apply the data engineering lifecycle to design and build a robust architecture							
	CO3	Assess data engineering problems using an end-to-end framework of best practices							
	CO4	Illustrate Cut through marketing hype when choosing data technologies, architecture and processes							
	CO5	Incorporate data governance and security across the data engineering lifecycle							
UNIT-I	Data Engineering Building Blocks				Periods:12				CO1,CO2
Data Engineering Described: Data Engineering Defined - The Data Engineering Lifecycle-Evolution of the Data Engineer -Data Engineering and Data Science. Data Engineering Skills andActivities: Data Maturity and the Data Engineer -The Background and Skills of a Data Engineer -Business Responsibilities - Technical Responsibilities- The Continuum of Data Engineering Roles,from A to B Data Engineering Lifecycle : Data Engineering Lifecycle - The Data Lifecycle Versus the Data Engineering Lifecycle : Generation: Source Systems - Storage - Ingestion – Transformation- Serving Data -Data Management - DataOps - Data Architecture - Orchestration – SoftwareEngineering.									
UNIT-II	Designing Good Data Architecture				Periods:12				CO2,CO3
Enterprise Architecture Defined -Data Architecture Defined - Principles of Good Data Architecture:Choose Common Components Wisely Plan for Failure - Architect for Scalability - Architecture IsLeadership: Build Loosely Coupled Systems - Make Reversible Decisions - Prioritize Security -Embrace FinOps - Major Architecture Concepts : Domains and Services - Distributed Systems,Scalability, and Designing for Failure - Tight Versus Loose Coupling: Tiers, Monoliths, and Microservices - User Access: Single Versus Multitenant - Event-Driven Architecture - Brownfield VersusGreenfield Projects :Examples and Types of Data Architecture - Data Warehouse - Data Lake -Lambda Architecture									
UNIT-III	Technologies Across the Data Engineering				Periods:12				CO3, CO4
Interoperability - Cost Optimization and Business Value: Total Cost of Ownership –TotalOpportunity Cost of Ownership - FinOps - Location: On Premises - Cloud - Hybrid Cloud -Multicloud -Decentralized: Blockchain and the Edge- Build Versus Buy: Open Source Software -Proprietary Walled Gardens. Monolith Versus Modular: Monolith - Modularity - The DistributedMonolith Pattern. Serverless Versus Servers: Serverless - Containers - Evaluate Server VersusServerless. Data Engineering Storage Abstractions : The Data Warehouse - The Data Lake –TheData Lakehouse - Data Platforms									
UNIT-IV	Queries, Modelling and Transformation				Periods:12				CO3, CO5
Queries - The Life of a Query - The Query Optimizer -Improving Query Performance - Queries onStreaming Data. Data Modeling : Data Model - Conceptual, Logical, and Physical Data Models -Normalization - Techniques for Modeling Batch Analytical Data - Modeling Streaming Data.Transformations :Batch Transformations - Materialized Views, Federation, and Query Virtualization -Streaming Transformations and Processing.									
UNIT-V	Security, Privacy, and the Future of Data Engineering				Periods:12				CO1,CO5
Security and Privacy : People - The Power of Negative Thinking - Always Be Paranoid Processes - Security Threat Versus Security Habit - Active Security - The Principle of Least Privilege – SharedResponsibility in the Cloud - Always Back Up Your Data. Security Policy - Technology - Patch andUpdate Systems - Encryption - Logging, Monitoring, and Alerting - Network Access - Security forLow-Level Data Engineering.									
Lecture Periods:45		Tutorial Periods:		Practical Periods:15		TotalPeriods:60			

Reference Books:

1. Reis, Joe, and Matt Housley. Fundamentals of Data Engineering: Plan and Build Robust DataSystems. O'Reilly Media, 2022.
2. Crickard, Paul, Data Engineering With Python: Work With Massive Datasets to Design DataModels and Automate Data Pipelines Using Python. Packt Publishing Ltd, 2020.
3. Haines, Scott. Modern Data Engineering With Apache Spark: A Hands-On Guide for BuildingMission-Critical Streaming Applications. Apress, 2022.

CO-PO/PSO MAPPING

CO/PO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PS01	PS02
CO1	3	1	-	-	-	-	-	-	-	-	-	3	-
CO2	2	-	-	2	2	-	-	-	-	-	-	3	-
CO3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO4	2	3	3	3	2	-	-	-	-	-	-	3	-
CO5	2	3	1	1	2	-	-	-	-	-	-	3	-

Department: IT		Programme:B.Tech.																											
Semester :VI		CourseCategoryCode:HNC								SemesterExamType: TY																			
CourseCode	CourseName		Periods/Week				Credit			MaximumMarks																			
			L	T	P	C				CA	SE		TM																
ITUH103	Multi-Biometrics		3	1	-	4				40	60		100																
Prerequisite:	Information Security																												
CourseOutcome	CO1	Learn the basics of biometric traits - understand																											
	CO2	Understand the structure and representation of biometric traits feature																											
	CO3	Analyse various components of biometric/multi-biometric systems																											
	CO4	Analyse various fusion methods for multi-biometrics																											
	CO5	Apply the multi-biometric traits in various real-time applications																											
UNIT-I	Introduction								Periods: 12																				
Introduction to Biometrics: Operation of a Biometric System – verification vs. identification – performance of a biometric system – biometrics characteristics –biometrics traits - application of biometrics.										CO1																			
UNIT-II	Physiological traits								Periods: 12																				
Fingerprint – Face – Iris – Hand geometry – Ear – palm print – knuckle print – Hand vascular – DNA traits – sensor models of every trait – feature extraction techniques – matching – performance evaluation – test databases – applications.										CO2, CO3																			
UNIT-III	Behavioural and Soft traits								Periods: 12																				
Key stroke – Signature – Voice – Gait – Driving Style – ECG – EEG - sensor models of every trait – feature extraction techniques – matching – performance evaluation – test databases – applications.										CO2, CO3																			
UNIT-IV	Multi-biometrics								Periods: 12																				
Limitations of Biometric System - Multi-biometrics System Design - Level of Fusion: Sensor Level - Feature Level - Rank Level - Decision Level.										CO3, CO4																			
UNIT-V	Applications								Periods: 12																				
National ID Card (UID), Voter Registration, Welfare Disbursement, Border Crossing. Forensic: Corpse Identification, Criminal Investigation, Parenthood Determination. Commercial: ATM, Access Control, CO5 Mobile Phone, Banking, E-Commerce, Smart Card.										CO5																			
LecturePeriods: 45		TutorialPeriods: 15		PracticalPeriods: -			TotalPeriods: 60																						
ReferenceBooks:																													
1. Loris Nanni, Sheryl Berlin Brahman, Biometric Systems, Sensors, 2021. 2. Arun A. Ross, KarthikNandakumar and Anil K. Jain, Introduction to Biometrics, Springer, 2014. 3. Arun A. Ross, KarthikNandakumar and Anil K. Jain, Handbook of Multibiometrics, Springer, 2011. 4. M.J. Burge and K.W. Bowyer, Handbook of Iris Recognition, Springer, 2013. 5. Anil K. Jain, Patrick Flynn and Arun A. Ross, Handbook of Biometrics, Springer, 2008. 6. Stan Z. Li and Anil K. Jain, Encyclopedia of Biometrics, Springer, 2009. 7. Ruud M. Bolle, SharathPankanti, Nalini K. Ratha, Andrew W. Senior and Jonathan H. Connell, Guide to Biometrics, Springer, 2009.																													

CO-PO/PSO MAPPING

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	2	-	-	-	-	-	-	-	-	2	1
CO2	2	1	2	-	-	-	-	-	-	-	-	2	1
CO3	2	2	2	-	-	-	-	-	-	-	-	2	1
CO4	2	2	2	2	2	-	-	-	-	-	2	2	2
CO5	2	2	2	2	2	-	-	-	-	-	2	2	2

Score: 3 – High; 2 – Medium; 1 – Low

Department: IT		Programme: B.Tech															
Semester :VII		CourseCategoryCode:HNC				SemesterExamType: TY											
CourseCode	CourseName	Periods/Week			Credit		MaximumMarks										
		L	T	P	C	CA	SE	TM									
ITUH104	Software Defined Networks	3	1		4	40	60	100									
Prerequisite: Computer Networks																	
Course Outcome	CO1	Identify the concepts of traditional networks and software defined networks															
	CO2	Explain the various components of SDN and their uses															
	CO3	Make use of SDN APIs and open-source tools															
	CO4	Utilize SDN in the data center															
	CO5	develop various applications of SDN															
UNIT-I	Introduction to SDN				Periods:12												
Basic packet switching terminology – The modern data center – Traditional switch architecture – Autonomous and dynamic forwarding table. Why SDN?: Evolution of switches and control planes – Cost-Data center innovation – Data center needs. The Genesis of SDN: The evolution of networking technology – Forerunners of SDN							CO1,CO2										
UNIT-II	SDN and OpenFlow				Periods:12												
How SDN works: Fundamental characteristics of SDN – SDN operation – SDN devices – SDN controllers – Alternate SDN methods. The OpenFlow specification: OpenFlow overview – OpenFlow 1.0 and OpenFlow basics – OpenFlow 1.1, 1.2 &1.3 Additions – OpenFlow Limitations.							CO1,CO2										
UNIT-III	SDN Definitions &open source				Periods:12												
Potential drawbacks of open SDN – SDN via APIs – SDN via hypervisor-based overlays – SDN via opening up the device – Network Functions virtualization – Alternatives overlap and ranking. SDN open source: Open source licensing issues – OpenFlow source code – Switch implementation – Controller implementations – Orchestration and Network virtualization – Simulation, Testing and Tools – OpenStack – Applying SDN open source							CO3										
UNIT-IV	SDN in Data Center				Periods:12												
Data center definition – Data center demands – Tunneling technologies for the data center- Path technologies in the data center – SDN and shortest path complexity – Ethernet fabrics in the data center – SDN use cases in the data center – Open SDN versus Overlays in the data center – Real-world data center implementation							CO1, CO4										
UNIT-V	SDN Environments and Applications				Periods: 12												
SDN in other environment: Wide area networks – Service provider and carrier networks – Campus networks – Hospitality networks – Mobile networks – Optical networks. SDN Applications: Reactive versus Proactive applications – A simple reactive Java application – Creating network virtualization tunnels – offloading flows in the data center – Access control for the campus – Traffic engineering for the service providers.							CO5										
Lecture Periods: 45		Tutoria lPeriods:-15		Practical Periods: -		Total Periods:60											
ReferenceBooks:																	
<ol style="list-style-type: none"> 1. Paul Goransson, Chuck Black AND Timothy Culver, "Software Defined Networks: A Comprehensive Approach", 2nd Edition, Morgan kaufmann, 2017. 2. Bruce Davie, "Software-Defined Networks ", 1st Edition, Systems Approach LLC, 2021 3. Thomas D. Nadeau, Ken Gray, "SDN: Software Defined Networks", 1st Edition, O'Reilly Media, 2013 																	

CO-PO/PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	2	2							3	3	
CO2	2	1										3	2
CO3	2		2	2								2	1
CO4	2	2	2	2								2	2
CO5	2	2	2	2							2	3	2

Score: 3 – High; 2 – Medium; 1 – Low

Department : IT				Programme: B. Tech.									
Semester : VIII				CourseCategoryCode:HNC			SemesterExamType:-						
Course Code	Course Name	Periods / Week			Credit	Maximum Marks							
		L	T	P	C	CA	SE	TM					
ITUH105	Seminar	-	-	-	2	100	0	100					
Prerequisite													
Course Outcome	CO1	Carry out literature survey, understand state of art techniques.											
	CO2	Apply theoretical knowledge to real-world scenarios or case studies											
	CO3	Take initiative in exploring topics beyond the curriculum and developing self-directed research habits											
	CO4	Present complex ideas concisely and clearly											
The objective of the seminar is to enable the students to present a seminar on any chosen topic related to their field of study. The topic shall be chosen in consultation with the Faculty coordinators. The student will present a Seminar on a topic in an emerging area in his/her discipline of Engineering. The student will make the presentation for duration of 20 to 25 minutes and also submit a brief report on the seminar topic for the purpose of evaluation. A departmental committee shall evaluate the performance of the students								CO1, CO2, CO3, CO4					
Lecture Periods:		Tutorial Periods: -		Practical Periods: -			Total Periods:						

CO -PO/PSO MAPPING

CO/PO	PO1	PO2	PO 3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02
CO1	2	2	3									2	2
CO2									3			2	3
CO3	2		3									2	2
CO4	3	3	3	3					2		2	2	3

Score: 3 – High; 2 – Medium; 1 – Low

Annexure II

**Syllabi of the *Ancillary Stream Elective Courses*
offered by the Department of Information
Technology**

**Ancillary stream title: Data Science (for Other
Department students)**

Department: IT		Programme: B.Tech																					
Semester : IV		CourseCategoryCode: ANC		SemesterExamType: TY																			
Course Code	Course Name		Periods/Week		Credit		MaximumMarks																
			L	T	P	C	CA	SE	TM														
ITUN101	Data structures and Algorithms		3	-	-	3	40	60	100														
Prerequisite:																							
Course Outcome	CO1	Learn to solve problems requiring sorting or searching using suitable algorithm																					
	CO2	Design Linear data structures and their operations for known applications																					
	CO3	Design Linear data structures and their operations for known applications																					
	CO4	Learn the various algorithm design and time complexity analysis methods and employ suitable methods for applications																					
UNIT-I	Sorting and Searching Techniques				Periods:9																		
	Sorting algorithms – Insertion sort- selection sort – shell sort – bubble sort – quick sort – heap sort- merge sort – radix sort – searching – linear search – binary search.						CO1 CO4																
UNIT-II	Stacks and Queues				Periods:9				CO2 CO4														
	Stack ADT – operations - implementation – application: expression evaluation Queue ADT – operations – implementation – application – priority queue																						
UNIT-III	Trees and Graphs				Periods:9				CO3 CO4														
	Binary tree – traversal methods – application – binary search tree-Graph – traversal methods – Dijkstra's algorithm - application																						
UNIT-IV	Algorithm analysis				Periods:9				CO4														
	Introduction: Algorithm – efficiency of algorithms – best, worst and average case analysis – the order of – asymptotic notations –solving recurrences – homogeneous recurrences – inhomogeneous recurrences																						
UNIT-V	Algorithm design				Periods:9				CO4														
	Strassen's Matrix multiplication –Greedy Knapsack problem solution – N queen's problem – all pairs shortest path algorithm								CO4														
LecturePeriods:45		Tutorial Periods:-		Practical Periods:-		Total Periods:45																	
ReferenceBooks:																							
<ol style="list-style-type: none"> Sharika.T.R, WillsonJoseph.C and Reshma.M.R, A guide to data structures and algorithms, Notion Press, 2024 Narasimha Karumanchi, Data Structures and Algorithms made easy, Career monk Publications, 2023 Vijayalakshmi G.A, —Data Structures and Algorithms: Concepts Techniques and Applications, McGraw Hill, 2009 ReemaThareja, "Data Structures using C", Oxford University Press, 2011. Ellis Horowitz, SartajSahni and SanguthevarRajasekaran, —Fundamentals of Computer Algorithms, Second Edition, Universities Press, 2011. Gilles Brassard and Paul Bratley, Fundamentals of Algorithmics, Theory and Practice PHI, 2010. 																							

CO-PO / PSO MAPPING

CO/ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2
CO1	1	1	1	1									
CO2	2	1	1	1									
CO3	2	1	1	1									
CO4	2	1	1	1									

Score: 3 – High; 2 – Medium; 1 – Low

Department: IT		Programme: B.Tech.													
Semester : V		CourseCategoryCode: ANC				SemesterExamType: TY									
CourseCode	CourseName	Periods/Week			Credit	Maximum Marks									
		L	T	P	C	CA	SE	TM							
ITUN102	Database Systems	3	-	-	3	40	60	100							
Prerequisite	Basics of Computers														
CO1	Understand the basic concepts database and its design principles														
CO2	Understand various Key Constraints and design ER diagram														
CO3	Formulate solutions to a broad range of query and data update problems using SQL														
CO4	Master in SQL queries using advanced operators and concepts														
CO5	Apply concurrency control & recovery mechanism for database problems														
UNIT-I	Introduction to Database				Periods:9										
Introduction to Database Systems: Overview – Difference between Data and Information, Database, Database Management System, Characteristics of Database Management System- Relational Database Management System, Components of DBMS- Data Models- Database System Architecture- Types of Database Architecture- Types of Database System Architectures						CO1									
UNIT-II	Entity- Relationship Model				Periods:9										
Basic Concepts – Basic Concepts of ER Model in DBMS– Entity, Types of Attributes, Data Model Keys- Keys Constraints – Design Issues – Entity Relationship Diagram: Components of ER Diagram –Entity Relationship1:1, 1: N, N:1, N:M- Entity Sets – Design of E-R Database Schema.						CO2, CO3									
Case study: ER Modelling for mini project															
UNIT-III	Introduction to SQL				Periods:9										
SQL: Data-Definition language SQL Command, DML: Data Manipulation Language, DCL: Data Control Language, TCL: Transaction Control Language, Basic Query Structure: Create Table Command, commonly used datatypes, INSERT, Alter, Drop, UPDATE, Rename, DELETE and Data manipulation.						CO2, CO3									
Integrity Constraints: NOT NULL, UNIQUE, PRIMARY KEY, FOREIGN KEY, CHECK and DEFAULT Column level constraints- Table level constraints.															
UNIT-IV	Advance SQL				Periods:9										
Create Table with Relationship –Select, Where Clause, Arithmetic Operators using WHERE clause, Behavior of Foreign Key Column on Delete-Set Operations using SQL, Aggregate Functions, String operation, Alias operation, Null Values – Nested Sub-Queries.						CO3, CO4									
UNIT-V	Transaction Management and Concurrency				Periods:9										
Storage Management- Storage Structure – Transaction Management: Transaction Processing, ACID Properties–Concurrency Control- Failure Classification – Recovery System: Recovery and Atomicity.						CO4, CO5									
Lecture Periods:45		Tutorial Periods:-		Practical Periods:-		Total Periods:45									
References															
1. AviSilberschatz, Henry F. Korth, S. Sudarshan “Database System Concepts”, 7th Edition, March 5, 2019. 2. RamezElmasri and Shamkant B. Navathe, Fundamentals of Database Systems, Pearson, Seventh Edition, Global Edition, 2016 3. C.J. Date, “An Introduction to Database Systems”, 8thEdition,Jun 24, 2019 4. Hugh Darwen, “Introduction to Relational Database Theory”, 3rd edition, 2012. 5. Oracle Sql and PL/SQL User Manual 2024															

CO-PO / PSO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	0	-	0	0	-	0	0	1	1
CO2	2	3	0	-	0	0	-	0	2	3	2
CO3	2	3	3	-	1	3	2	0	2	3	2
CO4	2	3	3	-	3	3	1	3	3	3	3
CO5	2	3	1	-	2	3	3	3	3	3	3

Score: 3 – High; 2 – Medium; 1 – Low

Department: IT		Programme: B.Tech						
Semester :VI		CourseCategoryCode: ANC				SemesterExamType: TY		
CourseCode	Course Name	Periods/Week			Credit		MaximumMarks	
		L	T	P	C	CA	SE	TM
ITUN103	Applied Data Science using Python	3	-	-	3	40	60	100
Prerequisite:	-							
Course Outcome	CO1	Apply Interactive Computing with Python						
	CO2	Utilize NumPy for Handling Structured Data						
	CO3	Handle Missing Data Effectively						
	CO4	Implement Statistical and Distribution-Based Visualizations						
	CO5	Implement Learning Algorithms						
UNIT-I	Essential Python & IPython	Periods: 9						
Introduction to Python for Data Science, Essential Python Libraries, Built-in Data Structures, Functions & File Handling in Python, Launching and Using Jupyter Notebook & IPythonShell, Help & Documentation in Python, Keyboard Shortcuts in Jupyter Notebook, IPython Magic Commands, Input & Output History, IPython & Shell Commands.								CO1
UNIT-II	Introduction to NumPy	Periods: 9						
Understanding Data Types in Python, NumPy Basics: Creating Arrays, Array Indexing, Slicing, Reshaping & Broadcasting, Computation on NumPy Arrays: Universal Functions (ufuncs), Aggregations: Min, Max, Mean, Standard Deviation, Element-wise Computation, Comparisons, Masks, and Boolean Logic in NumPy, Fancy Indexing & Sorting Arrays, Structured Data with NumPy Arrays.								CO2
UNIT-III	Data Manipulation with Pandas	Periods: 9						
Introduction to Pandas: DataFrames & Series, Data Indexing & Selection, Applying Functions & Operations on Data, Handling Missing Data: Filling, Interpolation, Dropping Null Values, Hierarchical Indexing, Combining Datasets: Concatenation & Append, Merge & Join Operations, Aggregation & Grouping, Pivot Tables & Vectorized String Operations.								CO3
UNIT-IV	Data visualization with Matplotlib & Seaborn	Periods: 9						
Introduction to Matplotlib: Line & Scatter Plots, Customizing Plots: Labels, Titles, and Annotations, Histograms, Binnings, and Density Plots, Bar Plots & Pie Charts, Heatmaps & Correlation Matrices, Customizing Legends & Colorbars, Multiple Subplots & Grid-Based Layouts, 3D Plotting in Matplotlib, Seaborn for Advanced Data Visualization.								CO4
UNIT-V	Introduction to Machine Learning with Scikit-Learn	Periods: 9						
Understanding the Machine Learning Workflow, Data Preprocessing & Feature Engineering, Hyperparameter Tuning & Model Validation, Supervised Learning Algorithms, Unsupervised Learning Algorithms, Principal Component Analysis (PCA), Hands-on ML Projects & Case Studies.								CO5
LecturePeriods: 45	TutorialPeriods:-	PracticalPeriods:-				TotalPeriods:45		
ReferenceBooks:								

1. VanderPlas, Jake. Python Data Science Handbook: Tools and Techniques for Developers. 2nd ed. Sebastopol, CA: O'Reilly Media, 2022.
2. McKinney, Wes. Python for data analysis: Data wrangling with pandas, numpy, and jupyter. " O'Reilly Media, Inc.", 2022.
3. Harrison, Matt. Effective Pandas: Patterns for Data Manipulation. Matt Harrison, 2021.
4. Dale, K., 2022. Data Visualization with Python and JavaScript: Scrape, Clean, Explore, and Transform Your Data. " O'Reilly Media, Inc."
5. Géron, Aurélien. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: 3rd Edition. 3rd ed. O'Reilly Media, 2022.

CO-PO / PSO MAPPING

CO/PO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	2	2	2	3	2	-	-	-	-	-	1	3	1
CO2	2	2	3	3	2	-	-	-	-	-	1	3	2
CO3	2	3	3	3	2	-	-	-	-	-	2	3	3
CO4	2	2	3	3	2	-	-	-	-	-	2	3	3
CO5	2	2	3	3	2	-	-	-	-	-	2	3	3

Score: 3 – High; 2 – Medium; 1 – Low

Department:IT		Programme: B.Tech.																											
Semester :VII		CourseCategoryCode:ANC								SemesterExamType: TY																			
CourseCode	Course Name		Periods/Week				Credit			MaximumMarks																			
ITUN104	Introduction to Machine Learning				L	T	P	C		CA	SE		TM																
Prerequisite:	-																												
Course Outcome	CO1	Learn the basics of artificial neurons, discrete and continuous data for machine learning-																											
	CO2	Understand the working principles of ANN with its layers and activation functions -																											
	CO3	Understand the working of supervised and unsupervised learning algorithms																											
	CO4	Compare various machine learning algorithms with discrete and continuous data sets. -																											
	CO5	Apply various machine learning algorithms in multi-disciplinary fields																											
UNIT-I	Introduction								Periods: 9																				
Introduction – Types of learning – Supervised Learning – Unsupervised Learning – Reinforcement Learning										CO1																			
– Learning Bias - Learning performance – Designing a Learning System – Data – Feature Selection – Model Selection – Learning – Evaluation – Density Estimation.																													
UNIT-II	Feed-Forward Networks								Periods: 9																				
Neural Network Graphs – weight initialization; activation functions: linear – stair-step – piecewise-linear – smooth functions; Back propagation - a tiny neural network – the learning rate; Optimizers: error as geometry – adjusting the learning rate – updating strategies – gradient descent variations.										CO2																			
UNIT-III	Supervised Learning								Periods: 9																				
Regression – Linear Regression – Non-linear Regression - Logistic Regression - Gradient-descent – Decision Trees - Classification – k-Nearest Neighbours (KNN) – Support Vector Machines (SVMs) – Decision Trees: building trees – splitting nodes – controlling overfitting - Naïve Bayes - Discriminant Analysis.										CO3, CO4																			
UNIT-IV	Unsupervised Learning								Periods: 9																				
Clustering – Similarity / Dissimilarity analysis - K-means – Hierarchical - Noise Reduction - Dimensionality Reduction – Principal Component Analysis – Gaussian Mixture - Hidden Markov Models - Ensemble methods: voting – bagging – random forests – extra trees – boosting – Adaboost.										CO3, CO4																			
UNIT-V	Recent trends in Machine Learning								Periods: 9																				
Medical Imaging – Speech Recognition – Credit Scoring – Electricity load forecasting – Algorithmic trading – Gene sequence analysis – Market Research – Object Recognition – Gambling – IoT applications - Review of NLU – Introduction to Transformers – Large Language Models – Gen AI – Explainable AI - ChatGPT – Meta AI – Copilot – Deepseek.										CO5																			
LecturePeriods:45		TutorialPeriods: -		PracticalPeriods: -			TotalPeriods: 45																						
ReferenceBooks:																													
1. Jeeva Jose, Introduction to Machine Learning, Khanna Book Publishing Company, 2020. 2. Vivienne Sze, Yu-Hsin Chen, Tien-Ju Yang and Joel S. Emer, "Efficient Processing of Deep Neural Networks", Morgan and Claypool, California, 2020. 3. Jason Brownlee, Machine Learning Mastery with Python, 2016. 4. Andrew Glassner, Deep Learning: From Basics to Practice, Volume 1, The Imaginary Institute, Seattle, WA, 2018. 5. Judith Hurwitz and Daniel Kirsch, Machine Learning, IBM Ltd. Edn., 2018.																													

CO-PO / PSO MAPPING

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	2	-	-	-	-	-	-	-	-	2	1
CO2	2	1	2	-	-	-	-	-	-	-	-	2	1
CO3	2	2	2	-	-	-	-	-	-	-	-	2	1
CO4	2	2	2	2	2	-	-	-	-	-	2	2	2
CO5	2	2	2	2	2	-	-	-	-	-	2	2	2

Score: 3 – High; 2 – Medium; 1 – Low

**Ancillary stream: Information Technology
Essentials**

(for Other Department students)

Department: IT				Programme: B.Tech																
Semester : IV				CourseCategoryCode:ANC				SemesterExamType: TY												
Course Code	Course Name			Periods/Week			Credit		MaximumMarks											
				L	T	P	C	CA	SE	TM										
ITUN101	Data structures and Algorithms			3	-	-	3	40	60	100										
Prerequisite:																				
Course Outcome	CO1	Learn to solve problems requiring sorting or searching using suitable algorithm																		
	CO2	Design Linear data structures and their operations for known applications																		
	CO3	Design Linear data structures and their operations for known applications																		
	CO4	Learn the various algorithm design and time complexity analysis methods and employ suitable methods for applications																		
UNIT-I	Sorting and Searching Techniques								Periods:9											
Sorting algorithms – Insertion sort- selection sort – shell sort – bubble sort – quick sort – heap sort- merge sort – radix sort – searching – linear search – binary search.										CO1	CO4									
UNIT-II	Stacks and Queues								Periods:9											
Stack ADT – operations - implementation – application: expression evaluation Queue ADT – operations – implementation – application – priority queue										CO2	CO4									
UNIT-III	Trees and Graphs								Periods:9											
Binary tree – traversal methods – application – binary search tree Graph – traversal methods – Dijkstra's algorithm - application										CO3	CO4									
UNIT-IV	Algorithm analysis								Periods:9											
Introduction: Algorithm – efficiency of algorithms – best, worst and average case analysis – the order of – asymptotic notations –solving recurrences – homogeneous recurrences – inhomogeneous recurrences										CO4										
UNIT-V	Algorithm design								Periods:9											
Strassen's Matrix multiplication –Greedy Knapsack problem solution – N queen's problem – all pairs shortest path algorithm										CO4										
Lecture Periods:45			Tutorial Periods:-			Practical Periods:-			Total Periods:45											
ReferenceBooks:																				
1. Sharika.T.R, WillsonJoseph.C and Reshma.M.R, A guide to data structures and algorithms, Notion Press, 2024 2. Narasimha Karumanchi, Data Structures and Algorithms made easy, Careermonk Publications, 2023 3. Vijayalakshmi G.A, —Data Structures and Algorithms: Concepts Techniques and Applications, McGraw Hill, 2009 4. ReemaThareja, "Data Structures using C", Oxford University Press, 2011. 5. Ellis Horowitz, Sartaj Sahni and Sangutheva rRajasekaran, —Fundamentals of Computer Algorithms, Second Edition, Universities Press, 2011. 6. Gilles Brassard and Paul Bratley, Fundamentals of Algorithmics, Theory and Practice PHI, 2010.																				

CO-PO / PSO MAPPING

CO/ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2
CO1	1	1	1	1									
CO2	2	1	1	1									
CO3	2	1	1	1									
CO4	2	1	1	1									

Score: 3 – High; 2 – Medium; 1 – Low

Department : IT				Programme : B.Tech.																				
Semester : V				Course Category Code: ANC				Semester Exam Type: TY																
Course Code	Course Name			Periods / Week				Credit	Maximum Marks															
				L	T	P		C	CA	SE	TM													
ITUN105	Java and Internet Programming			3	-	-		3	40	60	100													
Prerequisite:																								
Course Outcome	CO1	Understand the basics of Java Programming																						
	CO2	Apply threads, packages and Interfaces in Object Oriented programming																						
	CO3	Understand HTML programming and Java script																						
	CO4	Apply Extended Web Programming																						
	CO5	Learn Advanced Web Programming																						
UNIT-I	Introduction to Java			Periods: 9																				
Introduction to Object Oriented Programming – Java on the Internet – Multithreading and Persistence – Java keywords and flow control – Garbage collection – packages- Final declaration – Interfaces and inner classes – Java I/O classes – Run time type identification.									CO1															
UNIT-II	Threads, Interfaces and Packages			Periods: 9																				
Concepts of Multithreading, differences between process and thread, thread life cycle ,creating multiple threads using Thread class, Runnable interface, Synchronization, thread priorities, inter thread communication, daemon threads, deadlocks, thread groups Creating and Accessing a Package, Understanding CLASSPATH, importing Packages. Interfaces: Multiple inheritance.									CO2															
UNIT-III	Introduction to HTML programming and Java script.			Periods: 9																				
Foundations for Internet Programming: An overview of Internet Programming - WWW -HTML – forms – frames – tables – web page design - JavaScript introduction – control structures – functions – arrays – objects – simple web applications.									CO1,CO3															
UNIT-IV	Extended Web Programming			Periods: 9																				
Dynamic HTML – introduction – cascading style sheets – object model and collections –event model – filters and transition – data binding – data control – ActiveX control – handling of multimedia data - XML.									CO4,CO5															
UNIT-V	Advanced Web Programming.			Periods: 9																				
Servlets communication – Interactive Java Servlets – Deployment of simple servlets – web server (Java web server / Tomcat / Web logic) – HTTP GET and POST requests – session tracking – cookies – JDBC – simple web applications – multi-tier applications.									CO1,CO5															
Lecture Periods: 45		Tutorial Periods:		Practical Periods:				Total Periods:45																
Reference Books:																								
1. Deitel, Deitel and Nieto, Internet and World Wide Web – How to program , Pearson Education Publishers, 2012.																								
2. E. Balagurusamy , “Programming with Java”, 7th Edition , Paperback, 12 November 2023																								
3. R. Krishnamoorthy& S.Prabhu, “Internet and Java Programming , New Age International Publishers, 2012.																								
4. Thommo A. Powell, The Complete Reference HTML and XHTML, fourth edition, Tata McGraw Hill, 2003.																								
5. Naughton, The Complete Reference – Java2, Tata McGraw-Hill, 3rd edition, 1999.																								

CO-PO/PSO MAPPING

CO/PO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PS01	PS02
CO1	2	2	2	3							1	3	2
CO2	2	3	3	3							1	3	1
CO3	2	2	2	3							2	2	3
CO4	2	2	2	3							2	2	2
CO5	2	2	2	3							2	2	2

Department:IT		Programme: B.Tech															
Semester :VI		CourseCategoryCode: ANC				SemesterExamType: TY											
CourseCode	CourseName	Periods/Week			Credit		MaximumMarks										
		L	T	P	C	CA	SE	TM									
ITUN106	IoT and Python Programming	3	-	-	3	40	60	100									
Prerequisite:																	
Course Outcome	CO1	Understand the basics of IoT															
	CO2	Apply Data Analytics tools in various IoT applications															
	CO3	Develop Python programs for simple to complex problems															
	CO4	Apply Python modules and packages for IoT solutions															
	CO5	Develop Python programs using advanced constructs and files with exception handling															
UNIT-I	IoT Concepts			Periods:9													
Definition, Architecture of IoT , Enabling technologies: Sensors - Actuators - WSN - Embedded Systems - Cloud computing –Bigdata analytics, IoTPrototyping platforms: Arduino - Raspberry Pi - Nodemcu, Applications of IoT.							CO1 CO4										
UNIT-II	IoT Data Analytics and Security			Periods:9													
Role of Data analytics in IoT, Challenges, Data retrieval and visualization, Tools: Thingspeak— Datadog Security:Threats-Vulnerability—Risks-IoTAttacksandCountermeasures-Attacktrees-Faulttrees-CPSattacks							CO1 CO2										
UNIT-III	Introduction to Python			Periods:9													
Data types- variables, expressions, statements, tuple assignment, precedence of operators- Conditionals:Booleanvaluesandoperators,conditional(if),alternative(if-else),chainedconditional(if-elif-else);Iteration:state,while,for,break,continue,pass;Fruitfulfunctions:returnvalues,parameters,localandglob alscope,functioncomposition,recursion							CO3 CO5										
UNIT-IV	Advanced Constructs			Periods:9													
Strings: stringslices, immutability, string functions and methods, stringmodule; Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced listprocessing- list comprehension Lists as arrays.							CO5										
UNIT-V	Files and Exception Handling			Periods: 9													
Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules,packages							CO5										
Lecture Periods: 45		Tutorial Periods: -		Practical Periods: -		Total Periods: 45											
Reference books:																	
1. RajKamal, "Internet of Things: Architecture and Design Principles", 2 nd Edition, McGrawHill Education, 2022 2. PethuruRaj and Anupama C.Raman, "The Internet of Things: Enabling Technologies, Platforms, and UseCases", CRC Press, United States, 2017. 3. Arshdeep Bahga and Vijay Madisetti, " Internet of Things: A Hands- on Approach", Universities Press(India), Hyderabad, 2014. 4. Rob Mastrodomenico, "The Python Book", Wiley, 2022. 5. Martin C.Brown,Python: The Complete Reference, Fourth edition, McGrawHill, USA,2018. 6. Ashok NamdevKamthane and Amit Ashok Kamthane, Programming and problem solving with python, Mc Graw Hill, 2018.																	

CO-PO/PSO MAPPING

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	-	-	-	1	-	-	-	-	-	-	-
CO2	2	3	1	3	2	-	-	-	-	-	-
CO3	3	3	1	3	-	-	-	-	-	-	-
CO4	2	3	1	3	-	-	-	-	-	-	-
CO5	3	2	1	2	-	-	-	-	-	-	-

Score: 3 – High; 2 – Medium; 1 – Low

Department:IT		Programme: B.Tech																			
Semester :VII	CourseCategoryCode: ANC											SemesterExamType : TY									
Course Code	Course Name		Periods/Week			Credit		MaximumMarks 100													
ITUN107	Web Design and Development		L	T	P	C	CA	SE	TM												
Prerequisite:	-																				
Course Outcome	CO1	Understand the Website basics and its technologies																			
	CO2	Learn to design client side using HTML and Javascript																			
	CO3	Compare Servlets and Javascript for designing web tier																			
	CO4	Familiarize with the different back-end designs																			
	CO5	Design and deploy simple web-applications.																			
UNIT-I	Website Basics		Periods:9																		
Internet Overview - Fundamental computer network concepts - Web Protocols -URL – Domain Name- Web Browsers and Web Servers- Working principle of a Website –Creating a Website - Client-side and server-sidescripting.												CO1									
UNIT-II	Web Designing		Periods:9																		
HTML – Form Elements - Input types and Media elements - CSS3 - Selectors, Box Model, Backgrounds and Borders, Text Effects, Animations, Multiple Column Layout, User Interface.												CO1,CO2									
UNIT-III	Client Side Processing and Scripting		Periods:9																		
JavaScript Introduction – Variables and Data Types-Statements – Operators - Literals-Functions - Objects- Arrays-Built-in Objects- Regular Expression, Exceptions, Event handling, Validation - JavaScript Debuggers.												CO1,CO5									
UNIT-IV	Servlets		Periods:9																		
Servlets: Java Servlet Architecture – Servlet Life cycle- Form GET and POST actions -Sessions – Cookies												CO1, CO3,CO5									
UNIT-V	Database Connectivity		Periods:9																		
Database connectivity – JDBC - Creation of simple interactive applications - Simple database applications.												CO1,CO4,									
LecturePeriods:45		TutorialPeriods:		PracticalPeriods:		TotalPeriods:45															
ReferenceBooks:																					
1. Robin Nixon, "Learning PHP, MySQL, JavaScript, CSS & HTML5" Third Edition, O'Reillypublishers, 2014. 2. Paul Deitel, Harvey Deitel, Abbey Deitel, "Internet & World Wide Web - How to Program", 5 th edition, Pearson Education, 2012. 3. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006. 4. Nicky Huys, "Web Design for Beginners", Sixth Edition, Google ebook,2024. 5. Fritz Schneider, Thomas Powell, "JavaScript – The Complete Reference", 3rd Edition, McGraw HillPublishers, 2017. 6. Bates, "Developing Web Applications", Wiley Publishers, 2006																					

CO-PO/PSO MAPPING

CO/PO	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2	----	3	-	-	-	-	-	3	-	-
CO2	2	3	3	----	3	-	-	-	-	-	3	-	-
CO3	2	3	3	----	3	-	-	-	-	-	3	-	-
CO4	2	3	3	----	3	-	-	-	-	-	3	-	-
CO5	2	3	3	----	3	-	-	-	-	-	3	-	-

Score: 3 – High; 2 – Medium; 1 – Low

**Ancillary stream title: Business Analytics
(Inter Departmental Electives - for IT Department
students)**

Department:IT		Programme: B.Tech															
Semester :IV		CourseCategoryCode: ANC				SemesterExamType: TY											
CourseCode	CourseName	Periods/Week			Credit	MaximumMarks											
		L	T	P	C	CA	SE	TM									
ITUI101	Digital Marketing	3	-	-	3	40	60	100									
Prerequisite:	-																
CourseOutcome	CO1	Assess the Benefits and Opportunities of Digital Marketing															
	CO2	Analyze the Importance of SEO for Business Websites															
	CO3	Develop and Implement Effective Email Marketing Campaigns:															
	CO4	Optimize Business Profiles on Various Social Media Platforms:															
	CO5	Evaluate Emerging Trends in Digital Marketing															
UNIT-I	Introduction to Digital Marketing				Periods: 9												
What is Digital Marketing, Types of Digital Marketing, Differences Between Traditional and Digital Marketing, Importance & Scope of Digital Marketing, Elements of Marketing, Benefits & Opportunities, Content Marketing Overview, Application in Various Sectors.							CO1										
UNIT-II	Search Engine Marketing (SEM)&Search Engine Optimization (SEO)				Periods: 9												
Introduction to SEM& SEO, Importance of SEO for Business Websites, SEO Key Concepts, SEO Advantages & Disadvantages, Search Engine Marketing (SEM).							CO2										
UNIT-III	Email Marketing & Content Marketing				Periods: 9												
Introduction to Email Marketing & Content Marketing,Email Marketing Elements, Content Marketing Strategies,Introduction to Digital Display Advertising,Overview of Google Ads & Programmatic Advertising							CO3										
UNIT-IV	Social Media Marketing (SMM) & Social Media Optimisation				Periods: 9												
Understanding Different Social Media Setting Up Business Profiles & Pages, Content Strategy for Social Media, Impact of Social Media on SEO, Importance of Landing Pages & Conversion Optimization, Social Media Advertising.							CO4										
UNIT-V	Design Essentials & E-Commerce Management				Periods: 9												
Overview of Design Elements in Digital Marketing,Tools for Branding & Visual Desig,Introduction to E-Commerce &Marketplaces,Design Principles & Cultural Differences in Online Marketing, Marketing Automation & CRM Tools,Emerging Trends in Digital Marketing.							CO5										
Lecture Periods: 45		Tutorial Periods:		Practical Periods:		Total Periods: 45											
Reference Books:																	
1. Ryan Deiss & Russ Henneberry – <i>Digital Marketing for Dummies</i>, 3rd Edition (2020) John Wiley & Sons, Inc. 2. Adam Clarke – <i>SEO 2023: Learn Search Engine Optimization with Smart Internet Marketing Strategies</i> (2023) 3. Brad Geddes – <i>Advanced Google AdWords</i>, 3rd Edition (2018) 4. Ann Handley – <i>Everybody Writes: Your Go-To Guide to Creating Ridiculously Good Content</i>, 2nd Edition (2022) 5. Chad S. White – <i>Email Marketing Rules: A Step-by-Step Guide to the Best Practices that Power Email Marketing Success</i> (2023) 6. Neal Schaffer – <i>The Age of Influence: The Power of Influencers to Elevate Your Brand</i> (2020) 7. Gary Vaynerchuk – <i>Jab, Jab, Jab, Right Hook: How to Tell Your Story in a Noisy Social World</i> (2018) 8. Robert W. Bly – <i>The Content Marketing Handbook</i> (2021) 9. Jason Miles – <i>Instagram Power: Build Your Brand and Reach More Customers with the Power of Pictures</i>, 2nd Edition (2019) 10. Pradeep Kumar Thondapu – “The Bebiner’sGuige to SEO: Boost Four Website’s Visibility”. Kindle Edition 12th Feb. 2024.																	

CO-PO/PSO MAPPING

CO/PO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1		2	3	3	3			2	2	2		3	3
CO2		3	2	2	3			1	1			3	1
CO3		3	2	2	3			1	1			3	1
CO4		2	2	2	3			1	1	2		3	2
CO5		3	1	3	3			2	2	2		3	1

Score: 3 – High; 2 – Medium; 1 – Low

Department: IT		Programme: B.Tech													
Semester:V		CourseCategoryCode:ANC SemesterExamType: TY													
CourseCode	Course Name	Periods/Week		Credit		MaximumMarks									
		L	T	P	C	CA	SE	TM							
ITUI102	Business Process	3	-	-	3	40	60	100							
Prerequisite:	-														
Course Outcome	CO1	Understand the importance of Business Process													
	CO2	Understand Business Process Platforms													
	CO3	Model Business Process													
	CO4	Organize Life Cycle of Business Process													
UNIT-I	Introduction	Periods: 9													
Introduction – Definition of Business Process- Need and Importance of Business Process – Examples of Business Process - Business Process Excellence.								CO1							
UNIT-II	Business Process Platforms	Periods: 9													
Business Process Platforms – Specification and Modeling of Business Process – Integration of Business and Production Process – Integration of Business Process and Business Intelligence.								CO1, CO2							
UNIT-III	Process Modeling	Periods: 9													
Global View of Business Process – Local View of Business Process – Business Process Modelling – Events in Business Process Modeling – Semantics of Events.								CO2							
UNIT-IV	Business Process Tools	Periods: 9													
Decomposing Business Process – Motivation – Seamless Business Process – Business Process Specification – Tools for Process Specific								CO3							
UNIT-V	Life Cycle of Business Process	Periods: 9													
Life Cycle of Business Process– Classification of Business Process - Workflow Management – Business Process Management –Definition – Application- Life Cycle of Business Process Management.								CO1, CO4							
Lecture Periods:45		Tutorial Periods:-		Practical Periods: -		Total Periods:45									
ReferenceBooks:															
1. Dumas, M.,LaRosa,M.,Mendling,J.,Reijers, "Fundamentals of Business Process",2018. 2. Stiehl,Volker, "Process-Driven Applications with BPMN",2014. 3. Brocke and Rosemann, Hand book on Business Process Management2Strategic Alignment, Governance, People and Culture, Springer, 2012															

CO-PO/PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	3	2	2	2	3	2	2	2	-	2	2
CO2	2	2	3	3	2	2	2	3	2	2	2	-	2	2
CO3	2	3	3	3	3	3	2	3	3	3	3	-	3	3
CO4	3	3	3	3	3	3	2	3	3	3	3	-	3	3

Score: 3 – High; 2 – Medium; 1 – Low

Department: IT		Programme: B.Tech							
Semester :VI		CourseCategoryCode:ANC				SemesterExamType: TY			
CourseCode	Course Name	Periods/Week			Credit	MaximumMarks			
		L	T	P	C	CA	SE	TM	
ITUI103	Social Network analysis	3	-	-	3	40	60	100	
Prerequisite:	-								
Course Outcome	CO1	Understand the Evolution and Development of the Semantic Web:							
	CO2	Analyze Ontological Representations of Social Entities and Relationships:.							
	CO3	Analyze the Evolution of Web Communities:							
	CO4	Assess Privacy Concerns in Online Social Networks:							
	CO5	Employ Visualization Techniques for Social Networks							
UNIT-I	Introduction				Periods: 9				
Introduction to Semantic Web- Development of Semantic Web - Statistical Properties of Social Networks- Definitions-Data Descriptions-Static Properties- Dynamic Properties- Development of Social Network Analysis –Electronic Sources for Network Analysis: Electronic Discussion Networks –Applications of Social Network Analysis.								CO1	
UNIT-II	Modelling and knowledge representation				Periods: 9				
Ontology and its importance in Semantic Web: Ontology-based knowledge Representation - Ontology languages for Semantic Web: Resource Description Framework –Modelling social network data: Network Data Representation - Ontological Representation of Social Individuals-Ontological Representation of Social Relationships.								CO2	
UNIT-III	Extraction and Mining communities in web Social networks				Periods: 9				
Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Evaluating communities - Methods for community detection and mining - Applications of community mining algorithms - Tools for detecting communities social network infrastructures – Decentralizedonlinesocialnetworks-Multi-Relationalcharacterizationofdynamicsocial network communities.								CO3	
UNIT-IV	Predicting Human Behaviour and Privacy Issues				Periods: 9				
Understanding human behaviour for social communities - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivityanalysis- Combiningtrustandreputation-Attacksspectrumandcountermeasures.								CO4	
UNIT-V	Visualization and applications of Social Networks				Periods: 9				
Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation - Visualizing online social networks, Visualizing social networks with matrix-based representations-MatrixandNode-LinkDiagrams-Collaborationnetworks-Co-Citationnetworks-Random Walk based Proximity Measures - Clustering with random walk based measures-Algorithms for Computing Personalized Page Rank and SimRank— Application-Computer Vision - Text Analysis -Collaborative Filtering								CO5	
Lecture Periods: 45		Tutorial Periods:		Practical Periods:		Total Periods: 45			

Reference Books:

1. Peter Mika, "Social Networks and the Semantic Web", First Edition, Springer 2007.
2. Borko Furht, "Handbook of Social Network Technologies and Applications", 1st Edition, Springer, 2010.
3. Charu C. Aggarwal, "Social Network Data Analytics", Second Edition, Springer 2014.
4. David Camacho, Angel Gema Bello and Antonio, "The Four Dimensions of 55555555: An Overview of Research Methods, Applications, and Software Tools" Feb 2020.
5. Guandong Xu, Yanchun Zhang and Lin Li, "Web Mining and Social Networking — Techniques and applications", First Edition, Springer, 2012.
6. John G. Breslin, Alexander Passant and Stefan Decker, "The Social Semantic Web", Springer, 2009.

CO-PO/PSO MAPPING

CO/PO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO 2
CO1	2	2	2	3	2	-	-	-	-	-	1	3	1
CO2	2	2	3	3	2	-	-	-	-	-	1	2	1
CO3	2	3	3	3	2	-	-	-	-	-	2	3	1
CO4	2	2	3	3	2	-	-	-	-	-	2	3	1
CO5	2	2	3	3	2	-	-	-	-	-	2	3	1

Score: 3 – High; 2 – Medium; 1 – Low

Department:IT		Programme: B.Tech													
Semester :VII		CourseCategoryCode:ANC				SemesterExamType: TY									
CourseCode	CourseName	Periods/Week			Credit		MaximumMarks								
		L	T	P	C	CA	SE	TM							
ITUI104	Industry 4.0 with Industrial IoT	3	-	-	3	40	60	100							
Prerequisite:	Computer Networks														
Course Outcome	CO1	Explore the basics of Industrial Internet of things													
	CO2	Understand various IoT Layers and their relative importance													
	CO3	Impart the knowledge of IIoT security layers													
	CO4	Realize the importance of Data analytics and Middleware protocols in IoT													
	CO5	Apply IIoT in real time Industrial applications													
UNIT-I	Introduction to Industrial IoT and Industry 4.0	Periods:9													
Introduction: Key IIoT Technologies- Intelligent Devices – Industrial Internet Use cases – Health care –Oil and Gas Industry– IoT Innovations in Retail. Industry 4.0: Defining Industry 4.0- Four Main Characteristics of Industry 4.0 - Industry 4.0 Design Principles - Building Blocks of Industry 4.0								CO1							
UNIT-II	Technical and Business Innovators of Industrial Internet	Periods:9													
Miniaturization – Cyber Physical Systems – Wireless technology – IP Mobility – Network Functionality Virtualization – Cloud and Fog - Big Data and Analytics – M2M Learning and Artificial Intelligence								CO1, CO4							
UNIT-III	Industrial IoT Reference Architecture	Periods:9													
IIoT Reference Architecture – Industrial Internet Architecture Framework – Five Functional domains – Three tier architecture topology – Connectivity: Key system characteristics, Connectivity security and functional characteristics – Functions of communication layer – Data Management								CO1,C02							
UNIT-IV	Designing Industrial Internet Systems and Middleware Software Patterns	Periods:9													
Concept of the IIoT -Proximity Network – WSN Edge Node – Legacy Industrial Protocols – Modern Communication Protocols – Wireless communication Technologies - Industrial Ethernet – Industrial Gateways								CO4							
UNIT-V	Middleware Transport Protocols	Periods: 9													
TCP/IP, UDP, RTP, CoAP –Middleware Software patterns –Software Design patterns : MQTT-XMPP-AMQP- DDS – Delay tolerant Networks– Middleware IIoT platforms. Industrial IoT Security and Governance: Introduction – Security threats and vulnerabilities of IoT –Industrial IoT security architecture: IIoT architecture patterns – four Tier IIoT security model- Management risks with IIoT								CO3,CO4							
LecturePeriods: 45		TutorialPeriods:-		PracticalPeriods: -			TotalPeriods:45								
ReferenceBooks:															
1. Alasdair Gilchrist, "Industry 4.0: The Industrial Internet of Things", (Apress), 2017															
2. Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat "Industrial Internet of Things: Cyber manufacturing Systems" Springer, 2017															
3. Giacomo Veneri, Antonio Capasso, Packt "Hands-On Industrial Internet of Things: Create a powerful Industrial IoT" , 2018															

CO-PO/PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1		1							2	2	2
CO2	3	2	1	2								3	3
CO3	3	2	1	2								3	3
CO4	2	1		1								2	2
CO5	3	2	1	2							2	3	3

Score: 3 – High; 2 – Medium; 1 – Low