B. Tech. Information Technology

I Year: First Semester

Teaching Scheme					Contact Hours/Week			Exam Duration (h)		Relative Weights (%)				
S. No.	**Subject Code**	**Course Title**	**Subject Area**	**Credit**	**L**	**T**	**P**	**Theory**	**Practical**	**CWS**	**PRS**	**MTE**	**ETE**	**PRE**
1	AM101	Mathematics - I	BSC	4	3	1	0	3	0	25	-	25	50	-
2	CO101	Programming Fundamentals	ESC	4	3	0	2	3	0	15	25	20	40	-
3	EC101	Basic Electronics & Communication Engineering	ESC	4	3	0	2	3	0	15	25	20	40	-
4	EE101	Basic Electrical Engineering-I	ESC	4	3	0	2	3	0	15	25	20	40	-
5	CY103 / IT103	Fundamentals of Web Design	SEC	2	1	0	2	0	3	-	50	-	-	50
6	AEC/VAC	AEC/VAC	AEC/VAC	2	2/1/0	0	0/2/4	3/3/0	0/2/3	25/15/0	0/25/50	25/20/0	50/40/0	0/0/50
Total				**20**										

I Year: Second Semester

1	AM102	Mathematics-II	BSC	4	3	1	0	3	0	25	-	25	50	-
2	AP102	Physics	BSC	4	3	0	2	3	0	15	25	20	40	-
3	IT102	Discrete Structures	ESC	4	3	1	0	3	0	25	-	25	50	-
4	CY104 / IT104	Object Oriented Programming	DCC	4	3	0	2	3	0	15	25	20	40	-
5	IT106	Open Source Programming	SEC	2	1	0	2	0	3	-	50	-	-	50
6	AEC/VAC	AEC/VAC	AEC/VAC	2	2/1/0	0	0/2/4	3/3/0	0/2/3	25/15/0	0/25/50	25/20/0	50/40/0	0/0/50
Total				**20**										

B.Tech. Information Technology

II Year: Third Semester

Teaching Scheme					Contact Hours/Week			Exam Duration (h)		Relative Weights (%)				
S. No.	**Subject Code**	**Course Title**	**Subject Area**	**Credit**	**L**	**T**	**P**	**Theory**	**Practical**	**CWS**	**PRS**	**MTE**	**ETE**	**PRE**
1	IT201	Digital Systems and Microcontroller	ESC	4	3	0	2	3	0	15	25	20	40	-
2	IT203	Data Structures	DCC	4	3	0	2	3	0	15	25	20	40	-
3	IT205	Data Science and Visualization	DCC	4	3	0	2	3	0	15	25	20	40	-
4	IT207	Data Communications	DCC	4	3	1	0	3	0	25	-	25	50	-
5	IT209	Principles of Computing	DCC	4	3	1	0	3	0	25	-	25	50	-
6	AEC/VAC	AEC/VAC	AEC/VAC	2	2/1/0	0	0/2/4	3/3/0	0/2/3	25/15/0	0/25/50	25/20/0	50/40/0	0/0/50
7	MS299	Community Engagement Course	Mandatory	2										
Total				**24**										

II Year: Fourth Semester

1	IT202	Software Engineering	ESC	4	3	0	2	3	0	15	25	20	40	-
2	IT204	Operating Systems	DCC	4	3	0	2	3	0	15	25	20	40	-
3	IT206	Database Management Systems	DCC	4	3	0	2	3	0	15	25	20	40	-
4	IT208	Algorithm Analysis & Design	DCC	4	3	1	0	3	0	25	-	25	50	-
5	IT210	Machine Learning	DCC	4	3	0	2	3	0	15	25	20	40	-
6	AEC/VAC	AEC/VAC	AEC/VAC	2	2/1/0	0	0/2/4	3/3/0	0/2/3	25/15/0	0/25/50	25/20/0	50/40/0	0/0/50
Total				**22**										

Additional 02 credits are to be earned from mandatory community engagement course in second year to fulfil the requirement of award of the four year B.Tech Degree.

B. Tech. Information Technology

III Year: Fifth Semester

Teaching Scheme					Contact Hours/Week			Exam Duration (h)		Relative Weights (%)				
S. No.	**Subject Code**	**Course Title**	**Subject Area**	**Credit**	**L**	**T**	**P**	**Theory**	**Practical**	**CWS**	**PRS**	**MTE**	**ETE**	**PRE**
1	IT301	Compiler Design	DCC	4	3	0	2	3	0	15	25	20	40	-
2	IT303	Computer Network	DCC	4	3	0	2	3	0	15	25	20	40	-
3	IT305	Computer Organization and Architecture	DCC	4	3	1	0	3	0	25	-	25	50	-
4	HU301	Engineering Economics	SEC	3	3	1	0	3	0	25	-	25	50	-
5	IT3XX	Discipline Specific Elective Course - 1	DEC	4	3/3	0/1	2/0	3	0	15/25	25/0	20/25	40/50	-
6	GECXXX	Generic Elective Course -1	GEC	4	3/3	0/1	2/0	3	0	15/25	25/0	20/25	40/50	-
Total				**23**										

III Year: Sixth Semester

1	IT302	Data Engineering and Analytics	DCC	4	3	0	2	3	0	15	25	20	40	-
2	**IT304**	**Cyber Forensics**	DCC	4	3	0	2	3	0	15	25	20	40	-
3	MG302	Fundamentals of Management	SEC	3	3	1	0	3	0	25	-	25	50	-
4	IT3XX	Discipline Specific Elective Course - 2	DEC	4	3/3	0/1	2/0	3	0	15/25	25/0	20/25	40/50	-
5	IT3XX	Discipline Specific Elective Course - 3	DEC	4	3/3	0/1	2/0	3	0	15/25	25/0	20/25	40/50	-
6	GECXXX	Generic Elective Course -2	GEC	4	3/3	0/1	2/0	3	0	15/25	25/0	20/25	40/50	-
Total				**23**										

B. Tech. Information Technology

IV Year: Seventh Semester

Teaching Scheme					Contact Hours/Week			Exam Duration (h)		Relative Weights (%)				
S. No.	**Subject Code**	**Course Title**	**Subject Area**	**Credit**	**L**	**T**	**P**	**Theory**	**Practical**	**CWS**	**PRS**	**MTE**	**ETE**	**PRE**
1	IT401	B. Tech Project-I	DCC	4	-	-	-	-	-	-	40	-	-	60
2	IT403	Internship	DCC	2	-	-	-	-	-	-	40	-	-	60
3	IT4XX	Discipline Specific Elective Course - 4	DEC	4	3/3	0/1	2/0	3	0	15/25	25/0	20/25	40/50	-
4	IT4XX	Discipline Specific Elective Course - 5	DEC	4	3/3	0/1	2/0	3	0	15/25	25/0	20/25	40/50	-
5	GECXXX	Generic Elective Course - 3	GEC	4	3/3	0/1	2/0	3	0	15/25	25/0	20/25	40/50	-
6	VACXXX	Indian Knowledge System	VAC	Non Credit										
Total				**18**										

IV Year: Eight Semester

1	IT402	B. Tech Project-II	DCC	8	-	-	-	-	-	-	40	-	-	60
2	IT4XX	Discipline Specific Elective Course - 6	DEC	4	3/3	0/1	2/0	3	0	15/25	25/0	20/25	40/50	-
3	GECXXX	Generic Elective Course - 4	GEC	4	3/3	0/1	2/0	3	0	15/25	25/0	20/25	40/50	-
Total				**16**										

Cumulative Total	**166**	

B. Tech. Information Technology

Discipline Specific Elective Courses

Discipline Specific Elective Course - 1 (Semester - 5)	
IT307	Deep Learning
IT309	Cyber Laws
IT311	Malware Analysis
IT313	Internet of Things
IT315	Computer Graphics
IT317	Software Project Management
IT319	Information and Network Security
IT321	Introduction to Security of Cyber-Physical Systems

Discipline Specific Elective Course - 2 & 3 (Semester - 6)	
IT306	Distributed Cloud Computing
IT308	Pattern Recognition and Applications
IT310	Secure Coding
IT312	Wireless Mobile Ad hoc Networks
IT314	Blockchain Technology
IT316	Digital Image Processing
IT318	Natural Language Processing
IT320	**Cyber Security**
IT322	Computer Vision

Discipline Specific Elective Course - 4 & 5 (Semester - 7)	
IT405	Social Networks
IT407	Intrusion Detection and Information Warfare
IT409	High Performance Computing
IT411	High Speed Networks
IT413	Information Security and Audit
IT415	Multimedia System Design
IT417	Multimodal Data Processing
IT419	Big Data Analysis
IT421	Ethical Hacking
IT423	Soft Computing
IT425	Augmented Reality & Virtual Reality
IT427	Enterprise JAVA
IT429	Generative AI
IT431	Embedded Systems for IoT
IT433	IoT with Arduino, ESP, and Raspberry Pi

Discipline Specific Elective Course - 6 (Semester - 8)	
IT404	Speech and Natural Language Understanding
IT406	Mobile and Digital Forensics
IT408	Quantum Computing
IT410	GPU Computing
IT412	Autonomous Systems and Robotics
IT414	Semantic web and Web Mining
IT416	Dependable AI
IT418	Sensor Technology

	IT324	Artificial Intelligence				
	IT326	Software Testing				
	IT328	Competitive Programming				
	IT330	Ubiquitous Sensing, Computing, and Communication				
	IT332	Intelligent IOT				

Minor in Information Technology			
S. No.	**Course Code**	**Course Title**	**Course Type**
1	IT203	Data Structures	Compulsory
2	IT208	Algorithm Design & Analysis	Compulsory
3	IT303	Computer Networks	Compulsory
4	IT210	Machine Learning	Elective
5	IT301	Compiler Design	Elective
6	IT311	Malware Analysis	Elective
7	IT202	Software Engineering	Elective
8	IT319	Information and Network Security	Elective
9	IT419	Big Data Analysis	Elective
10	IT204	Operating Systems	Elective
11	IT304	Cyber Security	Elective
12	IT318	Natural Language Processing	Elective
13	IT308	Pattern Recognition and Applications	Elective
Minor in Cyber Security			
S. No.	**Course Code**	**Course Title**	**Course Type**
1	IT310	Secure Coding	Compulsory
2	IT311	Malware Analysis	Compulsory
3	**IT304**	**Cyber Forensics**	**Compulsory**
4	IT421	Ethical Hacking	Elective
5	IT319	Information and Network Security	Elective
6	IT309	Cyber Laws	Elective
7	IT413	Information Security and Audit	Elective
8	IT406	Mobile and Digital Forensics	Elective
Minor in Artificial Intelligence and Machine Learning			
S. No	**Course Code**	**Course Title**	**Course Type**
1	IT307	Deep Learning	Compulsory
2	IT322	Computer Vision	Compulsory
3	IT318	Natural Language Processing	Compulsory

4	IT308	Pattern Recognition and Applications	Elective
5	IT416	Dependable AI	Elective
6	IT316	Digital Image Processing	Elective
7	IT429	Generative AI	Elective
8	IT417	Multimodal Data Processing	Elective
9	IT404	Speech & Natural Understanding	Elective
Minor in Internet of Things (IoT)			
S. No.	**Course Code**	**Course Title**	**Course Type**
1.	IT313	Internet of Things	Compulsory
2.	IT330	Ubiquitous Sensing, Computing, and Communication	Compulsory
3.	IT431	Embedded Systems for IoT	Compulsory
4.	IT332	Intelligent IOT	Elective
5.	IT418	Sensor Technology	Elective
6.	IT433	IoT with Arduino, ESP, and Raspberry Pi	Elective
7.	IT321	Introduction to Security of Cyber-Physical Systems	Elective

FIRST SEMESTER

B.Tech. Information Technology

Course code: Course Title	Course Structure			Pre-Requisite
	L	T	P	
IT103: Fundamentals of Web Design	1	0	2	-

Course Objectives:1. Develop the skill & knowledge of Web page design.
2. Students will understand the knowhow and can function either as an entrepreneur or can take up jobs in the multimedia and Web site development studio and other information technology sectors

S. NO	Course Outcomes (CO)
CO1	Define the principle of Web page design
CO2	Visualize the basic concept of HTML.
CO3	Recognize the elements of HTML
CO4	Apply basics concept of CSS for styling the pages
CO5	Develop the concept of web publishing

S. NO	Contents	Contact Hours
UNIT 1	Introduction to Internet and HTML: WWW, Browser, URL, Web server, Web site, Domain Name, Basic principles involved in developing a web site, designing a web page, Page Layout, HTML Documents, Basic structure of an HTML document, Creating an HTML document, Mark up Tags, Heading-Paragraphs, Line Breaks, HTML Tags.	9
UNIT 2	Elements of HTML: Introduction, Working with Text, Working with Lists, Tables and Frames, Working with Hyperlinks, Images and Multimedia, Working with Forms and controls	9
UNIT 3	Introduction to Cascading Style Sheets: Concept of CSS, Creating Style Sheet, CSS Properties, CSS Styling, Working with block elements and objects, Working with Lists and Tables, CSS Id and Class, CSS Colour, Creating page Layout and Site Designs.	9
UNIT 4	Introduction to Web Publishing or Hosting: Creating the Web Site, Saving the site, working on the web site, creating web site structure, Creating Titles for web pages, Themes-Publishing web sites.	9
	TOTAL	36

REFERENCES

S. NO	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	HTML 5 in simple steps, Kogent Learning Solutions Inc, Dreamtech Press	
2	Beginner's Guide to HTML, Michael Gabriel	

3	Beginning HTML, XHTML, CSS, and JavaScript, John Duckett, Wiley India	
4	Beginning CSS: Cascading Style Sheets for Web Design, Ian Pouncey, Richard York, Wiley India	
5	HTML, XHTML, and CSS Bible, 5ed, Steven M. Schafer, Wiley India	

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	–	–	–	–	–	–	–	–	–	1	2	–	–
CO2	2	1	2	–	2	–	–	–	–	–	–	1	2	–	–
CO3	2	1	2	–	2	–	–	–	–	–	–	1	2	–	–
CO4	2	2	3	–	3	–	–	–	–	–	–	1	3	1	–
CO5	2	2	3	–	3	2	1	1	1	2	–	2	3	1	2

SECOND SEMESTER

B.Tech. Information Technology

Course code: Course Title	Course Structure			Pre-Requisite
	L	T	P	
IT102 Discrete Structures	1	1	0	-

Course Objectives:1. Learn the Concepts of Formal Logics.
2. Appraise the need for properties of relations, functions, and sequences to complete operations on discrete structures such as sets, functions, relations, and sequences.
3. Appraise the need for mathematical proofs using counter-examples, direct proofs, proof by contrapositive, proof by contradiction, case analysis, and mathematical induction.
4. Illustrate the use of Lattices and Boolean Algebra.
5. Demonstrate the use of Graph Theory.
6. Demonstrate the use of counting techniques and combinatorics to determine the discrete probability

S. NO	Course Outcomes (CO)
CO1	Apply the properties of relations, functions, and sequences to complete operations on discrete structures such as sets, functions, relations, and sequences.
CO2	Verify the correctness of an argument using propositional logic, predicate logic, and truth tables
CO3	Construct mathematical proofs using counter-examples, direct proofs, proof by contrapositive, proof by contradiction, case analysis, and mathematical induction
CO4	Apply counting techniques and combinatorics to determine discrete probability
CO5	Model relationships using graphs and trees

S. NO	Contents	Contact Hours
UNIT 1	IFormal Logic: Statement, Symbolic Representation and Tautologies, Quantifiers, Predicator and validity, Normal form, Prepositional Logic, Predicate Logic, Logic Programming and Proof of correctors	3
UNIT 2	Proof, Relation and Analysis of Algorithm: Technique for theorem proving: Direct Proof, Proof by Contra position, proof by exhausting cases and proof by contradiction, Principle of mathematical induction, principle of complete induction, recursive definition, solution methods for linear, first-order recurrence relations with constant coefficients, analysis of algorithms involving recurrence rotations-recursive selection sort, binary search, quick sort, solution method for a divide-and-conquer recurrence relation.	7
UNIT 3	Sets and Combinations: Sets, Subsets, power sets, binary and unary operations on a set, set operations/set identities, fundamental counting principles, principle of inclusion, exclusion and pigeonhole, permutation and combination, Pascal's triangles, binomial theorem, representation of discrete structures.	8
UNIT 4	Relation/function and matrices: Rotations, properties of binary rotations, operation on b equivalence relation, properties of function, composition of function, inverse, binary ar function, composition of cycles, Boolean matrices, Boolean matrices multiplication.	8

UNIT 5	Lattices & Boolean Algebra: Lattices: definition, sublattices, direct product, homomorphism Boolean algebra: Definition, properties, isomorphic structures (in particular, structures with binary operations) subs algebra, direct product and homomorphism, Boolean function, Boolean expression, representation & minimization of Boolean function.	**8**
UNIT 6	Graph Theory Terminology, isomorphic graphs, Euler's formula (Proof) four color problem and the chromatic number of a graph, five color theorem. Trees terminology, directed graphs, Computer representation of graphs, Warshall's algorithms, Decision Trees, Euler path & Hamiltonian circuits, Shortest path & minimal spanning trees, Depth-first and breadth first searches, analysis of search algorithm, trees associated with DFS & BFS Connected components, in order, preorder & post order tree traversal algorithms.	**8**
	TOTAL	**42**

REFERENCES

S.No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	Kenneth H. Rosen, "Discrete Mathematics and Its Applications", TMH (ISBN: 9780070681880),1999	1999
2	C.L. Liu, "Elements of Discrete Mathematics", TMH (ISBN: 9780007043477), 2000	2000
3	Kolman, Busby & Ross, "Discrete Mathematical Structures", PHI (ISBN-978- 0132297516),1996	1996
4	NarsinghDeo, "Graph Theory With Application to Engineering and Computer Science", PHI (ISBN: 9788120301450),2004	2004
5	J. P. Trembly& P. Manohar, "Discrete Mathematical Structures with Application Computer Science", McGraw Hill (ISBN: 0070651426),1997	1997

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	–	–	–	–	–	–	–	–	–	1	2	–	–
CO2	3	3	–	–	–	–	–	–	–	–	–	1	2	–	–
CO3	3	3	–	1	–	–	–	–	–	–	–	1	2	–	–
CO4	3	3	–	1	–	–	–	–	–	–	–	1	2	–	–
CO5	3	3	2	1	–	–	–	–	–	–	–	1	3	–	–

B.Tech. Information Technology						
Course code: Course Title		**Course Structure**			**Pre-Requisite**	
		L	**T**	**P**		

IT104 Object-Oriented Programming		3	0	2	-	

Course Objectives: 1. To understand the basics of classes and objects.
2. To provide knowledge of Object-Oriented programming features.
3. To understand the concept of operator overloading and inheritance
4. To understand the concept of exception handling, Input-Output and File Operation

S. NO	Course Outcomes (CO)	
CO1	To differentiate between structured and object-oriented programming	
CO2	To apply the concepts of Constructor, destructor, friend functions and classes and dynamic objects	
CO3	To investigate cases of operator overloading, inheritance and abstraction	
CO4	To implement generic programming with templates	
CO5	To investigate Byte code, casting and conversion and input-output	
CO6	To explain access specifiers, polymorphism and STL	

S. NO	Contents	Contact Hours
UNIT 1	Object oriented paradigm & C++ at a glance: Evolution of programming paradigm, structured versus object-oriented development, elements of object-oriented programming, Objects, classes, methods, popular OOP languages, software reuse. Classes and objects: Introduction, Class revisited, constant objects and constructor, static data members with constructors and destructors, constructor overloading, nested classes, objects as arguments, returning objects, friend functions and friend classes, constant parameters and member functions, static data and member functions.	9
UNIT 2	Dynamic objects: Introduction, pointers to objects, array of objects, pointers to object members, this pointer, self-referential classes Operator overloading and Inheritance: overloading of new and delete operators, conversion between objects and basic types, conversion between objects of different classes, overloading with friend functions, abstract classes, inheritance types, virtual base classes, virtual functions, pointer to derived class objects, and base class objects, pure virtual functions, virtual destructors	10
UNIT 3	Generic programming with templates: Introduction, function templates, overloaded function templates, class templates, inheritance of class template, class template containership, class template with overloaded operators	6
UNIT 4	Introduction to byte code, security and portability, Data Types, variables, operators, arrays, type conversion and casting, type promotion, Control statements, standard input-output, Designing Classes, constructors, methods, Access specifiers: public, private, protected, inheritance, packages and interfaces, Math, String, Vectors, and Array List classes, polymorphism: function and operator overloading, function overriding, abstract classes	8
UNIT 5	Exception Handling: exception types, nested try-catch, throw, throws and finally, statements, Multithread Programming: thread creation, synchronization and priorities. Input-output and file operations: Java.io, stream classes, Byte streams, character streams, serialization.	8
	TOTAL	36

REFERENCES						
S.No.	**Name of Books/Authors/Publishers**					**Year of Publication / Reprint**
1	Patrick Naughton, Herbert Schildt: "The Complete Reference: Java 2", 12th Edition, TMH.ISBN- 978-1260463415, McGraw Hill publisher, December 2021					2021
2	C Thomas Wu : "An Introduction to OO programming with Java", TMH, ISBN-10: 0073523305					
3	Balaguruswami, "Object oriented with C++", 8th Edition, TMH, 2020 ISBN 978-9389949186, McGraw Hill publisher, September 2020					2020
4	Budd, "Object Oriented Programming", Addison Wesley					
5	Mastering C++ K.R Venugopal Rajkumar, TMH.					
6	D Samantha, "Object oriented Programming in C++ and Java ", PHI.					

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	–	–	–	–	–	–	–	–	–	1	2	–	–
CO2	3	2	3	–	–	–	–	–	–	–	–	1	3	–	–
CO3	3	3	3	1	–	–	–	–	–	–	–	1	3	1	–
CO4	3	2	3	–	2	–	–	–	–	–	–	1	3	1	–
CO5	2	2	2	–	2	–	–	–	–	–	–	1	2	1	–
CO6	2	2	2	–	2	–	–	–	–	–	–	1	2	1	–

B.Tech. Information Technology						
Course code: Course Title	**Course Structure**				**Pre-Requisite**	
IT106 Open-Source Programming	**L**	**T**	**P**		**-**	
	1	**0**	**2**			
Course Objectives:1. Learn the syntax and semantics of Python Programming Language. 2. Write Python functions to facilitate code reuse and manipulate strings. 3. Illustrate the process of structuring the data using lists, tuples, and dictionaries. 4. Demonstrate the use of built-in functions to navigate the file system. 5. Appraise the need for working on web scraping 6. Appraise the need for extracting data from various file formats.						
S. NO	**Course Outcomes (CO)**					
CO1	Demonstrate the concepts of control structures in Python					
CO2	Implement Python programs using functions and strings					
CO3	Implement methods to create and manipulate lists, tuples, and dictionaries					
CO4	Apply the concepts of file handling and regex using packages					

CO5	Illustrate the working of scraping websites with CSV.
CO6	Illustrate the working of dealing with data in various types of files such as Excel, CS, PDF and JSON

S. NO	**Contents**	**Contact Hours**
UNIT 1	Python Basics: Entering Expressions into the interactive shell, The integer, floating and string data types, string concatenation and replication, storing values in variables, your first Python program. Flow Control: Boolean Values, comparison operators, Boolean Operators, flow control statements, Importing Modules. Functions: definition statement with parameters, Range values, and return values, The none value, Keyword arguments with printf(), Local and Global scope, The global statement, and Exceptional Handling	**9**
UNIT 2	LISTS: The list data type, working with lists, Augmented assignment operator, and List Methods. Dictionary: The Dictionary Data-Type, Using Dictionary to Model real-world Things like a tic-tact toe board, Nested Dictionary, and Lists. Manipulating Strings: Working with strings, Useful string Methods	**9**
UNIT 3	Pattern Matching with Regular Expression: Finding Patterns of text without regular expression, Finding Patterns of text with regular expression, Greedy, and Non-Greedy Matching, The findall() method. Reading and Writing Files: File and File Paths, The os.path module, The file reading or writing process,. Web Scrapping: maplt.py with the browser model, Downloading files from the web with request module, parsing HTML with beautiful soap module.	**9**
UNIT 4	Working with Excel Spread Sheets: Installing the openpyxl module, Reading Excel documents, and writing Excel documents. Working with PDF and Word Documents: creating PDF, Extracting text from PDF, Reading and writing Word documents. Working with CSV files and JSON Data: The CSV module (Reading objects and Writing objects), JSON module (Reading JSON and Writing JSON).	**9**
	TOTAL	**36**

REFERENCES

S.No.	**Name of Books/Authors/Publishers**	**Year of Publication / Reprint**
1	Al Sweigart, “Automate the Boring Stuff with Python”, William Pollock, 2015, ISBN: 978-1593275990	2015
2	Allen B. Downey, "Think Python: How to Think Like a Computer Scientist”, 2nd Edition, Green Tea Press, 2015, ISBN: 978-9352134755	2015
3	Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd. ISBN-13: 978-8126556014.	

CO-PO-PSO Mapping

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	–	–	1	–	–	–	–	–	–	1	2	–	–

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO2	3	3	2	–	2	–	–	–	–	–	–	2	3	2	–
CO3	3	3	2	–	2	–	–	–	–	–	–	2	3	2	–
CO4	3	2	2	1	3	–	–	–	–	–	–	2	3	3	1
CO5	2	2	2	2	3	–	–	–	–	1	–	2	2	3	3
CO6	2	2	2	2	3	–	–	–	–	1	–	3	3	3	3

THIRD SEMESTER

B.Tech. Information Technology

Course code: Course Title	Course Structure			Pre-Requisite
	L	T	P	
IT201 Digital Systems and Microcontroller	3	0	2	**Basic Eectronics**

Course Objectives: 1. To provide the basic knowledge of gates, Number Systems and their Arithmetic, Computer Codes, digital logic families, SOP and POS simplifications.
2. Ability to design MSI/LSI circuits.
3. Gain Knowledge about the function of Flip-Flops, Counters, Registers.
4. Understanding the concepts of Sequential circuits.
5. Understanding the architecture and programming capabilities of ARM microcontroller

S. NO	Course Outcomes (CO)
CO1	Ability to understand the fundamentals of digital systems.
CO2	Ability to apply learned fundamental to implement real systems that are useful for the society.
CO3	Ability to learn the basic concept of synthesis of synchronous as well as asynchronous sequential circuits.
CO4	Ability to understand and explore the selection criteria of ARM processors by learning the functional level trade off issues.

S. NO	Contents	Contact Hours
UNIT 1	Number Systems and Codes: Introduction to the positional number system, signed magnitude numbers, floating point numbers, binary arithmetic: addition, subtraction, multiplication and division, Base conversion, conversion formulas with examples, one's and two's compliment arithmetic, Computer codes – BCD codes, gray codes, excess-3 codes, parity checks, Hamming and alphanumeric codes.	**12**
UNIT 2	Combinational Logic Design: Introduction, standard representations for logical functions, Karnaugh map representation, simplification of logical functions using K-map, minimization of logical functions specified in minterms/maxterms or Truth Table, minimization of logical functions not specified in minterms/maxterms, Don't care conditions, design examples, Ex-or and Ex-nor simplification of K-maps, five and six-variable K-maps, QM method, MEV method, Introduction of multiplexers and their use in combinational logic design, demultiplexers /decoders and their use in combinational logic design, adders and their use as subtractors, digital comparators, parity generators/checkers, code converters, priority encoders, 7-segment decoder/driver.	**12**
UNIT 3	Synchronous Sequential Circuits and Asynchronous Sequential Circuits: Introduction, FSM model, memory elements and their excitation functions. Synthesis of synchronous sequential circuits, capabilities and limitation of FSM, state equivalence and minimization, simplification of incompletely specified machines, Fundamental mode circuits synthesis, state assignment, pulse mode circuits.	**10**
UNIT 4	ARM Microcontrollers: Introduction to the architecture, operation modes and states, registers, special registers, floating point registers, general information about Cortex-M3 and cortex M4 processors.	**8**
	TOTAL	**42**

REFERENCES		
S.No.	**Name of Books/Authors/Publishers**	**Year of Publication / Reprint**
1	R.P. Jain: Modern Digital Electronics, TMH Publications.	2009
2	Z Kohavi: Switching and Finite Automata Theory, TMH Publications.	2009
3	M.M. Mano: Digital Logic Design, PHI Publications.	2004
4	Dr. B.R. Gupta: Digital Electronics, Katson Publications.	2012
5	James W. Bignell& Robert Donovan: Digital Electronics, Cengage Learning Publications.	2013
6	Sanjay Kumar Bose: Digital Systems, New Age International Publishers	2019
7	ARM System Developer's Guide Designing and Optimizing System Software by Andrew N. SLOSS, Dominic SYMES, Chris WRIGHT, Elsevier Publications.	2004
8	The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors by Joseph Yiu, Elsevier Publications, 3rd Ed.,	2013

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	–	–	–	–	–	–	–	–	–	1	2	–	–
CO2	2	3	2	–	–	2	1	–	–	–	–	1	3	–	1
CO3	3	3	2	1	–	–	–	–	–	–	–	1	3	–	–
CO4	3	2	2	–	2	–	–	–	–	–	–	2	3	1	–

B.Tech. Information Technology						
Course code: Course Title		**Course Structure**			**Pre-Requisite**	
IT203 Data Structures		**L**	**T**	**P**	**Fundamentals of Programming**	
		3	**0**	**2**		
Course Objective: 1) Design correct programs to solve problems. 2) Choose efficient data structures and apply them to solve problems.						
S. NO	**Course Outcomes (CO)**					
CO1	Ability to select the data structures that efficiently model the information in a problem.					
CO2	Apply and implement stack and queue data structures using arrays, and solve problems involving expression evaluation, recursion, and priority queues.					
CO3	Design and implement linked list data structures and perform operations such as insertion, deletion, traversal, and searching					
CO4	Analyze and implement tree data structures and various operations on the tree.					
CO5	Apply concepts of graph theory and file structures, including graph representations, traversal algorithms, shortest paths, spanning trees, hashing, and indexing techniques.					
S. NO	**Contents**					**Contact Hours**

UNIT 1	Introduction: Introduction to Algorithmic, Complexity- Time-Space Trade off. Introduction to abstract data types, design, implementation and applications. Introduction to List data structure. Arrays and Strings: Representation of Arrays in Memory: one dimensional, Two dimensional and Multidimensional, Accessing of elements of array, performing operations like Insertion, Deletion. Sorting elements of arrays: Insertion Sort. Strings and String Operations. Searching: Linear Search, Binary search, Interpolation Search	**6**
UNIT 2	Stacks and Queues: Introduction to data structures like Stacks and Queues. Operations on Stacks and Queues, Array representation of Stacks , Applications of Stacks : recursion, Polish expression and their compilation conversion of infix expression to prefix and postfix expression, Operations of Queues, Representations of Queues Applications of Queues, Priority queues. .	**9**
UNIT 3	Linked Lists: Singly linked lists, Representation of linked list, Operations of Linked list such as Traversing, Insertion and Deletion, Searching, Applications of Linked List. Concepts of Circular linked list and Doubly linked list and their Applications. Stacks and Queues as linked list	**9**
UNIT 4	Trees: Basic Terminology, Binary Trees and their representation, binary search trees, various operations on Binary search trees like traversing, searching , Insertion and Deletion , Applications of Binary search Trees , Complete Binary trees, Extended binary trees. General trees, AVL trees, Threaded trees, B- trees, Red-Black Tree	**8**
UNIT 5	Graphs: Terminology and Representations, Graphs & Multi-graphs, Directed Graphs, Representation of graphs and their Transversal, Spanning trees, shortest path and Transitive Closure, Activity Networks, Topological Sort and Critical Paths, Strongly connected components, Bipartite Graphs. File Structure: File Organization, Indexing & Hashing, Hash Functions, Collision Resolution Techniques.	**10**
	TOTAL	**42**

REFERENCES

S.No.	**Name of Books/Authors/Publishers**	**Year of Publication / Reprint**
1	Horowitz and Sahni, “Fundamentals of Data structures”, Galgotia publications.	1999
2	Tannenbaum, “Data Structures”, PHI.	2007
3	An introduction to data structures and application by Jean Paul Tremblay & Pal G. Sorenson (McGraw Hill).	2017
4	Data Structures and Algorithms Made Easy by Narasimha Karumanchi, CareerMonk Publications	2016

CO-PO-PSO Mapping

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	–	–	–	–	–	–	–	–	–	1	2	–	–
CO2	3	3	–	1	–	–	–	–	–	–	–	1	3	–	–
CO3	3	3	2	–	–	–	–	–	–	–	–	1	3	–	–
CO4	3	3	3	1	–	–	–	–	–	–	–	2	3	1	–

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO5	3	3	3	1	–	–	–	–	–	–	–	2	3	1	–

B.Tech. Information Technology						
Course code: Course Title	**Course Structure**				**Pre-Requisite**	
IT205 Data Science and Visualization	**L**	**T**	**P**		Probability, Statistics, Linear Algebra	
	3	**0**	**2**			
Course Objective: 1. To familiarize with different types of data and its visualization. 2. To understand and practice data pre-processing and data exploration. 3. To solve real-world analytical problems in data science.						
S. NO.	**Course Outcomes (CO)**					
CO1	Ability to identify different types of data and data distributions.					
CO2	Ability to understand and apply different data cleaning and data transformation techniques.					
CO3	Ability to understand and implement different data visualization techniques.					
CO4	Ability to understand and execute different data exploration techniques.					
CO5	Ability to implement different real-world applications of data science.					
S. NO.	**Contents**					**Contact Hours**
UNIT 1	Introduction to data science: Basics of Probability & Statistics (Random Variables, Bayes's Theorem, Normal distribution, Central Limit Theorem). Defining data science, Recognizing different types of data, Data distributions. Data acquisition and data storage.					**10**
UNIT 2	Data pre-processing: Missing data problem, Outlier definition. Data cleaning, Data transformation or data wrangling procedures such as merging, ordering and aggregating.					**10**
UNIT 3	Introduction to data visualization; role and objectives in data analysis and decision making; coordinate systems, scaling and normalization; data-to-visual mapping and visual encoding (position, length, size, shape, color); chart selection for comparison, distribution, relationship, composition, temporal and hierarchical data; basic charts (bar, line, scatter, histogram, box plot, heat map); graph-based visualization for networks and hierarchies; dashboard definition, design principles, layout, interactivity and KPIs; data storytelling, interpretation of patterns, and common visualization errors.					**10**
UNIT 4	Exploratory Data Analysis: Data exploration for univariate data. Outlier detection techniques. Descriptive statistics (mean, standard deviation etc.) for data exploration. Correlation statistics for data exploration. Data exploration for multivariate data. Use of multivariate visualization tools such as bar charts, bar plots, heat maps, bubble charts, run charts, and scatter plots.					**12**
	TOTAL					**42**
REFERENCES						
S.No.	**Name of Books/Authors/Publishers**					**Year of Publication / Reprint**
1	Data science from scratch, Joel Grus, 2nd ed., O'Reilly Media.					2019

2	Doing data science: Straight talk from the frontline, Cathy O'Neil, Rachel Scutt, O'Reilly Media.	2013
3	Python data science handbook, Jake VanderPlas, 2nd ed., O'Reilly Media.	2016
4	Introducing data science, Davy Cielen, Arno D.B. Meysman, Mohamed Ali, 1st ed., Manning publications.	2016
5	The data science handbook, Field Cady, John Wiley & sons.	2017
6	Practical Statistics for Data Scientists: 50+ Essential Concepts Using R and Python Peter Bruce, Andrew Bruce, Peter Gedeck	2021
7	Visualization Analysis and Design,Tamara Munzner, A K Peters Visualization Series, CRC Press	2014

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	–	–	–	–	–	–	–	–	–	1	2	–	–
CO2	3	3	2	1	–	–	–	–	–	–	–	1	3	–	–
CO3	2	2	2	1	3	–	–	–	–	–	–	1	2	1	–
CO4	2	3	2	2	–	–	–	–	–	–	–	1	3	–	–
CO5	2	3	3	2	3	1	–	1	–	–	–	2	3	2	–

B.Tech. Information Technology						
Course code: Course Title	**Course Structure**			**Pre-Requisite**		
IT207 Data Communications	**L**	**T**	**P**	Mathematics, Physics		
	3	**1**	**0**			
Course Objective: 1. To understand various key components for data communication systems. 2. To familiarize with the mathematical and physical principles of digital transmission techniques. 3. To understand and differentiate among various data communication techniques and devices.						
S. NO.	**Course Outcomes (CO)**					
CO1	Understand the fundamental concepts and applications of data communications.					
CO2	Gain a comprehensive understanding of core data communication concepts, including digital transmission techniques, data representation, synchronization, and multiplexing.					
CO3	Learn the principles of the modulation process used in various digital modulation systems.					
CO4	Learn to evaluate the operation of waveform coding techniques and analyze their performance.					
CO5	Develop an understanding of the design issues related to digital communication channels, switching systems, and devices.					
S. NO.	**Contents**					**Contact Hours**
UNIT 1	Introduction to Data Communication: Definition, Characteristics & Components of Data Communication System. Data Representation, types of Communication and data transmission modes. Synchronous and Asynchronous Transmission. Communication model, Sender, Receiver, Carrier and data flow.					**7**

UNIT 2	Data and signals: Analog and Digital data & signals. Periodic and nonperiodic signals. Phase, wavelength, time and frequency domains, Concept of bandwidth. Bit rate, bit length, transmission of digital signals. Impairments, attenuation, distortion, noise. Data rate limits, bandwidth, throughput, latency (delay), bandwidth-delay product & jitter.	**13**
UNIT 3	Digital Transmission: Analog to digital and digital to digital conversion. Line Coding, Line Coding Schemes, Block Coding, Scrambling. Digital Modulation techniques, Pulse Code Modulation (PCM) and Delta Modulation (DM). Parallel and Serial Transmission, Bandwidth Utilization-Multiplexing and Spreading:	**10**
UNIT 4	Transmission media & Physical layer: Guided media: twisted-pair cable, coaxial cable, fiber-optic cable. Unguided media-wireless: radio waves, microwaves infrared. Performance comparison of Wired and Wireless Media. Physical Layer Specifications, Signaling, and network devices at Physical Layer	**8**
UNIT 5	Introduction of Switching Networks: Switching Methods and devices, access points, hubs, routers, gateways. Comparison of, Circuit, Packet Switching datagram and Virtual circuit switching. Structure of Switch.	**4**
	TOTAL	**42**

REFERENCES

S.No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	Data Communications and Networking , 6th Edition by Behrouz A. Forouzan ,Tata McGraw-Hill	2022
2	Data and Computer Communications, 10th Edition by Stallings William, Pearson Higher Ed Publication	2017
3	Computer Networks 6th Edition by Andrew S. Tanenbaum, Pearson Higher Ed Publication	2022
4	Communication Systems, Fourth Edition, Simon Haykin, — John Wiley & Sons.	2006

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	2	1	0	0	0	0	0	0	0	3	3	2
CO2	3	3	3	3	1	1	0	0	0	0	0	0	3	3	2
CO3	1	2	3	2	1	1	0	0	0	0	0	0	3	3	2
CO4	1	2	3	3	2	2	0	0	0	0	0	0	2	2	1
CO5	1	2	2	2	2	1	0	0	0	0	0	0	2	2	1

B.Tech. Information Technology

Course code: Course Title	Course Structure			Pre-Requisite
	L	**T**	**P**	
IT209 Principles of Computing	**3**	**1**	**0**	Elementary set theory, Relations, Mappings, and linear algebra

Course Objective: To provide knowledge and skills in theoretical foundations of computing that are needed to study and practice computer science.

S. NO	**Course Outcomes (CO)**
CO1	Analyze formal languages and automata by constructing and minimizing DFA, NFA, and ε-NFA.
CO2	Design and transform regular languages using regular expressions, automata, and regularity properties.
CO3	Construct and normalize context-free grammars by resolving ambiguity and applying CNF and GNF.
CO4	Analyze context-free languages using closure properties, pumping lemma, and PDA–CFG equivalence.
CO5	Evaluate computational limits using Turing machines and decidability concepts.

S. NO	**Contents**	**Contact Hours**
UNIT 1	Introduction: Alphabets, Strings and Languages; Automata and Grammars, Deterministic finite Automata (DFA)-Formal Definition, Simplified notation: State transition graph, Transition table, Language of DFA, Nondeterministic finite Automata (NFA), NFA with epsilon transition, Language of NFA, Equivalence of NFA and DFA, Minimization of Finite Automata, Distinguishing one string from other, Myhill-Nerode Theorem.	9
UNIT 2	Regular expression (RE): Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen's Theorem, Regular expression to FA, DFA to Regular expression, Arden Theorem, Non Regular Languages, Pumping Lemma for regular Languages. Application of Pumping Lemma, Closure properties of Regular Languages, Decision properties of Regular Languages, FA with output: Moore and Mealy machine, Equivalence of Moore and Mealy Machine, Applications and Limitation of FA.	7
UNIT 3	Context free grammar (CFG):Definition, Examples, Derivation , Derivation trees, Ambiguity in Grammar, Inherent ambiguity, Ambiguous to Unambiguous CFG, Useless symbols, Simplification of CFGs, Normal forms for CFGs: CNF and GNF,	7
UNIT 4	Context Free Languages (CFL): Closure properties of CFLs, Decision Properties of CFLs: Emptiness, Finiteness and Membership, Pumping lemma for CFLs.	5
UNIT 5	Push Down Automata (PDA): Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic PDA, Equivalence of PDA and CFG, CFG to PDA and PDA to CFG, Two stack PDA.	7
UNIT 6	Turing machines (TM): Basic model, definition and representation, Instantaneous Description, Language acceptance by TM, Variants of Turing Machine, TM as Computer of Integer functions, Universal TM, Church's Thesis, Recursive and recursively enumerable languages, Halting problem, Introduction to Undecidability, Undecidable problems about	7

	TMs. Post correspondence problem (PCP), Modified PCP, Introduction to recursive function theory.	
	TOTAL	**42**

REFERENCES

S.No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	Hopcroft, Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson Education. ISBN-13: 978-0321455369	2006
2	K.L.P. Mishra and N.Chandrasekaran, "Theory of Computer Science Automata, Languages and Computation", PHI, ISBN-10: 8120329686	2007
3	Grimaldi, Ralph P., "Discrete and Combinatorial Mathematics" Pearson Education.	2006
4	Papadimitrou, C. and Lewis, C.L., "Elements of the Theory of Computation", PHI, ISBN-13:978-0132624787	1998
5	Sipser, Michael, Ïntroduction to the theory of computation", 3rd ed., Cengage publishers	2014

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	–	–	–	–	–	–	–	–	–	1	2	–	–
CO2	3	3	2	1	–	–	–	–	–	–	–	1	3	–	–
CO3	3	3	3	1	–	–	–	–	–	–	–	1	3	1	–
CO4	3	3	3	2	–	–	–	–	–	–	–	1	3	1	–
CO5	3	3	2	2	–	–	–	–	–	–	–	2	3	2	–

FOURTH SEMESTER						
B.Tech. Information Technology						
Course code: Course Title		**Course Structure**			**Pre-Requisite**	
IT202 Software Engineering		**L**	**T**	**P**	Programming Fundamentals	
		3	**0**	**2**		
Course Objective: 1. This course focuses on engineering practices and processes that development team uses to make sure the team is setup for change. 2. The course introduces practices, techniques and processes that can help team build high quality software.						
S. NO.	**Course Outcomes (CO)**					
CO1	Understand the fundamental concepts and need of software engineering					
CO2	Develop a comprehensive understanding of principles, patterns, architecture and software components.					
CO3	Apply principles and algorithms to understand Agile software development model.					
CO4	Learn to critically evaluate the various tecsting techniques and test case generations.					
CO5	Comfortably and effectively participate in various techniques and processes for building scalable and high quality software.					
S. NO.	**Contents**					**Contact Hours**
UNIT 1	Introduction of Software Engineering: Need for software engineering, Software quality attributes, Software product pipelines, Software life cycle models and processes, Requirement engineering using UML Diagrams.					**9**
UNIT 2	Software Architecture and Design: Design principles, Design Patterns, Architecture Versus Design, Modularity,Software Components and Connectors, Architecture Styles.					**6**
UNIT 3	Essence of Modern Software Engineering: Software engineering essence, Essence language, Essence kernel, Using essence kernel in agile development practices, Agile Principles, Agile process models through essence kernel, Large scale complex development Using kernel					**13**
UNIT 4	Software Testing: Quality metrics, Coding style and Static analysis tools, Verification and validation ,Various testing techniques and Test case generations.					**7**
UNIT 5	Software Project Management: Software versioning and Continuous integration, Project management and Risk analysis, Configuration management, Cost analysis and estimation.					**7**
	TOTAL					**42**
REFERENCES						
S.No.	**Name of Books/Authors/Publishers**					**Year of Publication / Reprint**
1	R.S. PRESSMAN, B.R. MAXIM (2019), Software Engineering: A Practitioner's Approach, McGraw-Hill India, 2019, 9th Edition.					2019

2	Mark Richards, Neal Ford (2020), Fundamentals of Software Architecture, O'Reilly Media, Inc.	2020
3	L. BASS, P. CLEMENTS, R. KAZMAN (2012), Software Architecture in Practice, Pearson, 3rd Edition.	2012
4	I. JACOBSON, H. LAWSON, P.W. NG, P.E. McMAHON, M. GOEDICKE (2019), The Essentials of Modern Software Engineering, ACM Books.	2019

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	–	–	–	–	–	–	–	–	–	1	2	–	–
CO2	3	3	2	–	–	–	–	–	–	–	–	1	3	–	–
CO3	3	3	2	–	–	–	–	–	–	–	–	1	3	–	–
CO4	2	3	–	2	–	–	–	–	–	–	–	1	2	–	–
CO5	2	3	3	1	–	–	–	–	2	2	2	2	3	1	–

B.Tech. Information Technology						
Course code: Course Title	**Course Structure**			**Pre-Requisite**		
IT204 Operating Systems Operating Systems	**L**	**T**	**P**	**C Programming and Data Structures**		
	3	**0**	**2**			
Course Objective: 1. To provide an understanding of the fundamental concepts of operating systems. 2. To provide insight into the functional modules of operating systems. 3. To study the concepts underlying the design and implementation of operating systems.						
S. NO	**Course Outcomes (CO)**					
CO1	Abilty to understand the basic concepts and functions of operating systems.					
CO2	Abilty to understand Processes, Threads, and Deadlocks					
CO3	Abilty to analyze Scheduling algorithms					
CO4	Abilty to analyze memory management schemes.					
CO5	Abilty to understand I/O management and File systems.					
S. NO	**Contents**					**Contact Hours**
UNIT 1	Introduction: Operating system and function, Evolution of operating system, Batch, Interactive, Time Sharing and Real Time System, System protection. Operating System Structure: System Components, System structure, Operating System Services					**6**
UNIT 2	Concurrent Processes: Process concept, Principle of Concurrency, Producer Consumer Problem, Critical Section problem, Semaphores, Classical problems in Concurrency, Inter Process Communication, Process Generation, Process Scheduling. CPU Scheduling: Scheduling Concept, Performance Criteria of Scheduling Algorithm, Evolution, Multiprocessor Scheduling.					**10**
UNIT 3	Deadlock: System Model, Deadlock Characterization, Prevention, Avoidance and Detection, Recovery from deadlock combined approach.					**8**

UNIT 4	Memory Management: Base machine, Resident monitor, Multiprogramming with fixed partition, Multiprogramming with variable partition, Multiple base register, Paging, Segmentation, Virtual memory concept, Demand paging, Performance, Paged replacement algorithms, Allocation of frames, Thrashing, Cache memory organization, Impact on performance.	**10**
UNIT 5	I/O Management & Disk Scheduling: I/O devices and organization of I/O function, I/O Buffering, DISK I/O, Operating System Design Issues. File System: File Concept, File Organization and Access Mechanism, File Directories, File Sharing, Implementation Issues	**8**
	TOTAL	**42**

REFERENCES

S.No.	**Name of Books/Authors/Publishers**	**Year of Publication / Reprint**
1	Silberschatz, A, Galvin, P.B., Gagne G., "Operating System Concepts" 10th edition, Wiley Publishers.	2018
2	Stallings W, "Operating Systems ", 9th edition, Pearson Education	2018
3	Maurice Bach, "Design of Unix Operating System", PHI.	2013

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	2	1	1	0	0	0	0	0	0	3	2	3
CO2	3	3	2	3	1	1	0	0	0	0	0	0	3	3	2
CO3	2	2	2	2	1	1	0	0	0	0	0	0	2	3	2
CO4	3	2	3	3	2	2	0	0	0	0	0	0	2	2	2
CO5	1	2	2	2	2	1	0	0	0	0	0	0	2	2	2

B.Tech. Information Technology

Course code: Course Title	**Course Structure**			**Pre-Requisite**
	L	**T**	**P**	
IT206 Database Management Systems	**3**	**0**	**2**	**Data structures**

Course Objective: 1. To understand the concepts of database management system and its applications, data modeling, database design, and query languages.
2. To understand different files structures, transaction management, concurrency control, database recovery, query processing and optimization

S. NO	**Course Outcomes (CO)**
CO1	Analyze real-world problems and apply appropriate data modeling techniques to design conceptual and logical database schemas.
CO2	Design relational database schemas by applying integrity constraints and normalization principles.
CO3	Implement and manipulate databases using relational algebra, relational calculus, and SQL and Design RDBMS for real-life problems.
CO4	Select and apply suitable file organization, indexing, and hashing techniques for efficient data storage and access.

CO5	Analyze and apply transaction management, concurrency control, recovery, and query processing concepts.

S. NO	**Contents**	**Contact Hours**
UNIT 1	Introduction: Database system concepts and its architecture, Data models schema and instances, Data independence and database language and interface, Data definition languages, DML. Overall database structure.Data modeling using Entity Relationship Model: E.R. model concept, notation for ER diagrams mapping constraints, Keys, concept of super key, candidate key, primary key generalizations, Aggregation, reducing ER diagrams to tables, extended ER model.	**9**
UNIT 2	Relational Data Model and Language: Relational data model concepts, integrity constraints, Keys domain constraints, referential integrity, assertions, triggers, foreign key relational algebra, relational calculus, domain and tuple calculus, SQL data definition queries and updates in SQL.	**9**
UNIT 3	Data Base Design: Functional dependencies, normal forms, 1NF, 2NF, 3NF and BCNF, multi-valued dependencies fourth normal form, join dependencies and fifth normal form. Inclusion dependencies, lossless join decompositions, normalization using FD, MVD and JDs, alternative approach to database design.	**8**
UNIT 4	File Organization, Indexing and Hashing Overview of file organization techniques, Indexing and Hashing- Basic concepts, Static Hashing, Dynamic Hashing, Ordered indices, multi-level indexes, B-Tree index files, B+- Tree index files, Buffer management Transaction processing concepts: Transaction processing system, schedule and recoverability, Testing of serializability, Serializability of schedules, conflict & view serializable schedule, recovery from transaction failures, deadlock handling.	**8**
UNIT 5	Concurrency Control Techniques: Locking Techniques for concurrency control, time stamping protocols for concurrency control, concurrency control in distributed systems. multiple granularities and multi-version schemes.	**8**
	TOTAL	**42**

REFERENCES

S.No.	**Name of Books/Authors/Publishers**	**Year of Publication / Reprint**
1	Elmasri, Navathe,"Fundamentals of Database systems", Addision Wesley	2019
2	Korth, Silbertz, Sudarshan,"Data base concepts", McGraw-Hill.	2021
3	Ramakrishna, Gehkre, "Database Management System", McGraw-Hill	2002
4	Date C.J.,"An Introduction to Database systems"	2006

CO-PO-PSO Mapping

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	0	0	0	0	0	0	2	2	0	3	1	2
CO2	2	3	1	0	0	0	0	0	0	2	0	0	2	1	1
CO3	2	2	0	0	2	0	0	0	0	0	3	0	2	1	1
CO4	2	2	1	0	2	0	0	0	0	0	0	0	2	0	1
CO5	2	2	0	0	2	0	0	0	0	0	0	0	2	0	1

B.Tech. Information Technology						
IT208 ALGORITHM DESIGN AND ANALYSIS		**Course Structure**			**Pre-Requisite**	
		L	**T**	**P**	**Data Structures**	
		3	**1**	**0**		
Course Objective: To introduce the concept of algorithmic efficiency by analyzing various algorithms such as Searching, Sorting, Divide-and-Conquer algorithms and to know about Dynamic Programming techniques, Greedy Paradigm, Back Tracking, Branch and Bound, and Computational Complexity.						
S. NO	**Course Outcomes (CO)**					
CO1	Abilty to analyse and compare the runtime complexities of algorithms using various techniques.					
CO2	Abilty to classify and solve problems using Divide and Conquer technique					
CO3	Abilty to classify and solve problems using Dynamic Programming Techniques					
CO4	Abilty to classify and solve problems using Greedy Paradigm					
CO5	Abilty to identify and solve problems using Back-Tracking and Branch and Bound techniques					
CO6	Abilty to learn NP-complete and NP-hard problems, and design approximate Solutions.					
S. NO	**Contents**					**Contact Hours**
UNIT 1	Introduction: Concept of algorithmic efficiency, run time analysis of algorithms, Asymptotic Notations. Growth of Functions, Master's Theorem, Substitution method and Recursion Tree method. Red-Black Tree					**6**
UNIT 2	Divide and Conquer: Structure of divide-and-conquer algorithms; examples: binary search, quick sort, merge sort Strassen Matrix Multiplication, and Analysis of divide and conquer run time recurrence relations.					**7**
UNIT 3	Dynamic programming: Principles of dynamic programming. Applications: Rod cutting problem, Matrix Chain multiplication, Longest Common subsequence, Floyd-Warshall algorithm for all pair shortest paths, Travelling salesman Problem,0/1 Knapsack					**8**
UNIT 4	Greedy Method: Overview of the greedy paradigm examples of exact optimization solution: Activity Selection Problem., minimum cost spanning tree, approximate solutions: Fractional Knapsack problem, Kruskal's algorithm and Prim's algorithm for finding Minimum cost Spanning Trees, Dijkstra's, and Bellman Ford Algorithm for finding Single source shortest paths, Huffman coding.					**8**
UNIT 5	Back tracking: Overview, 8-queen problem, Sum of subsets problem, Graph coloring and Hamiltonian cycles Branch and bound: LC searching Bounding, FIFO branch and bound, LC branch and bound application: 0/1 Knapsack problem, Traveling Salesman problem.					**7**
UNIT 6	Computational Complexity: Complexity measures, Polynomial Vs non-polynomial time complexity; NP-hard and NP-complete classes, Cook's theorem examples: Circuit Satisfiability, Vertex cover, Subset Sum problem, String Matching, NP- Hard and NP-Completeness,					**6**
	TOTAL					**42**

REFERENCES						
S.No.	**Name of Books/Authors/Publishers**					**Year of Publication / Reprint**
1	T .H . Cormen, C . E . Leiserson, R .L . Rivest "Introduction to Algorithms", 3rd Ed., PHI.					2011(Reprint)
2	E. Horowitz, S. Sahni, and S. Rajsekaran, "Fundamentals of Computer Algorithms," Galgotia Publication					2010 (RePrint)
3	Sara Basse, A. V. Gelder, "Computer Algorithms: : Introduction to Design and Analysis" Addison Wesley, 3rd Edition, Pearson Education India					2002
4	Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman "Design & Analysis of Computer Algorithms", 1e Paperback – 1 January 2002, Pearson Education India					2002/eighth impression

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	–	1	–	–	–	–	–	–	–	1	2	–	–
CO2	3	3	2	–	–	–	–	–	–	–	–	1	3	–	–
CO3	3	3	3	–	–	–	–	–	–	–	–	1	3	–	–
CO4	3	3	2	–	–	–	–	–	–	–	–	1	3	–	–
CO5	3	3	2	1	–	–	–	–	–	–	–	1	3	–	–
CO6	3	3	2	2	–	–	–	–	–	–	–	2	3	1	–

B.Tech. Information Technology						
Course code: Course Title	**Course Structure**				**Pre-Requisite**	
IT210 Machine Learning	**L**	**T**	**P**		Probability, Statistics and Stochastic Processes, Linear Algebra	
	3	**0**	**2**			
Course Objective: 1. To understand various key paradigms for machine learning approaches. 2. To familiarize with the mathematical and statistical techniques used in machine learning. 3. To understand and differentiate among various machine learning techniques.						
S. NO.	**Course Outcomes (CO)**					
CO1	Understand the fundamental concepts and algorithms of machine learning					
CO2	Develop a comprehensive understanding of fundamental machine learning concepts, algorithms, and techniques, including supervised and unsupervised learning, classification, regression, clustering, and dimensionality reduction.					
CO3	Apply principles and algorithms to evaluate models generated from data					
CO4	Learn to critically evaluate the performance of machine learning models using appropriate metrics					
CO5	Develop the ability to identify and formulate problems suitable for machine learning solutions, design appropriate models, and interpret results in practical applications.					
S. NO.	**Contents**					**Contact Hours**

UNIT 1	Introduction to Machine Learning: Overview of different tasks: classification, regression, clustering, Concept of learning, Types of the Machine Learning, Data Table, Information System, Data Representation, diversity of data, Basic Linear Algebra and Probaboliy Theory, Optimization: Maximum likelihood, Expectation maximization, Gradient descent, Bias-Variance Tradeoff, Metrics to Evaluate Classification and Regression models	**14**
UNIT 2	Supervised Learning: Linear Regression, Logistic Regression, Baysian Decision Theory, Naïve Bayes, K-Nearest Neighbour, Support Vector Machine, Decision trees, Ensemble Classifier, Random Forest, Linear Classifiers and Kernels, Neural Networks, Deep Neural Network, Fundametals of Deep Learning: DNN, CNN.	**14**
UNIT 3	Unsupervised Learning: Clustering, Expectation Maximization, K-Mean Clustering, Hierarchical vs Partitional Clustering, Gaussian Mixture Model, Dimensionality Reduction, Feature Selection, PCA, factor analysis, manifold learning.	**14**
	TOTAL	**42**

REFERENCES

S.No.	**Name of Books/Authors/Publishers**	**Year of Publication / Reprint**
1	Introduction to Machine Learning, Alpaydin, E.,PHI Learning Pvt. Ltd.	2015
2	Machine Learning, Tom Mitchell, McGraw Hill	2017
3	Applied Machine Learning by M.Gopal|, McGraw Hill, ISBN: 978-9354601590	2021
4	Understanding Machine Learning: From Theory to Algorithms, 1st Edition,by Shai Shalev-Shwartz, Cambridge University Press	2015
5	Pattern Recognition and Machine Learning by Christopher Bishop, Springer Verlag	2006
6	Pattern Classification by Richard Duda, Wiley Publisher	2007

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	–	–	–	–	–	–	–	–	–	1	2	–	–
CO2	3	3	2	–	–	–	–	–	–	–	–	1	3	–	–
CO3	3	3	3	1	2	–	–	–	–	–	–	1	3	1	–
CO4	2	3	–	3	–	–	–	–	–	–	–	1	2	1	–
CO5	2	3	3	2	3	1	–	1	–	–	–	2	3	2	–

FIFTH SEMESTER

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
IT301 Compiler Design	**L**	**T**	**P**	Principles of computing
	3	**0**	**2**	

Course Objective: 1. To familiarize with the basic concepts of compiler design such as parsing and code optimization.
2. To design and implement different phases of a compiler.
3. To execute IR and target code generation and optimization.

S. NO.	Course Outcomes (CO)
CO1	Ability to understand and describe the phases of a compiler
CO2	Ability to design and implement lexical analyzer
CO3	Ability to design and implement top-down or LL parsers
CO4	Ability to design and implement bottom-up or LR parsers
CO5	Ability to translate various expressions and statements.
CO6	Ability to execute IR and target code generation and optimization

S. NO.	Contents	Contact Hours
UNIT 1	**Introduction:** Compiler flowchart - Phases of a compiler. Data Structure for Symbol Tables, representing scope information. Run time allocation: Stack versus Heap management.	**6**
UNIT 2	**Lexical analysis**: Input buffers and sentinels, Tokens and lexemes, Lexical categories, Implementation of Lexical Analyzer for an input string using regular expressions and NFA, Thompson algorithm, Subset construction, Automatic Lexical Analyzer Generator - Lex.	**8**
UNIT 3	**Syntax analysis**: Formal Grammars and their application to Syntax Analysis, BNF Notation, Derivation and Parse Trees, Top down parsing- elimination of left recursion, left factoring, recursive descent parsers, predictive parsers or LL(k) parsers. Bottom up parsing- LR Parsers, the canonical collection of LR(0) items, constructing SLR Parsing Tables, canonical LR Parsing tables and LALR parsing tables, An Automatic Parser Generator - YACC. Error detection and error recovery schemes.	**10**

UNIT 4	**Syntax Directed Translation**: Syntax Directed Definition (SDD), L-attributed and S-attributed SDD, Parse Trees, Annotated parse tree and Abstract Syntax Tree (AST), Syntax directed Translation Schemes, Postfix notation, Desktop calculator, Semantic analysis, Translation of Assignment Statements, Boolean expressions, Control Statements, Array references , Procedure Calls, Declarations and Case statements.	**8**
UNIT 5	**Code generation and optimization**: Three address code or IR code, Storage structures for IR code: Quadruple, Triple and Indirect Triple. Syntax directed translation for IR code generation. IR code optimization using Directed Acyclic Graph (DAG), Loop optimization, Global data flow analysis. Target code generation and optimization.	**10**
	TOTAL	**42**

REFERENCES

S.No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	Aho, Lam, Sethi and Ullman, "Compilers: Principles, Techniques and Tools", Second edition, Pearson Education.	2013
2	D.M.Dhamdhere, "Compiler Construction – Principles & Practice", Macmillan India.	2000
3	A. Appel, "Applied Intelligence for Medical Image Analysis", Cambridge university press.	2004
4	K.C. Loude, "Compiler construction: Principles and Practice", Course Technology Inc	1997
5	K.D. Cooper and L. Torczon, "Engineering a compiler", 3rd ed., Morgan Kaufmann.	2023

CO-PO-PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2	1	-	1	-	-	-	-	-	-	1	2	1	1
CO 2	3	3	2	1	3	-	-	-	-	-	-	1	3	3	1
CO 3	3	3	3	1	3	-	-	-	-	-	-	1	3	3	1
CO 4	3	3	3	1	3	-	-	-	-	-	-	1	3	3	1
CO 5	3	2	2	1	2	-	-	-	-	-	-	1	3	2	1
CO 6	3	3	3	2	3	-	-	-	-	-	-	2	3	3	2

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
IT303 Computer Networks	**L**	**T**	**P**	Operating systems, Algorithm Design and Analysis
	3	**2**	**0**	

Course Objective: To understand design and application of layered architechture and protocols of computer networks

S. NO	Course Outcomes (CO)
CO1	Explain the basic concepts of data communication, the OSI reference model, and the functional roles of each layer in network architecture.
CO2	Apply channel allocation methods, framing techniques, and error/flow control mechanisms at the Data Link Layer to ensure reliable data transmission.
CO3	Design and implement Network Layer functions, including IP addressing, subnetting, and routing protocols (IPv4/IPv6).
CO4	Analyze Transport Layer services, including port addressing, connection management (TCP/UDP), and end-to-end error/flow control.
CO5	Evaluate Application Layer protocols and services, including domain name system (DNS), web access, and file transfer services.

S. NO	Contents	Contact Hours
UNIT 1	Introductory Concepts: Goals and applications of networks, Categories of networks, Organization of the Internet, ISP, Network structure and architecture (layering principles, services, protocols and standards), The OSI reference model, TCP/IP protocol suite, Network devices and components. Physical Layer	**8**
UNIT 2	Link layer: Framing, Error Detection and Correction, Flow control (Elementary Data Link Protocols, Sliding Window protocols). Medium Access Control and Local Area Networks: Channel allocation, Multiple access protocols, LAN standards, Link layer switches & bridges	**8**

UNIT 3	Network Layer: Point-to-point networks, Logical addressing, Basic internetworking (IP, CIDR, ARP, RARP, DHCP, ICMP), Routing, forwarding and delivery, Static and dynamic routing, Routing algorithms and protocols, Congestion control algorithms, IPv6.	**9**
UNIT 4	Transport Layer: Process-to-process delivery, Transport layer protocols (UDP and TCP), Multiplexing, Connection management, Flow control and retransmission, Window management, TCP Congestion control, Quality of service.	**9**
UNIT 5	Application Layer: Domain Name System, World Wide Web and Hyper Text Transfer Protocol, Electronic mail, File Transfer Protocol, Remote login, Network management	**8**
	TOTAL	**42**

REFERENCES		
S.No.	**Name of Books/Authors/Publishers**	**Year of Publication / Reprint**
1	Behrouz Forouzan, "Data Communication and Networking", McGraw Hill	2021
2	Andrew Tanenbaum "Computer Networks", Prentice Hall.	2018
3	William Stallings, "Data and Computer Communication", Pearson.	2004
4	Kurose and Ross, "Computer Networking- A Top-Down Approach", Pearson.	2012

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	–	–	–	–	–	–	–	–	–	1	2	–	–
CO2	3	3	2	1	–	–	–	–	–	–	–	1	3	–	–
CO3	3	3	3	1	–	–	–	–	–	–	–	1	3	1	–
CO4	3	3	2	2	–	–	–	–	–	–	–	1	3	1	–
CO5	2	3	2	1	–	–	–	–	–	–	–	2	2	1	–

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
IT 305 Computer Organization and Architecture	**L**	**T**	**P**	Digital Electronics & Microcontrollers
	3	**1**	**-**	

Course Objective: To learn and understand the organisation and architecture of computer system.

S. NO	Course Outcomes (CO)
CO1	Explain the working of computer systems & its basic principles
CO2	Design the basic structure of processor and control design
CO3	Discuss the basic concepts of pipelining techniques
CO4	Highlights the memory hierarchy and its organization and working of I/O devices with its interfacing

S. NO	Contents	Contact Hours
UNIT 1	Introduction to digital electronics: combinational circuits and sequential circuits. Basic machine Principle, Structure and representation of real world data. Subroutine, Branching & Macro facility	6
UNIT 2	Processor Organization, Information representation and Number format, Instruction cycle and Instruction format, Addressing modes, Arithmetic operation, timed point addition, subtraction, multiplication and division, ALU design, Parallel processing – Performance consideration, Pipeline processor	9
UNIT 3	Instruction sequencing and Interpretation, Hardware Control design method and Microprogrammed Control	9
UNIT 4	Memory device characteristic, Random access and serial access memories, Virtual memory – memory hierarchies, Page replacement policies, Segments, pages and file organization, High speed memories – cache and associative memory	9
UNIT 5	Memory device characteristic, Random access and serial access memories, Virtual memory – memory hierarchies, Page replacement policies, Segments, pages and file organization, High speed memories – cache and associative memory	9
	TOTAL	42

REFERENCES		
S.No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	M.M. Mano: Computer System Architecture, 3rd Ed. PHI.	2017

2	J.P. Hayes: Computer Architecture and Organization, 3rd Ed. TMH	2017
3	C.W. Gear: Computer organization and Programming, TMH.	1980
4	T.C. Bartee: Digital Computer Fundamental, TMH.	2001
5	A. S. Tanenbaum: Structured Computer System Organization, PHI.	2016

CO-PO-PSO Mapping

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	–	–	–	–	–	–	–	–	–	1	2	–	–
CO2	3	3	3	–	–	–	–	–	–	–	–	1	3	–	–
CO3	3	2	2	1	–	–	–	–	–	–	–	1	3	–	–
CO4	3	3	2	1	–	–	–	–	–	–	–	2	3	1	–

DEPARTMENT ELECTIVE COURSE-1

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
	L	**T**	**P**	
IT307 Deep Learning	**3**	**0/1**	**2/0**	Machine Learning

Course Objective: The primary objective of a deep learning course for undergraduate students is to equip them with a solid foundation in the theory and practical application of deep learning techniques**.**

S. NO	Course Outcomes (CO)
CO1	Demonstrate a clear understanding of the fundamental concepts of deep learning, including neural networks, activation functions, loss functions, and optimization techniques.
CO2	Design, implement, and train basic neural network architectures, including feedforward networks, convolutional neural networks (CNNs), and recurrent neural networks (RNNs) using modern deep learning frameworks like TensorFlow or PyTorch.
CO3	Apply deep learning techniques to solve complex problems in various domains such as image classification, object detection, natural language processing, and time-series prediction.
CO4	Explore and implement advanced deep learning techniques such as transfer learning, generative adversarial networks (GANs), attention mechanisms, and transformers to address cutting-edge research and industry challenges.

S. NO	Contents	Contact Hours
UNIT 1	Overview of Artificial Intelligence, Machine Learning, and Deep Learning, History and evolution of deep learning, Applications of deep learning, Perceptron and multi-layer perceptron, Activation functions, Loss functions and their significance, Gradient Descent and Backpropagation, Neural Networks: Deep vs Shallow Networks, Training Deep Networks: Vanishing and Exploding Gradients, Techniques to mitigate gradient issues (Batch Normalization, Gradient Clipping), Optimization algorithms (SGD, Adam, RMSprop), Regularization techniques (L2, Dropout), and Weight Initialization	**16**

UNIT 2	Convolutional Neural Networks, and their significance in image processing, Convolution operations and feature maps. Pooling layers, CNN architectures: LeNet, AlexNet, VGG, ResNet, Inception, Transfer learning and fine-tuning pre-trained models, Object detection and segmentation (YOLO, SSD, Mask R- CNN), Introduction to Generative Adversarial Networks, Autoencoder. Variational Autoencoders.	**14**
UNIT 3	Recurrent Neural Networks (RNNs), Long Short-Term Memory (LSTM) networks, Gated Recurrent Unit (GRU), Attention Mechanisms and Transformers, Sequence-to-sequence models with attention, and applications in natural language processing.	**12**
	TOTAL	**42**

REFERENCES

S.No.	**Name of Books/Authors/Publishers**	**Year of Publication / Reprint**
1	Deep Learning by Ian Goodfellow , Yoshua Bengio , and Aaron Courville, MIT Press (https://www.deeplearningbook.org/)	2016
2	Deep Learning: Foundations and Concepts by Christopher M. Bishop and Hugh Bishop, Springer	2023
3	Introduction to Deep Learning by Eugene Charniak, MIT Press	2019
4	Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron	2022

CO-PO-PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	2	1	1	1	0	0	0	0	0	0	2	2	1	1
CO 2	3	3	3	2	3	0	0	0	1	1	0	2	3	2	2
CO 3	3	3	3	3	3	0	0	0	1	1	0	2	3	2	3
CO 4	3	3	3	3	3	0	0	0	1	1	0	3	3	3	3

Course code: Course Title	Course Structure			Pre-Requisite
	L	T	P	
IT309 Cyber Laws	3	1	0	

Course Objective: The purpose is to understand the basics of cyber security, laws, and related issues.

S. NO	Course Outcomes (CO)
CO1	To explain the information on cyber security and understand the issues that are specific to amendment rights.
CO2	Examine the risks and legal implications of copyright issues, internet infringement, privacy rights, and related constitutional and federal statutes.
CO3	Understand duty of care, criminal liability, procedural issues, and the legal framework surrounding electronic contracts, digital signatures, and civil rights.
CO4	Assess the ethical implications and societal impacts of cyber security, with a focus on legal developments, case studies, and the evolution of cyber law from the late 1990s to 2000.

S. NO	Contents	Contact Hours
UNIT 1	The World Wide Web, Web Centric Business, E Business Architecture, Models of E Business, E Commerce, Threats to virtual world. Cyber Crimes& social media, Cyber Squatting, Cyber Espionage, Cyber Warfare, Cyber Terrorism	**7**
UNIT 2	Computer ethics, moral and legal issues, descriptive and normative claims, Professional Ethics, code of ethics and professional conduct. Privacy, Computers and privacy issue.	**8**
UNIT 3	Web Servers and Browsers, HTTP, Cookies, Caching, Plug-in, ActiveX, Java, JavaScript, Secure Socket Layer (SSL), Secure Electronic Transaction (SET). E-mail Risks, Spam, E-mail Protocols, Simple Mail Transfer Protocol (SMTP), Post office Protocol (POP), Internet Access Message protocol (ICMP). Secured Mail Protocols	**10**
UNIT 4	Copyrights, Jurisdiction Issues and Copyright Infringement, Multimedia and Copyright issues, WIPO, Intellectual Property Rights, Understanding Patents, Understanding Trademarks, Trademarks in Internet, Domain name registration, Software Piracy, Legal Issues in Cyber Contracts, Authorship, Document Forgery.	**8**
UNIT 5	Indian IT ACT, Adjudication under Indian IT ACT, IT Service Management Concept, IT Audit standards, System audit, Information security audit, ISMS, SoA (Statement of Applicability), BCP (Business Continuity Plan), DR (Disaster Recovery), RA (Risk Analysis/Assessment).	**9**
	TOTAL	**42**

REFERENCES

S.No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	Jonathan Rosenoer. "Cyber Law: The law of the Internet", Springer-Verlag.	1997
2	Mark F Grady. Fransesco Parisi, "The Law and Economics of Cyber Security", Cambridge University Press, 2006	2006

CO-PO-PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	1	0	0	0	0	1	0	0	0	1	0	0	2	0	0

CO 2	1	0	0	0	0	2	0	0	0	0	0	0	1	0	0
CO 3	1	0	0	0	2	1	0	0	0	0	0	0	1	0	0
CO 4	0	1	1	0	0	2	0	1	0	0	0	0	2	1	0

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
	L	**T**	**P**	
IT311 Malware Analysis	**3**	**1/0**	**0/2**	**-**

Course Objective: To introduce fundamentals of malware and to set up a protected static and dynamic malware analysis environment. Learn various malware behavior monitoring tools and actionable detection signatures from malware indicators. Learn how to trick malware into exhibiting behaviors that only occur under special conditions.

S. NO	Course Outcomes (CO)
CO1	To list the goals of Malware Analysis and to define Malware Analysis techniques.
CO2	To employ and illustrate static malware analysis techniques.
CO3	To employ and illustrate dynamic malware analysis techniques.
CO4	To classify and describe malware functionalities and behaviors
CO5	To be able to examine malwares with reverse engineering.

S. NO	Contents	Contact Hours
UNIT 1	Introduction to malware, OS security concepts, malware threats, evolution of malware, malware types viruses, worms, rootkits, Trojans, bots, spyware, adware, logic bombs, malware analysis, static malware analysis, dynamic malware analysis.	**6**
UNIT 2	X86 Architecture- Main Memory, Instructions, Opcodes and Endianness, Operands, Registers, Simple Instructions, The Stack, Conditionals, Branching, Rep Instructions, C Main Method and Offsets. Antivirus Scanning, Fingerprint for Malware, Portable Executable File Format, The PE File Headers and Sections, The Structure of a Virtual Machine, Reverse Engineering- x86 Architecture, recognizing c code constructs in assembly, c++ analysis, Analysing Windows programs, Anti-static analysis techniques-obfuscation, packing, metamorphism, and polymorphism.	**8**
UNIT 3	Live malware analysis, dead malware analysis, analyzing traces of malware- system-calls, api-calls, registries, network activities. Anti-dynamic analysis techniques-anti-vm, runtime-evasion techniques, , Malware Sandbox, Monitoring with Process Monitor, Packet Sniffing with Wire shark, Kernel vs. User-Mode Debugging, OllyDbg, Breakpoints, Tracing, Exception Handling, Patching	**7**

UNIT 4	Downloader, Backdoors, Credential Stealers, Persistence Mechanisms, Privilege Escalation, Covert malware launching- Launchers, Process Injection, Process Replacement, Hook Injection, Detours, APC injection.	**8**
UNIT 5	Signature-based techniques: malware signatures, packed malware signature, metamorphic and polymorphic malware signature Non-signature based techniques: similarity-based techniques, machine-learning methods, invariant inferences	**7**
UNIT 6	Malware Characterization, Case Studies – Plankton, DroidKungFu, AnserverBot, Smartphone (Apps) Security	**6**
	Total	**42**

REFERENCES

S.No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	Practical malware analysis The Hands-On Guide to Dissecting Malicious Software by Michael Sikorski and Andrew Honig ISBN-10: 1-59327-290-1, ISBN-13: 978-1-59327-290-6	2012
2	Android Malware by Xuxian Jiang and Yajin Zhou, Springer ISBN 978-1-4614- 7393-0	2005
3	Hacking exposed™ malware & rootkits: malware & rootkits security secrets & Solutions by Michael Davis, Sean Bodmer, Aaron Lemasters, McGraw-Hill, ISBN: 978-0-07-159119-5	2010
4	Windows Malware Analysis Essentials by Victor Marak, Packt Publishing	2015

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	–	–	–	–	–	–	–	–	–	1	2	–	–
CO2	3	3	2	1	2	–	–	–	–	–	–	1	3	1	–
CO3	3	3	2	1	3	–	–	–	–	–	–	1	3	1	–
CO4	2	3	2	1	–	1	–	1	–	–	–	1	2	1	–
CO5	3	3	3	2	3	1	–	1	–	–	–	2	3	2	–

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
	L	**T**	**P**	
IT 313 Internet of Things	**3**	**0/1**	**2/0**	**Fundamental of Computer Networks**

Course Objective: (1) To introduce the terminology, technology and its applications
(2) To introduce the concept of M2M (machine to machine) with necessary protocols (3) To introduce the Python Scripting Language which is used in many IoT devices
(4) To introduce the Raspberry PI platform, that is widely used in IoT applications
(5) To introduce the implementation of web-based services on IoT devices

S. NO	Course Outcomes (CO)
CO1	Understand IoT value chain structure (device, data cloud), application areas and technologies involved.
CO2	Explore IoT sensors and technological challenges faced by IoT devices, with a focus on wireless, energy, power, and sensing modules
CO3	Explore and learn about Internet of Things with the help of preparing projects designed for Raspberry Pi.

S. NO	Contents	Contact Hours
UNIT 1	**Introduction to Internet of Things:** Definition and Characteristics of IoT, Sensors, Actuators, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Agriculture and Industry	**9**
UNIT 2	**IoT and M2M:** Software defined networks, network function virtualization, difference between SDN and NFV for IoT, Basics of IoT System Management with NETCONF, YANG- NETCONF, YANG, SNMP NETOPEER	**8**
UNIT 3	**IoT Physical Devices and Endpoints:** Introduction to Arduino and Raspberry Pi- Installation, Interfaces (serial, SPI, I2C) Controlling Hardware- Connecting LED, Buzzer, Switching High Power devices with transistors, Controlling AC Power devices with Relays,	**8**

	Controlling servo motor, speed control of DC Motor, unipolar and bipolar Stepper motors	
UNIT 4	**Introduction to Sensors:** Light sensor, temperature sensor with thermistor, voltage sensor, ADC and DAC, Temperature and Humidity Sensor DHT11, Motion Detection Sensors, Wireless Bluetooth Sensors, Level Sensors, USB Sensors, Embedded Sensors, Distance Measurement with ultrasound sensor	**8**
UNIT 5	**IoT Physical Servers and Cloud Offerings**: Introduction to Cloud Storage models and communication APIs Web Server – Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API	**9**
	TOTAL	**42**

REFERENCES

S.No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, ISBN: 9788173719547	2015
2	Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), ISBN: 9789350239759	2014
3	Sudip Misra, Anandarup Mukherjee, Arijit Roy, Introduction to IoT, Cambridge University Press	2021
4	Raspberry Pi Cookbook, Software and Hardware Problems and solutions, Simon Monk, O'Reilly (SPD), ISBN 7989352133895	2016
5	Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015, Editors Ovidiu Vermesan	2015
6	Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications	2013
7	Peter Friess,'Internet of Things – From Research and Innovation to Market Deployment', River Publishers, 2014	2014
8	N. Ida, Sensors, Actuators and Their Interfaces, SciTech Publishers, 2014	2014
9	Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press,2012	2012

10	Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applicationsand Protocols", Wiley, 2012.	2012

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	–	–	–	–	–	–	–	–	–	1	2	–	–
CO2	3	3	2	1	2	–	–	–	–	–	–	1	3	1	–
CO3	3	3	2	1	3	–	–	–	–	–	–	1	3	1	–
CO4	2	3	2	1	–	1	–	1	–	–	–	1	2	1	–
CO5	3	3	3	2	3	1	–	1	–	–	–	2	3	2	–

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
	L	**T**	**P**	
IT 315 Computer Graphics	**3**	**0/1**	**2/0**	**-**

Course Objective: To provide students with a comprehensive understanding of the fundamental principles and techniques in computer graphics, including graphic systems, transformations, viewing pipelines, clipping algorithms, curve and surface modeling, projection methods, shading models, and hidden surface removal.

S. NO	Course Outcomes (CO)
CO1	Apply various algorithms for line drawing, circle and ellipse generation, filling techniques, and anti-aliasing in computer graphics.
CO2	Apply 2D and 3D transformations, including matrix representations, composite transformations, and coordinate system conversions in computer graphics.
CO3	Implement viewing pipelines and apply various clipping algorithms for lines, polygons, and text in a two-dimensional viewing context.
CO4	Analyze and construct curves and surfaces using parametric equations, Bezier curves, and B- Spline techniques with continuity testing.
CO5	Understand and apply different projection methods, including parallel, oblique, and perspective projections for 3D objects onto 2D planes.
CO6	Utilize shading models, reflection calculations, and hidden surface removal techniques to enhance the visual realism of 3D scenes.

S. NO	Contents	Contact Hours

UNIT 1	**Overview of Computer Graphics:** Usage of Graphics and their applications, Over view of Graphics systems: Refreshing display devices, Random and raster scan display devices, Colour Models: RGB, HSV etc., Tablets, Joysticks, Track balls, Mouse and light pens. **Output primitives:** DDA Line drawing algorithm, Bresenham's Line Drawing Algorithm, Mid-point circle algorithm, Mid-point Ellipse algorithms, filling algorithms, boundary fill and flood fill algorithms, scanline filling, character generation, line attributes, fill styles, anti-aliasing	**6**
UNIT 2	**Transformations:** Basic 2D Transformations, Matrix representations & Homogeneous Coordinates, Matrix Representations for basic 2D and 3D transformations, Composite Transformations, reflection and shear transformations, affine transformation, transformations between coordinate systems.	**8**
UNIT 3	**Two dimensional viewing:** The viewing Pipeline, Viewing Coordinate Reference Frame, Window-to-Viewport Coordinate Transformation, Two Dimensional Viewing Functions, Barky line clipping algorithm, Algorithm for polygon clipping, Sutherland-Hodgeman polygon clipping, Wailer-Atherton polygon clipping, curve clipping, Text clipping.	**6**
UNIT 4	**Curves and Surfaces:** Representation of surfaces, polygon meshes, plane equations, parametric cubic curves, Hermite Curves, Bezier Curves, 4 point and 5 point Bezier curves using Bernstein Polynomials, Conditions for smoothly joining curve segments, Bezier bi-cubic surface patch, B-Spline Curves, Cubic B-Spline curves using uniform knot vectors, Testing for first and second order continuities.	**8**
UNIT 5	**Projection:** Parallel Projection, Oblique Projection on XY plane, Isometric Projection, Perspective Projection, One Vanishing Point (V.P.) projection, Generation of 2 V.P. Projection, planar geometric projections.	**7**
UNIT 6	Shading and Hidden Surface Removal: Shading, Illumination Model for diffused Reflection, Effect of ambient lighting, distances, Specular Reflection Model, Computing Reflection Vector, Curved Surfaces, Polygonal Approximations, Guard Shading, Phong Model, Hidden Surface Removal, Back Face Detection, Depth Buffer (Z-Buffer, A-Buffer) Method, Scan Line Method, Depth Sorting Method, Area Subdivision Method.	**7**
	TOTAL	**42**

REFERENCES

S.No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	D. Hearn , P. Baker& W. Carithers, "Computer Graphics with OpenGL", Pearson,	2015
2	Z. Xiang & R. Plastock "Computer Graphics", Schaum's Series, McGraw Hill	2007
3	David F. Rogers, "Procedural Elements for Computer Graphics", Tata McGraw Hill	2002
4	D. Rogers and J. Adams, "Mathematical Elements for Computer Graphics", MacGraw- Hill International Edition	2002
5	Foley et al., "Computer Graphics Principles & practice", Addison Wesley	1999

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	–	–	–	–	–	–	–	–	1	3	–	–
CO2	3	3	3	–	–	–	–	–	–	–	–	1	3	–	–
CO3	3	3	3	1	–	–	–	–	–	–	–	1	3	1	–
CO4	3	3	2	2	–	–	–	–	–	–	–	1	3	1	–
CO5	3	2	2	1	–	–	–	–	–	–	–	1	2	–	–
CO6	2	2	2	1	2	–	–	–	–	–	–	1	2	1	–

B.Tech. Information Technology				
Course code: Course Title	Course Structure			Pre-Requisite
IT317 Software Project Management	L	T	P	Software Engineering
	3	1	-	

Course Objective: To introduce concepts of software planning, estimation and time scheduling.

S. NO	Course Outcomes (CO)
CO1	Understand the fundamental concepts of project management, including process frameworks, software life cycle models, and key artifacts

CO2	Apply various cost and effort estimation models to accurately estimate project costs and schedules.
CO3	Implement project management techniques, including risk management, project tracking, and control mechanisms, to ensure successful project execution and delivery.
CO4	Perform project closure analysis by understanding the role of closure in a project and creating comprehensive closure analysis reports.
CO5	Analyze the evolution and impact of software economics on conventional and modern software management practices.
CO6	Discuss future trends in software project management, including next-generation software economics, modern project profiles, and process transitions.

S. NO	Contents	Contact Hours
UNIT 1	**Introduction:** Project Management concepts, Process Framework, Project Planning Software Life Cycle Models, Artifacts of the Project Management Process.	**6**
UNIT 2	**Cost and Scheduling Estimation Models:** Various Levels of COCOMO for Cost ,Effort, Schedule and Productivity Estimation. Approaches to Effort, Cost Estimation, and Schedule Estimation factors through COCOMO II, Putnam Estimation Model, Algorithmic models.	**8**
UNIT 3	**Project Management Techniques:** Project Organizations and Responsibilities, Establishing Project Environment, Risk Management Process, Project Tracking and Control Defect Tracking Concepts such as Process monitoring and audit, Reviews, Inspections and Walkthroughs.	**8**
UNIT 4	**Project Closure:** Project Closure Analysis, Role of Closure Analysis in a project, Performing Closure Analysis, Closure Analysis Report.	**6**
UNIT 5	**Software Project Management Renaissance:** Conventional Software Management, Evolution of Software Economics, Improving Software Economics, The old way and the new way.	**6**
UNIT 6	**Advance Topics in Software Project Management:** Discussion on future Software Project Management Practices & Modern Project Profiles, Next Generation Software Economics, Modern Process Transitions.	**8**
	TOTAL	**42**

REFERENCES		
S.No.	**Name of Books/Authors/Publishers**	**Year of Publication / Reprint**
1	Managing the Software Process, Watts S. Humphrey, Pearson Education	1989
2	Software Project Management, Bob Hughes, Tata McGraw Hill	2009
3	Sommerville, "Software Engineering", Addison Wesley	2001

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	–	–	–	–	–	–	–	–	1	1	2	–	–
CO2	2	3	–	1	–	–	–	–	–	–	2	1	2	–	–
CO3	2	3	2	1	–	–	–	–	2	1	3	1	3	1	–
CO4	2	2	–	2	–	–	–	–	–	1	2	1	2	–	–
CO5	2	3	–	1	–	–	–	–	–	–	2	2	2	–	–
CO6	2	2	–	–	–	–	–	–	–	–	1	3	1	–	–

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
IT319 Information and Network Security	**L**	**T**	**P**	Computer Networks, Operating Systems, Basic Programming
	3	**1/0**	**0/2**	

Course Objective: 1) To provide students with a comprehensive understanding of the principles and practices of information and network security.
2) To equip students with the knowledge and skills to implement cryptographic techniques and network security mechanisms.
3) To introduce students to secure software development practices and application security.
4) To explore advanced topics in security, including incident response, forensics, and emerging security challenges.
5) To prepare students to assess, design, and manage secure information systems and networks.

S. NO	Course Outcomes (CO)
CO1	Understand the fundamental concepts of information security, including threat models, security policies, and risk management.
CO2	Implement cryptographic algorithms and protocols to secure communication and data.
CO3	Apply network security techniques, including firewalls, intrusion detection, VPNs, and wireless security.
CO4	Develop secure software applications and mitigate web, mobile, cloud, and database security threats.
CO4	Engage with advanced security topics, conduct incident response and forensics, and address security challenges in emerging technologies.

S. NO	Contents	Contact Hours
UNIT 1	**Introduction to Information Security:** Overview: Definitions, Objectives, and Importance Security Threats and Vulnerabilities: Malware, Phishing, Social Engineering, and Insider Threats. Security Models: CIA Triad (Confidentiality, Integrity, Availability), Bell- LaPadula, and Biba Models Security Policies and Mechanisms: Authentication, Authorization, and Access Control Risk Management: Risk Assessment, Mitigation Strategies, and Security Audits	**10**

UNIT 2	**Cryptography** Introduction to Cryptography: Definitions and Goals Symmetric Key Cryptography: Algorithms (DES, AES), Modes of Operation, and Key Management Asymmetric Key Cryptography: RSA, ECC, and Digital Signatures Hash Functions: SHA, MD5, and Applications of Hashing Cryptographic Protocols: SSL/TLS, PGP, and Key Exchange Protocols	**12**
UNIT 3	**Network Security** Overview of Network Security: Goals, Threats, and Attack Vectors Firewalls: Types, Configuration, and Best Practices Intrusion Detection and Prevention Systems (IDPS): Techniques and Tools Virtual Private Networks (VPNs): Architecture, Protocols (IPSec, SSL VPN), and Applications Wireless Network Security: WEP, WPA, WPA2, and Wireless Attack Vectors	**10**
UNIT 4	**Application and Web Security** Secure Software Development: Secure Coding Practices, OWASP Top 10, and Threat Modeling Web Security: Cross-Site Scripting (XSS), SQL Injection, CSRF, and Secure Session Management Security in Mobile Applications: Common Threats, Security Frameworks, and Best Practices Cloud Security: Threats in Cloud Computing, Security Models, and Cloud Security Standards Database Security: SQL Injection Prevention, Data Encryption, and Access Control	**10**
UNIT 5	**Advanced Topics in Information and Network Security** Cybersecurity Frameworks and Standards: ISO 27001, NIST, and GDPR Compliance Incident Response and Forensics: Phases of Incident Response, Digital Forensics Tools, and Techniques Security in Emerging Technologies: IoT Security, Blockchain Security, and AI in Security Ethical Hacking and Penetration Testing: Methodologies, Tools, and Legal Aspects Future Trends in Information and Network Security: Quantum Cryptography, Zero Trust Security, and 5G Security	**10**
	TOTAL	**42**

REFERENCES		
S.No.	**Name of Books/Authors/Publishers**	**Year of Publication / Reprint**

1	Stallings, W., & Brown, L. Computer Security: Principles and Practice (5th ed.). Pearson. ISBN: 978-0134794105.	2023
2	Schneier, B. Applied Cryptography: Protocols, Algorithms, and Source Code in C (3rd ed.). Wiley. ISBN: 978-1119096726	2020
3	Kaufman, C., Perlman, R., & Speciner, M. Network Security: Private Communication in a Public World (3rd ed.). Pearson.	2022
4	Anderson, R. Security Engineering: A Guide to Building Dependable Distributed Systems (3rd ed.). Wiley. ISBN: 978-1119642787.	2021
5	Garfinkel, S., & Spafford, G. Practical UNIX and Internet Security (3rd ed.). O'Reilly Media. ISBN: 978-0596003234.	2022

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	–	–	–	1	–	1	–	–	–	1	2	–	–
CO2	3	3	2	1	–	–	–	–	–	–	–	1	3	1	–
CO3	3	3	2	1	2	–	–	–	–	–	–	1	3	1	–
CO4	3	3	3	1	3	1	–	2	–	–	–	2	3	2	–
CO5	2	3	2	2	2	1	–	2	–	–	–	2	3	2	1

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
IT 321 Introduction to Security of Cyber-Physical Systems	**L**	**T**	**P**	Computer Networks, Operating Systems, Basic Programming
	3	**1/0**	**0/2**	

Course Objective:

1. To learn the basics of security and various types of security issues.
2. To study different cryptography techniques available and various security attacks.
3. Explore network security and how they are implemented in real world.
4. To get an insight of various issues of Web security and biometric authentication.

S. NO	**Course Outcomes (CO)**
CO1	To Apply basics of security and issues related to it.

CO2	To use biometric techniques available and how they are used in today's world.
CO3	To investigate Security issues in web and how to tackle them.
CO4	To Learn mechanisms for transport and network security

S. NO	Contents	Contact Hours
UNIT 1	Overview of Security and Privacy in Information System.	**06**
UNIT 2	Applied Cryptography & Intrusion Detection, Architecture of Applied Cryptography, One Way Hash Function and Integrity, Encryption Algorithms and Confidentiality, Digital Signature and Authentication (DH, RSA, 2 class), Intrusion Detection and Information Theory.	**10**
UNIT 3	Internet of Things Security, Security and Privacy for IoT Case Study: Smart Home, Smart Grid Network, Modern Vehicle, Wearable Computing & BYOD, Mobile HealthCare.	**10**
UNIT 4	Software-Defined Networks, Introduction of Software-Defined Networks, Security for Software-Defined Networks, Privacy Leakages for Software-Defined Networks, Case Studies: How to Attack Software-Defined Networks.	**08**
UNIT 5	Cyber-Physical Systems (CPS), CPS - Platform components, CPS implementation issues, Intelligent CPS, Secure Deployment of CPS.	**08**
	TOTAL	**42**

REFERENCES

S.No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	Cyber Security, Nina Godbole, John Wiley & Sons.	2018

2	Li Da Xu, Shancang Li, "Securing the Internet of Things", Syngress.	2017
3	Alasdair Gilchrist, "IoT Security Issues", De Gruyter	2017
4	Sean Smith, "The Internet of Risky Things", Sean Smith, Shroff Publisher/O'Reilly Publisher	2017

CO-PO-PSO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	2	**1**	2	**0**	2	0	1	**0**	2	**3**	**2**	**1**
CO2	**3**	**3**	2	2	**2**	2	**0**	2	**0**	1	**0**	2	**3**	**3**	**1**
CO3	3	3	**3**	3	2	2	**0**	2	**0**	1	**0**	2	**3**	**3**	**2**
CO4	3	3	2	2	**2**	**2**	**0**	2	**0**	1	**0**	3	**3**	**3**	**2**

SIXTH SEMESTER

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
IT302 Data Engineering and Analytics	**L**	**T**	**P**	Probability, Statistics, Linear Algebra
	3	**0/1**	**2/0**	

Course Objective 1. To develop familiarity with the concepts of core data engineering processes, including data ingestion, transformation, storage, and data lifecycle management.

2. To analyze and apply data architecture patterns, including data warehouses, data lakes, and lakehouse systems, and to design data models using dimensional modeling techniques for analytical workloads.

3. To design, implement, and optimize scalable batch and stream data pipelines using modern data engineering frameworks.

S. NO.	Course Outcomes (CO)
CO1	Ability to understand and describe core data engineering processes, including data ingestion, data transformation, data storage, and data lifecycle management
CO2	Analyze data architectures: data warehouses, data lakes, lakehouse systems
CO3	Design analytical data models using dimensional modeling
CO4	Design and implement scalable batch and streaming data pipelines using modern data processing tools
CO5	Optimize and evaluate data pipelines for scalability, reliability, and performance

S. NO.	Contents	Contact Hours
UNIT 1	**Introduction to data engineering:** Storing data, Data loading, Data transformation, Data structures, SQL and NoSQL databases, Database normalization, Data cubes, Snowflake scheme, Data warehouses, Data lakes, Data Marts, Metadata in Data Warehouse, Data pipeline, Data integration- Extract, Transform, and Load (ETL) processes for integrating data from multiple sources.	**10**
UNIT 2	**Advanced data analytics and machine learning:** Cluster Analysis, Types of Data in Cluster Analysis, Partitioning methods, Hierarchical Methods. Classification techniques for linearly separable and non-linearly separable data- Linear Discriminant Analysis and Support Vector Machine. Feature Ranking and Feature Selection Algorithms. Associations and correlations- basic concepts, efficient and scalable frequent item sets mining methods, mining various kinds of association rules, constraint-based association mining.	**12**

UNIT 3	**Data warehousing**: Planning Your Data Warehouse, The Data Warehouse Project, Architectural Components: Understanding Data Warehouse Architecture, Infrastructure Supporting Architecture, Collection of Tools. Indexing the data warehouse, performance enhancement techniques.	**10**
UNIT 4	**Data design and data preparation**: From Requirements to Data Design, The STAR Schema, STAR Schema Keys, Advantages of the STAR Schema. Data modeling for data warehouses. Scalable data engineering solutions - handling massive datasets. Online Analytical Processing models, Online Transaction Processing models. .	**10**
	TOTAL	**42**

REFERENCES

S.No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	Fundamentals of Data Engineering, Joe Reis & Matt Housley, 1st ed., *O'Reilly.*	2022
2	The Data Warehouse Toolkit, Ralph Kimball & Margy Ross, 3rd ed., *John Wiley*.	2013
3	Data Mining: Concepts and Techniques, Jiawei Han, Micheline Kamber and Jian Pei, 4th ed., *Morgan Kaufmann*	2023
4	Designing Data-Intensive Applications, Martin Kleppmann, *O'Reilly*.	2017
5	Spark: The Definitive Guide by Bill Chambers and Matei Zaharia, *O'Reilly.*	2018
6	Data Pipelines with Apache Airflow by Bas P. Harenslak and Julian Rutger de Ruiter, 1st ed., *Manning*	2021
7	Data Engineering with Python, Paul Crickard, 1st ed., *Packt Publishing*.	2020
8	Fundamentals of database systems, Ramez Elmasri & Shamkant B. Navathe, *Pearson Education.*	2000

CO-PO-PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	2	0	0	1	2	0	0	0	0	0	0	0	2	0	2
CO 2	1	0	2	1	2	0	0	0	0	0	0	0	2	1	2

CO 3	1	0	2	1	2	0	0	0	0	0	0	0	2	1	2
CO 4	1	0	0	1	2	0	0	0	0	0	0	0	2	0	2
CO 5	1	0	1	1	2	0	0	0	0	0	0	0	2	1	2

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
IT304 Cyber Forensics	**L**	**T**	**P**	
	3	**0/1**	**2/0**	

Course Objective: Upon completion, students will understand cyber forensics principles and real-world crime examples, address challenging aspects like logging, system state and jurisdiction, and apply investigation processes using various forensic tools in Windows and UNIX/Linux environments.

S. NO	Course Outcomes (CO)
CO1	To employ various forensic tools and technologies in practical scenarios, ensuring the integrity and admissibility of digital evidence in legal proceedings.
CO2	To develop an understanding of various types of computer forensics enabling them to effectively analyze digital evidence from diverse sources
CO3	Students will be proficient in conducting live data collection and analysis in Windows environments.
CO4	Students will be proficient in conducting live data collection and analysis in Unix environments.
CO5	To demonstrate proficiency in conducting ethical hacking activities, including port scanning and vulnerability assessments using tools.

S. NO	Contents	Contact Hours
UNIT 1	Introduction to Digital forensics, Digital evidence and investigations, Real life examples of digital crime, Challenging aspects of digital forensics. Introduction to intellectual property rights and professional ethics. Incident response: IR lifecycle - preparation, detection, containment, eradication, recovery, lessons learned; creating IR process - scope, roles, severity; IR in cloud;	**8**
UNIT 2	Computer crime investigation process: The Investigation process, preparing a computer investigation. Overview of Types of computer forensics i.e. Media Forensics, Network forensics (internet forensics), Machine forensic, Email forensic (e-mail tracing and investigations). Digital forensics of image, audio etc files. External reconnaissance: Dumpster diving, social media mining; social	**9**

	engineering , phishing, vishing, spear phishing, baiting, pretexting, tailgating, water holing; six levers of social engineering. Internal reconnaissance & scanning: Scanning and sniffing concepts; System exploitation: Zero-day attacks, fuzzing, buffer overflows; phishing as attack delivery; payloads using Metasploit (msfconsole, msfvenom); Cybersecurity kill chain: Phases - reconnaissance, scanning, exploitation, privilege escalation, exfiltration, sustainment, assault, obfuscation; threat lifecycle management.	
UNIT 3	Live Data collection and investigating windows environment: windows Registry analysis, Gathering Tools to create a response toolkit (Built in tools like netstat , cmd.exe , nbtstat , arp , md5sum ,regdmpetc and tools available as freeware like Fport , Pslistetc)	**9**
UNIT 4	Live Data collection and investigating UNIX environment Forensic tools and report generation: Recovery of Deleted files in windows, Analyzing network traffic, sniffers	**8**
UNIT 5	Ethical Hacking, Hardware forensic tools like Port scanning and vulnerability assessment tools like Nmap ,Netscanetc .Password recovery, Mobile forensic tools.	**8**
	TOTAL	**42**

REFERENCES

S.No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	Mandia, Kevin, Prosise, Chris, and Pepe, Matt," Incident Response &Computer Forensics", McGraw-Hill.	2003
2	Beebe, Nicole Lang, and Jan Guynes Clark, "A Hierarchical, Objectives-Based Framework for the Digital Investigations Process	2005
3	Nelson, Bill, Amelia Phillips, Frank Enfinger, and Christopher Steuart," Guide to Computer Forensics and Investigations", Thompson Course Technology, Boston	2006
4	James Graham, Richard Howard & Ryan Olson, Cyber Security Essentials, CRC Press, 2011	2011

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	2	3	2	–	2	–	–	–	1	3	2	1

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO2	3	3	2	2	–	1	–	1	–	–	–	1	3	1	–
CO3	2	2	2	2	3	–	–	–	–	–	–	1	2	2	–
CO4	2	2	2	2	3	–	–	–	–	–	–	1	2	2	–
CO5	2	3	3	1	3	2	–	2	–	–	–	2	3	2	1

DEPARTMENT ELECTIVE COURSE-2,3

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
	L	**T**	**P**	
IT306 Distributed and Cloud Computing	**3**	**1/0**	**0/2**	Basic knowledge of programming, understanding of operating systems, Database and computer

Course Objective: 1)To provide students with a solid foundation in the principles and practices of distributed and cloud computing.
2) To equip students with the knowledge and skills to design, develop, and manage distributed systems and cloud-based applications.
3) To introduce students to distributed algorithms, middleware, and data consistency mechanisms.
4) To explore cloud architecture, storage solutions, and cloud security challenges.
5) To examine advanced topics in distributed and cloud computing, including edge computing, containerization, and big data.

S. NO	Course Outcomes (CO)
CO1	Understand the fundamental concepts and architectures of distributed and cloud computing.
CO2	Design and implement distributed algorithms and middleware solutions.
CO3	Develop and manage cloud-based applications, leveraging cloud architecture and storage solutions.
CO4	Apply security measures to protect distributed and cloud systems.
CO5	Explore advanced topics and emerging trends in distributed and cloud computing, preparing for future challenges in the field.

S. NO	Contents	Contact Hours

UNIT 1	**Unit 1: Introduction to Distributed Systems** Overview of Distributed Computing: Definitions, Characteristics, and Applications Distributed System Architectures: Client-Server, Peer-to-Peer, and Hybrid Models Communication in Distributed Systems: RPC, RMI, and Message Passing Synchronization in Distributed Systems: Clock Synchronization, Logical Clocks, and Distributed Mutual Exclusion Fault Tolerance and Recovery in Distributed Systems: Checkpointing, Replication, and Consensus Algorithms	**10**
UNIT 2	**Unit II: Introduction to Cloud Computing** Overview of Cloud Computing: Definitions, Characteristics, and Service Models (IaaS, PaaS, SaaS) Cloud Deployment Models: Public, Private, Hybrid, and Community Clouds Virtualization in Cloud Computing: Concepts, Hypervisors, and Virtual Machine Management Cloud Service Models: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS) Economic and Business Models of Cloud Computing: Cost-Benefit Analysis, Pricing Models, and SLA Management	**12**
UNIT 3	**Unit III: Distributed Algorithms and Middleware** Distributed Algorithms: Leader Election, Consensus Algorithms (Paxos, Raft), and Distributed Hash Tables (DHTs) Middleware for Distributed Systems: Definition, Components, and Examples Data Consistency and Replication in Distributed Systems: CAP Theorem, Consistency Models, and Quorum-Based Protocols Security in Distributed Systems: Threats, Encryption, and Authentication Mechanisms Case Studies: Middleware Platforms (CORBA, Java RMI, Microsoft DCOM) and their Applications.	**10**
UNIT 4	**Unit IV: Cloud Architecture and Storage** Cloud Architecture: Cloud Infrastructure, Resource Management, and Virtualization Cloud Storage: Data Storage Systems in Cloud, Distributed File Systems (HDFS, GFS), and NoSQL Databases Cloud Security: Security Issues, Data Protection, and Identity and Access Management (IAM) Cloud Application Development: Tools, Frameworks, and Best Practices Case Studies: Amazon Web Services (AWS), Google Cloud Platform (GCP), Microsoft Azure	**10**

UNIT 5	**Unit V: Advanced Topics in Distributed and Cloud Computing** Edge and Fog Computing: Concepts, Architectures, and Use Cases Serverless Computing: Function as a Service (FaaS) and Event-Driven Architectures Containerization and Orchestration: Docker, Kubernetes, and Microservices Big Data and Cloud Computing: Hadoop, Spark, and Data Analytics in the Cloud Future Trends in Distributed and Cloud Computing: AI Integration, Blockchain, and Quantum Computing	**10**
	TOTAL	**42**

REFERENCES

S.No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	Coulouris, G., Dollimore, J., & Kindberg, T. Distributed Systems: Concepts and Design (6th ed.). Pearson. ISBN: 978-0132143011.	2022
2	Tanenbaum, A. S., & Van Steen, M. Distributed Systems: Principles and Paradigms (3rd ed.). Pearson. ISBN: 978-0132392275.	2021
3	Rajkumar, B., Yeo, C. S., & Venugopal, S. Cloud Computing: Principles and Paradigms (2nd ed.). Wiley. ISBN: 978-1119524984.	2020
4	Erl, T., Puttini, R., & Mahmood, Z. Cloud Computing Design Patterns (1st ed.). Prentice Hall. ISBN: 978-0133858567.	2023
5	Hwang, K., Dongarra, J., & Fox, G. C. Distributed and Cloud Computing: From Parallel Processing to the Internet of Things (2nd ed.). Morgan Kaufmann. ISBN: 978-0128002049.	2022

CO-PO-PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	0	1	0	1	0	0	0	0	0	0	0	3	1	0
CO 2	0	0	3	0	0	0	0	0	0	0	0	0	2	2	0
CO 3	0	0	2	0	1	0	0	0	0	0	1	0	3	3	2
CO 4	1	0	0	1	1	1	0	0	0	0	0	0	3	0	0
CO 5	0	0	0	0	1	0	0	0	0	0	0	1	2	0	0

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
	L	**T**	**P**	
IT308 Pattern Recognition and Application	**3**	**0/1**	**2/0**	Linear Algebra, Probability Theory

Course Objective: To equip with basic mathematical and statistical techniques commonly used in pattern recognition. Also provide with an adequate background on probability theory, statistics, and optimization theory to tackle a wide spectrum of engineering problems.

S. NO	Course Outcomes (CO)
CO1	Able to apply the knowledge of mathematics for obtaining solutions in pattern recognition domain
CO2	Able to apply various algorithms for pattern recognition
CO3	Able to map the pattern recognition concepts for solving real life problems
CO4	Able to carry out implementation of algorithms using different simulation tools
CO5	To effectively implement pattern recognition algorithms for specific applications

S. NO	Contents	Contact Hours
UNIT 1	Introduction to Pattern Recognition, Feature Detection, Classification, Review of Probability Theory, Conditional Probability and Bayes Rule, Random Vectors, Expectation, Correlation, Covariance, Review of Linear Algebra, Basics of Estimation theory, Decision Boundaries, Decision region / Metric spaces/ distances.	**10**
UNIT 2	Classification: Bayes decision rule, Error probability, Normal Distribution, Discriminant functions, Decision surfaces, K-NN Classifier, Single Layer Perceptron, Multi-Layer Perceptron, Training set, test set; standardization and normalization.	**8**
UNIT 3	Clustering: Basics of Clustering; similarity / dissimilarity measures; clustering criteria, Different distance functions and similarity measures, Minimum within cluster distance criterion, K-means algorithm, K-medoids, DBSCAN, Data sets - Visualization; Unique Clustering, No existence of clusters.	**8**

UNIT 4	Feature selection: Problem statement and Uses; Algorithms - Branch and bound algorithm, sequential forward / backward selection algorithms, (l,r) algorithm; Probabilistic separability based criterion functions, interclass distance based criterion functions.	**8**
UNIT 5	Feature extraction: PCA, Structural PR, SVMs, FCM, Soft-computing and Neuro-fuzzy techniques, and real-life examples.	**8**
	TOTAL	**42**

REFERENCES

S.No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	R. O. Duda, P. Hart, D. Stork, Pattern Classification, 2nd Ed. Wiley, ISBN: 978 0-471-05669-0.,2000	2000
2	Bishop, C. M., Pattern Recognition and Machine Learning. Springer, ISBN 978- 0- 387-31073-2,2007	2007
3	Bishop, C. M., Neural Networks for Pattern Recognition, Oxford University Press, ISBN-13: 978-0198538646,1995	1995
4	Theodoridis, S. and Koutroumbas, K., Pattern Recognition, 4th Ed. Academic Press, ISBN :9781597492720.,2008	2008

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	–	–	–	–	–	–	–	–	–	1	2	–	–
CO2	3	3	2	–	–	–	–	–	–	–	–	1	3	–	–
CO3	2	3	3	1	–	–	–	–	–	–	–	1	3	1	–
CO4	2	2	2	1	3	–	–	–	–	–	–	1	2	1	–
CO5	2	3	3	2	3	1	–	1	–	–	–	2	3	2	–

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
	L	**T**	**P**	
IT310 Secure Coding	**3**	**1/0**	**0/2**	Basic knowledge of programming, operating systems & computer networks.

Course Objective: 1) To understand the principles and practices of secure coding.
2) To learn how to identify and mitigate common security vulnerabilities in software applications.
3) To study secure software development methodologies and tools.
4) To gain hands-on experience in writing secure code across different programming languages.

S. NO	Course Outcomes (CO)
CO1	Explain fundamental software security concepts and secure coding principles with reference to CERT standards.
CO2	Analyze string and pointer-based vulnerabilities in C/C++ programs and apply appropriate mitigation techniques.
CO3	Detect and prevent memory management and integer vulnerabilities using secure coding practices in C/C++.
CO4	AnAnalyze formatted output and concurrency vulnerabilities and implement effective mitigation strategies.
CO5	Apply secure file I/O practices and the Security Development Lifecycle to develop secure software systems.

S. NO	Contents	Contact Hours
UNIT 1	**Introduction to Secure Coding** Overview of Software Security: Importance of software security in modern applications. Common types of software vulnerabilities. The cost of insecure software. Principles of Secure Coding: Least Privilege, Défense in Depth, Secure by Default. Security policies and secure coding standards (e.g., CERT). Gauging the threat, Security Concepts, C and C++ brief history and problems, and Development platforms.	**8**
UNIT 2	**Strings:** Character String, Common string manipulation errors, string vulnerabilities and exploits, Mitigation strategies for strings, string handling functions, Runtime protection strategies, Notable vulnerabilities such as remote Loging, Kerberos. **Pointer Subterfuge:** Data Locations, Function pointers, object pointers, Modifying the instruction pointer, Global offset table, The. Dtors sections, virtual pointers, the at_exit() and on_exit() functions, the longjmp() functions, Exception handing, Mitigation strategies.	**10**
UNIT 3	**Dynamic Memory Management:** C memory management, Common C memory management errors, C++ memory management, Common C++ memory management errors, Memory Managers, Doug Lea's Memory Allocator, Double-Free Vulnerabilities, Mitigation Strategies, Notable Vulnerabilities such as CVC buffer overflow vulnerabilities, Microsoft Data Access Components (MDAC), CVC Server double-free. **Integer Security:** Integer Data types, Integer conversions, integer operations, integer vulnerabilities, Mitigation strategies.	**8**

UNIT 4	**Formatted Output:** Variadic Functions, Formatted Output Functions, Exploiting Formatted Output Functions, Stack Randomization, Mitigation Strategies, Notable Vulnerabilities such as Washington University FTP Daemon, CDE ToolTalk **Concurrency:** Multithreading, Parallelism, Performance Goals, Common Errors, Mitigation Strategies, Mitigation Pitfalls, Notable Vulnerabilities, DoS Attacks in Multicore Dynamic Random-Access Memory (DRAM) Systems, Concurrency Vulnerabilities in System Call Wrappers	**8**
UNIT 5	**File I/O:** File I/O Basics, File I/O Interfaces, Access Control, File Identification, Race Conditions, Mitigation Strategies. **Recommended Practices:** The Security Development Lifecycle, Security Training, Requirements, Design, Implementation, Verification	**8**
	TOTAL	**42**

REFERENCES

S.No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	"Software Security: Building Security In" by Gary McGraw, Addison-Wesley	2006
2	"The Art of Software Security Assessment: Identifying and Preventing Software Vulnerabilities" by Mark Dowd, John McDonald, Justin Schuh, Addison-Wesley	2006
3	"Hacking: The Art of Exploitation, 2nd Edition" by Jon Erickson, No Starch Press	2008
4	"The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, 2nd Edition" by Dafydd Stuttard, Marcus Pinto, Wiley	2011
5	"Secure Coding in C and C++, 2nd Edition" by Robert C. Seacord, Addison-Wesley	2013
6	"Effective Java, 3rd Edition" by Joshua Bloch, Addison-Wesley.	2017
7	"Web Security for Developers: Real Threats, Practical Defense" by Malcolm McDonald, No Starch Press	2020
8	"Cryptography and Network Security: Principles and Practice, 8th Edition" by	2020

	William Stallings, Pearson	
9	"The Art of Software Security Testing: Identifying Software Security Flaws, 1st Edition" by Chris Wysopal, Lucas Nelson, Addison-Wesley	2006
10	"Penetration Testing: A Hands-On Introduction to Hacking" by Georgia Weidman, No Starch Press	2014

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	**2**	1	0	**0**	**2**	**0**	**2**	0	1	**0**	1	**3**	**1**	**1**
CO2	**3**	**3**	2	0	**2**	**1**	**0**	**2**	**0**	0	**0**	1	**3**	**2**	**1**
CO3	3	3	2	1	**2**	**1**	**0**	**2**	**0**	0	**0**	1	**3**	**3**	**1**
CO4	3	**3**	3	1	**2**	**1**	**0**	**2**	**0**	1	**0**	1	**3**	**3**	**2**
CO5	2	2	3	1	**2**	**3**	**1**	**3**	**1**	2	**2**	2	**2**	**3**	**3**

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
IT312 Wireless Ad hoc Mobile Network	**L**	**T**	**P**	**Fundamental of Computer Networks**
	3	**0/1**	**2/0**	

Course Objective: (1) Explain the fundamental principles of Ad-hoc Networks. (2) Discuss the comprehensive understanding of Ad-hoc network protocols. (3) Outline the current and emerging trends in Ad- hoc Ad-hoc Networks. (4) Analyze the energy management techinques in ad-hoc wireless networks.

S. NO	Course Outcomes (CO)
CO1	Design their own wireless network
CO2	Choose appropriate protocol for various applications
CO3	Evaluate the existing network and improve its quality of service
CO4	Examine security measures present at different level and analyze energy consumption and management

S. NO	Contents	Contact Hours

UNIT 1	Ad-hoc Wireless Networks Introduction, Issues in Ad-hoc Wireless Networks, Ad-hoc Wireless Internet; MAC Protocols for Ad-hoc Wireless Networks: Introduction, Issues in Designing a MAC Protocol, Design Goals of MAC Protocols, Classification of MAC protocols, Contention-Based Protocols, Contention-Based Protocols with Reservation Mechanisms, Contention-Based Protocols with Scheduling Mechanisms, MAC Protocols.	**9**
UNIT 2	Routing Protocols for Ad-hoc Wireless Networks Introduction, Issues in Designing a Routing Protocol for Ad-hoc Wireless Networks; Classification of Routing Protocols; Table Driven Routing Protocols; On-Demand Routing Protocols, Hybrid Routing Protocols, Hierarchical Routing Protocols and Power-Aware Routing Protocols.	**8**
UNIT 3	Multicast Routing in Ad-hoc Wireless Networks Introduction, Issues in Designing a Multicast Routing Protocol, Operation of Multicast Routing Protocols, An Architecture Reference Model for Multicast Routing Protocols, Classifications of Multicast Routing Protocols, Tree-Based Multicast Routing Protocols and Mesh-Based Multicast Routing Protocols	**8**
UNIT 4	Transport Layer and Security Protocols for Ad-hoc Networks: Introduction, Issues in Designing a Transport Layer Protocol; Design Goals of a Transport Layer Protocol; Classification of Transport Layer Solutions; TCP over Transport Layer Solutions; Other Transport Layer Protocols for Ad-hoc Networks; Security in Ad-hoc Wireless etworks, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management and Secure Touting Ad-hoc Wireless Networks.	**8**
UNIT 5	Quality of Service and Energy Management in Ad-hoc Wireless Networks: Introduction, Issues and Challenges in Providing QoS in Ad-hoc Wireless Networks, Classification of QoS Solutions, MAC Layer Solutions, Network Layer Solutions; Energy Management in Ad-hoc Wireless Networks: Introduction, Need for Energy Management in Ad-hoc Wireless Networks, Classification of Energy Management chemes, Battery Management Schemes, Transmission Management Schemes, System Power Management Schemes	**9**
	TOTAL	**42**

REFERENCES		
S.No.	**Name of Books/Authors/Publishers**	**Year of Publication / Reprint**

1	C. Siva Ram Murthy & B. S. Manoj: Ad-hoc Wireless Networks, 2nd Edition, Pearson Education	2011
2	C.K. Toh: Ad-hoc Mobile Wireless Networks- Protocols and Systems, Pearson Education	2002
3	Ozan K. Tonguz and Gianguigi Ferrari: Ad-hoc Wireless Networks, John Wiley	2007
4	Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du: Ad-hoc Wireless Networking, Kluwer Academic Publishers	2004
5	Wireless Ad Hoc Mobile wireless Networks- principle, protocols and applications, Subir Kumar Sarkar , et al.,Auerbach publications, Taylor & Francis Group	2008

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	–	–	–	–	–	–	–	–	1	3	1	–
CO2	3	3	2	–	–	–	–	–	–	–	–	1	3	–	–
CO3	2	3	2	2	–	–	–	–	–	–	–	1	2	–	–
CO4	2	3	2	2	1	1	1	2	–	–	–	2	2	1	1

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
	L	**T**	**P**	
IT314 Blockchain Technology	**3**	**1/0**	**0/2**	Cryptography

Course Objective: This course provides a comprehensive introduction to blockchain technology, covering its fundamental concepts, key platforms, and cryptographic solutions. Students will explore security, privacy, scalability, and interoperability challenges, along with the consensus protocols that maintain blockchain integrity. By the end of the course, students will be prepared to understand and apply blockchain technology in various real-world scenarios.

S. NO	**Course Outcomes (CO)**
CO1	To understand the fundamentals of blockchain technology.
CO2	To acquire the knowledge on various blockchain platforms.
CO3	To study the Cryptographic Solution in Blockchain and understand their security and privacy

	issues.
CO4	To study the various consensus protocols used in the blockchain technology.
CO5	To understand the scalability, interoperability issues and their proposed solutions in current scenarios.

S. NO	Contents	Contact
UNIT 1	Introduction: Decentralised System: Difference between centralised, decentralised and distributed system, Introduction and need of decentralised ledger system. Blockchain Technology: Introduction of blockchain, Architecture of Blockchain, detailed knowledge of Block Structure, Working of Blockchain, main barrier to blockchain adoption, use-case of blockchain in various fields.	**8**
UNIT 2	Blockchain Platform: Introduction of Public/permissionless, Private/Permissioned Ethereum: Basics, Ethereum clients, Wallets, Tokens, Oracles, Ethereum Virtual Machine, Smart Contract, Introduction to Solidity	**8**
UNIT 3	Cryptography: Public key cryptography, Digital Signature, Hashing, SHA256, AES, RSA, Security and privacy: Issues in blockchain, attacks on Blockchains – such as Sybil attacks, selfish mining, 51% attacks, Smart Contract Vulnerability, Hard fork/ soft Fork, Mitigatation Techniques.	**8**
UNIT 4	Consensus: Foundation od Consensus, Classical Consensus, Nakamoto Consensus, Ethereum Merge, Blockchain Selfish Mining, Proof based consensus: PoW, Pos, PoA, PoET, Voting Based Consensus: Paxos, RAFT, PBFT	**10**
UNIT 5	Scalability and Interoperability: Addressing the Issue of Scalability and Interoperability, Blockchain scalability solutions: Layer 1, Layer 2, Various Off-chain Storage.	**8**
	TOTAL	**42**

REFERENCES

S.No.	Name of Books/Authors/Publishers	Year of
1	Mastering Blockchain: Inner workings of blockchain, from cryptography and decentralized identities, to DeFi, NFTs and Web3, 4th Edition "imran bashir", Packt Publishing	2023
2	Mastering Ethereum: Building Smart Contracts and DApps by Andreas M. Antonopoulos and Gavin Wood, Shroff/O'Reilly	2018
3	Mastering Bitcoin: Programming the Open Blockchain (Second Edition) "Andreas Antonopoulos", O'Reilly Media	2017

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	–	–	–	–	–	–	–	–	–	1	2	–	–
CO2	3	2	2	–	2	–	–	–	–	–	–	1	3	1	–
CO3	3	3	2	1	–	1	–	2	–	–	–	1	3	1	–
CO4	3	3	2	1	–	–	–	–	–	–	–	1	3	1	–
CO5	2	3	2	2	–	1	–	1	–	–	–	2	2	1	1

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
	L	**T**	**P**	
IT316 Digital Image Processing	**3**	**0/1**	**2/0**	**-**

Course Objective: To introduce to the concepts of digital image processing. The students will learn image transforms, image enhancement,restoration, morphological operations, edge detection, and segmentation algorithms.

S. NO	Course Outcomes (CO)
CO1	Understand the fundamental concepts of digital image representation, sampling, quantization, and basic image relationships.
CO2	Apply spatial domain techniques, including gray level transforms, histogram operations, and fuzzy logic, for enhancing digital images.
CO3	Utilize frequency domain techniques, including Fourier transforms, for image enhancement through filtering, smoothing, and sharpening.
CO4	Implement noise removal algorithms and color models to restore degraded images and enhance color images.
CO5	Apply morphological operations such as dilation, erosion, and boundary extraction to process and analyze digital images.
CO6	Detect edges, points, and lines using various operators, and apply image segmentation techniques for partitioning digital images.

S. NO	Contents	Contact Hours

UNIT 1	**Introduction And Digital Image Fundamentals:** Digital Image Representation, Fundamental Steps in Image Processing, Elements of Digital image processing systems, Sampling and quantization, some basic relationships like neighbours, connectivity, Distance measure between pixels, Imaging Geometry.	**6**
UNIT 2	**Image Enhancement (Spatial Domain):** Gray level transforms, histogram equalization, histogram specification, basics of the spatial filtering, smoothing operators, image gradients, sharpening operators **Fuzzy logic:** basic definitions, fuzzy operations, fuzzy inference, application of fuzzy logic in image processing.	**7**
UNIT 3	**Image Enhancement (Frequency domain):** Two-Dimensional Fourier transform and its properties, basics of frequency domain filtering, smoothing and sharpening in frequency domain	**7**
UNIT 4	**Image Restoration:** modelling of image degradations, noise models, noise removal algorithms for impulse and Gaussian noise, Adaptive filtering, estimation of degradation function, inverse filtering. **Color Image Processing:** Color models, conversion between different models, color transforms, color smoothing and sharpening.	**8**
UNIT 5	**Morphological Image Processing:** Dilation, Erosion, opening and closing, hit and miss transform, boundary extraction, region filling, thinning, thickening, skeletons, pruning, Gray scale image dilation and erosion.	**6**
UNIT 6	**Discontinuity Detection:** point, line and edge detection, Sobel, Canny, and LoG edge detectors, edge linking. **Image Segmentation:** Thresholding, optimal and global thresholding, multiple thresholding, region growing, region splitting and merging, dam construction watershed segmentation algorithm, spatial techniques, frequency domain techniques.	**8**
	TOTAL	**42**

REFERENCES

S.No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing', 3rd Edition, Pearson Education	2008
2	Anil K. Jain, Fundamentals of Digital Image Processing', Pearson	2002
3	William K. Pratt, Digital Image Processing' 6th Edition, John Wiley	2002

4	Rafael C. Gonzalez, Richard E. Woods, Steven Eddins,' Digital Image Processing using MATLAB, Pearson	2004

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	–	–	–	–	–	–	–	–	–	1	2	–	–
CO2	3	3	2	–	–	–	–	–	–	–	–	1	3	–	–
CO3	3	3	2	1	–	–	–	–	–	–	–	1	3	–	–
CO4	3	3	2	1	2	–	–	–	–	–	–	1	3	1	–
CO5	2	2	2	1	–	–	–	–	–	–	–	1	2	1	–
CO6	3	3	3	2	–	–	–	–	–	–	–	2	3	1	–

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
	L	**T**	**P**	
IT318 Natural language processing	**3**	**1/0**	**0/2**	Probability and statistics, Machine learning

Course Objective: : 1. To introduce core NLP concepts, including linguistic principles, formal models (regular expressions, finite state automata), and syntactic frameworks such as CFGs, parsing, PCFGs, and ambiguity resolution.
2. To develop an understanding of text representation techniques and classification methods, including preprocessing steps, frequency-based models, and sequence-based deep learning approaches.
3. To familiarize students with advanced NLP techniques such as lexical semantics, language modeling, natural language generation, and modern applications like large language models, machine translation, and question-answering systems

S. NO.	Course Outcomes (CO)
CO1	Ability to understand and implement text pre-processing techniques and pattern matching using regular expressions.
CO2	Ability to implement Bag-of-Words models for feature extraction and machine learning for text classification.
CO3	Ability to analyze the use of word senses and word embeddings with sequence learning using LSTM or transformer.
CO4	Ability to execute syntactic parsing of sentences for a given grammar and probabilistic inferencing.
CO5	Ability to design and implement text generation models using Language modelling and encoder- decoder models.
CO6	Ability to describe real-world applications of Natural Language Processing and Natural Language Generation.

S. NO.	Contents	Contact Hours
UNIT 1	**Introduction:** The study of Language, Introduction to NLP and various terms related to NLP- morphology, syntax, semantics, pragmatics, discourse, ambiguity. Regular Expression, Finite State Automata.	6
UNIT 2	**Text representation and classification**: Pre-processing: Tokenization, Lemmatization, Stemming. Frequency Based Methods: Bag-of-Words features, 1-hot encoding, TF, TF-IDF, Machine learning classifiers. Sequence Based Methods: Word Embeddings, LSTM/Transformer.	8
UNIT 3	**Lexical Semantics**: Word Senses, WordNet, SentiWordNet, Synsets, Hypernyms, Hyponyms, Meronyms, Holonyms, Word Sense Disambiguation, Word Similarity, Semantic Role Labelling.	8
UNIT 4	**Natural language generation:** Probabilistic Context-Free Grammars, Syntactic Parsing, Part-of-speech-tagging, Probabilistic Language Processing, N-gram language modelling for text generation. Encoder-decoder LSTM/Transformer models for sequence-to-sequence learning, Attention mechanism.	12
UNIT 5	**Advanced techniques:** Large Language Models, Machine Translation, Man- Machine Interfaces, Natural language Question-Answering Systems, Text summarization models, Information Retrieval.	8
	TOTAL	42

REFERENCES

S.No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	D. Jurafsky, J. H. Martin, Speech and Language Processing, 2/e, Pearson Education.	2013
2	James Allen, Natural Language Understanding, 2/e, Pearson Education.	2003
3	S. Bird, E. Klein, E. Loper, "Natural Language Processing with Python", O'Reilly.	2009
4	Manning and Schutze, "Foundation of Statistical Natural Language Processing", MIT press.	1999
5	U. Kamath, J. Liu, J. Whitaker, "Deep learning for NLP and speech recognition", Springer.	2019

6	D. Rothman, "Transformers for Natural Language Processing", Packt publishing.	2021

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	–	–	–	–	–	–	1	2	1	–
CO2	3	3	2	2	3	–	–	–	–	–	–	1	3	2	–
CO3	3	3	3	2	3	–	–	–	–	–	–	1	3	2	–
CO4	3	3	2	2	–	–	–	–	–	–	–	1	3	1	–
CO5	3	3	3	2	3	–	–	–	–	–	–	2	3	2	–
CO6	2	2	2	2	–	1	–	1	–	–	–	2	2	–	1

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
IT 320 Cyber Security	**L**	**T**	**P**	**-**
	3	**1/0**	**0/2**	

Course Objective: To learn the foundation of Cyber security and threat landscape and develop skills in students that can help them plan,implement,and monitor cyber security mechanisms to ensure the protection of information technology assests and responsible use of social media networks.

S. NO	Course Outcomes (CO)
CO1	Students would be able to understand the concept of Cyber Security and issues challenges associated with it.
CO2	Able to understand the cyber crimes,their nature,legal remedies,and as to how report the crimes through platforms.
CO3	Able to appreciate various privacy and security concerns on online social media,reporting on inappropriate content
CO4	Able to understand E-Commerce and didital payments and in their frauds and security issues,RBI guidelines
CO5	Able to understand the basic security aspects,use basic tools and technologies to protect their devices

S. NO	Contents	Contact Hours

UNIT 1	Introduction to Cyber Security: Defining Cyberspace & Overview of Computer, Architecture of Cyberspace, Communication & Web Technology, Internet, World Wide web,Advent of Internet Infrastructure for data transfer, governance&society, Regulation of cyberspace,Concept,Issues & challenges of Cyber Security	**6**
UNIT 2	Cyber Crime & Cyber Laws: Classification of cyber crimes,Common cyber crimes-cyber crime targeting computers and mobiles,cyber crime against women and children,financial frauds,social engineering attacks,malware and ransomware attacks,zero day and zero click attacks,Cybercriminals and modus- operandi,Reporting of cyber crimes,Remedial and mitigation measures,Legal perespective of cyber crime and offences,Organisations dealing with Cyber crime and Cyber Security in India,Case Studies	**10**
UNIT 3	Social Media Overview&Security:Introduction to Social Networks,Types of Social Media,Social media Platforms,Social Media monitoring,Hashtag,Viral Content,Social media marketing,media privacy,Challenges,oppurtunities,pitfall in online social network,Security issues,flagging,reporting inappropriate content,best practices for the use of social media,case studies	**6**
UNIT 4	E-Commerce & Digital Payments:Defination of ECommerce,Main Components,Elements,security,threats,security best practices,Introduction to digital payments,Components of digital payment and stake holders,Models of digital payments-Banking Cards,Unified Payment Interface(UPI),e- Wallets,Unstructured Supplementary Service Data(USSD),Aadhar enabled payments,frauds&preventive measures,RBI guidelines on digital payments and customer protection in unauthorised banking transactions.Relevant provisions of payment Settlement Act,2007.	**10**
UNIT 5	Digital Devices Security Tools&Technologies for Cyber Security: End point device and mobile phone security,Password policy,security patch management, Data backup, Downloading Management of third party software,Device Security policy,Cyber Security best practices, Significance & Managment of host firewall & Anti-virus, Wi-Fi Security, Configuration of basic security policy permissions	**10**
	Total	**42**

REFERENCES		
S.No.	**Name of Books/Authors/Publishers**	**Year of Publication / Reprint**

1	Cyber Crime Impact in the New Milennium, by R.C.Mishra, Auther Press	2010
2	Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perespectives by Sumit Belapure and Nina Godbole, Wiley India Pvt.Ltd.	2011
3	Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliveer, Create Space Independent Publishing Platform.	2001
4	Fundamentals of Network Security by E.Maiwald,McGraw Hill	2004

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	2	3	2	–	2	–	–	–	1	3	2	1
CO2	3	3	2	2	–	1	–	1	–	–	–	1	3	1	–
CO3	2	2	2	2	3	–	–	–	–	–	–	1	2	2	–
CO4	2	2	2	2	3	–	–	–	–	–	–	1	2	2	–
CO5	2	3	3	1	3	2	–	2	–	–	–	2	3	2	1

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
IT322 Computer Vision	**L**	**T**	**P**	Basic of Linear Algebra and Programming
	3	**0/1**	**2/0**	

Course Objective: To introduce fundamentals of computer vision so that students will understand to program a computer for understanding a scene or features in an image development.

S. NO	Course Outcomes (CO)
CO1	To describe Image Formation Models, Monocular imaging system, Orthographic & Perspective projections
CO2	To evaluate applications of 2D/3D Vision Filters, Binary Images, Features and Edge Detection
CO3	To describe Image Processing and Feature Extraction concepts
CO4	To analyze motion Estimation, Regularization theory, Optical computation, Stereo Vision
CO5	To investigate Shape Representation Segmentation, Deformable curves and surfaces

CO6	To explain about Object recognition, describe Hough transforms and other simple object recognition methods

S. NO	Contents	Contact Hours
UNIT 1	Image Formation Models: Monocular imaging system, Orthographic & &Perspective Projection, Cameras – lenses, projections, sensors, Radiometry –Measuring Light, light and surfacesRepresentation – color spaces, Camera model and Camera calibration, Binocular imaging systems, Sources, Shadows and Shading.	**8**
UNIT 2	2D/3D Vision: Filters, Binary Images, Features, Edge Detection, Texture, Shape, Segmentation, Clustering, Model Fitting, Probabilistic, 3D Vision:Multiview geometry, Stereo, Shape from X, 3D data	**6**
UNIT 3	Image Processing and Feature Extraction: Image representations (continuous and discrete), Linear Filters, Texture, Edge detection.	**6**
UNIT 4	Motion Estimation: Regularization theory, Optical computation, Stereo Vision, Motion estimation, Structure from motion.	**8**
UNIT 5	Shape Representation and Segmentation: Deformable curves and surfaces, Snakes and active contours, Level set representations, Fourier and wavelet descriptors, Medial representations, Multi- resolution analysis.	**8**
UNIT6	Object recognition: Hough transforms and other simple object recognition methods, Shape correspondence and shape matching, Principal component analysis, Shape priors for recognition.	**6**
	TOTAL	**42**

REFERENCES

S.No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	Computer Vision: A Modern Approach by D. A. Forsyth and J. Ponce, Prentice Hall, 2003/2011	2011
2	Computer Vision by Linda Shapiro and George Stockman, Prentice-Hall, 2001	2001

3	Robot Vision, by B. K. P. Horn, McGraw-Hill., 1986	1986
4	Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004	2004

CO-PO-PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0
CO 2	0	1	0	0	0	0	0	0	0	0	0	0	2	2	2
CO 3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO 4	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
CO 5	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0
CO 6	1	0	0	0	0	0	0	0	0	1	0	0	2	0	0

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
IT324 Artificial Intelligence	**L**	**T**	**P**	Data Structures and Algorithms
	3	**0/1**	**2/0**	

Course Objective: To provide the foundations for AI problem solving techniques and knowledge representation formalisms.

S. NO	**Course Outcomes (CO)**
CO1	Identify and formulate appropriate AI methods for solving a problem.
CO2	Implement AI algorithm
CO3	Compare different AI algorithms in terms of design issues, computational complexity, and assumptions

S. NO	**Contents**	**Contact Hours**

UNIT 1	Introduction: Uninformed search strategies, Greedy best-first search, And-Or search, Uniform cost search, A* search, Memory-bounded heuristic search. Local Search Techniques: Beam Search, Hill Climbing Search, Genetic Search techniques. Constraint Satisfaction Problems: Backtracking search for CSPs, Local search for CSPs	**12**
UNIT 2	Adversarial Search: Optimal Decision in Games, The minimax algorithm, Alpha-Beta pruning, Expectimax search. Knowledge and Reasoning: Propositional Logic, Reasoning Patterns in propositional logic; First order logic: syntax, semantics, Inference in First order logic, unification and lifting, backward chaining, resolution	**12**
UNIT 3	Representation: Information extraction, representation techniques, foundations of Ontology, Planning: Situation Calculus, Deductive planning, STRIPES, sub- goal, and Partial order planner. Bayesian Network and causality: Probabilistic models, directed and undirected models, inferencing, reasoning, causality	**12**
UNIT 4	Reinforcement Learning: MDP, Policy, Q-value	**6**
	TOTAL	**42**

REFERENCES

S.No.	**Name of Books/Authors/Publishers**	**Year of Publication / Reprint**
1	Artificial Intelligence: A Modern Approach by Russell and Norvig Pearson	2022
2	Artificial Intelligence by Kevin Knight, Elaine Rich, and Shivashankar B. Nair, McGraw Hill Education	2017
3	Introduction to Artificial Intelligence by Wolfgang Ertel, Springer	2011
4	Artificial Intelligence: Foundations of Computational Agents by David L. Poole and Alan K. Mackworths, Cambridge University Press	2017

CO-PO-PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3

CO 1	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0
CO 2	0	0	2	0	0	0	0	0	0	0	0	0	2	1	0
CO 3	0	2	2	0	0	0	0	0	0	0	0	0	2	1	0

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
	L	**T**	**P**	
IT326 Software Testing	**3**	**1/0**	**0/2**	**-**

Course Objective: To understand software testing concepts and applications.

S. NO	**Course Outcomes (CO)**
CO1	Understand the fundamental concepts of verification and validation, including terminologies, goals, roles, and applicability in software testing.
CO2	Comprehend the software testing process, levels of testing, and testing activities, including debugging and stress testing.
CO3	Apply verification methods and functional testing techniques like boundary value analysis and equivalence class testing to ensure software quality.
CO4	Implement structural testing methods, including path testing, cyclomatic complexity, and object-oriented testing techniques.
CO5	Evaluate and utilize various testing tools and methodologies for automated testing and debugging in software projects.
CO6	Prioritize test cases and apply advanced testing techniques for web applications and automated test data generation.

S. NO	**Contents**	**Contact Hours**
UNIT 1	**Introductory concepts:** Verification &Validation Terminologies like Goals, Role, Objectives, Limitations, Approaches & Applicability.	**4**

UNIT 2	**Software Testing:** Testing Process, Limitations of Testing, Testing activities. **Levels of Testing:** Unit Testing, Integration Testing, System Testing, Debugging, Domain Testing, Regression Testing, Stress Testing, Slice based testing	**8**

UNIT 3	**Verification Testing:** Verification Methods, SRS Verification, Software Design Document Verification, Code Reviews, User Documentation Verification, Software Project Audits. **Functional Testing techniques:** Boundary Value Analysis, Equivalence Class Testing, Decision Table Based Testing, Cause Effect Graphing Technique.	**8**
UNIT 4	**Structural Testing:** Path testing, DD-Paths, Cyclomatic Complexity, Graph Metrics, Data Flow Testing, Mutation testing. Object Oriented Testing: Class Testing, GUI Testing.	**8**
UNIT 5	**Testing Activities:** Unit Testing, Levels of Testing, Integration Testing, System Testing, Debugging **Software Testing Tools Taxonomy:** Methodology to evaluate automated testing. Using tools: Load Runner, Win runner and Rational Testing Tools, Java Testing Tools, JMetra, JUNIT Cactus and other recent tools.	**8**
UNIT 6	**Advanced Topics** on Testing: Prioritizing the Test-cases, Testing Web Applications, Automated Test Data Generation.	**6**
	TOTAL	**42**

REFERENCES

S.No.	**Name of Books/Authors/Publishers**	**Year of Publication / Reprint**
1	Paul C. Jorgenson, Software Testing A Craftsman's approach, CRC Press.,	1997
2	Yogesh Singh, "Software Testing", 1st Ed., Cambridge University Press	2012
3	Louise Tamres, "Software Testing", Pearson Education Asia,	2002

CO-PO-PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	0	0	2	1	0	0	0	0	0	0	0	2	3	0
CO 2	0	0	0	2	1	0	0	0	0	0	0	0	2	2	0
CO 3	1	1	0	2	1	0	0	0	0	0	0	0	2	3	0

CO 4	0	1	1	2	0	0	0	0	0	0	0	0	1	2	0
CO 5	0	1	0	2	2	0	0	0	0	0	1	0	1	2	0
CO 6	1	0	0	2	0	0	0	0	0	0	0	0	3	3	2

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
IT328 Competitive Programming	**L**	**T**	**P**	Data Structures, C/C++
	3	**1/0**	**0/2**	

Course Objective: To equip students with the skill to think critically and logically to solve any problem.

S. NO	**Course Outcomes (CO)**
CO1	To understand the different data structures as per the need of the problem statement
CO2	To understand the basic and advanced level maths behind different algorithms
CO3	To apply dynamic programming techniques with different data structures
CO4	To efficiently retrieve and manipulate elements within a specified range in a data structure

S. NO	**Contents**	**Contact Hours**
UNIT 1	Number Theory and Bit Manipulation: Binary Exponentiation Modular Arithmetic, Modular Inverse, Euclidean: GCD, Euclidean: LCM, Sieve of Eratosthenes, Linear Diophantine Equation with Two Variables, Chinese Remainder Theorem, Bit operations	**10**
UNIT 2	Combinatorics and Greedy Algorithms: Stars and Bars Factorial, Binomial Coefficient (nCr), Catalan Number, Two Pointer Sliding Window	**8**
UNIT 3	Searching Techniques and algorithms: Binary Search on answer and monotonic functions, Ternary Search on Convex Functions	**8**
UNIT 4	Dynamic Programming: DP on arrays, Dp on trees, Dp on directed graph, Game DP, Digit Dp, Dp with Bitmasking	**8**
UNIT 5	Range Queries: Segment tree Sparse table, Fenwick tree, Lazy Propagation, Square root decomposition (MO's Algorithm).	**8**

	TOTAL	42

REFERENCES		
S.No.	**Name of Books/Authors/Publishers**	**Year of Publication / Reprint**
1	COMPETITIVE PROGRAMMING IN PYTHON: 128 Algorithms to Develop your Coding Skills Christoph Dürr (Author), Jill-Jênn Vie (Author), Greg Gibbons (Translator), Danièle Gibbons (Translator)	2020
2	Algorithm Design Techniques: Recursion, Backtracking, Greedy, Divide and Conquer and Dynamic Programming by Narasimha Karumanchi	2018
3	Concrete Mathematics A textbook by Donald Knuth, Oren Patashnik, and Ronald Graham	1994

CO-PO-PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	0	0	1	0	0	0	0	0	0	0	0	2	0	0
CO 2	2	0	1	0	0	0	0	0	0	0	0	0	2	0	0
CO 3	1	0	0	1	2	0	0	0	0	0	0	0	3	1	0
CO 4	0	0	0	1	0	0	0	0	0	0	0	0	2	0	0

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
IT330 Ubiquitous, sensing, computing, and communication	**L**	**T**	**P**	**Internet of Things**
	3	**0/1**	**2/0**	

Course Objective:

1) Basic introduction of all the elements of IoT-Mechanical, Electronics/sensor platform, Wireless and wireline protocols, Mobile to Electronics integration, Mobile to enterprise integration.
2) To have an understanding of basics of open source/commercial electronics platform for IoT.

S. NO	Course Outcomes (CO)
CO1	To understand merging technological options, platforms and case studies of IoT implementation in home & city automation.
CO2	To determine the Market perspective of IoT.
CO3	Design and prototype systems that integrate sensing, computing, and communication for real-world applications.
CO4	Understand the communication protocols and standards

S. NO	Contents	Contact Hours
UNIT 1	Introduction, Overview, Challenges in IoT, Networking Basics of IoT, NFC, Wireless LAN.	6
UNIT 2	Location in ubiquitous computing: Personal assistants, Location aware computing, Location tracking, Architecture, Location based service and applications, Location based social networks (LBSN), LBSN Recommendation. Context-aware computing: Context and Context-aware Computing, Issues and Challenges, Developing Context-aware Applications, System Architecture.	10
UNIT 3	Privacy and security in ubiquitous computing, Energy constraints in ubiquitous computing. Wearable computing, Glass and Augmented Reality, Eye-Tracking, Digital Pen and Paper, Mobile social networking & crowd sensing, Event based social network.	8
Unit 4	Mobile affective computing: Human Activity and Emotion Sensing, Health Apps, Mobile p2p computing, Smart Homes and Intelligent Buildings, Mobile HCI, Cloud centric IoT, Open challenges, Architecture, Energy Efficiency, Participatory sensing, Protocols, QoS, QoE.	08
Unit 5	IoT and data analytics IoT and Data Management, Data cleaning and processing, Data storage models. Search techniques, Deep Web, Semantic sensor web, Semantic Web Data Management, Searching in IoT.	10

	Real-time and Big Data Analytics for The Internet of Things, Heterogeneous Data Processing, High-dimensional Data Processing, Parallel and Distributed Data Processing.	
	TOTAL	**42**

REFERENCES		
S.No.	**Name of Books/Authors/Publishers**	**Year of Publication / Reprint**
1	N. Jeyanthi, Ajith Abraham, Hamid Mcheick, "Ubiquitous Computing and Computing Security of IoT".	2020
2	John Krumm, Ubiquitous Computing Fundamentals, CRC Press.	2018
3	Dirk Slama, "Enterprise IoT", Shroff Publisher/O'Reilly Publisher	2015

CO-PO-PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	0	1	0	1	0	0	0	0	0	0	0	2	2	1
CO 2	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
CO 3	0	0	2	0	0	0	0	0	0	1	0	0	3	2	2
CO 4	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
IT332 Intelligent IOT	**L**	**T**	**P**	**Internet of Things**
	3	**0/1**	**2/0**	

Course Objective: 1) To introduce the concepts of Intelligent IoT and its applications in real-world scenarios.
2) To explore the integration of Artificial Intelligence (AI) and Machine Learning (ML) with IoT systems.
3) To develop skills in designing and implementing intelligent IoT systems.
4) To address challenges related to security, privacy, and scalability in Intelligent IoT systems**.**

S. NO	**Course Outcomes (CO)**
CO1	Explain the architecture and components of Intelligent IoT systems.

CO2	Design and implement intelligent IoT systems using AI/ML techniques.
CO3	Analyze and optimize the performance of Intelligent IoT systems.
CO4	Evaluate security and privacy challenges in Intelligent IoT systems and propose solutions.

S. NO	Contents	Contact Hours
UNIT 1	**Introduction to Intelligent IoT:** Overview of IoT and Intelligent IoT, Key components of Intelligent IoT: Sensors, Actuators, Communication Protocols, and Cloud/Edge Computing, Applications of Intelligent IoT: Smart Cities, Healthcare, Agriculture, and Industry 4.0, Challenges in Intelligent IoT: Scalability, Interoperability, and Energy Efficiency	**10**
UNIT 2	**AI/ML Techniques for IoT:** Role of AI and ML in IoT, Supervised, Unsupervised, and Reinforcement Learning for IoT Data, Real-time Data Processing and Decision Making, Case Studies: Predictive Maintenance, Anomaly Detection, and Smart Automation	**10**
UNIT 3	**Intelligent IoT Architecture and Platforms:** Layered Architecture of Intelligent IoT, Edge vs Cloud Computing in Intelligent IoT, IoT Platforms: AWS IoT, Google Cloud IoT, Microsoft Azure IoT, Tools and Frameworks: TensorFlow Lite, PyTorch, and Keras for IoT	**8**
UNIT 4	**Security and Privacy in Intelligent IoT:**Security Threats in Intelligent IoT: Data Breaches, Device Hijacking, and Network Attacks**,** Privacy Concerns and Data Protection Techniques**,** Encryption, Authentication, and Access Control Mechanisms**,** Blockchain for Secure IoT Systems	**8**
UNIT 5	**Advanced Topics and Future Trends:** Federated Learning for IoT, 5G and Beyond for Intelligent IoT, Quantum Computing and IoT, Ethical and Societal Implications of Intelligent IoT	**6**
	TOTAL	**42**
	REFERENCES	
S. NO	**Name of Books/Authors/Publishers**	**Year of Publication / Reprint**
1.	"Building the Internet of Things: Implement New Business Models, Disrupt Competitors, Transform Your Industry" by Maciej Kranz	2016

2.	"Artificial Intelligence for IoT Cookbook" by Michael Roshak	2020
3.	"IoT and Edge Computing for Architects" by Perry Lea	2020

SEVENTH SEMESTER

DEPARTMENT ELECTIVE COURSE-4,5

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
	L	**T**	**P**	
IT405 Social Networks	**3**	**0/1**	**2/0**	**None**

Course Objective: To analyze and interpret social network structures and dynamics for practical and theoretical applications.

S. NO	Course Outcomes (CO)
CO1	To analyze and interpret various social network structures and metrics, such as centrality, density, and clustering
CO2	gain proficiency in using software tools and techniques for social network analysis, including data collection, visualization, and interpretation
CO3	Understand how social networks evolve over time and be able to assess the impact of network dynamics on information flow and social behavior
CO4	To apply social network analysis insights to solve practical problems in fields such as marketing, organizational behavior, and social sciences

S. NO	Contents	Contact Hours
UNIT 1	Introduction: Graphs, Social Networks, Network Types, Network Data Sets, Gephi for Network Analysis. Network Properties: Network Measures, Strong and Weak Ties, Homophily, Structural Balance, and Components	**10**
UNIT 2	Network Models: Random Networks, Scale Free Networks, The Barabási- Albert Model, Erdos-Renyi Model, Structural Analysis of Networks using Python: Python for Network Analysis, Empirical Studies, Structural, Properties, Generate Synthetic Networks, Working with signed networks	**10**
UNIT 3	Social Network Applications: Information Cascades, Small-World Phenomenon, Epidemics, Community Detection, Link Prediction, and Page Rank	**14**

UNIT 4	Evolving Network and Temporal Networks: Network evolution, working with Temporal Network Data, Multiplex and Multi-layer network, Network Analysis in Other Fields: Network Analysis in Biology, Sports, Transports, etc.	**8**
	TOTAL	**42**

REFERENCES

S.No.	**Name of Books/Authors/Publishers**	**Year of Publication / Reprint**
1	Networks, Crowds, and Markets: Reasoning about a Highly Connected World by David Easley and Jon Kleinberg, Cambridge University Press	2010
2	Network Science by Albert-László Barabási, **Cambridge University Press**	2016
3	Networks by Mark Newman, OUP Oxford	2018
4	The Structure of Complex Networks: Theory and Applications by Ernesto Estrada, OUP Oxford	2011

CO-PO-PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	0	1	0	1	0	1	0	0	0	0	0	0	2	0	0
CO 2	0	1	0	2	3	1	0	0	0	0	0	0	3	1	0
CO 3	1	1	0	0	0	1	0	0	0	0	0	0	1	0	0
CO 4	2	1	0	0	0	1	0	0	0	0	0	0	1	0	0

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
IT407 Intrusion Detection and Information Warfare	**L**	**T**	**P**	Computer Networks, Information Security
	3	**1/0**	**0/2**	

Course Objective: To equip the students with knowledge about detection and prevention of various intrusions.

S. NO	Course Outcomes (CO)
CO1	Students will be introduced to basic concepts of intrusion detection system.
CO2	Students will be able to understand Intrusion Prevention Systems, Network IDs protocol and model for intrusion analysis.
CO3	To Apply knowledge of the fundamentals and history of Intrusion Detection in order to avoid common pitfalls in the creation and evaluation of new Intrusion Detection Systems.
CO4	To Understand when, where, how, and why to apply Intrusion Detection tools and techniques in order to improve the security posture of an enterprise.

S. NO	Contents	Contact Hours
UNIT 1	Introduction: Introduction to Intrusion Detection and Snort, Network Traffic Analysis Working with Snort Rules, Plugins, Preprocessors and Output Modules, Using Snort with MySQL, Using ACID and Snort Snarf with Snort, Miscellaneous Tools, Intrusion Prevention.	**10**
UNIT 2	Intrusion detection techniques: techniques to provide privacy in Internet Application and protecting digital contents (music, video, software) from unintended use, authentication.	**8**
UNIT 3	System and Application Security- mail security (PGP etc) file System security, program and security, memory security, Sandboxing.	**8**
UNIT 4	Security threads protection intruders: Viruses-trusted system. Secure programming languages- concepts structured multiprogramming, shared classes, cooperating sequential processes, structure of the multiprogramming system RC-4000 software. Information Warfare: offensive information warfare, defensive information warfare.	**8**
UNIT 5	Key management in Group communication systems, Router security, Denial of service and side-channel attacks, Intrusion detection systems, Intrusion detection techniques-centralized and distributed.	**8**
	TOTAL	**42**

REFERENCES

S.No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	Computer Security, Dicter gouman, John Wiley & Sons, 2014	2014
2	Introduction to computer Security- Mathew Bishop, Addison-Wisley, 2004	2004
3	Network Security – Private Communication in a Public World, 2nd edition, by C Kaufman, R. Pearlman, M. Speciner, Prentice Hall, 2002	2002
4	Network security, Kaufman, Perlman and Speciner, Pearson Education, 2012	2012

CO-PO-PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
CO 2	1	1	1	0	0	0	0	0	0	0	0	0	2	0	0
CO 3	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0
CO 4	2	1	0	0	2	1	0	0	0	0	0	0	2	0	0

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
	L	**T**	**P**	
IT409 High Performance Computing	**3**	**1/0**	**0/2**	Operating systems, Algorithm Design and Analysis

Course Objective: To understand design and application of advanced computer architectures and parallel algorithms to achieve high performance computing

S. NO	Course Outcomes (CO)
CO1	Understand basic concepts, advanced computer architectures, parallel algorithms
CO2	Apply priciples of Memory Hierarchies, Multi core Processors
CO3	Parallel Programming involving Revealing concurrency
CO4	Compare high performance methods with Achieving Measuring performance

S. NO	Contents	Contact Hours
UNIT 1	Introduction to advanced computer architectures, parallel algorithms, parallel languages, and performance oriented computing, discussing about the key characteristics of highend computing architectures.	**8**

UNIT 2	Introduction to Computational Science and Engineering Applications, their characteristics and requirements,Review of Computational Complexity, Performance: metrics and measurements, Granularity and Partitioning, emporal/spatial/stream/kernel, Basic methods for parallel programming, Real- world case studies which are drawn from multiscale, multidiscipline applications.	**8**
UNIT 3	Memory Hierarchies, Multi core Processors, Homogeneous and Heterogeneous, Sharedmemory Symmetric Multiprocessors, Vector Computers, Distributed Memory Computers, Supercomputers and Petascale Systems, Application Accelerators/ Reconfigurable Computing, Novel computers: Stream, multithreaded, and purposebuilt	**9**
UNIT 4	Parallel Programming involving Revealing concurrency in applications, Task and Functional parallelism, Task Scheduling, Synchronization Methods, Parallel Primitives (collective operations), SPMD Programming (threads, OpenMP, MPI), I/O and File Systems, Parallel Matlabs (Parallel Matlab, StarP, Matlab MPI) Partitioning Global Address Space (PGAS) languages (UPC, Titanium, Global Arrays).	**9**
UNIT 5	Discussion about high performance methods with Achieving Measuring performance, Identifying performance bottlenecks, Restructuring applications for deep memory hierarchies, Partitioning applications for heterogeneous resources, Using existing libraries, tools, and framework.	**8**
	TOTAL	**42**

REFERENCES

S.No.	**Name of Books/Authors/Publishers**	**Year of Publication / Reprint**
1	Introduction to Parallel Computing, Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, 2nd edition, AddisonWelsey	2021
2	Petascale Computing: Algorithms and Applications, David A. Bader (Ed.), Chapman & Hall/CRC Computational Science Series	2018
3	Chuck helebuyck, Programming PIC microcontrollers with PIC basic.	2004
4	Grama, A. Gupta, G. Karypis, V. Kumar, An Introduction to Parallel Computing, Design and Analysis of Algorithms: 2/e, AddisonWesley,2003	2012

CO-PO-PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	0	2	0	0	0	0	0	0	0	0	0	2	1	0
CO 2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO 3	0	0	0	0	2	0	0	0	0	0	0	0	2	1	0
CO 4	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0

Course code: Course Title	**Course Structure**			**Pre-Requisite**
	L	**T**	**P**	
IT411 High Speed Networks	**3**	**1/0**	**0/2**	Computer Networks

Course Objective: To understand design and application of architechture and protocols of high speed computer networks

S. NO	**Course Outcomes (CO)**
CO1	Understand concept of High Speed networks with Asynchronous transfer mode
CO2	Comprehend various Congestion And Traffic Management algorithms and Queuing Analysis-
CO3	Compare Integrated and differentiated network services
CO4	Learn Internetworking and Inter-domain Routing,

S. NO	**Contents**	**Contact Hours**
UNIT 1	High Speed networks: Asynchronous transfer mode – ATM Protocol Architecture,ATM logical Connection, ATM Cell – ATM Service Categories – AAL, High Speed LANs:Fast Ethernet, Gigabit Ethernet, Fiber Channel – Wireless LANs: applications,requirements –Architecture of 802.11	**9**
UNIT 2	Congestion And Traffic Management: Queuing Analysis- Queuing Models – Single Server Queues – Effects of Congestion –Congestion Control – Traffic Management – Congestion Control in Packet SwitchingNetworks	**8**

UNIT 3	TCP And ATM Congestion Control : TCP Flow control – TCP Congestion Control – Retransmission – Timer Management – Exponential RTO backoff – KARN's Algorithm – Window management – Performance ofTCP over ATM. Traffic and Congestion control in ATM – Requirements – Attributes –Traffic Management Frame work, Traffic Control – ABR traffic Management – ABR ratecontrol, RM cell formats, ABR Capacity allocations – GFR traffic management	**8**
UNIT 4	Integrated and differential services integrated services architecture - approach, components, servicesqueuing discipline, fq, ps, brfq, gps, wfq - random early detection, differentiated services	**8**
UNIT 5	Protocols for qos support rsvp - goals & characteristics, data flow, rsvp operations, protocol mechanisms - multiprotocol label switching - operations, label stacking, protocol details - rtp - protocol architecture, data transfer protocol, rtcp.	**9**
UNIT 6	Internetworking: Inter-domain Routing, BGP, IPv6, Multicast Routing Protocols, Applications and Other Networking Technologies: RTP, RTSP, SIP, VoIP, Security Systems, SSH, PGP, TLS, IPSEC, DDoS AttackStacking, Protocol details - RTP - Protocol Architecture, Data Transfer Protocol, RTCP.	**8**
	TOTAL	**42**

REFERENCES		
S.No.	**Name of Books/Authors/Publishers**	**Year of Publication / Reprint**
1	HIGH SPEED NETWORKS AND INTERNET, 2nd edition, 2002 by William Stallings, Pearson Education, (ISBN-13: 9788177585698)	2002
2	HIGH PERFORMANCE COMMUNICATION NETWORKS, by Warland & Pravin Varaiya, Jean Hardcourt Asia Pvt. Ltd (ISBN-978-1-55860-574-9)	2001
3	MPLS and VPN architecture by Irvan Pepelnjk,Jin Guichard and Jeff Apcar, Cisco Press, Volume 1 and 2 (ISBN-13: 061-9472143230)	2003
4	Behrouz A. Forouzan, Data Communications and Networking, Fourth Ed., Tata McGraw Hill, (ISBN-0072967757)	2007

CO-PO-PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0
CO 2	0	1	1	0	0	0	0	0	0	0	2	0	2	0	0
CO 3	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0
CO 4	1	0	0	0	0	0	0	0	0	0	0	1	2	0	0

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
IT413 Information Security and Audit	**L**	**T**	**P**	Networking
	3	**0/1**	**2/0**	

Course Objective: To understand the risk assessment while handling and processing information and implementing security in audit. To discovery knowledge in collecting data about organization. To do various analysis on Information Risk Assessment.To understand IT audit and its activities.

S. NO	Course Outcomes (CO)
CO1	Understand risk assessment in information handling and processing.
CO2	Implement security in auditing.
CO3	Acquire knowledge in data collection about organizations.
CO4	Perform various analyses on information risk assessment. Comprehend IT auditing and its activities.

S. NO	Contents	Contact
UNIT 1	Conventional Encryption Principles & Algorithms (DES, AFS, RC4, Blowfish), Block Cipher Modes of Operation, Location of Encryption Devices. Key Distribution. Public key cryptography principles, public key cryptography algorithms (RSA, Diffie-Hellman, ECC), public Key Distribution.	**8**
UNIT 2	Secure Hash Functions (SHA-512, MDS) and HMAC, Digital Signatures, Kerberos, X.509 Directory Authentication Service, Email Security: Pretty Good Privacy (PGP) IP Security: Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining SecurityAssociations and Key Management.	**9**

UNIT 3	Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET). Firewalls: Firewall Design principles, Trusted Systems, Intrusion Detection Systems.	**9**
UNIT 4	Introduction, Basic Terms Related to Audits, Security audits, The Need for Security Audits in Organization, Organizational Roles and Responsibilities for Security Audit, Auditors Responsibility in Security Audits, Types Of Security Audits.	**8**
UNIT 5	Approaches to Audits, Technology Based Audits Vulnerability Scanning And Penetration Testing, Resistance to Security Audits, Phase in security audit, Security audit Engagement Costs and other aspects, Budgeting for security audits, Selecting external Security Consultants. Key Success factors for security audits.	**8**
	TOTAL	**42**

REFERENCES		
S.No.	**Name of Books/Authors/Publishers**	**Year of**
1	Information Systems Security, Nina Godbole, Wiley	2008
2	Principles of Information Security, Whitman, Thornson,	2008
3	Cryptography and Network Security, William Stallings, Fourth Edition	2007

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	–	–	–	1	–	1	–	–	–	1	2	–	–
CO2	2	3	2	1	2	1	–	2	–	–	–	1	3	–	–
CO3	2	2	–	–	–	–	–	–	–	–	–	1	2	–	–
CO4	2	3	2	2	–	1	–	2	–	–	–	2	3	1	–

B.Tech. Information Technology				
Course code:	**Course Structure**			**Pre-Requisite**
IT415 Multimedia System Design	**L**	**T**	**P**	Basic of Linear Algebra and Programming
	3	**1/0**	**0/2**	

Course Objective: To study the concepts of multimedia data, algorithms and compression.

S. NO	**Course Outcomes (CO)**

CO1	To describe Multimedia Information, Multimedia Objects and Multimedia in business and work.
CO2	To analyze Multimedia Building Blocks like Text, Sound MIDI, Digital Audio, audio file formats.
CO3	To apply Data Compression: Huffman Coding, Shannon Fano Algorithm.
CO4	To explain Speech Compression & Synthesis, Digital Audio concepts
CO5	To analyze Multiple monitors, bitmaps, Vector drawing.

S. NO	Contents	Contact Hours
UNIT 1	Introduction to Multimedia, Multimedia Information, Multimedia Objects, Multimedia inbusiness and work. Convergence of Computer, Communication and EntertainmentProducts ,Stages of Multimedia Projects:Multimedia hardware, Memory & storage devices, Communication devices, Multimedia softwares, presentation tools, tools for object generations, video, sound, image capturing,authoring tools, card and page based authoring tools.	**8**
UNIT 2	Multimedia Building Blocks: Text, Sound MIDI, Digital Audio, audio file formats, MIDI under windows environment, Audio & Video Capture.	**6**
UNIT 3	Data Compression: Huffman Coding, Shannon Fano Algorithm, Huffman Algorithms, Adaptive Coding,Arithmetic Coding Higher Order Modeling. Finite Context Modeling, Dictionary basedCompression, Sliding Window Compression, LZ77, LZW compression, Compression,Compression ratio loss less & lossy compression.	**6**
UNIT 4	Speech Compression & Synthesis : Digital Audio concepts, Sampling Variables, Loss less compression of sound, lossy compression & silence compression.	**8**
UNIT 5	Images: Multiple monitors, bitmaps, Vector drawing, lossy graphic compression, image fileformats, animations, Images standards, JPEG Compression, Zigzag Coding	**8**
UNIT6	MultimediaDatabase. Content based retrieval for text and images, Video: Video representation, Colors,Video Compression, MPEG standards, MHEG Standard Video Streaming on net, VideoConferencing, Multimedia Broadcast Services, Indexing and retrieval of Video Database,recent developments in Multimedia.	**6**
	TOTAL	**42**

REFERENCES		
S.No.	**Name of Books/Authors/Publishers**	**Year of Publication / Reprint**
1	Tay Vaughan "Multimedia, Making IT Work" Osborne McGraw Hill. (ISBN-10: 0072264527), 2014, 2010	2010
2	Buford "Multimedia Systems" Addison Wesley (ISBN-13: 9780201532586), 2000	2000
3	Agarwal & Tiwari "Multimedia Systems" Excel, 2002	2002

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	–	–	–	–	–	–	–	–	–	1	2	–	–
CO2	3	3	2	–	–	–	–	–	–	–	–	1	3	–	–
CO3	3	3	2	1	–	–	–	–	–	–	–	1	3	–	–
CO4	2	2	2	1	–	–	–	–	–	–	–	1	2	–	–
CO5	2	3	2	1	–	–	–	–	–	–	–	1	3	1	–

B.Tech. Information Technology				
Course code:	**Course Structure**			**Pre-Requisite**
	L	**T**	**P**	
IT417 Multimodal Data Processing	**3**	**1/0**	**0/2**	Machine Learning

Course Objective:: To Understand the fundamentals of Multimodal data, text processing techniques, language models, and multimodal learning frameworks.

S. NO	Course Outcomes (CO)
CO1	Identify and explain the idea of multimodal data processing along with its applications in text processing
CO2	Analyze image, video, and speech data processing techniques.
CO3	Understand fusion methods, multimodal learning architectures, and associated challenges.
CO4	Apply multimodal approaches in real-world intelligent systems.

S. NO	Contents	Contact Hours

UNIT 1	**Introduction to Multimodal Data Processing:** Introduction to multimodal data and applications, Multimodal representation: Joint and Coordinate approaches, Challenges of multimodal data, Data collection and cleaning. **Text Processing:** Text normalization, Lemmatization, Morphology, Sub-word tokenization, TF-IDF, BM25, Zipf's law, Heap's law, Language models and smoothing techniques, Vector Space Models.	**10**
UNIT 2	**Image and Video Processing:** Point processing, Neighborhood processing, Enhancement, Edge detection, Segmentation, Feature descriptors, Restoration, Morphological operations, Image transforms, Spatial and temporal data handling.	**10**
UNIT 3	**Speech Processing:** Speech production and perception, Acoustic and articulatory phonetics, Short-term analysis, Need and windowing, Energy, Zero-crossing rate, Autocorrelation function, Fourier transform, Spectrogram, Short-term synthesis: Overlap-add method, Cepstrum analysis, Mel-cepstrum.	**11**
UNIT 4	**Multimodal Fusion Techniques, Applications and Challenges:** Fusion of two or more modalities such as vision, language, audio and biomedical signals. Introduction to shallow and deep multimodal learning models. Applications including image captioning, visual question answering, recommendation systems, and cognitive state estimation. Challenges in alignment, missing modalities, scalability, and interpretability.	**11**
	TOTAL	**42**

REFERENCES

S.No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	R. C. Gonzalez, R. E. Woods, "Digital Image Processing", Pearson, Prentice-Hall, 4th Edition	2017
2	R. Klette, "Concise Computer Vision: An Introduction into Theory and Algorithms", Springer, Latest Edition	2014
3	L. R. Rabiner, R. W. Schafer, "Introduction to Digital Speech Processing", Now Publishers Inc, Latest Edition	2007

CO-PO-PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2	1	1	1	0	0	0	0	0	0	2	2	1	1

CO 2	3	3	3	2	3	0	0	0	1	1	0	2	3	2	2
CO 3	3	3	3	3	3	0	0	0	1	1	0	2	3	2	3
CO 4	3	3	3	3	3	0	0	0	1	1	0	3	3	3	3

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
IT419 Big Data Analysis	**L**	**T**	**P**	Database Management system
	3	**0/1**	**2/0**	

Course Objective: Mastering the process of mapping and knowlegde extraction from huge volumes of data

S. NO	Course Outcomes (CO)
CO1	To learn about distributed file system.
CO2	To understand the working of Apache Hadoop ecosystem.
CO3	To underatand working and commands of Hdoop.
CO4	To study usgaes and design og Hbase concepts.
CO5	To apply big data analytics in real life problem solving .

S. NO	Contents	Contact Hours
UNIT 1	Introduction – distributed file system – Big Data and its importance, Four Vs, Drivers for Big data, Big data analytics, Big data applications. Algorithms using map reduce.	**8**
UNIT 2	Big Data – Apache Hadoop & Hadoop EcoSystem – Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce - Data Serialization.	**8**
UNIT 3	Hadoop Architecture, Hadoop Storage: HDFS, Common Hadoop Shell commands , Anatomy of File Write and Read., NameNode, Secondary NameNode, and DataNode, Hadoop MapReduce paradigm, Map and Reduce tasks, Job, Task trackers - Cluster Setup – SSH & Hadoop Configuration – HDFS Administering –Monitoring & Maintenance.	**9**

UNIT 4	HBase concepts- Advanced Usage, Schema Design, Advance Indexing - PIG, Zookeeper - how it helps in monitoring a cluster, HBase uses Zookeeper	**9**
UNIT 5	Data Analytics with R: Machine Learning: Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering. Big Data Analytics with BigR.	**8**
	TOTAL	**42**

REFERENCES

S.No.	**Name of Books/Authors/Publishers**	**Year of Publication / Reprint**
1	C. J. Date Introduction to Database Systems . 8th Ed. Publisher: Addison- Wesley; ISBN-10: 0321197844/ ISBN-13: 978-0321197849.	2003
2	R. A. Mata-Toledo and P. Cushman, Fundamentals of SQL Programming. Schaum's Outline Series. McGraw-Hill	2000
3	H. Garcia-Molina and et al. Prentice Hall, Database Systems the Complete Book; ISBN-10: 0131873253 / ISBN-13: 978- 013187325	2008
4	R. Elmasri and S. Navathe, Fundamentals of Database Systems Addison-Wesley;ISBN-10: 0136086209/ISBN-13: 978-0136086208	2010

CO-PO-PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0
CO 2	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
CO 3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO 4	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0
CO 5	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
	L	**T**	**P**	

IT421 Ethical Hacking	**3**	**0/1**	**2/0**	Information Security/ Malware Analysis

Course Objective: This course aims to equip students with a comprehensive understanding of security and ethical hacking principles, including reconnaissance, scanning, and password cracking techniques. Students will learn to identify and address vulnerabilities in web applications and wireless networks, using practical tools and methodologies to enhance their ability to secure systems and applications.

S. NO	Course Outcomes (CO)
CO1	Understand Security and Ethical Hacking: Grasp fundamental security principles, ethical hacking concepts, and key terminologies
CO2	Conduct Reconnaissance and Scanning: Perform footprinting and port scanning using relevant tools.
CO3	Analyze Cracking and Sniffing Techniques: Understand password cracking methods and sniffing techniques.
CO4	Secure Web Applications and Wireless Networks: Identify vulnerabilities in web applications and secure wireless networks.

S. NO	Contents	Hours
UNIT 1	Understanding the importance of security, Concept of ethical hacking and essential TerminologiesThreat, Attack, Vulnerabilities, Target of Evaluation, Exploit. Phases involved in hacking.	**9**
UNIT 2	Footprinting - Introduction to foot printing, Understanding the information gathering methodology of the hackers,Tools used for the reconnaissance phase.Port Scanning - Introduction, using port scanning tools, ping sweeps, Scripting Enumeration-Introduction, Enumerating windows OS & Linux OS.	**11**
UNIT 3	Aspect of remote password guessing, Role of eavesdropping ,Various methods of password cracking, Keystroke Loggers, Understanding Sniffers ,Comprehending Active and Passive Sniffing, ARP Spoofing and Redirection, DNS and IP Sniffing, HTTPS Sniffing.	**9**
UNIT 4	Web application vulnerabilities, application coding errors, SQL injection into Back-end Databases, cross-site scripting, cross-site request forging, authentication bypass, web services and related flaws, protective http headers Understanding Session Hijacking, Phases involved in Session Hijacking,Types of Session Hijacking, Session Hijacking Tools.	**9**

UNIT 5	Introduction to 802.11, Role of WEP, Cracking WEP Keys, Sniffing Traffic, Wireless DOS attacks, WLANScanners, WLANSniffers, Hacking Tools, Securing Wireless Networks.	**4**
	TOTAL	**42**

REFERENCES

S.No.	**Name of Books/Authors/Publishers**	**Year of Publication / Reprint**
1	"Certified Ethical Hacker", Kimberly Graves, Wiley India Pvt Ltd ISBN 978-0- 470-52520-3	2019
2	"Network Seuciryt and Ethical Hacking", Rajat Khare, Luniver Press ISBN:978- 1-905986-00-2	2006
3	Thomas Mathew, "Ethical Hacking", OSB publishers ISBN: 0972936211	2003
4	Ramachandran V, BackTrack 5 Wireless Penetration Testing Beginner's Guide (3rd ed.). Packt Publishing, ISBN: 9781849515580	2011

CO-PO-PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	0	0	0	0	1	0	1	0	0	0	0	2	0	0
CO 2	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0
CO 3	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
CO 4	0	1	0	0	0	0	0	0	0	0	0	0	3	2	2

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
	L	**T**	**P**	
IT423 Soft Computing	**3**	**1/0**	**0/2**	Probability and statistics, Machine learning

Course Objective: 1. To design fuzzy systems for real-world problems using fuzzy logic and fuzzy sets.
2. To design and describe the architecture and functioning of neural networks and neuro-fuzzy systems.
3. To describe various evolutionary algorithms with application to real-worls optimization problems.

S. NO.	**Course Outcomes (CO)**

CO1	Ability to distinguish between supervised, unsupervised and reinforcement learning.
CO2	Ability to construct a neural network architecture and describe its functioning mathematically.
CO3	Ability to execute operations with fuzzy sets and construct fuzzy rules.
CO4	Ability to solve simple problems involving fuzzy arithmetic and fuzzy numbers.
CO5	Ability to explain and compare different evolutionary algorithms.
CO6	Ability to construct the architecture and describe the functioning of neuro-fuzzy systems for simple application problems.

S. NO.	Contents	Contact Hours
UNIT 1	**Neural Networks:** Introduction to Learning Paradigms-Supervised, Unsupervised and reinforcement Learning. History of neural networks, overview of biological Neuro-systems, Mathematical Models of Neurons, ANN architecture and training algorithms- Perceptron, Multi-Layer Perceptron Model, Back Propagation algorithm, Applications of Artificial Neural	**12**
UNIT 2	**Fuzzy Logic:** Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation.	**6**
UNIT 3	**Operations on Fuzzy Sets:** Complement, Intersections, Unions, Combinations of Operations, Aggregation Operations. Nonspecificity of Fuzzy & Crisp Sets, Fuzziness of Fuzzy Sets. Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations.	**8**
UNIT 4	**Evolutionary Optimization:** Introduction to evolutionary optimization algorithms - Genetic Algorithm, Particle Swarm Optimization, Grey Wolf Optimization, Artificial bee colony algorithm. Comparison to classical optimization using gradient descent and Meta-heuristic optimization algorithm - Simulated annealing.	**10**
UNIT 5	**Neuro-Fuzzy Systems:** Adaptive neuro-fuzzy inference systems - ANFIS, CANFIS, MANFIS. Architecture and learning process, Examples of application to real-world problems.	**6**

	TOTAL	42

REFERENCES		
S.No.	**Name of Books/Authors/Publishers**	**Year of Publication / Reprint**
1	Jang, Sun, Mizutani, "Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence", Pearson Education India.	2015
2	G.J. Klir & B. Yuan, "Fuzzy Sets & Fuzzy Logic", PHI.	2009
3	T.J. Ross, "Fuzzy Logic with Engineering Applications", 3ed, Wiley.	2011
4	S. Rajasekaran & G. A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI.	2003
5	S. V. Kartalopoulos, "Understanding Neural Networks and Fuzzy Logic: Basic Concepts and Applications", IEEE Press – PHI.	1997
6	S. Roy, U. Chakraborty, "Soft Computing", Pearson India.	2013

CO-PO-PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	0	0	0	0	0	0	0	0	0	0	2	1	0	0
CO 2	1	0	2	0	0	0	0	0	0	0	0	0	2	1	0
CO 3	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0
CO 4	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
CO 5	0	1	1	0	0	0	0	0	0	1	0	0	2	0	0
CO 6	0	0	2	0	0	0	0	0	0	0	0	0	2	2	1

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
IT425 Augmented Reality & Virtual Reality	**L**	**T**	**P**	Programming, Problem Solving, Engineering Graphics
	3	**1**	**-**	

Course Objective:
1. Learn the fundamental Computer Vision, Computer Graphics and Human-Computer interaction techniques related to VR/AR
2. Review the Geometric Modeling Techniques in AR/VR
3. Discuss the Virtual Environment and Examine VR/AR Technologies
4. Use of various types of Hardware and Software in Virtual Reality systems
6. Simulate and Apply Virtual/Augmented Reality to varieties of Applications

S. NO	Course Outcomes (CO)
CO1	Understand the fundamental Computer Vision, Computer Graphics and Human Computer Interaction Techniques related to VR/AR
CO2	Learn Geometric Modeling Techniques and its Virtual Environment.
CO3	Analyze and Evaluate the VR/AR Technologies.
CO4	Apply various types of hardware and software in Virtual Reality systems and formulate AR/VR applications.

S. NO	Contents	Contact Hours
UNIT 1	**Introduction to Virtual Reality (VR):** Virtual Reality and Virtual Environment, Computer graphics, Real time computer graphics, Flight Simulation, Virtual environment requirement, benefits of virtual reality, Historical development of VR, Scientific Landmark	**8**
UNIT 2	**Virtual Environment:** Input/Output Devices: Input (Tracker, Sensor, Digital Gloves, Movement Capture, Videobased Input, 3D Menus & 3D Scanner, etc.), Output (Visual/Auditory/Haptic Devices) **Generic VR system:** Introduction, Virtual environment, Computer environment, VR technology, Model of interaction, VR Systems, **Animating the Virtual Environment:** Introduction, The dynamics of numbers, Linear and Nonlinear interpolation, the animation of objects, linear and non-linear translation, shape & object in between, free from deformation, particle system **Physical Simulation:** Introduction, Objects falling in a gravitational field, Rotating wheels, Elastic collisions, projectiles, simple pendulum, springs, Flight dynamics of an aircraft	**12**

UNIT 3	**Augmented Reality (AR):** Taxonomy, Technology and Features of Augmented Reality, AR Vs VR, Challenges with AR, AR systems and functionality, Augmented Reality Methods, Visualization Techniques for Augmented Reality, Enhancing interactivity in AR Environments, Evaluating AR systems	**8**
UNIT 4	**Development Tools and Frameworks Human factors:** Introduction, the eye, the ear, the somatic senses **Hardware:** Introduction, sensor hardware, Head-coupled displays, Acoustic hardware, Integrated VR systems **Software:** Introduction, Modelling virtual world, Physical simulation, VR toolkits, Introduction to VRML **AR / VR Applications:** Introduction, Engineering, Entertainment, Science, Training, Game Development	**6**
	TOTAL	**42**

REFERENCES

S.No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	Craig, A. B., "Understanding Augmented Reality, Concepts and Applications," Morgan Kaufmann, ISBN: 9780240824086	2013
2	Craig, A. B., Sherman, W. R., Will, J. D., "Developing Virtual Reality Applications, Foundations of Effective Design," Morgan Kaufmann	2009
3	John Vince, J., (2002), "Virtual Reality Systems, " Pearson, ISBN: 9788131708446	2002
4	Anand, R., "Augmented and Virtual Reality," Khanna Publishing House	2022
5	Kim, G. J., (2005), "Designing Virtual Systems: The Structured Approach", ISBN: 9781852339586	2005
6	John Vince, "Virtual Reality Systems", Pearson Ed	2002

CO-PO-PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0

CO 2	0	0	1	0	0	0	1	0	0	0	0	1	1	0	0
CO 3	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
CO 4	1	1	0	0	1	0	0	0	0	0	0	0	3	3	2

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
IT427 Enterprise Java Programming	**L**	**T**	**P**	Core JAVA
	3	**1**	**0**	

Course Objective: To familiarize students with advanced JAVA programming constructs.

S. NO	**Course Outcomes (CO)**
CO1	To introduce fundamentals of Enterprise Java Programming,
CO2	To implement interfaces, collections
CO3	To implement TCP/IP programming
CO4	To learn database Connectivity

S. NO	**Contents**	**Contact Hours**
UNIT 1	Interfaces, packages, Collections : Collection Interfaces, Concrete Collections, Collections Framework.	**8**
UNIT 2	Multithreading : Creating and running thread, Multiple thread synchronization, Thread communication, Thread group, Thread priorities, Daemon Thread, Life Cycle ofThread.	**8**
UNIT 3	Fundamentals in Networking: Sockets in Java - Internet Addressing - DNS – Ipv4,IPv6- URL class - TCP/IP and Datagram. The interfaces and classes for networking :Interfaces and classes of java.net package; InetAddress class : IP address scope - Host name resolution - Methods of InetAddress class; Program to look up the IP addresses for a hostname - Factory methods - Creating and using Sockets : Socket class - constructors and methods of Socket class. Creating TCP servers &clients : TCP/IP server sockets - Constructors and methods of ServerSocket class - Program to create a TCP/IP server and client.	**8**

UNIT 4	Handling URL: URL class - constructors and methods of URL class - URLConnection class - fields of URLConnection class - methods of URLConnection class. Working with Datagrams: DatagramPacket - Constructors for DatagramPacket class - Methods of DatagramPacket class - creating Datagram server and client	**8**
UNIT 5	JDBC Package :JDBC – JDBC versus ODBC – Types of JDBC drivers – Connection – Statement – PreparedStatement.ResultSet :Fields of ResultSet – Methods of ResultSet – Executing a query - ResultSetMetaData – DatabaseMetaData. Datatypes in JDBC : Basic datatypes in JDBC – Advanced datatypes in JDBC – fields of Statement – methods of Statement – CallableStatement Interface – BatchUpdates	**10**
	TOTAL	**42**
	REFERENCES	
S.No.	**Name of Books/Authors/Publishers**	**Year of Publication / Reprint**
1	Java 2 Programming Black Book - Steven Holzner dreamTech Press(ISBN9788177226553	2005
2	Head first EJB-O'Reilly (ISBN: 8173665265)	2003
3	"Beginning Java™ EE 6 Platform with GlassFish 3 From Novice to Professional" by Antonio Goncalves– Apress publication(ISBN: 9781430219545)	2009

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	0	0	0	2	0	0	0	0	0	0	0	2	1	0
CO2	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0
CO3	0	0	1	0	2	0	0	0	0	0	0	0	2	2	0
CO4	0	0	0	1	0	0	0	0	0	0	0	1	2	0	0

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
IT429 Generative AI	**L**	**T**	**P**	Natural Language Processing
	3	**1/0**	**0/2**	

Course Objective: 1. To introduce the fundamental concepts and techniques of Generative AI.

2. To explore various generative models and their applications in real-world scenarios.
3. To develop skills in designing, training, and evaluating generative models.
4. To address ethical and societal implications of Generative AI technologies

S. NO	Course Outcomes (CO)
CO1	Explain the principles and architectures of generative models.
CO2	Implement and train generative models such as GANs, VAEs, and autoregressive models.
CO3	Apply Generative AI techniques to solve real-world problems in areas like image synthesis, text generation, and data augmentation.
CO4	Analyze ethical concerns and challenges associated with Generative AI, including bias, misuse, and intellectual property issues.

S. NO	Contents	Contact Hours
UNIT 1	Introduction to Generative AI:Overview of Generative AI and its applications Key concepts: Latent spaces, probability distributions, and sampling, Comparison between discriminative and generative models, Ethical considerations in Generative AI	**8**
UNIT 2	Foundations of Generative Models: Autoregressive models: RNNs, LSTMs, and Transformers, Variational Autoencoders (VAEs): Architecture, training, and applications, Flow-based models: Normalizing flows and their use cases, Evaluation metrics for generative models: Inception Score, FID, etc.	**8**
UNIT 3	**Generative Adversarial Networks (GANs):** GAN architecture: Generator and Discriminator**,** Training GANs: Challenges and techniques (e.g., mode collapse, Wasserstein GANs)**,** Applications of GANs: Image synthesis, style transfer, and data augmentation**,** Advanced GAN variants: Conditional GANs, CycleGANs, and StyleGAN	**10**

UNIT 4	**Applications of Generative AI:** Text generation: GPT models and their applications**,** Image generation: DALL·E, Stable Diffusion, and MidJourney**,** Audio and video synthesis: WaveNet, DeepMind's VQ-VAE**,** Case studies: Generative AI in healthcare, art, and entertainment	**8**
UNIT 5	**Advanced Topics and Future Trends:** Multimodal generative models: CLIP, DALL·E 2**,** Federated learning for Generative AI**,** Ethical and societal implications: Deepfakes, misinformation, and bias**,** Future directions: Quantum generative models and AI creativity	**8**
	Total	**42**
	REFERENCES	
S.No.	**Name of Books/Authors/Publishers**	**Year of Publication / Reprint**
1	"Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play" by David Foster	2022
2	"GANs in Action: Deep Learning with Generative Adversarial Networks" by Jakub Langr and Vladimir Bok	2019
3.	"Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville (Chapter on Generative Models)	2016

CO-PO-PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	1	0	2	0	0	0	0	0	0	1	0	0	2	1	0
CO 2	0	0	2	0	0	0	0	0	0	0	0	0	1	1	0
CO 3	1	0	0	1	0	0	0	0	0	0	0	0	2	0	0

CO 4	0	1	0	0	0	0	0	1	0	0	0	0	2	0	0

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
IT431 Embedded Systems for IoT	**L**	**T**	**P**	Internet of Things
	3	**1/0**	**0/2**	

Course Objective: 1)To make students know the basic concept and architecture of embedded systems.

2) Different design platforms used for an embedded system for IoT applications.

3) To have knowledge about the IoT enabled technology.

S. NO	Course Outcomes (CO)
CO1	Understand the embedded system concepts and architecture of embedded systems.
CO2	Understand the different hardware/software co-design techniques for microcontroller-based embedded systems, apply techniques in IoT applications.
CO3	To be able to design web/cloud based IoT applications.

S. NO	Contents	Contact Hours
UNIT 1	Purpose and requirement specification, IoT level specification, Functional view specification, Operational view specification, Device and component integration, Pillars of Embedded IoT and Physical Devices: The internet of devices.	**8**
UNIT 2	Design of Embedded Systems: Common Sensors, Actuators, Embedded Processors, Memory Architectures, Software architecture.	**8**
UNIT 3	Inputs and Outputs: Digital Inputs and Outputs, Digital Inputs, Digital Outputs, BusIn, BusOut, and BusInOut, Analog Inputs and Outputs, Analog Inputs, Analog Outputs, Pulse Width Modulation (PWM), Accelerometer and Magnetometer, SD Card, Local File System (LPC1768).	**10**
UNIT 4	IoT Enabling Technologies: Communications, RFID and NFC (Near-Field Communication), Bluetooth Low Energy (BLE), LiFi, 6LowPAN, ZigBee, Z-Wave, LoRa, Protocols, HTTP, WebSocket, MQTT, CoAP, XMPP, Node-RED, Platforms, IBM Watson IoT—Bluemix, Eclipse IoT, AWS IoT, Microsoft Azure IoT Suite, Google Cloud IoT,	**8**

	ThingWorx, GE Predix, Xively, macchina.io, Carriots.	
UNIT 5	Web of Things and Cloud of Things: Web of Things versus Internet of Things, Two Pillars of the Web, Architecture Standardization for WoT, Platform Middleware for WoT, Cloud of Things. IoT Physical Servers, Cloud Offerings and IoT Case Studies: Introduction to Cloud Storage Models, Communication API.	**8**
	Total	**42**
	REFERENCES	
S.No.	**Name of Books/Authors/Publishers**	**Year of Publication / Reprint**
1	RMD Sundaram Shriram K Vasudevan, Abhishek S Nagarajan, Internet of Things, John Wiley and Sons.	2018
2	Klaus Elk, "Embedded Software for the IoT".	2017
3	Perry Xiao, "Designing Embedded Systems and the Internet of Things (IoT) with the ARM Mbed".	2018

CO-PO-PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	0	1	0	0	0	0	0	0	0	0	0	2	2	0
CO 2	2	0	1	0	1	0	0	0	0	0	0	0	3	3	2
CO 3	0	0	1	0	1	0	0	0	0	0	0	0	3	2	2

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
IT433 IoT with Arduino, ESP, and Raspberry Pi	**L**	**T**	**P**	Internet of Things
	3	**1/0**	**0/2**	

Course Objective: 1) To give students hands-on experience using different IoT architectures.

2) To provide skills for interfacing sensors and actuators with different IoT architectures.

3) To develop skills on data collection and logging in the cloud.

S. NO	Course Outcomes (CO)
CO1	To understand Arduino Uno, NODE MCU 8266 and Raspberry PI along with critical protocols and its communication to cloud.
CO2	To apply commonly used IOT protocols such as REST API, MQTT through IOT based demonstration.
CO3	To solve analog sensor and digital sensor Interfacing with IOT devices.

S. NO	Contents	Contact Hours
UNIT 1	IoT- introduction and its components, IoT building blocks, Sensors and Actuators, IoT Devices, IoT boards (Arduino Uno, ESP 8266-12E Node MCU, and Raspberry Pi 3).	**8**
UNIT 2	Arduino Uno – getting started with the Uno boards, blink program, connection of sensors to the Uno board, reading values of sensors from the Uno board, interrupts. Case study: Temperature/Humidity Control; Case Study: Sending values Temperature/Humidity values to the Internet via GSM module.	**8**
UNIT 3	ESP 8266-12E Node MCU – getting started with the ESP board, Micropython and Esplorer IDE, Flushing the ESP8266 board with micropython, connecting sensors to the ESP board, Connecting ESP board to WiFi, Interfacing ESP with the Cloud (REST API-GET, POST, MQTT), interrupts, comparison of ESP 32 board with the ESP 8266 board. Case Study: Switching light on /off remotely. Case Study: Voice-based Home. Automation for switching lights on/off (Android phone – Google Assistant (Assistant <-> IFTTT), MQTT (ESP <-> IFTTT), ESP 8266 <-> Lights).	**10**
UNIT 4	Raspberry Pi 3 - Rpi3 introduction and installing the Raspbian Stretch OS, Headless - Computer and Rpi3 configuration to connect through SSH via Ethernet, Headless - connecting Rpi3 remotely without Ethernet cable via SSH, IP address, Rpi 3 - Testing the GPIO pins through Scripts.	**8**

UNIT 5	Raspberry pi3 interfacing with Sensor DHT11, Raspberry pi3 python library install and reading sensor feed, 'Plug and play ' type cloud platform overview for integration to IOT devices, 'Plug and play' cloud platform for integration to IOT device - actuator (LED), Plug and play platform - Custom widget (DHT11-Sensor) integration through Python. New - Raspeberry Pi 4 Vs Raspberry Pi3 Mobel B Comparison, LoRawan /LPWAN – Overview.	**8**
	Total	**42**
	REFERENCES	
S.No.	**Name of Books/Authors/Publishers**	**Year of Publication / Reprint**
1	Rao, M. (2018). Internet of Things with Raspberry Pi 3: Leverage the power of Raspberry Pi 3 and JavaScript to build exciting IoT projects. Packt Publishing Ltd	2018
2	Baichtal, J. (2013). Arduino for beginners: essential skills every maker needs. Pearson Education.	2013
3	Schwartz, M. (2016). Internet of Things with ESP8266. Packt Publishing Ltd.	2016

CO-PO-PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	0	0	0	1	0	0	0	0	1	0	0	2	0	0
CO 2	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
CO 3	0	0	0	0	1	0	0	0	0	0	0	0	2	0	0

EIGHTH SEMESTER

DEPARTMENT ELECTIVE COURSE-6

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
	L	**T**	**P**	
IT404 Speech & Natural language Understanding	**3**	**1**	**0**	Probability and statistics, Machine learning

Course Objective: 1. To familiarize with basic fundamentals of speech signals and text pre-processing for natural language understanding
2. To understand and implement feature extraction techniques for speech and text.
3. To understand, analyze and implement advanced techniques for natural language understanding using speech and text.

S. NO.	Course Outcomes (CO)
CO1	Ability to understand and explain various terminology related to Speech and Natural Language Understanding.
CO2	Ability to implement text pre-processing and pattern matching using regular expressions.
CO3	Ability to analyze and classify text using Bag of words, word embeddings, and WordNet.
CO4	Ability to differentiate between types of phonemes, and conduct phonetic analysis of English words .
CO5	Ability to analyze speech waveforms and spectrograms, and describe the feature extraction process for speech recognition.
CO6	Ability to describe real-world applications of Speech and Natural Language Understanding.

S. NO.	Contents	Contact Hours
UNIT 1	**Introduction to natural language understanding using speech:** Introduction to Natural Language Understanding using speech signals. Characteristics of speech signals-pitch, energy, formants etc. Extraction, analysis and classification of speech-based features such as MFCC and spectrograms. Phonetics- phonemes, phonetic analysis of English words.	**12**

UNIT 2	**Introduction to natural language understanding using text**: Introduction to Natural Language Understanding using text. Pattern matching using regular expressions. Text pre-processing: Tokenization, Lemmatization, Stemming. Bag of Words, 1-hot encoding, TF, TF-IDF, N-gram language modelling, Word Embeddings.	**12**
UNIT 3	**Text-based semantics:** Word Senses, WordNet, Synsets, Hypernyms, Hyponyms, Meronyms, Holonyms, Word Sense Disambiguation, Word Similarity, Semantic Role Labelling.	**8**
UNIT 4	**Advanced techniques:** Large Language Models, Deep learning models for speech and text, Machine Translation, Man-Machine Interfaces, Advanced speech recognition systems.	**10**
	TOTAL	**42**

REFERENCES

S.No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	D. Jurafsky, J. H. Martin, Speech and Language Processing, 2/e, Pearson Education.	2013
2	L. Rabiner, "Fundamentals of speech recognition", Prentice-Hall.	1993
3	S. Bird, E. Klein, E. Loper, "Natural Language Processing with Python", O'Reilly.	2009
4	Manning and Schutze, "Foundation of Statistical Natural Language Processing", MIT press.	1999
5	U. Kamath, J. Liu, J. Whitaker, "Deep learning for NLP and speech recognition", Springer.	2019
6	D. Rothman, "Transformers for Natural Language Processing", Packt publishing.	2021

CO-PO-PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	1	0	0	0	0	0	0	0	0	1	0	0	2	0	0
CO 2	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0

CO 3	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0
CO 4	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0
CO 5	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0
CO 6	1	0	0	0	0	0	0	0	0	0	0	0	2	2	2

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
IT406 Mobile and Digital Forensics	**L**	**T**	**P**	Malware Analysis
	3	**1/0**	**0/2**	

Course Objective: Become knowlageble in mobile phone forensics and android forensics

S. NO	**Course Outcomes (CO)**
CO1	The use of mobile phones and digital devices across the globe has increased dramatically
CO2	These devices are more suspectible to information security attacks
CO3	Thus they also posses huge evidences which shall be used during crime scene investigation
CO4	This course on mobile and digital forensics will provide a better understanding for these course participants on different forms of evidences in many digital devices,collections and interpretation of the same.

S. NO	**Contents**	**Contact**
UNIT 1	Overview of wireless technologies and Security: Personal Area networks,Wireless Local Area Networks, Metropolitan Area Networks,Wide Area Networks.	**4**
UNIT 2	Wireless threats, Vulnerabilities and Security: Wireless LANs,War Driving,War Chalking,War Flying,Common Wi-fi security recommendations,PDA Security,Cell phones and Security,Wireless DoS attacks,GPS Jamming, Identity theft.	**8**

UNIT 3	CIA triad in mobile phones-Voice, SMS and Identification data interception in GSM: Introduction, practical setup and tools, implementation- Software and Hardware Mobile phone tricks: Netmonitor, GSM network service codes, mobile phone codes, catalog tricks and AT command set- SMS security issues	**10**
UNIT 4	Mobile phone forensics: crime and mobile phones, evidences, forensic procedures, files present in SIM card, device data, external memory dump, evidences in memory card, operators systems- Android forensics: Procedures for handling an android device, imaging android USB mass storage devices, logical and physical techniques10	**10**
UNIT 5	Digital forensics: Introduction – Evidential potential of digital devices: closed vs. open systems, evaluating digital evidence potential- Device handling: seizure	**10**
	TOTAL	**42**

REFERENCES

S.No.	Name of Books/Authors/Publishers	Year of
1	Iosif I.Androulidakis,"Mobile Phone security and forensics: A practical approach", Spriinger publications, ISBN 978-3-319-29742-2	2012
2	Gregory Kipper, "Wireless Crime and Forensic Investigation",Auerbach publications	2007
3	Andrew Hoog,"Android Forensics:Investigation,Analysis and Mobile Security for google Android",Elsevier publications.	2011
4	Angus M.Marshall,"Digital forensics:Digital evidence in criminal investigations", John- Wiley and Sons.	2008

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	–	–	–	–	–	–	–	–	–	1	1	–	–
CO2	2	2	–	–	–	1	–	1	–	–	–	1	2	–	–
CO3	2	2	–	1	–	1	–	1	–	–	–	1	2	–	1
CO4	2	3	2	2	2	1	–	1	–	–	–	2	3	1	1

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
	L	**T**	**P**	Linear algebra, probability, complex numbers, Algorithms, data structure
IT 403Quantum Computing	**3**	**1**	**0**	

Course Objective: To familiarize students with the concepts of quantum computing.

S. NO	Course Outcomes (CO)
CO1	Understand the Fundamental Principles of Quantum Mechanics and Computing
CO2	Develop Proficiency in Quantum Algorithms and Circuit Design
CO3	Explore Quantum Information Theory and Its Applications
CO4	Evaluate Quantum Hardware Technologies and Address Implementation Challenges

S. NO	Contents	Contact Hours
UNIT 1	Introduction to Quantum Computing: Basics of Quantum Mechanics, Quantum states, superposition, and entanglement. Quantum measurement and operators. Quantum Computation Overview Comparison with classical computing. Quantum vs. classical bits (qubits). Quantum Gates and Circuits Quantum Gates : Single-qubit gates: Pauli-X, Pauli-Y, Pauli-Z, Hadamard, Phase, and T-gates. Multi-qubit gates: CNOT, Toffoli, SWAP. Quantum Circuits	**10**
UNIT 2	Quantum Algorithms: Basic Algorithms Deutsch-Josza algorithm. Grover's algorithm for unstructured search. Shor's Algorithm, Quantum factorization and implications for cryptography. Quantum Fourier Transform (QFT) Applications in quantum algorithms.	**8**
UNIT 3	Quantum Information Theory: Quantum Entanglement Bell states, EPR pairs, and teleportation. Quantum Error Correction Error correction codes: Shor code, Steane code. Quantum Cryptography Quantum key distribution (e.g., BB84 protocol).	**8**
UNIT 4	Quantum Simulation and Optimization Quantum Simulators Simulating quantum systems with quantum computers. Quantum Optimization Algorithms Variational Quantum Eigensolver (VQE), Quantum Approximate Optimization Algorithm (QAOA).	**8**

UNIT 5	Practical Quantum Computing Quantum Programming Languages Qiskit, QuTiP, Cirq, and others. Quantum Computing Frameworks IBM Quantum Experience, Google Quantum AI, Microsoft Quantum Development Kit.	**8**
	TOTAL	**42**

REFERENCES		
S.No.	**Name of Books/Authors/Publishers**	**Year of Publication / Reprint**
1	Quantum Computation and Quantum Information" by Michael A. Nielsen and Isaac L. Chuang (2000)	2000
2	Quantum Computing: An Applied Approach" by Jack D. Hidary (2021)	2021
3	Quantum Computation and Quantum Information: 10th Anniversary Edition" by Michael A. Nielsen and Isaac L. Chuang (2010)	2010
4	Quantum Computing: A Gentle Introduction" by Yasir A. Abbas (2021)	2021

CO-PO-PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0
CO 2	1	0	0	0	0	1	0	0	0	0	0	0	2	0	0
CO 3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO 4	1	0	0	1	1	0	0	0	0	0	0	0	1	0	0

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
	L	**T**	**P**	
IT410 GPU Computing	**3**	**0**	**2**	Computer Architecture

Course Objective: This course aims to provide a solid understanding of GPU architecture and programming models like CUDA and OpenCL. Students will learn to develop GPU-accelerated applications, apply GPU computing to solve real-world problems, and evaluate the suitability of GPU computing for various computational tasks.

S. NO	Course Outcomes (CO)
CO1	Understand the fundamental concepts and architecture of GPUs.
CO2	Utilize GPU programming models (e.g., CUDA, OpenCL) to develop efficient GPU-accelerated applications.
CO3	Apply GPU computing techniques to solve real-world problems in various domains.
CO4	Evaluate the suitability of GPU computing for specific computational tasks.

S. NO	Contents	Contact Hours
UNIT 1	**Introduction to GPU Computing:** GPU Architecture: Comparison with CPUs, CUDA Cores, SMs, and Memory Hierarchy, GPU Programming Models: CUDA and OpenCL, Basic Concepts and Syntax Parallel Programming Paradigms: Data Parallelism, Task Parallelism , Hybrid Parallelism	**8**
UNIT 2	**CUDA Programming**: CUDA Programming Fundamentals: Kernels and Device Functions, Memory Management (Host and Device Memory), Thread and Block Hierarchies, CUDA Performance Optimization:, Memory Coalescing, Shared Memory Optimization, Texture, Memory Utilization, Occupancy and Warp Divergence, CUDA Examples:, Matrix Multiplication, Image Processing, Monte Carlo Simulations	**9**
UNIT 3	**OpenCL Programming:** OpenCL Basics: OpenCL Runtime and Host API, OpenCL Kernels and Work Items, Memory Management (Host and Device Memory), OpenCL Performance Optimization:, Work Group and Work Item Scheduling, Data Transfer Optimization, Kernel, Optimization Techniques, OpenCL Examples:, Image Filtering, Molecular Dynamics Simulations, Scientific Computing Applications	**9**
UNIT 4	**Advanced GPU Topics:** GPU Heterogeneous Computing: CPU-GPU Integration, GPU-GPU Communication, GPU Libraries and Frameworks:, CUDA Toolkit, OpenCL Runtime, cuBLAS, cuFFT, cuDNN, GPU Programming Patterns:, Reduction Operations, Scan Operations, Sorting Algorithms, GPU Debugging and Profiling Tools	**8**

UNIT 5	**GPU Applications and Case Studies:** GPU Applications in Various Domains:, Machine Learning and Deep Learning, Computational Fluid Dynamics, Bioinformatics, Financial Modeling, Scientific Visualization, GPU Case Studies:, Real-world examples of GPU-accelerated applications, Performance analysis and benchmarking, Future Trends in GPU Computing	**8**
	TOTAL	**42**

REFERENCES

S.No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	CUDA by Example: An Introduction to General-Purpose GPU Programming	2010
2	GPU Computing Gems Jade Edition	2011
3	Hands-On GPU Programming with Python and CUDA: Explore high-performance parallel computing with CUDA	2018

CO-PO-PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	0	1	0	0	0	0	0	0	0	0	0	1	1	0
CO 2	0	0	2	0	3	0	0	0	0	0	0	0	3	3	2
CO 3	1	0	0	0	0	0	0	0	0	0	0	0	2	0	0
CO 4	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
IT412 Autonomous Systems and Robotics	**L**	**T**	**P**	
	3	**1**	**0**	

Course Objective: To Understand significance of autonomus components and robotics

S. NO	Course Outcomes (CO)
CO1	Introduction to significance of autonomus components and robotics

CO2	Study field transmitters
CO3	Compare Final control elements and accessories:
CO4	Understand Components of Industrial Robot

S. NO	Contents	Contact Hours
UNIT 1	Overview: Introduction, significance of autonomus components, Industiral applications	**8**
UNIT 2	Autonomus Systems and Robotics	**8**
UNIT 3	Field Transmitters	**9**
UNIT 4	Final control elements and accessories: Control valves, actuators, converters, vfd, safety valves	**9**
UNIT 5	Auxiliary control components	**8**
UNIT 6	Components of Industrial Robot	**8**
	TOTAL	**42**

REFERENCES		
S.No.	**Name of Books/Authors/Publishers**	**Year of Publication / Reprint**
1	Autonomous Systems: Theory and Applications, Reza Malekzadeh, Mohammadreza Abolhasani	2023
2	Introduction to Autonomous Robots: Mechanisms, Sensors, Actuators, and Algorithms, Nikolaus Correll, Bradley Hayes, David Coleman	2024
3	Modern Robotics: Mechanics, Planning, and Control, Kevin M. Lynch, Frank C. Park	2022
4	utonomous Vehicle Systems: Planning, Control, and Communication, Marko Bjelica, Silvio Giordano	2023

CO-PO-PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3

CO 1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
CO 2	1	0	0	0	0	0	0	0	0	0	0	1	0	0
CO 3	0	1	0	0	0	0	0	0	0	0	0	0	0	0
CO 4	1	0	0	0	0	0	0	0	0	0	0	0	0	0

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
IT414 Sementic Web and Web Mining	**L**	**T**	**P**	Web Technologies
	3	**0/1**	**2/0**	

Course Objective: Understand the concept structure of the semantic web technology and how this technology revolutionizes the World Wide Web. Understand the concepts of Web Science, semantics of knowledge and resource, ontology.

S. NO	**Course Outcomes (CO)**
CO1	To understand fundamentals of sementic web.
CO2	To study Knowledge Representation for the Semantic Web Ontologies.
CO3	To learn Web Ontology Engineering process.
CO4	To learn different application of sementic web.
CO5	To get infrormed with different web resources.

S. NO	**Contents**	**Contact Hours**
UNIT 1	Semantic Web Introduction: fundamental of semantic web, Examples of semantic web, Semantic web technologies, layered approach Web Intelligence Thinking and Intelligent Web Applications, The World Wide Web, Limitations of Today's Web.	**8**
UNIT 2	Structured web documents in XML: The XML language, Structuring, Namespaces, Querying and Addressing XML documents. Knowledge Representation for the Semantic Web Ontologies and their role in the semantic web, Ontologies Languages for the web, UML, XML/XML Schema	**9**

UNIT 3	Web Ontology Engineering: Introduction, OWL language, Examples, OWL in OWL, Future extensions, Ontology Engineering, Ontology Engineering, Constructing Ontology, Ontology Development Tools, Ontology Methods.	**9**
UNIT 4	Applications: Semantic Search, e-learning, Semantic Bioinformatics, Knowledge Base, XML Based Web Services, Creating an OWL-S Ontology for Web Services, Semantic Search Technology, Web Search Agents and Semantic Methods.	**8**
UNIT 5	Describing Web Resources: Introduction, RDF, RDF Schema, RDF: XML- Based Syntax, RDF serialization, syntax and language, Direct Inference System, Querying RQL, A query language for RDF: SPARQL	**8**
	TOTAL	**42**

REFERENCES

S.No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	Berners Lee, Godel and Turing, Thinking on the Web, Wiley inter science.	2008
2	Grigoris Antoniou and Frank Van Hermelen , A Semantic web Primer, MIT Press.	2002
3	John Davies, Rudi Studer, Paul Warren, Semantic Web Technologies, Trends and Research in Ontology Based Systems.	2006

CO-PO-PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0
CO 2	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0
CO 3	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0
CO 4	1	0	0	0	0	0	0	0	0	0	0	1	2	1	1
CO 5	1	0	0	0	0	0	0	0	0	0	0	0	2	0	0

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
IT416 Dependable AI	**L**	**T**	**P**	Basic knowledge of Machine Learning, Probability, and Statistics
	3	**1**	**0**	

Course Objective: 1. To introduce the principles of building reliable, safe, and trustworthy AI systems.

2. To explore techniques for ensuring robustness, fairness, and transparency in AI models.
3. To address challenges related to bias, security, and ethical concerns in AI systems.
4. To develop skills in designing and evaluating dependable AI systems for real-world applications.

S. NO	Course Outcomes (CO)
CO1	Explain the principles of dependable AI, including robustness, fairness, and interpretability.
CO2	Implement techniques to improve the reliability and safety of AI systems.
CO3	Analyze and mitigate biases and vulnerabilities in AI models.
CO4	Evaluate the ethical and societal implications of AI systems and propose solutions to ensure trustworthiness.

S. NO	Contents	Contact Hours
UNIT 1	**Introduction to Dependable AI** • Overview of dependable AI: Reliability, safety, and trustworthiness • Importance of dependable AI in critical applications (e.g., healthcare, autonomous vehicles, finance) • Challenges in building dependable AI: Bias, adversarial attacks, and data quality • Ethical and societal implications of AI systems	**8**
UNIT 2	**Robustness and Security in AI** • Robustness in AI: Handling uncertainty and noisy data • Adversarial attacks and defenses: Evasion attacks, poisoning attacks, and countermeasures • Techniques for improving model robustness: Adversarial training, regularization, and ensemble methods	**8**

	• Case studies: Robust AI in autonomous systems and cybersecurity	
UNIT 3	**Fairness and Bias Mitigation** • Understanding bias in AI: Data bias, algorithmic bias, and societal bias • Fairness metrics: Demographic parity, equalized odds, and disparate impact • Techniques for bias detection and mitigation: Reweighting, adversarial debiasing, and fairness constraints • Case studies: Fair AI in hiring, lending, and criminal justice	**9**
UNIT 4	**Interpretability and Explainability** • Importance of interpretability in AI systems • Techniques for explainable AI: LIME, SHAP, and decision trees • Model-agnostic vs. model-specific interpretability methods • Case studies: Explainable AI in healthcare and finance	**9**
UNIT 5	**Ethical and Trustworthy AI Systems** • Ethical frameworks for AI: Principles of beneficence, non-maleficence, and justice • Regulatory and compliance considerations: GDPR, AI Act, and ethical guidelines • Building trustworthy AI: Transparency, accountability, and user consent • Future trends: Human-AI collaboration and AI governance	**8**
	TOTAL	**42**

REFERENCES

S.No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	"Interpretable Machine Learning" by Christoph Molnar	2022
2	"Fairness and Machine Learning: Limitations and Opportunities" by Solon Barocas, Moritz Hardt, and Arvind Narayanan	2023
3	"Robust Machine Learning: Distributed Methods for Safe AI" by Rachid Guerraoui and Nirupam Gupta	2020

4	"AI Ethics" by Mark Coeckelbergh	2020

CO-PO-PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	0	0	1	0	0	0	0	0	1	0	0	2	0	0
CO 2	0	1	1	0	0	1	0	0	0	0	0	0	2	1	0
CO 3	0	1	1	0	0	0	0	0	0	0	0	0	2	0	0
CO 4	0	1	1	0	0	0	0	1	0	0	0	0	2	0	0

B.Tech. Information Technology				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
IT418 Sensor Technology	**L**	**T**	**P**	
	3	**0/1**	**2/0**	

Course Objective:

1. To introduce the fundamental principles and working mechanisms of various sensors.
2. To explore the design, fabrication, and applications of sensors in real-world systems.
3. To develop skills in interfacing sensors with microcontrollers and signal processing systems.
4. To analyze the performance, limitations, and advancements in sensor technologies.

S. NO	**Course Outcomes (CO)**
CO1	Explain the working principles and characteristics of different types of sensors.
CO2	Design and implement sensor-based systems for real-world applications.
CO3	Interface sensors with microcontrollers and process sensor data effectively.
CO4	Evaluate the performance and limitations of sensors in various applications.

S. NO	**Contents**	**Contact Hours**

UNIT 1	**Introduction to Sensors** • Overview of sensors and their role in modern technology • Classification of sensors: Active vs Passive, Analog vs Digital • Sensor characteristics: Sensitivity, Accuracy, Resolution, Linearity, and Hysteresis • Applications of sensors in IoT, healthcare, automotive, and environmental monitoring	**8**
UNIT 2	**Types of Sensors** • Temperature sensors: Thermocouples, RTDs, and Thermistors • Pressure sensors: Piezoelectric, Capacitive, and MEMS-based sensors • Optical sensors: Photodiodes, Phototransistors, and Infrared sensors • Motion and position sensors: Accelerometers, Gyroscopes, and Encoders	**9**
UNIT 3	**Sensor Signal Conditioning and Interfacing** • Signal conditioning: Amplification, Filtering, and Analog-to-Digital Conversion • Interfacing sensors with microcontrollers: Arduino, Raspberry Pi, and ESP32 • Communication protocols: I2C, SPI, and UART • Case studies: Sensor networks and data acquisition systems	**9**
UNIT 4	**Advanced Sensor Technologies** • MEMS and NEMS-based sensors • Biosensors: Principles and applications in healthcare • Smart sensors: Integrated sensing, processing, and communication • Nanotechnology in sensor development	**8**

UNIT 5	**Applications and Future Trends** • Sensors in IoT and smart devices • Wearable sensors for health monitoring • Environmental and industrial sensing applications • Emerging trends: Quantum sensors, flexible sensors, and AI-driven sensing	**8**
	TOTAL	**42**

REFERENCES

S.No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	**"Sensor Technology Handbook"** by Jon S. Wilson	2004
2	"Introduction to Sensors" by John P. Bentley	2014
3	"Sensors and Signal Conditioning" by Ramon Pallas-Areny and John G. Webster	2001

CO-PO-PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0
CO 2	0	0	2	0	0	0	0	0	0	0	0	0	2	3	2
CO 3	0	0	0	1	0	0	0	0	0	0	0	0	2	1	0
CO 4	0	1	0	0	0	0	0	0	0	0	0	0	2	2	2