B. Tech. (Information Technology)

Syllabus

(Semester V-VIII)

2020 Iteration (w.e.f. 2021-22)

Sem V									
No.	**Type**	**Code**	**Course**	**L**	**T**	**P**	**O**	**E**	**C**
1	PC	IT301	Theory of Computation	3	0	0	6	9	3
2	PC	IT302	Software Engineering	3	0	2	5	10	4
3	PC	IT303	Foundation of Signal Processing	3	0	2	5	10	4
4	PC	IT304	Distributed Computing	3	0	2	5	10	4
5	SBC	IT305	Internet Technology Lab	1	0	2	5	08	2
6	ABL	SVXX/STXX	SEVA II or III /SATVA II or III	0	0	0	2	02	1
7	HSSE	HSEX3	HSS-III	2	0	0	3	05	2
8	S/M	SCX2/MNX2	SCOPE-II/Minor-II						3
TOTAL				**15**	**0**	**8**	**31**	**54**	**20**

Sem VI For Cat 1 students (Normal Students)									
No.	Type	Code	Course	L	T	P	O	E	C
1	OE	OEXXX	Open Elective-I	2	0	2	4	08	3
2	PC	IT306	Information System Security	3	0	2	5	10	4
3	PC	IT307A/ IT307B	Big Data Analytics/ Artificial Intelligence and Machine Learning	3	0	2	5	10	4
4	PE	IT3X1	Program Elective-I	2	0	2	4	08	3
5	PE	IT3X2	Program Elective-II	2	0	2	4	08	3
6	SBC	IT308	Mini Project-II/Ind Internship-II	0	0	0	8	08	3
7	ABL	SVXX/STXX	SEVA II or III /SATVA II or III	0	0	0	3	03	1
8	S/M	SCX3/MNX3	SCOPE-III/Minor-III						3
				12	**0**	**10**	**33**	**55**	**21**

Sem VI For Cat 2 students (who have preferred semester long internship)									
No.	Type	Code	Course	L	T	P	O	E	C
1	PE*	IT3X1	Program Elective-I	2	0	2	4	08	3
2	PE*	IT3X2	Program Elective-II	2	0	2	4	08	3
3	SBC	IT310	Industry Internship	0	0	0	40	40	15
4	S/M*	SCXX/MNXX	SCOPE-III/Minor-III						3
			TOTAL	**4**	**0**	**4**	**48**	**56**	**21**
			*To be completed online mode or allied courses from MOOCs						

Sem VII									
No.	Type	Code	Course	L	T	P	O	E	C
1	OE	OEXXX	Open Elective-II	2	0	2	4	08	3
2	OE	OEXXX	Open Elective--III*	2	0	2	4	08	3
3	PE	IT4X3	Program Elective-III	2	0	2	4	08	3
4	PE	IT4X4	Program Elective-IV	2	0	2	4	08	3
5	SBC	IT401	Main Project Stage-I	0	0	0	4	04	2
6	ABL	SVXX/STXX	SEVA-III/SATVA-III	0	0	0	4	04	2
7	S/M/H	SCX4/MNX4 / HOXX	SCOPE-IV/Minor-IV/Honors-I						3
		*OE-III must be from Basic Science Elective or Engineering Science Elective							
			TOTAL	**8**	**0**	**8**	**24**	**40**	**16**

Sem VIII (Option A: Cat1/Cat2)									
No.	Type	Code	Course	L	T	P	O	E	C
1	OE*	OEHXX	Open Elective –IV	2	0	2	4	08	3
2	PE	IT4X5	Program Elective –V	2	0	2	4	08	3
3	PE	IT4X6	Program Elective –VI	2	0	2	4	08	3
4	SBC	IT402	Main Project Stage-II	0	0	0	12	12	6
5	ABL	SVXX / STXX	SEVA-IV/SATVA-IV	0	0	0	04	04	2
6	H	HOXX	Honors-II						3
	*must be from Humanities and Management group, May be taken from MOOCs								
			TOTAL	**6**	**0**	**6**	**28**	**40**	**17**

Sem VIII (Option B-Only for Cat 1 students)									
No.	Type	Code	Course	L	T	P	O	E	C
1	SBC	IT403	Main Project Stage-II	0	0	0	36	36	15
2	ABL	SVXX / STXX	SEVA-IV/SATVA-IV	0	0	0	04	04	2
3	H	HOXX	Honors-II						3
			TOTAL	0	**0**	**0**	**40**	**40**	**17**

Note: Please refer to the separate document for "Open Electives and Syllabus" to choose Open Electives

Table 2: Program Electives

PE/TD	Program Elective-I	Program Elective-II	Program Elective- III	Program Elective- IV	Program Elective- V	Program Elective- VI
Machine Learning	IT311 : Machine Learning	IT312: Soft Computing	IT413: Natural Language Processing	IT414: Deep Learning	IT311, IT312, IT321, IT322, IT331, IT332, CS331, CS332 CS311, CS312, CS321, CS322	IT311, IT312, IT321, IT322, IT331, IT332, CS331, CS332 CS311, CS312, CS321, CS322
Information Security	IT321: Number Theory and Cryptography	IT322: Digital Forensics	IT423: Security Operations Center	IT424: Blockchain Technology		
General	IT331 : Advanced Database Systems IT312, IT321, IT322, IT332, CS331, CS332 CS311, CS312, CS321, CS322	IT332 : Data Science IT311, IT312, IT321, IT322, IT331, CS331, CS332 CS311, CS312, CS321, CS322	IT433 : Digital Image Processing IT413, IT423, IT434, CS413, CS423, CS431, CS432	IT434 : Project Management IT413, IT423, IT433, CS413, CS423, CS431, CS432		

SEMESTER V

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PC	Theory of Computation	3	0	0	6	9	3	0	0	3
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
IT301		Theory	75		75		150			300
		Laboratory	--		--		--			--

Pre-requisite Course Codes, if any.	IT201: Discrete Structures and Graph Theory
Course Objective: To give an overview of the theoretical foundations of computer science from the perspective of formal languages which provides the mathematical foundation of formal models of computation, and fundamentals of formal grammars and languages that is used in most areas of computer science.	
Course Outcomes (CO): ***At the end of the course students will be able to***	
IT301.1	Design finite automaton for a regular expressions and languages.
IT301.2	Apply the properties of regular languages.
IT301.3	Construct the grammar for a language and convert it into normal forms.
IT301.4	Design and Evaluate Pushdown Automata and Turing Machine for a language.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT301.1	3	3	2	-	1	-	-	-	1	1	-	-
IT301.2	3	2	-	-	-	-	-	-	1	1	-	-
IT301.3	2	3	-	-	1	-	-	-	1	1	-	-
IT301.4	2	2	2	-	1	-	-	-	1	1	-	-

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
IT301.1	2	1	-	-	-	-	-
IT301.2	2	1	-	-	-	-	-
IT301.3	2	1	-	-	-	-	-
IT301.4	2	1	-	-	-	-	-

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
			✓		

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Title**	**Sets, Relations and Languages**	**T1, R3**	**3**
	1.1	Relations and functions		
	1.2	Alphabets and languages		
	1.3	Types of proof		
2	**Title**	**Finite Automata**	**T1, R1, R3**	**7**
	2.1	Regular languages and regular expressions		
	2.2	Finite Automata, Nondeterministic Finite Automata, Nondeterministic Finite Automata with **ϵ**-transitions		
	2.3	Kleene's theorem		
	2.4	NFA to DFA Conversion		
	2.5	Finite Automata with output (Moore and Mealy Machine)		
3	**Title**	**Regular Languages**	**T1, R1**	**6**
	3.1	The pumping lemma for regular languages, Applications of the pumping lemma		
	3.2	Closure properties for regular languages		
	3.3	Equivalence and minimization of automata: Testing equivalence of states, Minimization of DFA's		
4	**Title**	**Context-Free Grammars and Languages**	**T1, R3**	**5**
	4.1	Context free grammars: Definition of context free grammars, Derivations using a grammar, The language of a grammar, Sentential forms		
	4.2	Parse trees: Constructing parse trees, From inferences to trees, From trees to derivations, From derivations to recursive inferences		
	4.3	Ambiguity in grammars and languages: Ambiguous grammars, Removing ambiguity from grammars		
5	**Title**	**Pushdown Automata**	**T1, T2**	**6**
	5.1	Definition of the pushdown automaton: The formal definition of pushdown automata, A graphical notation for PDA's, Instantaneous descriptions of a PDA		
	5.2	The languages of a PDA: Acceptance by final state, Acceptance by empty stack, From empty stack to final state, From final state to empty stack		
	5.3	Equivalence of PDA's and CFG's: From grammars to pushdown automata, From PDA's to Grammar		
	5.4	Deterministic pushdown automata: Definition of a deterministic PDA, Regular languages and deterministic PDA's, DPDA's and context free languages		
6	**Title**	**Properties of Context-Free Languages**	**T1, T2, R1**	**5**
	6.1	Eliminating useless symbols, Computing the generating and reachable symbols, Chomsky normal form, Greibach normal form		

	6.2	The Pumping lemma for context free languages: Applications of the pumping lemma for CFL's		
7	**Title**	**Introduction to Turing Machines**	**T1, T2**	**6**
	7.1	Turing machines: Formal definition of a Turing machine, Examples of Turing machines		
	7.2	Halting Problem, Post Correspondence Problem (PCP)		
	7.3	Variants of Turing machines: Multitape Turing Machines		
	7.4	Church-Turing hypothesis		
8	**Title**	**Recursively Enumerable Languages**	**R1**	**4**
	8.1	Recursively Enumerable and recursive		
	8.2	Enumerating a language		
	8.3	Context sensitive languages and the Chomsky hierarchy		
	Self Study	**Tractable and Intractable Problems:** Tractable and Possibly Intractable Problems: P and NP, Polynomial-Time Reductions and NP-Completeness, Cook's Theorem	**R1**	**5***
Total				**42**

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Introduction to Automata Theory, Languages, and Computation	Third Edition	John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman	Pearson	2008
2	Introduction to the Theory of computation	Third Edition	Michael Sipser	Cengage	2013

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Introduction to Languages and the Theory of Computation	Fourth Edition	John C. Martin	McGraw-Hill	2010
2	Elements of the Theory of Computation	Second Edition	Harry R. Lewis, Christos H. Papadimitriou	Pearson	2015
3	Automata and Computability	--	Dexter C. Kozen	Springer	1997

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PC	Software Engineering	3	0	2	5	10	3	0	1	4
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
IT302		Theory	50		50		100			200
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	CS102: Object-oriented programming language IT204: Database Management Systems
Course Objective: To understand the best practices in software engineering and gain knowledge to analyze, design, implement and test software project.	
Course Outcomes (CO): ***At the End of the course students will be able to***	
IT302.1	Analyze software requirements.
IT302.2	Apply UML models for a project.
IT302.3	Evaluate system architecture and develop detailed task schedule from the overall estimates and planning.
IT302.4	Illustrate different coding principles with unit test process.
IT302.5	Understand the need for DevOps.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT302.1	-	3	-	-	-	-	-	-	2	2	-	-
IT302.2	-	2	-	-	2	-	-	-	2	2	-	-
IT302.3	-	3	2	1	2	-	-	-	2	2	2	-
IT302.4	-	-	3	-	2	-	-	-	2	-	-	-
IT302.4	-	1	1	-	-	-	-	-	-	-	-	1

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
IT302.1	3	-	-	-	-	-	-
IT302.2	3	2	-	-	-	-	-
IT302.3	3	2	-	-	2	-	-
IT302.4	3	-	-	-	2	-	-
IT302.5	1	2	1	-	-		1

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
				✓	

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Introduction**		06
	1.1	Software Development Challenges, Software Scope, The Human Side of Software Development	T1,T2	
	1.2	Software Methodologies and Related Process Models with applications, Traditional Life Cycle Models, Waterfall, Incremental, Iterative models, Agile Software Engineering Process Models, SCRUM, Extreme Programming	T1,T2	
2	Title	**Requirements Management and Project Planning**		10
	2.1	Requirements Development Methodology, Specifying Requirements, Eliciting Accurate Requirements, Documenting Business Requirements, SRS, Defining User Requirements, Validating Requirements, Achieving Requirements Traceability, Managing Changing Requirements, Agile Requirements Engineering	T1,T2	
	2.2	Scheduling, Work Breakdown Structure, Gantt Chart, Pert Chart, Critical Path, Earned Value Analysis, Schedule and Cost slippage, Estimation, Decomposition techniques, Empirical estimation models, Software Risk Management**:** Risk Identification, Risk Projection, Risk Refinement, RMMM Plan	T1,T2	
3	Title	**Software Analysis**		08
	3.1	Difference between Structured and Object-Oriented analysis, Structured Analysis, Data Flow Diagrams	R2,R3	
	3.2	Object Oriented Analysis, Uses Case, Class diagram, Interaction diagrams, Activity diagram, State Chart diagram, Component and Deployment diagram	R2,R3	
4	Title	**Software Design & Development**		08
	4.1	Software Architecture, Architectural and Pattern-Based Design, Model Driven Architectures	T1,T2	
	4.2	Software Development, Component Infrastructures, Refactoring, Test Driven Development (TDD)	T1,T2	
	4.3	DevOps, Continuous Integration, Continuous Deployment, System Provisioning and Configuration Management	R1	
	4.4	Software Change Management, Change Control, Version Control	T1,T2	
5	Title	**Software Quality & Testing**		10
	5.1	Software Quality Concepts, Quality Assurance, Quality Control, Formal Technical Reviews	T1,T2	
	5.2	Software Metrics, Product Metrics – McCall's Quality Factor, Metrics for Analysis Model and Design Model, Project Metrics, Process Metrics, Metrics for Source Code	T1,T2	
	5.3	Software Testing, Unit Testing, Integration Testing, System Testing	T1,T2	
6	Title	Advance Topic in software Engineering		5*
	Self Study	• Design Pattern		
Total				42

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	Gather requirements and write a project proposal for case study. Prepare SRS document. (Use IEEE template)
2	Design UML diagram -Use Case, Class diagram
3	Design UML diagram -Interaction diagrams
4	Design Data flow diagram (level 0 and1) for the case study.
5	Create work breakdown structure and schedule the activities
6	Develop Risk Mitigation, Monitoring and Management Plan for the case study.
7	Create versions of software using version control tool.
8	Implement any one Module from chosen case study.
9	Prepare test cases and perform Unit Testing (test scenario, test cases, test data)
10	Study on continuous Integration using DevOp

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Software Engineering: A Practitioner's Approach	Ninth Edition	Roger S. Pressman and Bruce Maxim	McGraw-Hill	2019
2	Fundamentals of Software Engineering	Fifth Edition	Rajib Mall	PHI Learning	2018

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations	--	Gene Kin, Patrick Debois, John Willis, Jez Humble and John Allspaw	IT Revolution Press	2016
2	UML for Java Programmers	--	Robert C. Martin	Pearson	2006
3	UML Distilled: A Brief Guide to the Standard Object Modeling Language	Third Edition	Martin Fowler	Addition Wesley	2003

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PC	Foundation of Signal Processing	3	0	2	5	10	3	0	1	4
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
IT303		Theory	50		50		100			200
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	
Course Objective: Foundations of Digital Signal Processing! The study of digital signal processing explores how we transform data into new representations to better understand, compress, and leverage it. The course begins with a rigorous review of tools from Signals and Systems: sampling, convolution, Fourier representations and flow graph, fast linear filtering algorithms. It also comoares DSP Processor and General Purpose Processor.	
Course Outcomes (CO): ***At the End of the course students will be able to***	
IT303.1	Interpret DT signal and perform signal manipulation in Time Domain and Frequency Domain
IT303.2	Develop FFT flow-graph
IT303.3	Implement Fast Linear filtering algorithms
IT303.4	Compare the DSP processor with General Purpose Processor (GPP)

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT303.1	2	2		-	-	-	-	-	-	-	-	-
IT303.2	-	-	3	-	-	-	-	-	-	-	-	-
IT303.3	-	-	3	-	-	-	-	-	-	-	-	-
IT303.4	-	2	-	-	-	-	-	-	-	-	-	-

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
IT303.1	-	-	-	3	-	-	-
IT303.2	-	-	-	3	3	-	-
IT303.3	-	-	-	3	3	-	-
IT303.4	-	-	-	3	-	-	-

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
		✓	✓	✓	

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Title**	**Discrete-Time Signal**	**T1,T2**	**12**
	1.1	Introduction: Signals, Systems, and Signal, Continuous Time signal, Discrete - Time signal and representation, Digital signal, The Sampling theorem, Some elementary discrete time signals, Classification of Discrete - Time Signals, Modifications of Discrete - Time Signals.	**T1,T2**	**04**
	1.2	Operations on Discrete - Time Signals: Linear Convolution, Circular Convolution, Matrix Representation of Circular Convolution, Linear Convolution using Circular Convolution, Auto and Cross Correlation.	**T1,T2**	**05**
	1.3	Discrete - Time systems: Static and dynamic, time variant and time invariant, linear and nonlinear, causal and non causal. Representation of system using impulse response, Finite Impulse Response (FIR) and Infinite Impulse Response (IIR) system, Response of the FIR system using convolution.	**T1,T2**	**03**
2	**Title**	**Discrete Fourier Transform**	**T1,T2**	**08**
	2.1	Introduction to DTFT, Relation between DFT and DTFT, DFT of DT signal, Inverse DFT.	**T1,T2**	**02**
	2.2	Properties of the DFT: Scaling and Linearity, Symmetry for real valued signal, Periodicity, Time Shift and Frequency Shift, Time Reversal, Convolution Property and Parsevals Energy Theorem.	**T1,T2**	**06**
3	**Title**	**Fast Fourier Transform**	**T1,T2**	**08**
	3.1	Fast Fourier Transform: Need of FFT, Radix-2 DIT-FFT algorithm	**T1,T2**	**04**
	3.2	Flow graph for N=4 and 8 using Radix-2 DIT-FFT, Inverse FFT algorithm, Comparison of complex and real, multiplication and additions of DFT and FFT	**T1,T2**	**04**
4	**Title**	**DSP Algorithms**	**T1,T2**	**08**
	4.1	Fast Circular Convolution Algorithm, Fast Linear Convolution Algorithm.	**T1,T2**	**04**
	4.2	Linear FIR filtering using Overlap Add Algorithm and Overlap Save Algorithm and implementation using FFT.	**T1,T2**	**04**
5	**Title**	DSP Processors and Applications of DSP	**T3**	**06**
	5.1	Need DSP processor, Difference between DSP processor & General Purpose (GP) Processor.	**T3**	**02**
	5.2	Case study of DSP applications to Speech Signal Processing and Biomedical Signal Processing.	**T3**	**04**
6	**Self Study ***	Multi-rate Signal Processing: Up sampling and Down sampling, Signal Compression, Carl Correlation Coefficient for measurement of degree of similarity between two signals.	**T1, T2, T3,R1 ,R2**	**02 02 01**
Total				**42**

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment	Marks
1	Signal Operations	5
2	Discrete Convolution	5
3	Discrete Correlation	5
4	Discrete Fourier Transform	5
5	Magnitude and Phase Spectrum	5
6	Fast Fourier Transform	5
7	Overlap Add Method using FFT	5
8	Overlap Save Method using FFT	5
9	Application of DSP Part I	5
10	Application of DSP Part II	5

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Digital Signal Processing : Principles, Algorithms and Applications	Fourth Edition	Proakis Manolakis	Pearson Education, ISBN 81-317-1000-9	2007
2	Digital Signal Processing	First Edition	S. Salivahanan, A. Vallavaraj, C. Gnanapriya	TataMcgraw Hill ISBN 978-0-07-066924-6	2010
3	Digital Signal Processing: A Computer Science Perspective	First Edition published on 25th Sept, 2000	Jonathan (Y) Stein	Copyright © 2000 John Wiley & Sons, Inc Print ISBN:9780471295464 |Online ISBN:9780471200598 |DOI:10.1002/047120059X	2000

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Digital Signal Processing: A Practical Approach	--	Emmanuel C. Ifeachor, Barrie W. Jervis	Pearson Education ISBN 0-201-59619- 9	2001
2	Digital Signal Processing	Sixth Edition	P. Ramesh Babu	Scitech Publication	2014

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PC	Distributed Computing	3	0	2	5	10	3	0	1	4
IT304		Examination Scheme								
		Component	ISE		MSE		ESE			Total
		Theory	75		75		150			300
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	IT206: Operating Systems IT207: Computer Networks and Communications
Course Objective: To familiarize students with the fundamental concepts, techniques and design of Distributed Systems and use of distributed computing applications domains.	
Course Outcomes (CO): ***At the End of the course students will be able to***	
IT304.1	Understand the principles and desired properties of distributed systems.
IT304.2	Apply the various communication techniques for distributed communication.
IT304.3	Apply the concepts of process, naming, consistency, replication and faults tolerance in distributed environment.
IT304.4	Apply the algorithms such as clock synchronization, election, and mutual exclusion in distributed applications.
IT304.5	Identify the challenges in developing distributed applications.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT304.1	2	1	-	-	-	-	-	-	-	-	-	2
IT304.2	2	2	2	1	-	-	-	2	2	1	-	2
IT304.3	2	2	2	1	-	-	-	2	2	1	-	2
IT304.4	2	2	2	1	-	-	-	2	2	1	-	2
IT304.5	2	2	2	1	-	-	-	1	2	1	-	2

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PE04	PSO1	PSO2	PS03
IT304.1	1	1	1	-	-	-	-
IT304.2	1	1	1	-	-	1	-
IT304.3	1	1	1	-	-	1	-
IT304.4	1	1	1	-	-	1	-
IT304.5	1	1	1	-	-	1	-

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
			✓		

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Introduction to Distributed Systems**		
	1.1	Definition, Type, Goals, Distributed Computing Models, Issues in Distributed Systems.	T1, T2	08
	1.2	Hardware Concepts, Software Concepts, The Client-Server Model, Positioning Middleware, Models of Middleware, Services offered by Middleware, models of Distributed Algorithms and some fundamental problems.	T1, T2	
2	Title	**Communication In Distributed Systems**		12
	2.1	Introduction to Message Passing, Desirable Features of a Good Message-Passing System, Issues in IPC by Message Passing, Synchronization, Buffering, Multi-datagram Messages, Group Communication.	T1, T2, R1	
	2.2	Remote Procedure Call (RPC): Basic RPC Operations, Parameter Passing, Extended RPC Models. Remote Object Invocation: Distributed Objects, Binding a Client to an Object, Static Vs Dynamic RMI Message Oriented Communication: Persistence and synchronicity in communication, Message Oriented Transient and Persistent Communications	T1, T2	
3	Title	**Process in Distributed Systems**		6
	3.1	Introduction to Threads, Threads in Distributed Systems, Clients, Server	T1, T2	
	3.2	Code Migration: Approaches to Code Migration, Models, Migration and Local Resources, Migration in Heterogeneous Systems	T1, T2	
4	Title	**Synchronization in Distributed Systems**		10
	4.1	Clock Synchronization: Physical Clocks, Global Positioning System, Clock Synchronization Algorithms; Logical Clocks: Lamport's Logical Clocks, Vector Clocks	T1, T2	
	4.2	Election Algorithms: Bully and Ring; Mutual Exclusion: Centralized Algorithm, Decentralized Algorithm, Distributed Algorithm, Token Ring Algorithm, Comparison of Algorithms; Load Balancing: Goals, Types, Strategies.	T1, T2,	
5	Title	**Consistency and Replication**		6
	5.1	Reasons for Replication, Object Replication, Replication as Scaling Technique Data Replication in Distributed Systems, Goals, Types, Schemes,	T1	
	5.2	Data-Centric Consistency Models, Client Centric Consistency Models Continuous Consistency, Consistent Ordering of Operations	T1	
6	Self Study	Naming Entities, Locating Mobile Entities, Distribution Protocols, Consistency Protocols, Faults Tolerance: Process Resilience, Distributed Commit, Recovery	T1, T2, R1, R2	8
Total				42

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiments
1	Implementation of Client Server Communication using RPC/RMI.
2	Implementation of Clock Synchronization (logical/physical).
3	Implementation of Election algorithm.
4	Implementation of Mutual Exclusion algorithm.
5	Implementation of Client Server based program to check data consistency.
6	Implement Load Balancing Algorithms.
7	Mini Project.

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Distributed Systems– Principles and Paradigms.	First Edition	Andrew S. Tanenbaum, Maarten Van Steen	PHI	2004
2	Distributed Operating Systems Concepts and Design	Second Edition	P. K. Sinha	PHI	2010

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Distributed Systems – Concept and Design	Fourth Edition	George Coulouris, Jean Dollimore, Tim Kindberg & Gordon Blair	Pearson	2010
2	Distributed VOD Systems	First Edition	Sudhir D. & Bandu B.M	Research India Publication	2011

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
SBC	Internet Technology Lab	1	0	2	5	8	1	0	1	2
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
IT305		Theory		--		--		--		--
		Laboratory		100		--		100		200

Pre-requisite Course Codes, if any.	CS208/IT208 Mini Project
Course Objective: To impart knowledge of different Internet Technologies.	
Course Outcomes (CO): *At the End of the course students will be able to*	
IT305.1	Develop a sophisticated web UX
IT305.2	Create, integrate and test REST based web services
IT305.3	Design secured web application/ web services
IT305.4	Demonstrate behaviour of web crawlers and testing of web application

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT305.1	-	-	1		3	-	-	-	-	-	-	-
IT305.2	-	-	-	2	3	-	-	-	-	-	-	-
IT305.3	-	-	-	1	3	-	-	-	-	-	-	-
IT305.4	-	-	-	1	3	-	-	-	-	-	-	-

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
IT305.1	-	-	-	-	-	-	3
IT305.2	-	-	-	-	-	-	3
IT305.3	-	-	-	-	-	-	3
IT305.4	-	-	-	-	-	-	3

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
					✓

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Designing UI**		**2**
	1.1	Fundamentals of UX Design, Defining UX Solutions, Design Communication and Visualizing Ideas	T1	
2		**Web content management system**		**1**
	2.1	Introduction to Web CMS, different types of Web CMS	T2,R1	
3		**Web services**		**2**
	3.1	Introduction to web service, REST architecture	T3,R3	
4		**Web mashups**		**1**
	4.1	Introduction to web mashups, server side mashups, client side mashups	T2	
5		**Secured Web application**		**2**
	5.1	Introduction to Web Tokens, Auth2.0, OAuth, Access token	T2	
6		**Integration of web services**		**2**
	6.1	Introduction to Mule ESB, Introduction to Anypoint studio, Integrating Web Services using Any point studio	T4,R2	
7		**Web crawlers**		**2**
	7.1	Introduction to web crawler, role of crawler in the internet, concept of page ranking	T3	
8		**Testing web applications**		**2**
	8.1	Introduction to different types of testing, manual testing, automated testing, performance testing and functional testing, open source tools used for testing	T2	
Total				**14**

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	Design web pages using HTML, CSS and javascript
2	Design UX for a given problem definition by using open source UX tools
3	Create a website using web CMS (Node Js/Angular Js/React Js/Flask/Django/Wordpress/Joomla etc.)
4	Create a Restful webservice to demonstrate different HTTP methods
5	Testing of restful web service using Postman/ARC
6	Create a web mashup of web services using open source framework
7	Design secured Web application using web token
8	Integration of web services using open source integration tools like Mulesoft
9	Demonstrate the behavior of Web Crawlers/ spiders (use XPATH,CSS PATH),extract information and store it in the database.
10	Test the web application using open source testing tools like Selenium, Test runner and Junit

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Sketching the User experiences	Second Edition	Bill Buxton	Diane Cerra	2010
2	Rich Internet Application AJAX and Beyond	Third Edition	Dana Moore, Raymond Budd, Edward Benson	WROX Publisher	2017
3	Web Technology	Second Edition	Srinivasan	Pearson	2014
4	API Recipes with Mulesoft(r) Anypoint Platform	First Edition	WHISHWORKS Editorial Board	White falcon	2017

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Internet Technology And Web Design	First Edition	R. K. JAIN	Khanna Book Publishing Company	2015
2	Understanding the Internet: A Clear Guide to Internet Technologies	First Edition	Keith Sutherland	A Butterworth-Heinemann Title	2016
3	RESTful Web APIs: Services for a Changing World	Third Edition	Leonard Richardson, Mike Amundsen, Sam Ruby	O'REILLY	2013

SEMESTER VI

SEM VI FOR CAT 1 STUDENTS (NORMAL STUDENTS)

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PC	Information System Security	3	0	2	5	10	3	0	1	4
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
IT306		Theory	75		75		150			300
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	IT206:Operating System IT207:Computer Communications and Networks
Course Objective: To analyze the use of different terminologies involved in information and system security	
Course Outcomes (CO): ***At the End of the course students will be able to***	
IT306.1	Illustrate the different types of cryptographic algorithm to secure information
IT306.2	Classify the various attacks in each layer of TCP/IP model
IT306.3	Apply various authentication protocols.
IT306.4	Analyze and use the system security practices.
IT306.5	Select and apply the appropriate counter measures to secure the web application.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT306.1	2	2	2	2	-	-	-	1	-	-	-	3
IT306.2	2	3	3	3	3	-	-	2	-	-	-	3
IT306.3	2	3	3	2	-	-	-	3	-	-	-	3
IT306.4	2	3	3	-	3	-	-	3	-	-	-	3
IT306.5	2	3	3	3	3	-	-	2	-	-	-	3

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
IT306.1	2	3	-	2	-	1	2
IT306.2	3	3	2	2	-	1	3
IT306.3	2	3	-	2	-	1	2
IT306.4	2	3	2	2	-	1	3
IT306.5	3	3	2	2	-	1	3

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
			✓		

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Cryptographic Techniques**	T2, R1	11
	1.1	Security Goals, Threats and Attack on Information, Classic Cryptography. Traditional Symmetric-Key Ciphers. Block and steam cipher.		
	1.2	Symmetric Key Cryptography-DES, Triple DES, AES.		
	1.3	Public and Private Key Cryptography – RSA, Diffie-Hellman. Hash Functions-SHA.		
2	Title	**Authentication and Authorization**	T1	6
	2.1	Authentication Methods and Protocols, Password based authentication, Token Based Authentication, Biometric Authentication. Message Authentication Code, Multi factor authentication.		
	2.2	Digital Certificates, X.509 Directory Services, PKI, Needham Schroeder, Kerberos.		
3	Title	**Access Control**	T1	4
	3.1	Access control Policies: DAC, MAC, RBAC, Access control Matrix, ACLs and Capability Lists.		
	3.2	Multiple level security model: Biba and Bell La Padula Models, Multilateral security, Covert channel, CAPTCHA.		
4	Title	**Software security**	T1, R2	6
	4.1	Software Flaws, Buffer Overflow, Incomplete Mediation, Race conditions. Malware: Viruses, Worms, Trojans, Logic Bomb.		
	4.2	Miscellaneous Software Attacks: Salami attack, Linearization Attacks, Trusted Computing: Software reverse engineering, Digital Rights management.		
	4.3	System Security- Processor vulnerabilities -Melt down, spectre attack		
5	Title	**Network Security**	T1, T2	12
	5.1	Network security basics, TCP/IP vulnerabilities Layer wise. Internet Security Protocols: SSL, TLS, IPSEC, Secure Email and S/MIME.		
	5.2	Denial of Service: Classic DOS attacks, Distributed Denial of Service, Defences against Denial-of-Service Attacks. Firewalls, Intrusion Detection Systems: Host Based and Network Based IDS, IPS,Honey pots.		
6	Title	**Web Security**	T1, R1	3
		SQL Injection Techniques, Cross Site Scripting, Cross-Site Request Forgery, Session Hijacking and Management, Phishing and Pharming Techniques, Web Services Security.		
7	Self Study	Mathematics of Cryptography-finite fields, prime numbers, Fermat's and Euler's theorems, steganography, Md5.	T1, T2	6*
Total				42

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	Demonstration of Symmetric Key Cryptography
2	Demonstration of public key cryptography
3	Use of Hashing Techniques
4	A. Foot printing a target network. B. Scanning a network using: a) Nmap Network Mapper b) Nessus vulnerability scanner
5	Implementing the firewall using iptables
6	Exploit Windows vulnerability to get unauthorized access. Exploiting Client-side vulnerabilities and establishing a VNC session
7	Implementing HIDS and NIDS
8	Performing Man-in-the-Middle Attack using Wireshark and Ettercap
9	A. Creating a Trojan using Social-Engineer Toolkit. B. Implementing DoS attack.
10	Performing SQL injection. A. Manual SQL Injection, John the Ripper. B. Automate SQL Injection with Sql Map

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Information security Principles and Practice	Second Edition	Mark Stamp	Wiley publication	2011
2	Cryptography and Network Security	Second Edition	Behrouz A. Forouzan, Debdeep Mukhopadhyay	McGraw-Hill Education	2010

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Information Theory, Coding and Cryptography	Second Edition	Ranjan Bose	Tata McGraw Hill	2008
2	Network security bible	Second Edition	Eric Cole	Wiley	2009

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PC	Big Data Analytics	3	0	2	5	10	3	0	1	4
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
IT307A		Theory	75		75		150			300
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	IT204:Database Management Systems
Course Objective: To understand the concept of big data and the tools used for accessing the big data	
Course Outcomes (CO): ***At the End of the course students will be able to***	
IT307A.1	Apply rules of linear algebra for processing big data.
IT307A.2	Choose appropriate storage structures to make sense out of big data.
IT307A.3	Apply scalable algorithms based on Hadoop and Map Reduce to perform Big Data Analytics.
IT307A.4	Analyze information from social network graphs.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO 3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT307A.1	2	-	-	-	-	-	-	-	-	-	-	-
IT307A.2	-	-	2	-	-	-	-	-	-	-	-	-
IT307A.3	-	-	-	-	3	-	-	-	-	-	-	-
IT307A.4	-	-	-	2	-	-	-	-	-	-	-	-

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
IT307A.1	-	-	-	-	-	-	-
IT307A.2	-	-	-	-	-	-	-
IT307A.3	-	-	-	-	-	-	-
IT307A.4	-	-	-	-	-	-	-

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
			✓		

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Introduction to Big data and Linear Algebra**		8
	1.1	Big Data characteristics, types of Big Data, Traditional vs. Big Data, Big data challenges	T1,R1	
	1.2	Matrices as linear transformations, Linear systems and vector spaces, Solving linear systems, role of Eigen values and eigenvectors in data analytics, SVD - Singular Value Decomposition	T3	
2	Title	**Memory-efficient data structures**		12
	2.1	Introduction to data streams, problems related to handling data stream, Need of dimensionality reduction - PCA, Mining Data Streams using DGIM algorithm	T3,R1	
	2.2	Hash functions, universal / perfect hash families, Bloom filters, Sketches for distinct count, Flajolet Martin Sketch, Majority Algorithm, Misra-Gries sketch, Count-Min Sketch, Count Sketch, kd-trees, LSH, MinHash, SimHash	T2	
3	Title	**Scaling with Big Data using Hadoop**		10
	3.1	HDFS - Data in Hadoop	T1	
	3.2	Hadoop Ecosystem architecture **Hive** - Architecture, various data operations using Hive **HBase** - Architecture, General Commands **Pig** - What is Pig, advantages	T1	
	3.3	Relational Algebra using Big data framework - Map Reduce Selection,Projections, Union, Intersection, Natural Join, Grouping and Aggregation by Map Reduce, Matrix Multiplication	T1	
4	Title	**Frequent Itemsets And Clustering**		5
	4.1	Handling Larger Data sets in Main Memory Algorithm - Park, Chen and Yu Algorithm, The Multi stage Algorithm, The Multihash Algorithm. The SON Algorithm, BFR clustering algorithm, CURE algorithm	T1,R3	
5	Title	**Mining Social- Network Graphs and Link Analysis**		7
	5.1	Clustering of Social-Network Graphs - Clique Percolation Method, counting triangles, PageRank, Efficient Computation of PageRank, Topic-Sensitive PageRank, Link Spam, Hubs and Authorities	T1,R3	
6	Self Study	Scaling with Big Data using Apache SPARK SPARK Ecosystem, SPARK streaming, Distributed Batch Processing with Spark	T4	5*
Total (*Not included)				**42**

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	Installation of Hadoop and execution of HDFS commands
2	Study of any latest research paper on memory efficient data structure for big data.
3	Implement algorithms in Map-Reduce on Strings and integers
4	Implement algorithms in Map-reduce on Relational Algebra
5	Download a real world dataset and find insights using map reduce. For e.g for a movie dataset list all the movies and the number of ratings, list all the Movie IDs which have been rated (Movie Id with at least one user rating it), list all the Users who have rated the movies (Users who have rated at least one movie), list of all the User with the max, min, average ratings they have given against any movie
6	Explore and present interactive data insights from real world dataset (Dashboards) using Tableau
7	Extract facts in real world dataset using Hive
8	Extract sessions in real world dataset using Pig
9	Implement word count using Apache Spark.
10	Demonstrate use of modern tools like Matlab for Exploratory Data Analysis.

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Mining of Massive Datasets	Third Edition	Anand Raja Raman and Jeff Ullman	Cambridge University	2019
2	Algorithms and models of computation	First Edition	Jeff Erickson	University of Illinois	2015
3	Introducing Data Science	Third Edition	Davy Cielen, Meysman, Mohamed Ali	Dreamtech Press	2014
4	Learning Apache Spark 2	Second Edition	Muhammad Asif Abbasi	Packt Publishing	2017

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Data streams :Algorithms and applications.	Second Edition	Muthukrishnan. S.	now publishers Inc	2005
2	Introducing Data Science	Third Edition	Davy Cielen, Meysman, Mohamed Ali	Dreamtech Press	2015
3	Hadoop, the Definitive Guide	Third Edition	Tom White	O'Reilly	2013

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PC	Artificial Intelligence and Machine Learning	3	0	2	5	10	3	0	1	4
IT307B		Examination Scheme								
		Component	ISE		MSE		ESE			Total
		Theory	75		75		150			300
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	IT 202: Data Structures, MA203: Probability and Statistics
Course Objective: This course covers the fundamental concepts of Artificial Intelligence and machine learning.	
Course Outcomes (CO): ***At the End of the course students will be able to***	
IT307B.1	Understand AI building blocks presented in intelligent agents
IT307B.2	Solve the problems using suitable searching methods.
IT307B.3	Solve the problems using suitable reasoning and knowledge representation methods.
IT307B.4	Apply suitable machine learning technique for a given problem
IT307B.5	Design an intelligent system using different AIML techniques for real life problems.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT307B.1	2	3	-	-	2	-	-	-	-	-	2	-
IT307B.2	2	3	2	2	-	-	-	-	-	-	2	-
IT307B.3	2	3	2	2	-	-	-	-	-	1	2	-
IT307B.4	2	3	-	-	2	-	-	-	-	2	2	-
IT307B.5	2	3	2	2	2	-	-	-	-	2	2	2

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
IT307B.1	-	-	-	-	-	-	-
IT307B.2	-	-	-	-	-	-	-
IT307B.3	-	-	-	-	-	-	-
IT307B.4	1	1	1	-	-	-	-
IT307B.5	2	2	2	-	2	-	-

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
				✓	

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Title**	**Introduction to Artificial Intelligence**	**T1**	**04**
	1.1	Definition of AI, History and Future of AI, Problem solving Approach to Typical AI problem.		
	1.2	**Intelligent Agents and Environment** What is an Intelligent Systems, Types of Agents, structure of agent		
	1.3	Environments and Its Properties, PEAS Representation for an Agent		
2	**Title**	**Problem solving by Searching**	**T1**	**10**
	2.1	Searching: characteristics and issues in design of search programs		
	2.2	**Uninformed search techniques:** State Space Search, Depth First Iterative Deepening		
	2.3	**Informed Search methods:** Heuristic Search, Hill Climbing.		
	2.4	**Adversarial Search:** Game playing, Min-Max Search, Alpha-Beta Pruning		
3	**Title**	**Knowledge Representation and Reasoning**	**T1**	**08**
	3.1	Reasoning: Representing and Reasoning with Uncertain Knowledge		
	3.2	Knowledge representation: A Knowledge-Based Agent, The Wumpus World.		
	3.3	Propositional Logic, First-order predicate logic, Forward and Backward Chaining		
4	**Title**	**Introduction to Machine Learning**	**T2,T3**	**12**
	4.1	Introduction: What is Machine Learning, History and overview of machine learning,		
	4.2	Types of Machine Learning – Supervised, Unsupervised Semi-Supervised Learning and Reinforcement Learning, Design a Learning System, The curse of dimensionality		
	4.3	Evaluating a hypothesis: Model selection, training/validation/testing procedures, diagnosing bias versus variance and vice versa, regularization and bias/variance, learning curves		
5	**Title**	**Linear Models for Regression**	**T4**	**8**
	5.1	Two Simple Approaches to Prediction: Least Squares and Nearest Neighbors		
	5.2	Linear Regression, Multivariate Regression, Subset Selection, Shrinkage Methods		
6	**Self Study**	**Linear model for Classification**: Logistic Regression, Linear Discriminant Analysis, Perceptron, Support Vector Machines, PCA	**T3,T4**	**5***
Total				**42**

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	Implement an Intelligent agent.
2	Implement a given problem using the searching technique.
3	Implement a given problem using knowledge representation and reasoning rules
4	To design and implement an intelligent system, incorporating the matching algorithm and the rule language. 1. It should provide a fact base updating function. 2. It should provide a function that checks the rules' LHS and return which rules were matched. 3. It should support firing RHS according to matches. Using SWISH Prolog or Java or Python or any other open-source tool
5	Implement supervised learning algorithms.
6	Implement unsupervised learning algorithms.
7	Implement the regression model
8	Minor project covering the concepts of AIML on the real life problem statements.

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Artificial Intelligence: A Modern Approach	Third Edition	Stuart Russell and Peter Norvig	Prentice-Hall	2009
2	Machine Learning A Probabilistic Perspective	First Edition	Kevin P. Murphy	Massachusetts Institute of Technology	2012
3	Machine Learning,	First Edition	Tom. M. Mitchell	McGraw Hill International Edition	1997
4	The Elements of Statistical Learning	Second Edition	Trevor Hastie, Robert Tibshirani, Jerome Friedman	Springer	2009

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Artificial Intelligence: Making a System Intelligent	First Edition	Nilakshi Jain	Wiley Publication	2019
2	Pattern Recognition and Machine Learning	First Edition	C. M. Bishop	Springer	2013

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PE	Machine Learning	2	0	2	4	8	2	0	1	3
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
IT311		Theory	50		50		100			200
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	IT307B: Artificial Intelligence and Machine Learning
Course Objective: To learn methodology and tools to apply machine learning algorithms to real data and evaluate their performance.	
Course Outcomes (CO): ***At the End of the course students will be able to***	
IT311.1	Identify machine learning techniques suitable for a given problem
IT311.2	Apply Dimensionality reduction techniques for appropriate feature selection
IT311.3	Evaluate the performance of various machine learning algorithms
IT311.4	Design an application using machine learning techniques

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT311.1	2	2	2	2	2	1	-	-	2	2	2	2
IT311.2	2	2	2	2	2	1	-	-	2	2	2	2
IT311.3	2	2	2	2	2	1	-	-	2	2	2	2
IT311.4	2	2	2	2	2	1	-	-	2	2	2	2

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
IT311.1	2	2	1	-	2	1	1
IT311.2	2	2	1	-	2	1	1
IT311.3	2	2	1	-	2	1	1
IT311.4	**2**	**2**	1	-	**2**	1	1

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
					✓

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Title**	**Introduction**	**T1T,2 ,R1**	**2**
	1.1	Introduction to Machine Learning, Supervised, Unsupervised Semi-Supervised Learning. Machine learning Models: Geometric Models, Logical Models, and Probabilistic Models Classification: Binary Classification, Multiclass Classification.		**1**
	1.2	Estimating Hypothesis Accuracy, Basis of Sampling theory, Hypothesis Testing.		**1**
2	**Title**	**Linear Models for Classification**	**T1,T2 ,R1**	**8**
	2.1	Logistic Regression, K-Nearest Neighbors.		**2**
	2.2	Support Vector Machine: Maximum Margin Linear Separators, Kernel SVM, Kernels for learning non-linear functions, Naive Bayes.		**3**
	2.3	Decision Trees: Constructing Decision Trees using Gini Index, Classification and Regression Trees (CART).		**3**
3	**Title**	**Linear model for Clustering**	**T1,T2**	**10**
	3.1	Clustering: k-means, Derivation of K-means algorithm, Gaussian mixture model.		**3**
	3.2	Hypothesis testing, Ensemble Methods, Bagging Adaboost Gradient Boosting, k-Fold Cross-Validation, Grid Search, XGBoost		**4**
	3.3	Expectation-Maximization (EM) algorithm: Estimating means of k Gaussians.		**3**
4	**Title**	**Dimensionality Reduction**	**T1,T2**	**8**
	4.1	Introduction: Curse of Dimensionality, Feature selection, Feature Extraction, Subset Selection: Forward and backward selection, Univariate, Multivariate Feature selection		**4**
	4.2	Principal Component Analysis (PCA)		**2**
	4.3	Linear Discriminant Analysis (LDA)		**2**
5	**Self Study**	**Reinforcement Learning**		
		Elements of Reinforcement Learning, Q Learning, Non deterministic rewards and actions, Temporal Difference Learning, Generalization	**T1,R1**	**5***
Total				**28**

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	Implement Logistic Regression
2	Implement k-nearest Neighbors algorithm
3	Implement classification using SVM
4	Implement Decision Tree learning
5	Implement K-means/ K-Modes Clustering/ Expectation-Maximization(EM) algorithm to Find Natural Patterns in Data
6	Implement Principle Component Analysis for Dimensionality Reduction
7	To implement Linear Discriminant Analysis (LDA) for Dimensionality Reduction
8	Evaluating ML algorithms with balanced and unbalanced datasets Comparison of Machine Learning algorithms.
9	Capstone project covering the concepts of Machine Learning.
10	Capstone project covering the concepts of Machine Learning.

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Machine Learning,	First Edition	Tom. M. Mitchell	McGraw Hill International Edition	1997
2	Introduction to Machine Learning	Third Edition	Ethem Alpaydın	MIT , PRESS	2012

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Pattern Recognition and Machine Learning,	First Edition	C. M. Bishop	Springer	2013
2	Machine Learning In Action	First Edition	Peter Harrington	DreamTech Press	2001

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PE	Soft Computing	2	0	2	4	8	2	0	1	3
IT312		Examination Scheme								
		Component	ISE		MSE		ESE			Total
		Theory	50		50		100			200
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	
Course Objective: This course introduces three important soft computing techniques like Neural network, Fuzzy Logic and Genetic algorithms in brief. Students will be able to understand the supervised and unsupervised learning algorithm for real world applications. The design of fuzzy logic controller helps them to develop an adaptive control system for industrial operations. This course also covers the importance of optimizations and its use in computer engineering fields.	
Course Outcomes (CO):*At the End of the course students will be able to*	
IT312.1	Illustrate the basic principles of soft computing techniques.
IT312.2	Apply the supervised and unsupervised neural network learning algorithm for real world applications.
IT312.3	Design a fuzzy controller system using different FIS.
IT312.4	Apply genetic algorithms to solve optimization problems.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT312.1	2	-	-	-	-	-	-	-	-	-	-	-
IT312.2	2	2	-	-	-	-	-	-	2	2	-	2
IT312.3	3	2	2	-	-	-	-	-	2	2	-	2
IT312.4	3	2	2	-	-	-	-	-	-	-	-	2

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
IT312.1	1	1	1	-	-	-	-
IT312.2	2	2	2	-	-	-	-
IT312.3	2	2	2	-	-	-	-
IT312.4	2	2	2	-	-	-	-

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
		✓			

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Title**	**Introduction to Soft Computing**	**T3,T4**	**04**
	1.1	Soft computing Constituents, Characteristics of Neuro Computing and Soft Computing		
	1.2	Difference between Hard Computing and Soft Computing, Concepts of Learning and Adaptation		
2	**Title**	**Neural Networks**	**T1,T3,R1,R2,R5**	**10**
	2.1	Basics of Neural Networks: Introduction to Neural Networks, Biological Neural Networks and their artificial models		
	2.2	McCulloch Pitt model, Hebb Network, Linear separability		
	2.3	Supervised Learning algorithms: Perceptron (Single Layer, Multilayer), Delta learning rule, Back Propagation algorithm.		
	2.4	Un-Supervised Learning algorithms: Winner take all, Self-Organizing Maps, Learning Vector Quantization.		
3	**Title**	**Fuzzy Set theory**	**T2,T3,R1,R3**	**10**
	3.1	Classical Sets and Fuzzy Sets, Membership functions, Classical Relations and Fuzzy Relations		
	3.2	Fuzzy Max-Min and Max-Product Composition, Fuzzy extension principle		
	3.3	Fuzzy Systems- fuzzification, defuzzification methods, and design of fuzzy controllers.		
4	**Title**	**Genetic Algorithms**	**T3,T4,R4**	**04**
	4.1	Biological Background: The Cell, Chromosomes, Genetics, Reproduction, Selection, Traditional Optimization and Search Techniques		
	4.2	Simple GA, Operators in GA, Encoding, Selection, Crossover, Mutation, Stopping Condition for GA .Applications of GA.		
5	**Self Study**	Recurrent Neural Networks, Deep Learning: Deep Belief Network, Deep Reinforcement Learning		**04***
Total				**28**

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

<table>
<tr><th>Sr. No.</th><th>Title of the Experiment</th></tr>
<tr><td>1</td><td>To implement (MP-Neuron) Mc-Culloch Pitts Model.</td></tr>
<tr><td>2</td><td>To implement Transfer/Activation Functions.
A symmetric hard limit transfer function.
A Binary step activation function.
A Bipolar step activation function.
A saturating linear transfer function.
A hyperbolic tangent sigmoid (tansig) transfer function.
A log-sigmoid transfer function</td></tr>
<tr><td>3</td><td>To implement Basic Neural Network learning rules.

PROBLEM TO DISTINGUISH BETWEEN APPLES AND ORANGES
A produce dealer has a warehouse that store a variety of fruits & vegetables. When fruit is brought to the warehouse , a various types of fruits may be mixed together. The dealer wants a machine that will sort the fruit according to type . There is a conveyer belt on which the fruit is loaded .This conveyer passes through a set of sensors, which measure three properties of fruits :shape , texture and weight.
Bias= < Any Value>

<table>
<tr><td>Type of sensor</td><td>Output of sensor</td><td>Condition</td></tr>
<tr><td rowspan="2">Shape sensor</td><td>1</td><td>if fruit is approx. round</td></tr>
<tr><td>0</td><td>if fruit is elliptical.</td></tr>
<tr><td>Texture Sensor</td><td>1</td><td>If surface is smooth</td></tr>
<tr><td></td><td>0</td><td>If surface is rough</td></tr>
<tr><td rowspan="2">Fruit sensor</td><td>1</td><td>Apple</td></tr>
<tr><td>0</td><td>Orange</td></tr>
</table>
Design a perceptron to recognize these patterns using Joone Editor.</td></tr>
<tr><td>4</td><td>Write a program to design a perceptron to recognize these patterns for the problem statement in experiment No.3.(Use any Open source tools)</td></tr>
<tr><td>5</td><td>To implement Multilayer Perceptron Learning algorithm.(EBPTA)</td></tr>
<tr><td>6</td><td>To implement an unsupervised learning algorithm (KSOFM) for pattern classification problem.</td></tr>
<tr><td>7</td><td>To implement an unsupervised learning algorithm (LVQ) for pattern classification problem.</td></tr>
<tr><td>8</td><td>To implement fuzzy set and fuzzy relations for a given problem.</td></tr>
<tr><td>9</td><td>To design and implement Fuzzy Controller for a given problem</td></tr>
<tr><td>10</td><td>To apply genetic algorithms for a given problem.</td></tr>
</table>

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Introduction to Artificial Neural Systems	--	Jacek M. Zurada	Jaico Publishing House	1992
2	Fuzzy Logic with Engineering Applications	Third Edition	Timothy J. Ross	Wiley India	1995
3	Principles of Soft Computing	Second Edition	S. N. Sivanandam and S. N. Deepa	Wiley, India	2011
4	Neural Networks, Fuzzy Logic and Genetic Algorithms	Kindle Edition	S.Rajasekaran and G.A.Vijayalaks	PHI Learning	2013

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Neuro-Fuzzy and Soft Computing– A Computational Approach to Learning and Machine Intelligence	First Edition	Jang J.S.R, Sun C. T. and Mizutani E.	PHI	1997
2	Fundamentals of Neural Networks – Architectures, Algorithms, And Applications	First Edition	Laurene Fausett	Pearson Education	2004
3	Fuzzy Set Theory and its Applications	Second Edition	H.J. Zimmermann	Allied Publishers Ltd.	1996
4	An Introduction to Genetic Algorithms	Fifth Edition	Melanie Mitchell	The MIT Press	1999
5	Neural Network Design	Second Edition	Hagan, Demuth, Beale	CENGAGE Learning, India Edition	1996

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PE	Number Theory and Cryptography	2	0	2	2	6	2	0	1	3
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
IT321		Theory	50		50		100			200
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	IT206: Operating systems IT207: Computer Communications and Networks
Course Objective: To understand the techniques involved in number theory, symmetric key and public key cryptography.	
Course Outcomes (CO): ***At the End of the course students will be able to***	
IT321.1	Explain the use of key management and its distribution.
IT321.2	Apply various cryptographic algorithms to secure the information.
IT321.3	Apply number theory algorithms to solve the given problem.
IT321.4	Demonstrate the different attacks involved in cryptanalysis.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT321.1	3	-	2	-	-	-	-	2	2	1	-	-
IT321.2	-	-	2	-	-	-	-	-	2	1	-	-
IT321.3	-	-	-	-	-	-	-	-	2	1	-	-
IT321.4	-	3	2	1	3	1	1	-	-	-	-	3

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
IT321.1	-	2	-	-	3	-	-
IT321.2	-	2	-	-	3	1	-
IT321.3	-	-	-	-	3	-	-
IT321.4	1	2	-	-	3	1	-

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
			✓		

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Introduction to Number Theory**	T1, R1	9
	1.1	Divisibility and the Division Algorithm, The Euclidean Algorithm, Modular Arithmetic, Prime Numbers.		
	1.2	Fermat's and Euler's Theorems, Testing for Primality, The Chinese Remainder Theorem, Discrete Logarithms		
	1.3	Finite Fields - Groups, Rings, Fields, Finite Fields of the Form GF(p), Polynomial Arithmetic, Finite Fields of the Form GF(2n).		
2	Title	**Symmetric Ciphers**	T1, T2, R2	10
	2.1	Symmetric Cipher Model, Substitution techniques, Transposition Techniques. Cryptanalysis.		
	2.2	Block cipher and the Data Encryption Standard- Traditional Block Cipher Structure, The Data Encryption Standard, Block Cipher Design Principles, Advanced Encryption Standard, Electronic codebook.		
3	Title	**Asymmetric Ciphers**	T1, T2, R2	4
	3.1	Public-Key Cryptography and RSA, Diffie-Hellman Key Exchange, Elgamal Cryptographic System, Elliptic Curve Arithmetic, Elliptic Curve Cryptography.		
4	Title	**Cryptographic Data Integrity Algorithms**	T1, R2	3
	4.1	Cryptographic Hash Functions, Applications of Cryptographic Hash Functions, Secure Hash Algorithm (SHA).		
	4.2	Message Authentication Codes- MAC, HMAC. Digital Signatures - Elgamal Digital Signature Scheme, Elliptic Curve Digital Signature Algorithm.		
5	Title	**Key Management and Distribution**	T1, R2	2
	5.1	X.509 Certificates, Public-Key Infrastructure.		
6	Self-study	QR code, Captcha, steganography, watermarking, Md5		6*
Total				**28**

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	Implementation of Fermat's theorem and Euler's theorem
2	Implementation of Chinese remainder theorem
3	Implementation of Modular arithmetic
4	Implementation of classical cryptography
5	Implementation of hash function and digital signature
6	Implementation of RSA and ECC with comparison
7	Implementation of Diffie-hellman
8	Demonstration of Hacking Secret Ciphers using Python
9	Mini project
10	Mini project

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Cryptography And Network Security Principles and Practice	Seven Edition	William Stallings	Pearson Education	2017
2	Cryptography and Network Security	Third Edition	Behrouz A. Forouzan and Debdeep Mukhopadhyay	McGraw Hill Education	2015

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Cryptography: Theory and Practice	Third Edition	Stinson. D.	Chapman & Hall/CRC	2010
2	Elementary Number Theory with applications	Second	Thomas Koshy	Elsevier	2007

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PE	Digital forensics	2	0	2	2	6	2	0	1	3
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
IT322		Theory	50		50		100			200
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	IT206: Operating Systems IT207: Computer Communications and Networks
Course Objective: To emphasize the fundamentals and importance of digital forensics	
Course Outcomes (CO): At the End of the course students will be able to	
IT322.1	Explain the principles and techniques associated with the digital forensic practices.
IT322.2	Understand the importance of evidence handling and storage for various devices.
IT322.3	Analyze the adequate perspectives of digital forensic investigation in various applications.
IT322.4	Analyze the Post-mortem investigation.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT322.1	3	-	-	-	-	-	-	-	3	-	-	-
IT322.2	-	3	-	3	-	-	-	-	-	-	2	-
IT322.3	-	-	3	-	3	-	-	-	-	-	-	2
IT322.4	-	-	-	-	-	3	-	3	-	-	-	-

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
IT322.1	-	-	-	-	-	-	-
IT322.2	-	-	-	-	-	-	-
IT322.3	2	-	2	-	-	-	2
IT322.4	-	-	-	-	-	-	-

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
			✓		

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Introduction to Digital Forensics**	T1, T2, R1	5
	1.1	Introduction , A brief history of digital forensics, Digital forensics methodology, The need for digital forensics as technology advances, Commercial tools available in the field of digital forensics, Lab setup for digital forensics. Operating systems forensics , Anti-forensics: threats to digital forensics.		
	1.2	Understanding File systems and Storage Media, Filesystems and operating systems, Data volatility ,The paging file and its importance in digital forensics		
2	Title	**Incident Response and Data Acquisition**	T1, T2	7
	2.1	Introduction, Digital evidence acquisitions and procedures, Incident response and first responders, Documentation and evidence collection.		
	2.2	Chain of Custody ,Powered-on versus powered-off device acquisition, Write blocking, Data imaging and hashing, Device and data acquisition guidelines and best practices		
3	Title	**Digital forensics tool**	T1, R2	8
	3.1	Evidence Acquisition and Preservation ,Drive and partition recognition in Linux, Maintaining evidence integrity, Image acquisition using Guymager.		
	3.2	File Recovery and Data Carving with Foremost, Scalpel, and Bulk Extractor, Forensic test images used in Foremost and Scalpel, Using Foremost for file recovery and data carving, Using Scalpel for data carving, Bulk extractor. Memory Forensics with Volatility, About the Volatility Framework, Downloading test images for use with Volatility		
4	Title	**Post-mortem analysis**	T1, R2	7
	4.1	Autopsy – The Sleuth Kit, Kit, Sample, Digital forensics with Autopsy		
	4.2	Network and Internet Capture Analysis with Xplico , Software required, Packet capture analysis using Xplico, Revealing Evidence Using DFF, Installing DFF		
5	Self-study	Use python libraries to develop forensics tools for portable devices or tiny OS. Cloud forensics, mobile and portable device forensics.	R3, R1	6*
Total				**28**

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	To acquire a disk image
2	To study the use of md5deep hashing tool to compute the hashes of the directories and compare them to check the integrity of the directories.
3	Imaging a disk using AccessData FTK imager on windows
4	a. To use a forensic tool Foremost in order to recover files b. To use Vinetto forensic tool to analyze Thumps.db files and extract data.
5	Use of Galleta tool to study cookie created in during browsing.
6	a. Use of password forensics tool to crack zip and rar password protected files b. Use of password forensic tool to get an access to a windows machine
7	Learn art of steganography
8	Memory forensic tool to capture and analyze RAM's image
9	Use of wireshark to do network forensics
10	Analyze a PDF file to check if its malicious or not.

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Digital Forensics with Kali Linux	Second Edition	Shiva V. N. Parasram	Packt	2017
2	Computer Forensics: Incident Response	Essentials	First Warren G. Kruse II and Jay G. Heiser	Addison-Wesley Professional	2001

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Guide to Computer Forensics and Investigations	Second Edition	Nelson, B, Phillips, A, Enfinger, F, Stuart, C	Thomson Course Technology	2006
2	Computer Forensics, Computer Crime Scene Investigation	First Edition	Vacca, J	Charles River Media,	2005
3	Learning Python for Forensics	Second Edition	Preston Miller,Chapin Bryce	Packt Publishing	2019

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PE	Advanced Database Systems	2	0	2	4	8	2	0	1	3
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
IT331		Theory	50		50		100			200
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	IT204: Database Management Systems
Course Objective: To get knowledge of Query optimization, data warehousing, data models, graph databases, Parallel and distributed database systems,	
Course Outcomes (CO): ***At the End of the course students will be able to***	
IT331.1	Evaluate the performance of query.
IT331.2	Apply NO SQL, graph databases and enhanced data model concepts for a given scenario.
IT331.3	Apply data warehousing concepts for a given scenario.
IT331.4	Design parallel and distributed databases.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT331.1	2	-	-	-	2	-	-	-	-	-	-	2
IT331.2	-	2	-	-	2	-	-	-	2	-	-	2
IT331.3	-	-	-	-	3	-	-	-	2	1	-	2
IT331.4	-	-	-	2	3	-	-	-	2	-	-	2

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
IT331.1	1	-	-	-	-	-	-
IT331.2	-	2	2	2	1	-	-
IT331.3	-	-	2	2	-	-	1
IT331.4	-	-	-	1	-	-	1

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
				✓	

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Parallel Database**	T1,T2	4
	1.1	Introduction, Architectures for parallel database,		
	1.2	Parallel query Evaluation, Parallelizing individual operation, Parallel Query Optimization		
2	Title	**Distributed Database Systems**	T1,T2	8
	2.1	Distributed Database Concepts , Types of Distributed Database Systems, Distributed Database Architectures		
	2.2	Data Fragmentation, Replication, and Allocation Techniques for Distributed Database Design, Query Processing and Optimization in Distributed Databases, Overview of Transaction Management in Distributed Databases, Overview of Concurrency Control and Recovery in Distributed Databases, Current Trends in Distributed Databases		
3	Title	**NOSQL And Graph Databases**	T4	6
	3.1	No SQL, Weaknesses of the Relational Data Model, Inadequate Representation of Data, Semantic Overloading.		
	3.2	Graph database: Graphs and Graph Structures, The Property Graph Model, Storing Property Graphs in Relational Tables, Advanced Graph Models, Neo4J, Hyper Graph DB		
4	Title	**Enhanced Data Models**	T1	4
	4.1	Temporal Database Concepts, Spatial Database Concepts, Multimedia Database Concepts, Image database		
	4.2	Applications of Enhanced Data Models		
5	Title	**Overview of Data Warehousing and OLAP**	T3,R1	6
	5.1	Introduction, Definitions, and Terminology, Characteristics of Data Warehouses, Data Modeling for Data Warehouses, Building a Data Warehouse ,		
	5.2	Typical Functionality of a Data Warehouse, Data Warehouse versus Views , Difficulties of Implementing Data Warehouses, OLTP, OLAP		
6	Self Study	Applications of Hyper Graph DB, cloud database, Block chain databases, data warehousing tools.	T2,T3 ,T4,R 1	5*
Total				28

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	Demonstrate the concept of deadlock in distributed systems.
2	Design a distributed database by applying the concept of horizontal fragmentation.
3	Design a distributed database by applying the concept of vertical fragmentation.
4	To implement the replication technique for a given scenario.
5	Demonstration of use of Cloud Database.
6	Demonstration of graph database.
7	Demonstration of Multimedia database
8	Build Data Warehouse and explore WEKA tool.
9	Create a data model for a given scenario.
10	Apply OLAP operations on a given scenario.

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Fundamentals of Database Systems	Seventh Edition	Ramez Elmasri & Shamkant B.Navathe	Pearson Education	2016
2	Principles of Distributed Database Systems	Fourth Edition	M. Tamer Ozsu ,Patrick Valduriez	Springer	2019
3	Data Warehousing, Data Mining & OLAP	Tenth Edition	Alex Berson and Stephen J. Smith	TataMc Graw Hill Edition	2007
4	"Advanced Data Management: For Sql, Nosql, Cloud And Distributed Databases	First Edition	Lena Wiese	De Gruyter Oldenburg	2015

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Database Systems – Design, Implementation and Management	Ninth Edition	Peter Rob and Corlos Coronel	Thompson Learning, Course Technology	2011
2	Database System Concepts	Seventh Edition	Henry F Korth, Abraham Silberschatz, S. Sudharshan	McGraw Hill	2010

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PE	Data Science	2	0	2	4	8	2	0	1	3
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
IT332		Theory	50		50		100			200
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	IT303B: Artificial Intelligence and Machine Learning MA203: Probability and Statistics
Course Objective: To choose and apply tools, methodologies to solve *data science* tasks.	
Course Outcomes (CO): *At the End of the course students will be able to*	
IT332.1	Make use of data to perform exploratory data analysis.
IT332.2	Apply supervised and unsupervised learning on a dataset.
IT332.3	Apply Association rule mining on a dataset.
IT332.4	Develop a data science application using ethical practices.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT332.1	-	1	2	-	2	-	-	-	-	-	-	2
IT332.2	-	1	2	-	2	-	-	-	-	-	-	2
IT332.3	-	1	2	-	2	-	-	-	-	-	-	2
IT332.4	-	1	2	-	2	-	-	2	2	-	2	2

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
IT332.1	-	-	2	-	-	-	2
IT332.2	-	-	2	-	-	-	2
IT332.3	-	-	2	-	-	-	2
IT332.4	-	-	2	-	2	-	2

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
					✓

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Introduction**	**T1, T2**	**04**
	1.1	Introduction : Data Science, data science process, stages of a data science project		
	1.2	Preliminaries for Data Science: Data Cleaning, mean, median, mode, standard deviation, correlation coefficient, regression coefficient		
2		**Exploratory Data Analysis and Data visualization**	**T1, T2**	**06**
	2.1	Data Integration; Data Reduction: Attribute subset selection, Dimensionality Reduction, Sampling; Data Transformation & Data Discretization: Normalization, Binning, Histogram Analysis and Concept hierarchy generation		
	2.2	Visualizing Geographical data, network data, Temporal data		
3		**Supervised and Unsupervised Learning**	**T1, T2**	**06**
	3.1	Supervised Learning: Basic Concepts, Statistical Model Fitting, Classification using Decision Tree Induction, Attribute Selection Measures, Tree pruning		
	3.2	Unsupervised Learning: Basic Concepts; Partitioning Methods: K-Mediods; Hierarchical Methods: Agglomerative, Divisive, BIRCH; Density-Based Methods: DBSCAN, OPTICS		
4		**Association Rule Mining**	**T1, T2**	**06**
	4.1	Market Basket Analysis, Frequent Item sets, Closed Item sets, and Association Rules		
	4.2	The Apriori Algorithm, The FP Growth algorithm, Introduction to Mining Multilevel Association Rules and Multidimensional Association Rules		
5		**Applications and Ethics of Data Science**	**T1, T2**	**06**
	5.1	Data Science for Business Applications: Recommendation Systems, Text Mining, Mining Social-Network graphs, Fraud Detection, Click stream Mining, Time Series, Market Segmentation, retail industry, etc.		
	5.2	Data Privacy, data security and ethics in data science. Qualities of data scientist		
6	**Self Study**	Applications of data science using Neural Networks, Deep Learning and Big Data	**R1**	**04***
Total				**28**

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	To identify various tools and types of data
2	To perform the data exploration on a dataset
3	To Identify the data needed in terms of attributes, class inputs, training, validating, and testing files.
4	To perform data visualization
5	To perform supervised learning on a dataset
6	To perform unsupervised learning on a dataset
7	To perform density based clustering on a dataset
8	To perform association rule mining on a dataset
9	Mini Project Phase-I: To develop an application on a real life scenario
10	Mini Project Phase-II : To develop an application on a real life scenario

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Learning From Data	First Edition	Yaser S. Abu-Mostafa, Malik Magdon-Ismail, Husan-Tien Lin	AMLBook	2012
2	Doing Data Science	First Edition	First Cathy O'Neil, Rachel Schutt	O'Reilly	2013

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Python Data Science Handbook: Essential Tools for Working with Data	First Edition	Jake VanderPlas	O'Reilly	2016

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
SBC	Mini Project-II	0	0	0	8	8	0	0	0	3
		Examination Scheme								
IT308		Component	ISE		MSE		ESE		Total	
		Theory	--		--		--		--	
		Laboratory	200		--		100		300	

Pre-requisite Course Codes, if any.	
Course Objective: This course inculcates self-learning, research and entrepreneurship attitude in students. Students will be able to understand the formal project development process to complete a project in a team. It will help students to develop communication, organizational skills and maturity through discussion, presentation etc.	
Course Outcomes (CO): ***At the End of the course students will be able to***	
IT308.1	Conduct a survey of basic and contemporary literature in the preferred field by identifying problems based on societal /research needs.
IT308.2	Formulate the problem statement by making judgments on validity of ideas.
IT308.3	Conclude suitable inferences from obtained results through theoretical/experimental/simulations based analysis.
IT308.4	Develop interpersonal skills to work as member of a team.
IT308.5	Prepare a report of the findings for the study conducted in the preferred domain.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT308.1	2	2	-	-	-	2	1	3	3	3	-	2
IT308.2	2	3	2	2	-	-	1	3	3	3	-	2
IT308.3	2	2	2	2	2	-	-	3	3	3	-	2
IT308.4	-	-	-	-	-	-	-	3	3	3	3	2
IT308.5	2	2	-	-	-	-	-	3	3	3	2	2

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
IT308.1	2	2	2	2	2	2	2
IT308.2	2	2	2	2	3	2	2
IT308.3	2	2	2	2	3	2	2
IT308.4	2	2	2	2	2	2	2
IT308.5	2	2	2	2	2	2	2

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
					✓

Mini Project II is an opportunity to inculcate the research aptitude in students. It helps them to identify research gaps and come up with possible solutions. Students should be able to analyze these solutions for feasibility of their implementation. Mini project II is based on a small research project correlating scientific knowledge and day to day experience which encourages development of scientific attitude to solve real life problems among students.

Steps for Research:

✓ Keen observation of the surrounding/society

✓ Read existing Literature to understand and identify the research gaps

✓ Analysis of the problem

✓ Formulation of the problem statement

✓ Collection of relevant information by formulating research questions

✓ Suggesting plan of action

✓ Conducting experiments and draw conclusion

✓ To find the possible solution to rectify the problem

✓ To execute experiments and remedial measures wherever possible

Students can seek guidance from teachers, other experts and make effective use of other sources of information available around them. Students must ensure that problem to be manageable in one semester.

Criteria of a good project:

✓ Appropriate idea, clear understanding and proper presentation of the concept

✓ Quality of work

✓ Project plan and its execution

✓ Credibility of the work

✓ Probable impact of the work on the attitude of students and society

✓ Scientific attitude, creativity and novelty reflected in project work and analysis of the situation

✓ Utility and innovation of the remedial measures

✓ Desirability, Feasibility and Viability in real life

The H/W and S/W resources required to complete the Mini Project II may be beyond the scope of curriculum of courses taken or may be based on the courses but thrust should be on

- ✔ Learning additional skills
- ✔ Development of ability to define and design the problem and lead to its accomplishment with proper planning
- ✔ Learn the behavioral discipline by working in a team. Students should work in groups of three on the Mini Project-II.

Evaluation:

Project report should be submitted on A-4 size pages. Use both printing. Report must carry project title, student details, certificate and acknowledgements. Other sections of the report shall be decided by the department based on projects. But it must have introduction, necessity of project, objectives, hypothesis, plan, observations, and analysis of results, conclusion and references along with other sections related to technology.

The ISE and ESE evaluation will be carried out based on the rubrics framed by the Department. ISE marks will be based on the performance of the individual student in three phases of evaluation. The evaluation of the Phase I will be based on Title approval where the domain and scope of the project will be evaluated. Phase II will be on presentation of the selected approach, justification and Design and some part of implementation. Evaluation of Phase III is based on demonstration of complete implementation, testing, presentation and technical report.

The ESE marks will be based on demonstration in front of the expert appointed by the Department. In the ESE examination each individual student would be assessed for his/her contribution in selecting the originality of the problem statement, understanding and knowledge gained about the task completed through presentation/demonstration, work done, and preparing the technical report/poster/technical paper of the project in the standard format provided by the Department.

Bhartiya Vidya Bhavan's

Sardar Patel Institute of Technology

(Autonomous Institute Affiliated to University of Mumbai)

[Knowledge is Nectar]

Liberal, Pi-Model of Engineering Education @ SPIT

(Department of Information Technology)

Final Year Engineering

(Semester VII – VIII)

Sem VII									
No	Type	Code	Course	L	T	P	O	E	C
1	OE	OEXXX	Open Elective-II	2	0	2	4	08	3
2	OE	OEXXX	Open Elective--III*	2	0	2	4	08	3
3	PE	IT4X3	Program Elective-III	2	0	2	4	08	3
4	PE	IT4X4	Program Elective-IV	2	0	2	4	08	3
5	SBC	IT401	Main Project Stage-I	0	0	0	4	04	2
6	ABL	SVXX/STXX	SEVA-IV/SATVA-IV	0	0	0	4	04	2
7	S/M/H	SCX4/MNX4 /HOXX	SCOPE-IV/Minor-IV/Honors-I						3
		*OE-III must be from Basic Science Elective or Engineering Science Elective							
			TOTAL	**8**	**0**	**8**	**24**	**40**	**16**

Sem VIII (Option A: Cat1/Cat2)									
No	Type	Code	Course	L	T	P	O	E	C
1	OE*	OEHXX	Open Elective –IV	2	0	2	4	08	3
2	PE	IT4X5	Program Elective –V	2	0	2	4	08	3
3	PE	IT4X6	Program Elective –VI	2	0	2	4	08	3
4	SBC	IT402	Main Project Stage-II	0	0	0	12	12	7
5	ABL	SVXX/STXX	SEVA-IV/SATVA-IV	0	0	0	04	04	1
6	H	HOXX	Honors-II						3
	*must be from Humanities and Management group, May be taken from MOOCs								
			TOTAL	**6**	**0**	**6**	**28**	**40**	**17**

Sem VIII (Option B-Only for Cat 1 students)									
No	Type	Code	Course	L	T	P	O	E	C
1	SBC	IT403	Main Project Stage-II	0	0	0	36	36	16
2	ABL	SVXX/STXX	SEVA-IV/SATVA-IV	0	0	0	04	04	1
3	H	HOXX	Honors-II						3
			TOTAL	0	**0**	**0**	**40**	**40**	**17**

SEMESTER VII

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PE	Natural Language Processing	2	0	2	4	8	2	0	1	3
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
IT413		Theory		50		50		100		200
		Laboratory		50		--		50		100

Pre-requisite Course Codes, if any.	IT307B: Artificial Intelligence and Machine Learning
Course Objective: To understand the basic knowledge on various morphological, syntactic and semantic NLP tasks.	
Course Outcomes (CO): ***At the End of the course students will be able to***	
IT413.1	Apply the Natural language processing pipeline to solve a given problem
IT413.2	Identify use of Natural language Models
IT413.3	Analyze Parts-Of-Speech tagging, Parsing and Semantic Analysis models for a given scenario
IT413.4	Develop system to solve a Natural Language Processing problem

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT413.1	2	-	-	-	2	-	-	-	-	-	-	2
IT413.2	2	-	-	-	2	-	-	-	-	-	-	2
IT413.3	2	-	-	-	2	-	-	-	-	-	-	2
IT413.4	2	-	-	-	2	-	-	-	-	1	1	2

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
IT413.1	-	-	2	-	1	-	2
IT413.2	-	-	2	-	1	-	2
IT413.3	-	-	2	-	1	-	2
IT413.4	-	-	2	-	1	-	2

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
			✓		

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Introduction**	**1,2**	**06**
	1.1	Introduction: NLP tasks/pipeline, syntax, semantics, classical applications in NLP, Role of Machine Learning in Natural Language Processing.		
	1.2	Spelling error and Noisy Channel Model; Concepts of Parts-of-speech and Formal Grammar of English.		
2		**Language Modelling: N-gram and Neural Language Models**	**1,2**	**07**
	2.1	Language Modelling with N-gram, Simple N-gram models, Estimating parameters in Smoothing, Evaluating language models		
	2.2	Neural Networks and Neural Language Models		
3		**Parts-of-speech Tagging**	**1,2**	**07**
	3.1	Rule based Part of Speech Tagging, Transformation based Tagging (TBL)		
	3.2	POS tagging using HMM, POS Tagging using Neural Model		
4		**Parsing and Semantics**	**1,2**	**08**
	4.1	Basic concepts: Grammar Formalism, Treebank, Syntactic parsing: CKY parsing, Probabilistic Context Free Grammar (PCFG); Probabilistic CKY Parsing of PCFGs		
	4.2	Vector Semantics, Words and Vector, Measuring Similarity, Semantics with dense vectors, Embeddings from prediction: Skip-gram and CBOW		
5	**Self Study**	Applications: Sentiment Analysis, Text Summarization, chatbots, Language Translation; Word Sense, WordNet	**3,4**	**04***
Total				**28**

Laboratory Component (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	To perform Lexical Analysis on a given text data
2	To perform Syntax Analysis on a given text data
3	To perform n-gram model on a given text data
4	To perform N-grams smoothing on a given text data
5	To perform POS Tagging using HMM and neural model
6	To apply parsing techniques on the data
7	To perform Semantic Analysis on a given text data
8	To perform word embedding on a given text data
9	Capstone Project- Phase I: To develop an application on a real life scenario
10	Capstone Project-Phase II: To develop an application on a real life scenario

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Speech and Language Processing	Third Edition	Daniel Jurafsky, James H. Martin	Prentice Hall	2018
2	Foundations of Statistical Natural Language Processing	First Edition	Christopher D.Mannig and Hinrich Schutze,	MIT Press	1999

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Natural Language Processing and Information Retrieval	First Edition	Siddiqui and Tiwary U.S	Oxford University Press	2008
2	Natural Language Processing with TensorFlow	First Edition	Thushan Ganegedara	Pakt Publishing Ltd.	2018

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PE	Deep Learning	2	0	2	4	8	2	0	1	3
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
IT414		Theory	50		50		100			200
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	IT312: Soft Computing
Course Objective: To introduce the fundamental concepts of Deep learning with primary focus on the architectures and applications as appropriate to real world problems	
Course Outcomes (CO):*At the End of the course students will be able to*	
IT414.1	Interpret the mathematical foundations of Deep Learning architectures.
IT414.2	Construct deep neural networks for a given problem.
IT414.3	Analyze deep learning models for a given scenario.
IT414.4	Develop real-world applications using various deep learning techniques.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT414.1	2	2	2	-	3	-	-	-	-	-	-	1
IT414.2	3	2	3	-	3	-	-	-	-	-	-	1
IT414.3	3	2	3	2	3	-	-	-	-	-	-	1
IT414.4	3	3	3	2	3	-	-	-	3	3	2	2

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
IT414.1	1	2	2	-	-	-	2
IT414.2	1	2	2	-	-	-	2
IT414.3	1	2	2	-	-	-	2
IT414.4	2	2	2	-	3	-	3

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
					✓

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Title**	**Introduction to Deep Learning**	**T1,T2**	**4**
	1.1	Revision of Learning Algorithms Concepts: Capacity, Overfitting and Underfitting, Hyperparameters and Validation Sets, Estimators, Bias and Variance, Stochastic Gradient Descent,		
	1.2	Challenges Motivating Deep Learning		
2	**Title**	**Convolutional Neural Networks**	**T1,T2, T4,R2**	**6**
	2.1	The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior,		
	2.2	Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features		
3	**Title**	**Autoencoders**	**T1, T2,R1, R2**	**6**
	3.1	Architecture of Autoencoder, Undercomplete v/s Overcomplete Autoencoder, Regularized Autoencoders,		
	3.2	Representational Power, Layer Size and Depth, Applications of Autoencoders		
4	**Title**	**Sequence Modelling**	**T1,T2, T3,T4, R1,R2**	**6**
	4.1	Recurrent Neural Networks (RNN), Bidirectional RNNs		
	4.2	Encoder-Decoder sequence to sequence architecture		
	4.3	Deep Recurrent Network, Long short term memory (LSTM) and gated RNNs		
5	**Title**	**Generative Adversarial Networks**	**T3,R2**	**6**
	5.1	Introduction to GANs, The GAN Architecture: Discriminator, Generator,		
	5.2	Training the GAN, Applications of GAN		
6	**Self Study**	Applications of Deep Learning: Large-Scale Deep Learning, Computer Vision, Speech Recognition, Natural Language Processing, Other Applications	**T3, R1,R2**	**4***
Total				**28**

Laboratory Component:

** Lab experiments may be performed using any open-source, freely available deep learning frameworks.

Sr. No.	Title of the Experiment
1	To implement a deep feed-forward network for a given problem
2	To implement a CNN for image data.
3	To implement a CNN for textual data.
4	To implement autoencoders.
5	To implement RNN for a given problem.
6	To implement Encoder-Decoder Model for a given problem
7	To implement generative adversarial networks for a given problem
8-10 Capstone Project	Capstone project covering the concepts of Deep Learning on real world problem statements.

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Deep Learning	First Edition	Ian Goodfellow, Yoshua Bengio, Aaron Courvile	An MIT Press book	2016
2	Fundamentals of Deep Learning	First Edition	Nikhil Buduma	O'Reilly	2017
3	Generative Deep Learning	First Edition	David Foster	O'Reilly	2019
4	Deep Learning using Python	First Edition	Dr. S Lovelyn Rose, Dr. L Ashok Kumar, Dr. D Karthika Renuka	Wiley	2019

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Deep Learning: Methods and Applications	First Edition	Deng & Yu	Now Publishers	2013
2	Deep Learning CookBook	First Edition	Douwe Osinga	O'Reilly	2017

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PE	Security Operations Center	2	0	2	2	6	2	0	1	3
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
IT423		Theory	50		50		100			200
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	IT206: Operating systems IT207: Computer Communications and Networks
Course Objective: To analyze the security incidents, events and respond to it.	
Course Outcomes (CO): ***At the End of the course students will be able to***	
IT423.1	Explain the SOC processes, procedures, technologies, and workflows.
IT423.2	Identify the indicators of compromise by recognizing the attacker tools, tactics, and procedures.
IT423.3	Analyze the logs and alerts from various technologies.
IT423.4	Evaluate the use cases that are widely used across the SIEM deployment.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT423.1	3	-	-	-	-	-	-	-	-	-	-	-
IT423.2	-	3	3	3	3	-	-	-	-	-	-	-
IT423.3	-	-	-	2	3	-	-	2	-	-	-	-
IT423.4	-	-	-	-	-	2	2	-	-	-	-	3

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
IT423.1	2	-	-	-	-	-	-
IT423.2	-	-	-	-	-	-	2
IT423.3	-	-	2	2	-	-	2
IT423.4	-	-	-	2	-	-	-

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
				✓	

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**SOC basics**	T1, T2, R1	7
	1.1	Introduction to SOC, security challenges, Information assurance, risk management, security incident response, SOC generations. A modern SOC - SecOps and next-gen tech.		
	1.2	Elements of SOC-data collection and analysis, vulnerability management, threat intelligence, compliance.		
2	Title	**The plan phase**	T1	7
		SOC strategy – strategy element, SOC model operation, SOC services, SOC capabilities road map.		
3	Title	**The design phase**	T1	6
	3.1	The SOC infrastructure -design consideration, model of operation, facilities and active infrastructure.		
	3.2	Security event generation and collection -data collection, cloud security, intrusion detection and prevention system, honeypots, DNS server.		
4	Title	**The build and operate phase**	T1, R2	8
	4.1	The technology- network, security, system, storage, collaboration Breach detection, sandboxes.		
	4.3	Key challenges -people, process, technology. Reacting to events and incidents. maintain review and improve- reviewing and assessing the SOC, maintaining and improving SOC.		
5	Self-study	**User and Entity Behavioral Analytics, SIEM Analytics and Incident Response and Automation**		6*
Total				**28**

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	To do Vulnerability Scanner set-up by Configuring nessus and OpenVAS
2	Implementation of SOC using Prelude SIEM
3	Establishing baselines of files and directories with Kali Linux and Windows 7.
4	To implement event log collection and correlation
5	To conduct log analysis and cross examination for false positives
6	To generate log event reports
7	To prioritization and escalation of incidents by generating incident ticket
8	To implement containment of incidents
9	To implement eradication of incidents
10	To recover data from the incidents and Creating report of the incident

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Security Operations Center: Building, Operating, and Maintaining your SOC	First Edition	Joseph Muniz	Cisco Press	2015
2	Blue Team Handbook: A Condensed Field Guide for the Cyber Security Incident Responder: Incident Response Edition: A condensed field guide for the Cyber Security Incident Responder	First Edition	Don Murdoch	Lightning Source Inc	2014

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	The Modern Security Operations Center	First Edition	Joseph Muniz	Addison-Wesley Professional	2021
2	Security Operations Center - SIEM Use Cases and Cyber Threat Intelligence	First Edition	Arun E Thomas	Arun E Thomas	2018

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PE	Blockchain Technology	2	0	2	5	10	3	0	1	3
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
IT424		Theory	50		50		100			200
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	IT206:Operating systems IT207:Computer Communications and Networks
Course Objective: To understand and use the blockchain technology	
Course Outcomes (CO): *At the End of the course students will be able to*	
IT424.1	Explain the basic concepts of blockchain technology, Bitcoin and Ethereum.
IT424.2	Apply a smart contract on the Ethereum test network
IT424.3	Build a Decentralized Application running on a decentralized peer-to-peer network
IT424.4	Explain the General Data Protection Regulation for relevant blockchain application

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT424.1	2	-	-	-	-	-	-	-	-	-	-	2
IT424.2	-	2	-	-	2	2	1	-	-	-	-	2
IT424.3	-	-	3	2	3	2	1	-	-	-	-	2
IT424.4	-	-	-	-	-	2	1	2	-	-	-	2

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
IT424.1	-	-	-	-	-	-	-
IT424.2	2	2	2	2	-	2	2
IT424.3	2	2	2	2	-	2	2
IT424.4	2	-	-	2	-	2	-

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
					✓

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Introduction to Blockchain**	T1, T2, R1	6
	1.1	The consensus problem - Asynchronous Byzantine Agreement - AAP protocol and its analysis - Nakamoto Consensus on permission-less, nameless, peer-to-peer network - Abstract Models for BLOCKCHAIN - GARAY model - RLA Model		
	1.2	Proof of Work (PoW) as random oracle - formal treatment of consistency, liveness and fairness - Proof of Stake (PoS) based Chains - Hybrid models (PoW + PoS).		
2	Title	**Consensus**	T1, T2	8
	2.1	Bitcoin - Wallet - Blocks – Merkle Tree - hardness of mining - transaction verifiability - anonymity - forks - double spending - mathematical analysis of properties of Bitcoin.		
	2.2	Permissioned Blockchain: Basics, Distributed consensus, RAFT Consensus, Byzantine General Problem, Practical Byzantine Fault Tolerance.		
3	Title	**Hyperledger Fabric**	T1, T2	8
	3.1	Transaction Flow. Hyperledger Fabric Details, Fabric - Membership and Identity Management, Hyperledger Fabric Network Setup, Fabric Demo on IBM Blockchain Cloud.		
	3.2	Hyperledger Composer - Application Development. Hyperledger Composer - Network Administration, Ethereum - Ethereum Virtual Machine (EVM) - Wallets for Ethereum - Solidity - Smart Contracts - some attacks on smart contracts. Blockchain: Enterprise use cases.		
4	Title	**Data Protection and applications of blockchain**	T1, T2, T3, R2	6
	4.1	General Data Protection Regulation (GDPR) and its relevance for Indian businesses, Internal Policy on management and sharing data, GDPR compliance between multiple organizations. Liability and indemnity under GDPR, GDPR for Entrepreneurs.		
	4.2	Applications of blockchain - Uses of Blockchain in E-Governance, Land Registration, Medical Information Systems, and smart cities, smart industries, anomaly detections, FinTech, Shaping the Financial World, IoT.		
6	Self-study	Scaling the blockchain: payment channels and state channels Scaling the blockchain using optimism and using SNARK Privacy in public blockchain: deanonymizing the blockchain and mixing.	R1, R2	6*
Total				28

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	Implementation of symmetric key cryptosystems – I
2	Implementation of asymmetric key cryptosystems – I
3	To implement Merkle Tree and genesis block
4	Demonstration of Bootstrapping
5	Demonstration of Hyperledger Fabric
6	Demonstration of Hyperledger Fabric – Ethereum
7	Implementation of Bitcoin
8	To implement the application: Land Registration
9	To implement the application: Smart Contract
10	To implement the application: FinTech

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction	Illustrated	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder	Princeton University Press	2016
2	Blockchain: Blueprint for a New Economy	First Edition	Melanie Swa	O′Reilly	2015
3	Building-Blocks of a Data Protection Revolution: The Uneasy Case for Blockchain Technology to Secure Privacy and Identity	First Edition	Shraddha Kulhari	Nomos	2018

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	The Bitcoin Standard: The Decentralized Alternative to Central Banking	First Edition	Saifedean Ammous	Wiley	2018
2	Blockchain For Dummies	Second Edition	Tiana Laurence	Wiley	2019

Course(Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PE	Digital Image Processing	2	0	2	4	8	2	0	1	3
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
IT433		Theory	50		50		100			200
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	
Course Objective: To Evaluate the techniques for image processing to analyze Images.	
Course Outcomes (CO):*At the End of the course students will be able to*	
IT433.1	Evaluate the techniques for enhancing and segmenting Images.
IT433.2	Analyze images using various transforms.
IT433.3	Categorize various compression techniques and standards for Images and Videos.
IT433.4	Apply image processing algorithms in practical applications.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT433.1	3	2	2	-	2	-	-	-	-	-	-	-
IT433.2	3	2	-	-	2	-	-	-	-	-	-	-
IT433.3	3	2	2	-	2	-	-	-	-	-	-	-
IT433.4	2	1	-	-	1	-	-	-	2	2	-	-

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
IT433.1	2	-	-	-	-	-	-
IT433.2	2	-	-	-	-	-	-
IT433.3	2	-	-	-	-	-	-
IT433.4	2	2	-	1	2	-	1

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
			✓		

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Fundamentals of Image Processing**		03
	1.1	Structure of the Human Eye, Light, Brightness adaption and discrimination, Pixels, Coordinate conventions	T1	
	1.2	Imaging Geometry, Image acquisition, Sampling and Quantization, image resolution, basic relationship between pixels, color images, RGB, HSI models	T1	
2		**Image Enhancement and Segmentation**		07
	2.1	Point Processing, Histogram processing, Smoothing and Sharpening Filters.	T1	
	2.2	Detection of discontinuities, Edge linking and Boundary detection, Hough transform, Thresholding, Region oriented segmentation.	T1	
3		**Image Transform and Morphology**		06
	3.1	Discrete Fourier Transforms, Hadamard-Walsh Transform, Discrete Cosine Transform, Discrete Wavelet Transform.	T1	
	3.2	Image Morphology: Structuring Element, Erosion & Dilation, Opening & Closing, Region filling.	T1	
4	Title	**Video Processing**		05
	4.1	Digital Video Sampling, Video Frame classifications, Moving picture types, Macroblock, Motion Compensation.	R1	
	4.2	Motion Models, 2D Apparent-Motion Estimation, 3D Motion and Structure Estimation.	T2	
5	Title	**Image and Video Compression**		07
	5.1	Redundancies, Lossy and Lossless Compression	T1	
	5.2	RLE, Huffman Coding, Arithmetic Coding, LZW, JPEG, Predictive Coding	T1	
	5.3	H.261, MPEG	R1	
6	Self Study	Object Representation and Object Recognition, Image Restoration, Applications of Image Processing	T1	6*
Total				28

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	Image Enhancement using Point Processing Operations.
2	Smoothing and Sharpening of Images.
3	To enhance Image using Histogram equalization.
4	To segment Image using Image Segmentation.
5	To perform morphological operations on Image
6	To perform Region Filling in the Image
7	To implement transform on the Image.
8	To implement compression of the Image.
9	To detect object in the Video.
10	To Implement an application of Image Processing

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Digital Image Processing	Third Edition	Rafael C. Gonzalez and Richard E. Woods	Pearson Education	2010
2	Digital Video Processing	Second Edition	Murat Tekalp	Pearson Education	2010

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Multimedia Systems Design	--	Prabhat K Andleigh / Kiran Thakrar	Pearson	2015
2	Handbook on Image and Video Processing	--	A.I.Bovik	Academic Press	2009

Course(Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PE	Project Management	2	0	2	4	8	2	0	1	3
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
IT434		Theory	50		50		100			200
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	IT 302: Software Engineering
Course Objective: To study the fundamentals of Project Management	
Course Outcomes (CO):*At the End of the course students will be able to*	
IT434.1	Align the project to the organization's strategic plans and business justification throughout its lifecycle
IT434.2	Manage the scope, cost, timing, and quality of the project, at all times focused on project success as defined by project stakeholders
IT434.3	Identify Project constraints and justify resource utilization.
IT434.4	Adapt projects in response to issues that arise internally and externally
IT434.5	Analyze the failed projects

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT434.1	-	-	2	-	-	-	-	-	2	2	-	-
IT434.2	-	-	2	-	-	-	-	-	2	2	3	-
IT434.3	-	-	-	-	-	-	2	1	2	2	3	-
IT434.4	-	-	-	2		1	2	1	2	2	-	-
IT434.5	-	-	-	2	1	1	2	1	2	2	3	2

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
IT434.1	3	-	-	-	2	-	-
IT434.2	3	-	-	-	2	-	-
IT434.3	-	1	-	-	-	-	-
IT434.4	-	-	2	-	-	-	1
IT434.5	-	-	2	-	-	-	1

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
				✓	

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Introduction**		**04**
	1.1	Project Attributes, Project Characteristics, The Framework of Project Management	**T1,T2, T3**	
	1.2	The Project Life Cycle, Overview of Scrum Project Management		
2		**Project Initiation and Planning**		**08**
	2.1	Project Initiation, Project Charter	**T1,T2, T3**	
	2.2	Project Scope , Work Breakdown Structure, Project Schedule and Time Management, Project Costs , Make/buy/outsource decision		
3		**Software Project Status Monitoring**		**06**
	3.1	Network Scheduling technique, Earned Value Analysis, Schedule & Cost slippage, Critical chain project management , Goldratt's critical chain	**T1,T2, T3**	
	3.2	Resource Loading and Leveling, Techniques for Managing Resources		
4		**Change Management**		**06**
	4.1	Change management plan , Dealing with resistance and conflicts.	**T1,T2, T3**	
	4.2	Project Risk Management		
	4.3	Techniques for Quality management		
5		**Project Implementation & Closure**		**04**
	5.1	Project Implementation methods	**T1,T2, T3**	
	5.2	Administrative closure , Project evaluations		
	5.3	Project audit ,Post production review		
6	**Self Study**	**Case studies, Co- located and Distributed Projects, Project failures, Challenges and tools.**		**8**
Total				**28**

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	To design Business Case for given case study
2	Define Scope and WBS
3	To use decision making tools for Project make- buy decision
4	Project planning using MS Project or using similar tools
5	Project status reporting EVA
6	Risk assessment/ Quality Management Tools
7	Project communication Using JIRA
8	Software Contracts
9	Resource Loading and Leveling
10	Case study on conflict Management using Meyers Briggs Model

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Project Management For Engineering Business And Technology	2021 Edition	John M. Nicholas and Herman Steyn	Taylor and Francis	August 2020
2	Project Management	--	Adrienne Watt	Creative Commons-ShareAlike 4.0 International License	2015
3	Information Technology Project Management	Fourth Edition	Jack T. Marchewka	4th edition, Wiley India	2014

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Managing Information Technology Project	Fourth Edition	Kathy Schwalbe	Cengage Learning publication	September 2010
2	Effective Software Project Management	--	Robert K.Wysocki	Wiley Publication	September 2010
3	Project Management in Distributed Projects	--	Thomas Gollubits	VDM Verlag Dr. Mueller E.K	May 2008

SEMESTER VIII