College of Arts, Science & Commerce

SIES

R I S E   W I T H   E D U C A T I O N

Sion (West), Mumbai – 400022.

(Autonomous)

Faculty: Science

Program: M.Sc.

Subject: INFORMATION TECHNOLOGY

Academic Year: 2020 – 2021

PART 2

Credit Based Semester and Grading Syllabi approved by Board of Studies in Information Technology to be brought into effect from June 2020

Semester III

Course Code	Course Title	Credits
SIPSIT31	Advanced Database Management Systems	4
SIPSIT32	IT in Forensic Science	4
Elective I (Select any one)		
SIPSIT33(a)	Advanced Web Technologies	4
SIPSIT33(b)	Speech Recognition	4
Elective II (Select any one)		
SIPSIT34(a)	Natural Language Processing	4
SIPSIT34(b)	Virtual Reality and Virtual Environment	4
SIPSITP31	Advanced Database Management Systems Practical	2
SIPSITP32	IT in Forensic Science Practical	2
Elective -I (Select any one)		
SIPSITP33(a)	Advanced Web Technologies Practical	2
SIPSITP33(b)	Speech Recognition Practical	2
Elective - II (Select any one)		
SIPSITP34(a)	Natural Language Processing Practical	2
SIPSITP34(b)	Virtual Reality and Virtual Environment Practical	2
TOTAL CREDITS		**24**

Semester III

Advanced Database Management Systems

Learning Objective:
Students to be introduced to Objected Oriented Data Model, Web-DBMS integration technology and XML for Internet database applications.

Learning Outcome:
The students would gain practical knowledge about the working and use of OODBMS and Distributed Databases, Active database, Temporal database, Spatial databases and Deductive databases.

Theory Component:

M. Sc (Information Technology)	Semester – III – SIPSIT31
Course Name	**Advanced Database Management Systems**
Periods per week (1 Period is 60 minutes)	4
Credits	4

Unit	Contents	No. of Lectures
I	**The Extended Entity Relationship Model and Object Model:** The ER model revisited, Motivation for complex data types, User defined abstract data types and structured types, Subclasses, Super classes, Inheritance, Specialization and Generalization, Constraints and characteristics of specialization and Generalization, Relationship types of degree higher than two.	12
II	**Object-Oriented Databases:** Overview of Object-Oriented concepts, Object identity, Object structure, and type constructors, Encapsulation of operations, Methods, and Persistence, Type hierarchies and Inheritance, Type extents and queries, Complex objects; Database schema design for OODBMS; OQL, Persistent programming languages, OODBMS architecture and storage issues, Transactions and Concurrency control, Example of ODBMS **Object Relational and Extended Relational Databases:** Database design for an ORDBMS - Nested relations and collections, Storage and access methods, Query processing and Optimization, An overview of SQL3, Implementation issues for extended type, Systems comparison of RDBMS, OODBMS, ORDBMS	12
III	**Parallel and Distributed Databases and Client-Server Architecture:** Architectures for parallel databases, Parallel query evaluation, Parallelizing individual operations, Sorting, Joins, Distributed database concepts, Data	12

	fragmentation, Replication, and allocation techniques for distributed database design, Query processing in distributed databases, Concurrency control and Recovery in distributed databases. An overview of Client-Server architecture	
IV	**Databases on the Web and Semi Structured Data:** Web interfaces to the Web, Overview of XML, Structure of XML data, Document schema, Querying XML data, Storage of XML data, XML applications, The semi structured data model, Implementation issues, Indexes for text data	12
V	**Enhanced Data Models for Advanced Applications:** Active database Concepts. Temporal database Concepts, Deductive databases and Query processing, Mobile databases, Geographic information systems.	12

Books and References

Sr. No.	Title	Author/s	Publisher	Edition	Year
1	Fundamentals of Database Systems	Elmasri and Navathe,	Pearson Education	4th	2003
2	Database Management Systems	Raghu Ramakrishnan, Johannes Gehrke	McGraw-Hill	2nd	2002
3	Database System Concepts	Korth, Silberchatz, Sudarshan	McGraw-Hill	7th	2019
4	Database Systems, Design, Implementation and Management	Peter Rob and Coronel	Thomson Learning	9th	2010

Internal Evaluation: 40 Marks

20 Marks	20 Marks
Online Class Test	Analysis of Research Papers/Project Work/ Case Studies/ Subject related Course with' SWAYAM-NPTEL'

Practical Component:

M. Sc (Information Technology)	Semester – III - SIPSITP31
Course Name	**Advanced Database Management Systems Practical**
Periods per week (1 Period is 60 minutes)	4
Credits	2

List of Practical:

Implement any 10 Practical relevant to Advanced Database Management Concepts.

IT in Forensic Science

Learning Objective: To identify various types of evidence that may be collected at a crime scene including procedures for identification, collection, and analysis for the purpose of investigating and prosecuting crimes.

Learning Outcome: Students will be able to:-

- Understand the basic terminology of computer forensics, extract and handle digital data that will be processed tackle micro threats and various methods of information warfare.
- Understand, from a legal standpoint, the importance of properly securing a crime scene.
- Outline protocols used when a crime scene is being secured and evidence is being procured bylaw enforcement members.
- Classify the various types of evidence that may be obtained at a crime scene.
- Identify the importance of taking safety precautions at a crime scene.

Theory Component:

M.Sc (Information Technology)	Semester – III – SIPSIT32
Course Name	**IT in Forensic Science**
Periods per week (1 Period is 60 minutes)	4
Credits	4

Unit	Contents	No. of Lectures
I	**Digital Evidence:** Increasing awareness of digital evidence, challenging aspects of digital evidence, challenging aspects of cyber trail, forensic science and digital evidence, computer image verification and authentication, digital image watermarking and its application in forensic science, Various techniques for digital watermarking, Logical structures of the Microsoft operating system FAT file system, DOS and Windows boot process, How to recover deleted files, The significance and determination of the creation date and time. **Case Study:-** Computer Forensic Investigation	12
II	**Digital signature and cryptography**: Signature in paper based society, Transfer of computer based documents, digital signature and authentication, digital signature generation and verification, certification of public keys, certification of authority. **Passwords and encryption techniques**: Importance of keeping a log, Explanation of passwords keys and hashes.	12
III	**Seizure of computers**: Preparations to be made before seizure, Actions at the scene, Treatment of exhibits, bitstream (exact copies) of the original media, Establishing a case in computer forensics, Computer forensic analysis within the forensic tradition,	12

	Investigation: Investigating on various imaging methods. Lay down the image provided onto a hard disk and provide a disk map of the suspect drive. Extraction of all relevant information from a hard disk. Instruction on the acquisition, collection and seizure of magnetic media. How to best acquire, collect or seize the various operating systems.Legal and privacy issues, Forensic examination procedures, Preparing and verifying forensically sterile storage media. **Case Study:-** Corporate Investigators	
IV	**Cyberspace**: Concept of Cyberspace, Emergence of Cyberspace, Nature & Meaning of Cyberspace, Attributes of Cyberspace, Classification of Cyberspace, Legal Framework for Cyberspace. **Research Directions and Future Developments**: Introduction, Forensic data mining, finding useful patterns in evidence, Text categorization, Authorship attribution: identifying e-mail authors, Association rule mining, application to investigative profiling, Evidence extraction, link analysis, and link discovery, Evidence extraction and link analysis, Link discovery Stego forensic analysis Image mining, Cryptography and cryptanalysis, The future society and technology. **Case Study:-** Banking Industry	12
V	**Cyber crimes and related offences and penalties:** Introduction to Cybercrimes, Classification of cybercrimes, Distinction between cyber crime and conventional crimes, Reasons for commission of cyber crime, Kinds of cyber crimes – cyber stalking; cyber pornography; forgery and fraud; crime related to IPRs; Cyber terrorism; Spamming, Phishing, Privacy and National Security in Cyberspace, Cyber Defamation and hate speech, computer vandalism etc.	12

Books and References

Sr. No.	Title	Author/s	Publisher	Edition	Year
1	Computer Forensics	Nathan Clarke		Fifth edition	2010
2	Computer forensics and Digital Investigation.with EnCase Forensic	Suzanne Widup	Tata McGraw Hill	First Edition	2014
3	Computer Forensics and Cyber Crime:An Introduction	Marjie. T Britz	Pearson	Fourth Edition	2020

Internal Evaluation: 40 Marks

20 Marks	20 Marks
Online Class Test	Analysis of Research Papers/Project Work/ Case Studies/ Subject related Course with' SWAYAM-NPTEL'

Practical Component:

M. Sc (Information Technology)	Semester – III – SIPSITP32
Course Name	**IT in Forensic Science Practical**
Periods per week (1 Period is 60 minutes)	**4**
Credits	**2**

List of Practical: (Implemented using various forensic tools)

1	Analyze hard drives or smart phones using forensic tools
2	Capture the physical memory of a computer and analyze artifacts in memory.
3	Detect OS, hostname, sessions and open ports through packet sniffing.
4	Acquire web pages for forensic investigation.
5	Calculate the MD5 and SHA1 hashes.
6	View the USB drives content without leaving the fingerprint, changes to metadata and timestamps
7	Use tools to read, write and edit meta information for a number of file types.
8	Use tools to collect, preserve and reveal *digital* evidence without compromising systems and data.
9	Use tools that scans a hard drive, locate deleted emails and scan a disk.

Advanced Web Technologies

Learning Objective:
- To orient the students on advanced technologies like angular JS, React Native and cross-platform documen oriented database program like MongoDB
- To understand the design of single-page applications and how AngularJS facilitates their development.
- Enable the learners to create Native Apps using React

Learning Outcome: The learner will be able to:-
- Properly separate the model, view, and controller layers of your application and implement them using AngularJS, along with its expressions and filters
- Learn MongoDB design goals
- Setup MongoDB environment and List MongoDB tools
- Create cross-platform iOS and Android apps
- Apply the most useful React Native components

Theory Component:

M.Sc (Information Technology)	Semester – III – SIPSIT33(a)
Course Name	**Advanced Web Technologies**
Periods per week (1 Period is 60 minutes)	**4**
Credits	**4**

Unit	Contents	No. of Lectures
I	**Introduction to Angular JS:** JavaScript Client-Side Frameworks, Single-Page Applications, Bootstrapping the Application, Dependency Injection, AngularJS Routes, AngularJS Templates, AngularJS Views (MVC), AngularJS Models (MVC), AngularJS Controllers (MVC) The IDE and AngularJS, MVC and AngularJS	12
II	**AngularJS Controllers:** Initializing the Model with Controllers, Adding Behavior with Controllers, **AngularJS Views and Bootstrap**- Creating the Blog Project, Adding a New Blog Controller **AngularJS Models-**Changes to the Controllers, Model Properties, Blog Application Public Services **AngularJS Directives**-Building Custom Directives, Naming Conventions for Directives, Template Attributes	12
III	**The MongoDB Data Model:** The Data Model, JSON and BSON, The Identifier (_id), Capped Collection, Polymorphic Schemas, Object-Oriented Programming, Schema Evolution	12

	Using MongoDB Shell: Basic Querying, Create and Insert, Explicitly Creating Collections, Inserting Documents Using Loop, Inserting by Explicitly Specifying _id, Update, Delete, Read, Using Indexes, Stepping Beyond the Basics, Using Conditional Operators, Regular Expressions, MapReduce, aggregate(), Designing an Application's Data Model, Relational Data Modeling and Normalization, MongoDB Document Data Model Approach **MongoDB Architecture:** Core Processes, mongod, mongo, mongos, MongoDB Tools, Standalone Deployment, Replication, Master/Slave Replication, Replica Set, Implementing Advanced Clustering with Replica Sets, Sharding, Sharding Components, Data Distribution Process, Data Balancing Process, Operations, Implementing Sharding, Controlling Collection Distribution (Tag-Based Sharding), Points to Remember When Importing Data in a ShardedEnvironment, Monitoring for Sharding, Monitoring the ConfigServers, Production Cluster Architecture, Scenario 1, Scenario 2, Scenario 3, Scenario 4	
IV	**MongoDB Storage Engine:** Data Storage Engine, Data File (Relevant for MMAPv1), Namespace (.ns File), Data File (Relevant for WiredTiger), Reads and Writes, How Data Is Written Using Journaling, GridFS – The MongoDB File System, The Rationale of GridFS, GridFSunder the Hood, Using GridFS, Indexing, Types of Indexes, Behaviors and Limitations **MongoDB Use Cases:** Use Case 1 -Performance Monitoring, Schema Design, Operations, Sharding, Managing the Data, Use Case 2 – Social Networking, Schema Design, Operations, Sharding **JSON:** Introduction, JSON Grammar, JSON Values, JSON Tokens, Syntax, JSON vs XML, Data Types, Objects, Arrays, Creating JSON, JSON Object, Parsing JSON, Persisting JSON, Data Interchange	**12**
V	**React Native:** Why React?, Rendering with JSX, Understanding Properties and State, Event Handling, The React Component Lifecycle, Validating Component Properties, Handling Navigation with Routes, Server Side React Components, Why React Native?, Navigating between screens, Collecting user input, Alerts ,Notifications	**12**

Books and References

Sr. No.	Title	Author/s	Publisher	Edition	Year
1	Angular JS	Brad Green & Shyam Seshadri	O'Reilly	First	2013
2	Mongo DB – The definitive Guide	Kristina Chodorow	O'Reilly	Second	2013
3	Practical MongoDB	Shakuntala Gupta Edward Navin Sabharwal	Apress		
4	Next Generation Databases	Guy Harrison	Apress		

5	React and React Native	Adam Boduch	Packt Publishing	First	2017
6	Beginning JSON	Ben Smith	Apress		

Internal Evaluation: 40 Marks

20 Marks	20 Marks
Class Test	Analysis of Research Papers/Project Work/ Case Studies/ Subject related Course with' SWAYAM-NPTEL'

Practical Component:

M. Sc (Information Technology)	**Semester – III – SIPSITP33(a)**
Course Name	**Advanced Web Technologies Practical**
Periods per week (1 Period is 60 minutes)	**4**
Credits	**2**

List of Practical:

Implement any 10 Practical relevant to Angular JS, Mongo DB and React Native.

Speech Recognition

Learning Objective: To acquaint the students with the concepts in speech and audio processing, and their applications in communication systems.

Learning Outcome: To familiarize the learners with modeling the vocal tract as a digital, linear time-invariant system and convey details of a range of commonly used speech feature extraction techniques.

Theory Component:

M. Sc (Information Technology)	Semester – III – SIPSIT33(b)
Course Name	**Speech Recognition**
Periods per week (1 Period is 60 minutes)	**4**
Credits	**4**

Unit	Contents	No. of Lectures
I	Digital speech processing and its applications, production and classification of speech sounds, lossless tube models, digital models for speech signals; Analysis and synthesis of pole-zero speech models, Levinson recursion, lattice synthesis filter.	12
II	Time dependent processing of speech, pitch period estimation, frequency domain pitch estimation; Discrete-time short-time Fourier transform and its application, phase vocoder, channel vocoder.	12
III	Homomorphic speech processing, waveform coders, hybrid coders and vector quantization of speech; Model based coding: Linear predictive, RELP, MELP, CELP; Speech synthesis.	12
IV	Principles of speech recognition, spectral distance measures, dynamic time warping, word recognition using phoneme units, hidden Markov models and word recognition, speech recognition systems, speaker recognition.	12
V	Ear physiology, psychoacoustics, perception model and auditory system as filter bank; Filter bank design and modified discrete cosine transform algorithm for audio compression in MP3 and AAC coders; Standards for high-fidelity audio coding.	12

Books and References

Sr. No.	Title	Author/s	Publisher	Edition	Year
1	Digital Processing of Speech Signals	Rabiner, L.R. and Schafer, R.W.	Pearson Education	--	2006
2	Discrete-Time Speech Signal Processing: Principles and Practice	Quatieri, T.F.	Pearson Education.	--	2002
3	Digital Speech Processing, Synthesis and Recognition	Furui, S.	CRC Press	2nd	2000
4	Multi Rate Digital Signal Processing	Fliege, N.J.	John Wiley & Sons.	--	1999
5	Audio Signal Processing and Coding	Spanias, A., Painter, T. and Venkatraman, A.	John Wiley & Sons	--	2007
6	Speech and Audio Signal Processing	Gold, B. and Morgan, N.	John Wiley & Sons	--	2002

Internal Evaluation: 40 Marks

20 Marks	20 Marks
Online Class Test	Analysis of Research Papers/Project Work/ Case Studies/ Subject related Course with' SWAYAM-NPTEL'

Practical Component:

M. Sc (Information Technology)	Semester – III – SIPSITP33(b)
Course Name	Speech Recognition Practical
Periods per week (1 Period is 60 minutes)	4
Credits	2

List of Practical:

1	Introduction to MATLAB
2	Spectral Analysis
3	Time Frequency Analysis
4	Pitch Extraction
5	Formant Tracking
6	Speech Enhancement
7	Front-End Processing
8	Speech Recognition

Natural Language Processing

Learning Objective:

This course introduces students to Natural Language processing the field that has various language technologies from predictive text and email filtering to automatic summarization and translation.

Learning Outcome:

Making Python programs work on unstructured text, the students gain knowledge of algorithms used for analyzing the content and structure of written communication.

Theory Component:

M. Sc (Information Technology)	Semester – III – SIPSIT34(a)
Course Name	**Natural Language Processing**
Periods per week (1 Period is 60 minutes)	**4**
Credits	**4**

Unit	Contents	No. of Lectures
I	**Language Processing and Python:** Computing with Language: Texts and Words, A Closer Look at Python: Texts as Lists of Words, Computing with Language: Simple Statistics, Back to Python: Making Decisions and Taking Control, Automatic Natural Language Understanding **Accessing Text Corpora and Lexical Resources:** Accessing Text Corpora, Conditional Frequency Distributions, More Python: Reusing Code, Lexical Resources, WordNet	**12**
II	**Processing Raw Text:** Accessing Text from the Web and from Disk, Strings: Text Processing at the Lowest Level, Text Processing with Unicode, Regular Expressions for Detecting Word Patterns, Useful Applications of Regular Expressions, Normalizing Text, Regular Expressions for Tokenizing Text, Segmentation, Formatting: From Lists to Strings **Writing Structured Programs:** Back to the Basics, Sequences, Questions of Style, Functions: The Foundation of Structured Programming, Doing More with Functions, Program Development Algorithm Design	**12**
III	**Categorizing and Tagging words:** Using a Trigger, Tagged Corpora, Mapping words to properties using Python Dictionaries,Tagging, How to determine category of a word **Learning to classify text:** Supervised Classification,Evaluation, Decision Trees, Naïve Bayes Classifier, Maximum Entropy Classifiers,Modeling Linguistic Patterns	**12**
IV	**Extracting Information from Text:**.Information Extraction, Chunking, Developing and Evaluating Chunkers, Recursion in Linguistic Structure, Named Entity Recognition, Relation Extraction	**12**

	Analyzing Sentence Structure: Some Grammatical Dilemmas, What's the Use of Syntax?, Context-Free Grammar, Parsing with Context-Free Grammar, Dependencies and Dependency Grammar, Grammar Development	
V	**Building Feature-Based Grammars:** Grammatical Features, Processing Feature Structures, Extending a Feature-Based Grammar **Analyzing the Meaning of Sentences:** Natural Language Understanding, Propositional Logic, First-Order Logic, The Semantics of English Sentences, Discourse Semantics **Managing Linguistic Data:** Corpus Structure: A Case Study, The Life Cycle of a Corpus, Acquiring Data, Working with XML, Working with Toolbox Data, Describing Language Resources Using OLAC Metadata	**12**

Books and References

Sr. No.	Title	Author/s	Publisher	Edition	Year
1	Natural Language Processing with Python	Steven Bird, Ewan Klein and Edward Loper	OReilly Media	1st Edition	2009
2	Speech and Language Processing	Daniel Jurafsky and James H Martin		3rd Edition	2019

Internal Evaluation: 40 Marks

20 Marks	**20 Marks**
Online Class Test	Analysis of Research Papers/Project Work/ Case Studies/ Subject related Course with' SWAYAM-NPTEL'

Practical Component:

M. Sc (Information Technology)	**Semester – III -- SIPSITP34(a)**
Course Name	**Natural Language Processing Practical**
Periods per week (1 Period is 60 minutes)	**4**
Credits	**2**

List of Practical:

Implement any 10 Practical relevant to NLP

Virtual Reality and Virtual Environment

Learning Objective:
- To make students know the basic concept and framework of virtual reality.
- To teach students the principles and multidisciplinary features of virtual reality.

Learning Outcome:
- Identify, examine, and develop software that reflects fundamental techniques for the design and deployment of VR experiences.
- Choose, develop, explain, and defend the use of particular designs for VR experiences.

Theory Component:

M. Sc (Information Technology)	Semester – III – SIPSIT34(b)
Course Name	**Virtual Reality and Virtual Environment**
Periods per week (1 Period is 60 minutes)	4
Credits	4

Unit	Contents	No. of Lectures
I	**Introduction:** The historical development of VR: Scientific landmarks Computer Graphics, Real-time computer graphics, Flight simulation, Virtual environments, Requirements for VR, benefits of Virtual reality.	**12**
II	**3D Computer Graphics:** The virtual world space, positioning the virtual observer, projections, Human vision, Stereo perspective projection, 3D clipping, Color Models, 3D modelling, illumination models, shading algorithms, radiosity, hidden surface removal, realism, stereographic images	**12**
III	**Virtual Reality Hardware & Software:** Sensor hardware, Head-coupled displays, Acoustic hardware, Integrated VR Systems, Modelling Virtual worlds, Physical simulation, VR tool kits**.** **Geometric modelling & transformation:** From 2D to 3D, 3D space curves, 3D boundary representation, Frames of reference, Modelling transformations, instances, picking flying, Scaling the VE, Collision detection	**12**
IV	**A generic VR Systems and Animation:** The virtual Environment, The computer environment, VR Technology, Modes of Interaction, VR systems, Dynamics of numbers, the animation of objects, shape and object inbetweening, free-form deformation, particle systems	**12**

V	**Physical Simulation, Human Factor & Applications:** Objects falling in a gravitational field, rotating wheels, Elastic collisions, Projectiles, simple pendulums, springs, flight dynamics of an aircraft, The eye, The ear, the somatic senses, Equilibrium, Engineering, Entertainment, science, Education, training Future Virtual Environment, Modes of Interaction	**12**

Books and References

Sr. No.	Title	Author/s	Publisher	Edition	Year
1	Virtual Reality Systems	John Vince	Pearson Education Asia		
2	"Developing Virtual Reality Applications: Foundations of Effective Design"	Alan B Craig, William R Sherman and Jeffrey D Will,			
3	"Designing Virtual Systems: The Structured Approach",	Gerard Jounghyun Kim,			
4	Virtual Reality Technology	Burdea, G. C. and P. Coffet.	Wiley	2nd	

Internal Evaluation: 40 Marks

20 Marks	20 Marks
Online Class Test	Analysis of Research Papers/Project Work/ Case Studies/ Subject related Course with' SWAYAM-NPTEL'

Practical Component:

M. Sc (Information Technology)	**Semester – III - SIPSITP34(b)**
Course Name	**Virtual Reality and Virtual Environment Practical**
Periods per week (1 Period is 60 minutes)	**4**
Credits	**2**

List of Practical:

Implement any 10 Practical relevant to Virtual Reality

Semester IV

Course Code	Course Title	Credits
SIPSIT41	Cloud Security	4
SIPSIT42	Blockchain Technology	4
Elective 1 (Select any one)		
SIPSIT43(a)	Machine Learning	4
SIPSIT43(b)	Intelligent Computing	4
Elective 2 (Select any one)		
SIPSIT44(a)	Ethical Hacking	4
SIPSIT44(b)	Web and Social Network Data Analytics	4
SIPSIT45	Project Report	2
Elective 1 (Select any one)		
SIPSITP43(a)	Machine Learning Practical	2
SIPSITP43(b)	Intelligent Computing Practical	2
Elective 2 (Select any one)		
SIPSITP44(a)	Ethical Hacking Practical	2
SIPSITP44(b)	Web and Social Network Data Analytics Practical	2
SIPSITP45	Project Implementation	2
	TOTAL CREDITS	24

Semester IV

Cloud Security

Learning Objective:
- To understand underlying principles of infrastructure security.
- To explore software vulnerabilities, attacks and protection mechanisms.
- To learn security aspects of wireless network infrastructure and protocols.
- To develop policies for security management and mitigate security related risks in the organization.

Learning Outcome:

The learner will be able to :-

1) Explain various security solutions for Web and Cloud infrastructure.

2) Understand and evaluate different attacks on Open Web Applications and Web services.

Theory Component:

M.Sc (Information Technology)	Semester – IV - SIPSIT41
Course Name	Cloud Security
Periods per week (1 Period is 60 minutes)	4
Credits	4

Unit	Contents	No. of Lectures
I	Introduction to Cloud Computing • Delivery models: Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS) • Cloud types (public, private, hybrid) • Explaining the Jericho Cloud Cube Model Security Challenges in the Cloud • Introduction to the topic: Why is this hard? • Virtualization and multi-tenancy • Risk assessment for cloud migration • Unique SaaS challenges and Cloud Access Security Brokers (CASBs) **Case Study:-** Implementation of Paas/Iaas	**12**

II	Policy and Governance for Cloud Computing
	   • Internal policy needs
	   • Contract requirements for security
	   • Service-level agreements
	   • Governance models for the cloud
	Compliance and Legal Considerations
	   • Compliance challenges for the cloud
	   • Legal and geographic jurisdiction
	   • Privacy concerns
		12

III	Risk, Audit, and Assessment for the Cloud: Provider Focus
	   • Risk management
	   • Auditing the cloud
	   • Remote
	   • Onsite
	   • Cloud Audit A6
	Infrastructure Security in the Cloud
	   • Patch and configuration management
	   • Change management
	   • Network and virtualization security
	   • Application security for SaaS, PaaS, and IaaS
	Case Study:- VMware VCloud , 5nine security
		12

IV	Network level security, Host level security, Application level security
	Disaster Recovery and Business Continuity Planning in the Cloud
	Identity and Access Management (IAM)
	   • IAM architecture and relevance to the cloud
	   • Authentication and authorization standards
	   • Account management and provisioning
	   • Federation
	Access Control,Trust, Reputation,Authentication in cloud computing
	Data Security in the Cloud
	   • Encryption types and availability
	   • Key management and encryption architectures
	   • Data/information lifecycle
	   • Retention
	   • Disposal
	   • Classification
	Case Study:- Cain & Abel, Ettercap
		12

V	Intrusion Detection and Incident Response
	   • Incident detection for different cloud models
	   • Managing Intrusion Detection System/Intrusion Prevention System (IDS/IPS) and alerting
	   • The event management feedback loop
	Risk, Audit, and Assessment for the Cloud
		12

	• Risk management	
	• Assessments for the cloud	
	• Penetration testing the cloud	
	• Internal assessments	

Books and References

Sr. No.	Title	Author/s	Publisher	Edition	Year
1	Securing the Cloud Cloud Computer Security Techniques and Tactics	Vic (J.R.) Winkler	-	-	2014
2	Privacy and security for cloud computing	Springer	-	-	2014

Internal Evaluation: 40 Marks

20 Marks	20 Marks
Online Class Test	Analysis of Research Papers/Project Work/ Case Studies/ Subject related Course with' SWAYAM-NPTEL'

Blockchain Technology

Learning Objective:
1. The course will familiarize the functional/operational aspects of cryptocurrency ecosystem.
2. It will help the students understand emerging abstract models for Blockchain Technology.
3. It will enable the students to identify major research challenges and technical gaps existing between theory and practice in cryptocurrency domain.

Learning Outcome:

Students should be able to:
- Understand the structure of a blockchain and why/when it is better than a simple distributed database.
- Analyze the incentive structure in a blockchain based system and critically assess its functions,benefits and vulnerabilities.
- Attain awareness of the new challenges that exist in monetizing businesses around blockchains and smart contracts.

Theory Component:

M.Sc (Information Technology)	Semester – IV– SIPSIT42
Course Name	Blockchain Technology
Periods per week (1 Period is 60 minutes)	4
Credits	4

Unit	Contents	No. of Lectures
I	Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof. **Case Study:-** Turing Complete	12
II	Introduction to Blockchain: Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.	12
III	Consensus:	12

	Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate. **Case Study:-** Implementation of Proof of Work	
IV	Cryptocurrency: History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin **Case Study:-** Distributed Ledger	12
V	Blockchain in Government and Blockchain Security. Research Aspects in Blockchain. Security and Research Aspects.	12

Books and References

Sr. No.	Title	Author/s	Publisher	Edition	Year
1	Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder	Princeton University Press	--	2016
2	The Science of the Blockchain	Wattenhofer	--	--	2016
3	Mastering Bitcoin: Unlocking Digital Cryptocurrencies	Antonopoulos	--	1st Edition	2015

Internal Evaluation: 40 Marks

20 Marks	20 Marks
Online Class Test	Analysis of Research Papers/Project Work/ Case Studies/ Subject related Course with' SWAYAM-NPTEL'

Machine Learning

Learning Objective:
- To introduce several fundamental concepts and methods for machine learning.
- To familiarize the students with some basic learning algorithms and techniques and their applications, as well as general questions related to analyzing and handling large data sets.

Learning Outcome:

The student will be able to:-
- Understand the implementation procedures for the machine learning algorithms.
- Design Java/Python programs for various Learning algorithms and apply appropriate data sets to the Machine Learning algorithms.
- Identify and apply Machine Learning algorithms to solve real world problems.

Theory Component:

M.Sc (Information Technology)	Semester – IV – SIPSIT43(a)
Course Name	**Machine Learning**
Periods per week (1 Period is 60 minutes)	**4**
Credits	**4**

Unit	Contents	No. of Lectures
I	**Introduction to Machine Learning**: What is machine learning?, Types of learning, Applications of Machine Learning algorithms. **Supervised Learning:** Learning a Class from Examples, Vapnik-Chervonenkis (VC) Dimension, Probably Approximately Correct (PAC) Learning, Noise, Learning Multiple Classes, Regression, Model Selection and Generalization, Dimensions of a Supervised Machine Learning Algorithm	**12**
II	**Bayesian Decision Theory:** Classification, Losses and Risks, Discriminant Functions, Utility Theory, Association Rules **Parametric Methods:** Maximum Likelihood Estimation, Evaluating an Estimator: Bias and Variance, The Bayes' Estimator, Parametric Classification, Regression **Multivariate Methods:** Multivariate Data, Parameter Estimation, Estimation of Missing Values, Multivariate Normal Distribution, Multivariate Classification	**12**

III	**Dimensionality Reduction:** Subset Selection, Principal Components Analysis, Factor Analysis, Multidimensional Scaling, Linear Discriminant Analysis, Isomap **Clustering:** Mixture Densities, k-Means Clustering, Expectation-Maximization Algorithm, Hierarchical Clustering **Non-Parametric Methods**: Nonparametric Density Estimation, Generalization to Multivariate Data, Nonparametric Classification, Condensed Nearest Neighbor **Case Study**:- Machine Learning at Google, Banking Sector, Healthcare sector.	**12**
IV	**Decision Trees:** Univariate Trees, Pruning, Rule Extraction from Trees, Learning Rules from Data, Multivariate Trees **Linear Discrimination:** Generalizing the Linear Model, Geometry of the Linear Discriminant, Pairwise Separation, Parametric Discrimination, Logistic Discrimination. **Bayesian Estimation:** Estimating the Parameter of a Distribution, Bayesian Estimation of the Parameters of a Function, Gaussian Processes **Case Study**:- Machine Learning for car manufacturing sector, NASA	**12**
V	**Hidden Markov Models**: Discrete Markov Processes, Three Basic Problems of HMMs, Evaluation Problem, Finding the State Sequence, Learning Model Parameters **Graphical Models:** Example of Graphical Models, d-Separation, Belief Propagation, Undirected Graphs, Learning the Structure of a Graphical Model **Reinforcement Learning:** Elements of Reinforcement Learning ,Model-Based Learning ,Temporal Difference Learning, Generalization, Partially Observable States **Case Study**:- Machine Learning at Walmart,Netflix	**12**

Books and References

Sr. No.	Title	Author/s	Publisher	Edition	Year
1	Introduction to Machine Learning	Ethem Alpaydın	The MIT Press Cambridge	Second Edition	2010
2	UNDERSTANDING MACHINE LEARNING : From Theory to Algorithms	Shai Shalev-Shwartz, Shai Ben-David	Cambridge University Press	First Edition	2014
3	Machine Learning	Rudolph Russell			2018
4	Machine Learning: Algorithms and Applications	Mohssen Mohammed, Badruddin Khan, Eihab Bashier	CRC Press		2017

Internal Evaluation: 40 Marks

20 Marks	20 Marks
Online Class Test	Analysis of Research Papers/Project Work/ Case Studies/ Subject related Course with' SWAYAM-NPTEL'

Practical Component:

M. Sc (Information Technology)	Semester – IV – SIPSITP43(a)
Course Name	**Machine Learning Practical**
Periods per week (1 Period is 60 minutes)	**4**
Credits	**2**

List of Practical:

Implement the following in Java/python using pre-defined data sets.

1	Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples.
2	Implement and demonstrate the Candidate-Elimination algorithm
3	Write a program to demonstrate the working of the decision tree based ID3 algorithm.
4	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
5	Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task.
6	Write a program to construct a Bayesian network considering medical data.
7	Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm.
8	Write a program to implement k-Nearest Neighbour algorithm.

Intelligent Computing

Learning Objective: Introduce major deep learning algorithms, the problem settings, and their applications to solve real world problems.

Learning Outcome: Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains. Implement deep learning algorithms and solve real-world problems.

Theory Component:

M.Sc (Information Technology)	Semester – IV – SIPSIT43(b)
Course Name	Intelligent Computing
Periods per week (1 Period is 60 minutes)	4
Credits	4

Unit	Contents	No. of Lectures
I	**Introduction:** Various paradigms of earning problems, Perspectives and Issues in deep learning framework, review of fundamental learning techniques. **Feedforward neural network:** Artificial Neural Network, activation function, multi-layer neural network.	12
II	**Training Neural Network:** Risk minimization, loss function, backpropagation, regularization, model selection, and optimization.	12
III	**Conditional Random Fields:** Linear chain, partition function, Markov network, Belief propagation, Training CRFs, Hidden Markov Model, Entropy.	12
IV	**Deep Learning:** Deep Feed Forward network, regularizations, training deep models, dropouts, Convolutional Neural Network, Recurrent Neural Network, Deep Belief Network.	12
V	**Probabilistic Neural Network:** Hopfield Net, Boltzman machine, RBMs, Sigmoid net, Autoencoders. **Deep Learning research:** Object recognition, sparse coding, computer vision, natural language processing.	12

Books and References

Sr. No.	Title	Author/s	Publisher	Edition	Year
1	Deep Learning	Goodfellow, I., Bengio,Y and Courville, A.	MIT Press	--	2016.
2	Pattern Recognition and Machine Learning	Bishop, C. ,M.	Springer	--	2006.
3	Artificial Neural Networks	Yegnanarayana, B.	PHI Learning Pvt. Ltd	--	2009
4	Matrix Computations	Golub, G.,H. and Van Loan,C.,F.	JHU Press	--	2013
5	Neural Networks: A Classroom Approach.	Satish Kumar	Tata McGraw-Hill Education,	--	2004
6	PRACTICAL OPTIMIZATION Algorithms and Engineering Applications.	A. Antoniou, W. S. Lu	Springer	--	2007

Internal Evaluation: 40 Marks

20 Marks	20 Marks
Online Class Test	Analysis of Research Papers/Project Work/ Case Studies/ Subject related Course with' SWAYAM-NPTEL'

Practical Component:

M. Sc (Information Technology)	Semester – IV – SIPSITP43(b)
Course Name	**Intelligent Computing Practical**
Periods per week (1 Period is 60 minutes)	**4**
Credits	**2**

List of Practical:

1	Deep Learning for computer vision with MATLAB and cuDNN –Object Detection and Recognition using a pretrained CNN Classifier (Refer:- https://devblogs.nvidia.com/deep-learning-for-computer-vision-with-matlab-and-cudnn/)
2	Deep Learning for computer vision with MATLAB and cuDNN –Training the classifiers in Object Detection and Recognition
3	Deep Learning for computer vision with MATLAB and cuDNN –Feature extraction using CNN in Object Detection and Recognition
4	Deep Learning for computer vision with MATLAB and cuDNN – Training a classifier using CNN Features
5	Training a classifier using Transfer Learning (Use Python caffe) (Refer:- http://adilmoujahid.com/posts/2016/06/introduction-deep-learning-python-caffe/) (http://christopher5106.github.io/deep/learning/2015/09/04/Deep-learning-tutorial-on-Caffe-Technology.html)
6	Create the Neural network layers and set up parameters (weights, biases). Calculate the predicted output and measure error.(Forward Propagation)(Use PyTorch)
7	Perform Back propagation on errors(Use PyTorch)
8	Perform iterative optimization(Use PyTorch) (Refer:- https://towardsdatascience.com/pytorch-for-deep-learning-a-quick-guide-for-starters-5b60d2dbb564)

Ethical Hacking

Learning Objective: To introduce the concepts of Ethical Hacking and to learn about different tools and techniques in Ethical hacking and security and practically apply some of the tools.

Learning Outcome:
A student should be able to:
- Identify and analyse the stages an ethical hacker requires to take in order to compromise a target system.
- Identify tools and critically evaluate security techniques used to protect system and user data.
- Demonstrate systematic understanding of the concepts of security at the level of policy and strategy in a computer system.

Theory Component:

M.Sc (Information Technology)	Semester – IV– SIPSIT44(a)
Course Name	**Ethical Hacking**
Periods per week (1 Period is 60 minutes)	**4**
Credits	**4**

Unit	Contents	No. of Lectures
I	**Introduction to Information Systems:** Introduction, Types of Information Systems, Introduction to Information Security, Need for Information Security. **Application Security :** Introduction, Data Security considerations, Security Technology, Security threats, Security threats to E-commerce, Information warfare, Digital Signature.	**12**
II	**Explore Ethical Hacking:** Information security threats and attack vectors, Hacking and Ethics, Information security policy, Incident management , Vulnerability assessment, Penetration testing **Exploring Reconnaissance /Investigation Techniques:** Reconnaissance and Foot-printing, Reconnaissance procedures, Network scanning, Information aggregation and packet capture tools,Gathering organizational intelligence, Detecting Preventing and Responding to Reconnaissance.	**12**
III	**Gathering Information about target computer systems:** Foot-printing concepts, Foot-printing methodology, Foot-printing tools, Countermeasures ,Foot-printing Penetration testing.	**12**

	Scanning computer in the networks : Network scanning, Scanning methodology, Live systems scanning, Port scanning, Banner grabbing, Vulnerability scanning tool, Network mapping, Proxy preparing, Scanning pen testing.	
IV	**Vulnerabilities associated with systems:** Vulnerability assessment, Security vulnerability life cycle, Network vulnerability assessment. **Enumeration-Listing the system/users and connecting them:**Enumeration in ethical hacking, NETBIOS Enumeration, SNMP Enumeration, LDAP Enumeration, NTP Enumeration, Enumeration countermeasures.	12
V	**Gaining access to systems-Hacking:** Goals and methodology of Hacking, Password cracking, Escalating privileges, Executing applications, Hiding files, Covering Tracks. **Monitoring and capturing data packets using sniffing:** Network sniffing, MAC attacks, DHCP Attacks, DNS poisoning, Various sniffing tools, Honeypot.	12

Books and References

Sr. No.	Title	Author/s	Publisher	Edition	Year
1	Ethical hacking	Rajesh Maurya and Vipul Saluja	STAREDU solutions	--	2018
2	Hacking: The Art of Exploitation	Jon Erickson	Penguin	2nd	2017
3	CEH Certified Ethical Hacker	Matt Walker	TMH	3rd	2017

Internal Evaluation: 40 Marks

20 Marks	20 Marks
Online Class Test	Analysis of Research Papers/Project Work/ Case Studies/ Subject related Course with' SWAYAM-NPTEL'

Practical Component:

M. Sc (Information Technology)	Semester – IV – SIPSITP44(a)
Course Name	**Ethical hacking Practical**
Periods per week (1 Period is 60 minutes)	**4**
Credits	**2**

List of Practical: (Implemented using various hacking tools)

1	Utilize the Nessus vulnerability scanner
2	Implement Network scanning
3	Implement NET-BIOS Enumeration.
4	Implement SMTP Enumeration.
5	Implement password cracking.
6	Perform IP scanning
7	Perform network mapping
8	Perform brute force attack

Web and Social Data Analytics

Learning Objective:

- To introduce the concepts of Web and Information Retrieval and Web Mining in Social Network.
- To study the basic concepts of Social Network Analysis.
- To interpret Social networks through mathematical representation.
- To analyze relations, descriptive measures and models to overview research questions related to Social Networks.

Learning Outcome:

The students will be able to:-

- Choose and analyze various Information Retrieval Models and in turn will be able to develop Information Retrieval Systems
- Gather relevant network data, and some of the associated questions and problems.
- To build various applications based on Social Network platform.

Theory Component:

M. Sc (Information Technology)	Semester – IV – SIPSIT44(b)
Course Name	**Web and Social Data Analytics**
Periods per week (1 Period is 60 minutes)	**4**
Credits	**4**

Unit	Contents	No. of Lectures
I	**Information Retrieval and Web Search:** Basic Concepts, Information Retrieval Models, Text and Web Page Pre-Processing, Inverted Index and Its Compression, Latent Semantic Indexing, Web Search, Meta-Search, Web Spamming	**12**
II	**Social Network Analysis**: Co-Citation and Bibliographic Coupling, PageRank, HITS Algorithm, Community Discovery **Web Crawling**: A Basic Crawler Algorithm, Implementation Issues, Universal Crawlers, Topical Crawlers, Crawler Ethics and Conflicts	**12**
III	**Structured Data Extraction: Wrapper Generation:** Preliminaries, Wrapper Induction, Instance-Based Wrapper Learning, Automatic Wrapper Generation, String Matching and Tree Matching, Multiple Alignment, Flat Data Records, Nested Data Records, Extraction Based on Multiple Pages	**12**

IV	**Opinion Mining and Sentiment Analysis:** The Problem of Opinion Mining, Document Sentiment Classification, Sentence Subjectivity and Sentiment Classification, Aspect-Based Opinion Mining, Mining Comparative Opinions, Opinion Search and Retrieval, Opinion Spam Detection	**12**
V	**Web Usage Mining:** Data Collection and Pre-Processing, Data Modeling, Discovery and Analysis of Web Usage Patterns, Recommender Systems and Collaborative Filtering, Query Log Mining	**12**

Books and References

Sr. No.	Title	Author/s	Publisher	Edition	Year
1	Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data	Bing Liu	Springer	Second	2011
2	Mining the Social Web	Matthew A. Russell and Mikhail Klassen	O'Reilly	Third	2019
3	Analyzing Social Networks.	Stephen P. Borgatti	SAGE	First	2013

Internal Evaluation: 40 Marks

20 Marks	20 Marks
Online Class Test	Analysis of Research Papers/Project Work/ Case Studies/ Subject related Course with' SWAYAM-NPTEL'

Practical Component:

M. Sc (Information Technology)	Semester – IV – SIPSITP44(b)
Course Name	**Web and Social Data Analytics Practical**
Periods per week (1 Period is 60 minutes)	4
Credits	2

List of Practical: (To be implemented using any of the web mining tools)

1	Page Rank Algorithm
2	Weighted Page Rank Algorithm
3	HITS Algorithm
4	Crawler Algorithms
5	Structured Data Extraction through Wrapper Generation
6	Opinion Search and Retrieval
7	Sentiment Analysis
8	Web Content Mining
9	Web Structure Mining
10	Case Studies: Google, Facebook, Twitter, Instagram

Project Component:

M. Sc (Information Technology)	Semester – IV – SIPSIT45
Course Name	Project Report
Credits	2
Evaluation	50 marks

M. Sc (Information Technology)	Semester – IV – SIPSITP45
Course Name	Project Implementation
Credits	2
Evaluation	50 marks