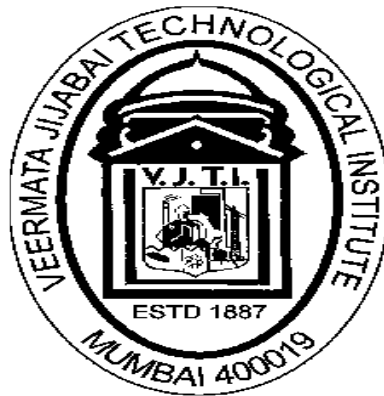


VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE  
(VJTI)  
MATUNGA, MUMBAI 400 019

(Autonomous Institute affiliated to University of Mumbai)



**Curriculum**  
**(Scheme of Instruction & Evaluation and Course contents)**  
(Revision 2018)

For  
Final year  
of  
Four Year Undergraduate Programmes Leading to  
Bachelor of Technology (B Tech) Degree in Information Technology

**Implemented from the batch admitted in Academic Year 2018-2019**

VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

(Autonomous Institute Affiliated to University of Mumbai)

**Curriculum**

(Course Contents)

For

Final Year

of

Four Year Undergraduate Programmes Leading to

Bachelor of Technology (B. Tech.)

In

INFORMATION TECHNOLOGY

**(2021-22)**

## **Institute Vision and Mission**

### **Vision**

To establish global leadership in the field of Technology and develop competent human resources for providing service to society

### **Mission**

- To provide students with comprehensive knowledge of principles of engineering with a multi-disciplinary approach that is challenging
- To create an intellectually stimulating environment for research, scholarship, creativity, innovation and professional activity.
- To foster relationship with other leading institutes of learning and research, alumni and industries in order to contribute to National and International development.

## **Department Vision and Mission**

### **Vision**

To become the world-class student-centered department which fosters high- quality learning and research for both undergraduate and graduate students.

### **Mission**

To equip our graduates with the knowledge and expertise to contribute significantly to the knowledge and information industry and to continue to grow professionally.

- To collaborate with local, state, national, and international entities in education and research.
- To engage faculty, students and alumni in research activities.
- To nurture our graduate's interpersonal and entrepreneurial skills so they can provide leadership within the information industry's diverse culture.

## **B.Tech. (Information Technology)**

### **Program Outcomes (POs)**

After the completion of the B.Tech. Information Technology programme, the graduates of the department will have

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
12. Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

### **Program Specific Outcomes (PSOs)**

After the completion of the B.Tech. Information Technology programme, the graduates of the department will have

1. An ability to use and apply Engineering conceptual knowledge and practices in the core information technologies of programming, networking, web technologies, human computer interaction and information management.
2. Skills to synthesize extensible and reusable code or systems to strive balance between increasing complexity and reduction in time available for development.
3. Understanding of professional ethics like confidentiality, restraining from use of unethical practices, due respect to IPR issues.
4. Aptitude for contemporary technological developments.

**VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE**  
**B.Tech. (Information Technology)**  
Scheme of Instruction and Evaluation  
**SEMESTER- III**

Scheme of Instruction						Scheme of Evaluation			
S. No	Course Code	Course Name	L-T-P (Hours / Week)			Credits	Evaluation Scheme		
			L	T	P		TA	MST	ESE
1	R4MA2007S	Linear Algebra	3	1	0	4	20	20	60
2	R4IT2001S	Discrete Mathematics	3	1	0	4	20	20	60
3	R4IT2002T	Fundamentals of Data Structures	3	0	0	3	20	20	60
4	R4IT2002P	Data Structures Lab	0	0	3	1.5	60	0	40
5	R4IT2003S	Digital Systems and Logic Design	3	0	0	3	20	20	60
6	R4IT2004S	Computer Organizations and Architectures	3	0	0	3	20	20	60
7	R4IT2005A	Program Development Lab	0	1	3	2.5	60	0	40
8	R4CH2001A	Environmental Studies	2	0	1	MNC	60	0	40
9	R4IT2006A	Development Engineering	2			P/NP	20	20	60
		Total	19	3	7	21			

Abbreviations: **L**: Lecture, **T**: Tutorial, **P**: Practical, **TA**: Teacher Assessment / Term work Assessment, **IST**: In Semester Tests (comprise of average of two in semester tests), **ESE**: End Semester Written Examination, **CIE**: Continuous In-semester Evaluation

**VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE**

**B.Tech. (Information Technology)**

Scheme of Instruction and Evaluation

Semester- IV

S. No	Course Code	Course Name	Hours/Week			Credits	Evaluation Scheme		
			L	T	P		TA	MST	ESE
1	R4MA2017S	Data Interpretation and Analysis	3	1	0	4	20	20	60
2	R4IT2007S	Design and Analysis of Algorithms	3	0	0	3	20	20	60
3	R4IT2008S	Theory of Computations	3	0	0	3	20	20	60
4	R4IT2009T	Operating Systems	3	0	0	3	20	20	60
5	R4IT2009P	Operating Systems Lab	0	0	2	1	60	0	40
6	R4IT2010T	Database Management Systems	3	0	0	3	20	20	60
7	R4IT2010P	Database Management Systems Lab	0	0	2	1	60	0	40
8	R4IT2011S	Introduction to Geospatial Technologies	2	0	2	3	60	20	40
9	R4IT2012A	Open Source Computing	2			MNC	60	0	40
			19	1	6	21			

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**VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE**

**B.Tech. (Information Technology)**

Scheme of Instruction and Evaluation

Semester- V

S No	Course Code	Course Name	Hours/Week			Credit	Evaluation Scheme		
			L	T	P		TA	MST	ESE
1	R4IT3001S	Artificial Intelligence	3	1	0	4	20	20	60
2	R4IT3002T	Software Engineering	3	0	0	3	20	20	60
3	R4IT3003T	Spatial & Graph Databases	3	0	0	3	20	20	60
4	R4IT3004T	Computer Networks	3	0	0	3	20	20	60
5	R4IT3005S	Compiler Design	3	0	0	3	20	20	60
6	R4IT3006A	Financial Technologies	2	0	0	P/NP			
7	R4IT3002P	Software Engineering Lab	0	0	2	1	60	0	40
8	R4IT3003P	Spatial & Graph Databases Lab	0	0	2	1	60	0	40
9	R4IT3004P	Computer Networks Lab	0	0	2	1	60	0	40
10	R4IT3007S	Web Information Management	1	0	2	2	60	0	40
			18	1	8	21			

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**VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE**

**B.Tech. (Information Technology)**

Scheme of Instruction and Evaluation

Semester- VI

S. No	Course Code	Course Name	Hours / Week			Credits	Evaluation Scheme		
			L	T	P		TA	MST	ESE
1	R4IT3011T	Machine Learning	3	0	0	3	20	20	60
2	R4IT3012T	Wireless Networks	3	0	0	3	20	20	60
3	R4IT3013T	Parallel Computing	3	0	0	3	20	20	60
4		Professional Elective1	3	0	0	3	20	20	60
5		Open Elective 1	3	0	0	3	20	20	60
6	R4HM3002L	Professional Communication Skills	1	0	2	2	60		40
7	R4IT3011P	Machine Learning Lab	0	0	2	1	60	0	40
8	R4IT3012P	Wireless Networks lab	0	0	2	1	60	0	40
9	R4IT3013P	Parallel Computing Lab	0	0	2	1	60	0	40
10		Professional Elective1 Lab	0	0	2	1	60	0	40
			16	0	10	21			

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**Minimum six weeks mandatory internship in industry/research Institute after 6<sup>th</sup> Semester**

<b>Professional Electives –1</b>	
<b>S. No</b>	<b>Course Title</b>
R4IT3101T	Spatial Data Analysis and Visualization
R4IT3102T	Object Oriented Analysis and Design
R4IT3103T	Number Theory
R4IT3104T	Digital Image Processing
R4IT3105T	Digital Forensic Analysis

<b>Professional Electives –1 Lab</b>	
<b>S. No</b>	<b>Course Title</b>
R4IT3101P	Spatial Data Analysis and Visualization Lab
R4IT3102P	Object Oriented Analysis and Design Lab
R4IT3103P	Number Theory Lab
R4IT3104P	Digital Image Processing Lab
R4IT3105P	Digital Forensic Analysis Lab

Open Elective 1

<b>S No</b>	<b>Course Title</b>
R4IT3601S	System Administration
R4CO3601S	Network Security

**VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE**  
**B.Tech. (Information Technology)**  
Scheme of Instruction and Evaluation  
**SEMESTER- VII**

S N	Course Code	Course Name	Hours / Week			Credits	Evaluation Scheme		
			L	T	P		TA	MST	ESE
1	R4IT4001T	Data Mining and Data Warehousing	3	0	0	3	20	20	60
	R4IT4001P	Data Mining and Data Warehousing Lab	0	0	2	1	60	0	40
2	R4IT4002T	Cyber Security	3	0	0	3	20	20	60
3	R4IT4002P	Cyber Security Lab	0	0	2	1	60	0	40
4		Professional Elective 2	3	0	0	3	20	20	60
6		Professional Elective 2 Lab	0	0	2	1	60	0	40
7		Open Elective 2	3	0	0	3	20	20	60
8	R4IT4901D	Project –I	4			2	60	0	40
9	R4IT4003A	Presentation on Internship work	4			2	60	0	40
			12	0	14	19			

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	<b>Professional Electives –2</b>		<b>Professional Electives –2 Lab</b>
<b>S. No</b>	<b>Course Title</b>	<b>S. No</b>	<b>Course Title</b>
R4IT4201T	Software Project Management	R4IT4201P	Software Project Management Lab
R4IT4202T	Geospatial Programming and Web Application Development	R4IT4202P	Geospatial Programming and Web Application Development lab
R4IT4203T	Blockchain Technology	R4IT4203P	Blockchain Technology lab
R4IT4204T	Natural Language Processing	R4IT4204P	Natural Language Processing lab
R4IT4205T	Software Architecture	R4IT4205T	Software Architecture Lab

### **Open Electives –II**

<b>Sr. No</b>	<b>Course Title</b>
R4IT4601S	Database Management Systems
R4IT4602S	Data Analytics
R4IT4603S	Software Engineering

**VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE**  
**B.Tech. (Information Technology)**  
Scheme of Instruction and Evaluation  
**SEMESTER- VIII**

S N	Course Code	Course Name	Hours / Week			Credits	Evaluation Scheme		
			L	T	P		TA	MST	ESE
1	R4IT4011T	Big Data Analytics	4	0	0	4	20	20	60
	R4IT4011P	Big Data Analytics Lab	0	0	2	1	60	00	40
2	R4IT4012T	Cloud Computing	3	0	0	3	20	20	60
3	R4IT4012P	Cloud Computing Lab	0	0	2	1	60	00	40
4		Professional Elective-3	3	0	0	3	20	20	60
5		Professional Elective 3 Lab	0	0	2	1	60	00	40
6		Professional Elective-4	3	1	0	4	20	20	60
7	R4IT4902D	Project –II	8			4	60	00	40
			13	1	14	21			

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<b>Professional Electives –3</b>		<b>Professional Electives –3 Lab</b>	
<b>S. No</b>	<b>Course Title</b>	<b>S. No</b>	<b>Course Title</b>
R4IT4301T	Software Testing	R4IT4301P	Software Testing Lab
R4IT4302T	Human Computer Interaction	R4IT4302P	Human Computer Interaction Lab
R4IT4303T	Social Networking and Analysis	R4IT4303P	Social Networking and Analysis Lab
R4IT4304T	Service Oriented Architecture	R4IT4304P	Service Oriented Architecture Lab
R4IT4305T	Soft Computing	R4IT4305P	Soft Computing Lab

<b>Professional Electives –4</b>	
<b>S No</b>	<b>Course Title</b>
R4IT4401S	Multicore Technologies
R4IT4402S	Advanced database Engineering
R4IT4403S	Internet of Things
R4IT4404S	Virtual Reality
R4IT4405S	Distributed Algorithms

<b>Program Name</b>	<b>B. Tech. (Information Technology)</b>	<b>Semester – VII</b>
<b>Course Code</b>	<b>R4IT4001T</b>	
<b>Course Title</b>	<b>Data Mining and Data Warehousing</b>	
<b>Prerequisite</b>	<b>Statistics, Database, Data Structures and Algorithms</b>	

<b>COURSE OUTCOMES: Students will be able to</b>	
1.	Perform the preprocessing of data and apply mining and data warehousing techniques on it.
2.	Identify and Implement association rules, classification, and clustering algorithms
3.	Implement real world problems in business and scientific information using data mining
4.	Apply data analysis tools for scientific applications

#### **COURSE CONTENTS**

**Hrs CO**

- |   |   |     |
|---|---|-----|
| 1. <b>Introduction to Data Mining:</b> Introduction, Data Mining Techniques, Knowledge Discovery, KDD Process.  | 2 | 1   |
| 2. <b>Data Warehouse and OLAP Technology for Data Mining:</b> Introduction to Data Warehouse, Data Cube and OLAP, Data Warehouse Design and Usage, Data Warehouse Implementation.   | 4 | 1   |
| 3. <b>Data Processing:</b> Types of Data, Data Quality, Data Pre-processing, Data Cleaning, Outlier Detection, Missing Value Detection, Data Integration, Data Reduction, Data Transformation and Data Discretization, Similarity and Dissimilarity, Summary Statistics, Visualization, | 7 | 1,2 |
| 4. <b>Classification:</b> Decision Tree, Model Overfitting, Evaluating Performance of Classifier, Rule-Based Classifier, Nearest-Neighbor Classifier, Bayesian Classifier, ANN, SVM, Ensemble Methods, Class Imbalance Problems.  | 7 | 2,3 |
| 5. <b>Association:</b> Frequent Item Generation, Rule Generation, Compact Representation of Frequent Itemsets, FP-Growth Algorithm  | 4 | 2,3 |
| 6. <b>Clustering:</b> K-Means, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation, Density-Based Clustering.   | 4 | 2,3 |
| 7. <b>Web Mining:</b> Web Content Mining, Web Structure Mining, Web Usage mining.   | 3 | 2,3 |
| 8. <b>Visualization:</b> Data Generalization and Summarization-Based Characterization, Analytical Characterization: Analysis of Attribute Relevance, Mining Class Comparisons: Discriminating Between Different Classes, Mining Descriptive Statistical Measures in Large Databases.    | 4 | 4   |
| 9. <b>Applications:</b> Anomaly Detection, Time Series Prediction, Visual and Audio Data Mining, Recommendation Systems.  | 2 | 3,4 |
| 10. <b>Advances in Data Mining.</b>   | 2 | 3,4 |

## **TEXTBOOKS**

1. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, “Introduction to Data Mining”, Pearson Education, ISBN: 978-93-3257-140-2
2. Jiawei Han, Micheline Kamber, and Jian Pei, “Data Mining Concepts and Techniques”, 3<sup>rd</sup> Edition, Morgan Kaufmann, ISBN: 978-93-80931-91-3

## **RECOMMENDED READING**

- 1 M. Berry and G. Linoff, “Mastering Data Mining”, John Wiley and Sons, 2<sup>nd</sup> Edition.
- 2 I.H. Witten and E. Frank, “Data Mining: Practical Machine Learning Tools and Techniques”, Morgan Kaufmann, 4<sup>th</sup> Edition.



<b>Program Name</b>	<b>B. Tech. (Information Technology)</b>	<b>Semester – VII</b>
<b>Course Code</b>	<b>R4IT4001P</b>	
<b>Course Title</b>	<b>Data Mining and Data Warehousing Lab</b>	
<b>Prerequisite</b>	<b>Statistics, Data Structures and Algorithms</b>	

**COURSE OUTCOMES: Students will be able to**

1.	Investigate different data mining and data warehouse tasks and evaluate the algorithms with respect to their accuracy.
2.	Analyze the results of a data mining exercise and compare the results.
3.	Design and Implement a data mining solution to a practical problem.

**LIST OF EXPERIMENTS:**

	<b>Hrs</b>	<b>CO</b>
1. To perform a multidimensional data model using SQL queries. e.g. snowflake, star and fact constellation schema.	2	1
2. To perform various OLAP operations such as: slice, dice, roll up, drill up etc.	2	1
3. To perform data cleaning and preparing for operations	2	1,2
4. Study of Decision Trees and other classification Algorithms.	4	2,3
5. To perform association rule mining	4	2, 3
6. Study of predictive algorithms.	2	2, 3
7. Study of clustering and its different techniques.	4	2, 3
8. To perform text mining on the given data warehouse and perform correlation analysis between for the given data sets	2	2, 3

**TEXTBOOKS**

- 1 Pang-Ning Tan, Michael Steinbach and Vipin Kumar, “Introduction to Data Mining”, Pearson Education, ISBN: 978-93-3257-140-2
- 2 Jiawei Han, Micheline Kamber, and Jian Pei, “Data Mining Concepts and Techniques”, 3<sup>rd</sup> Edition, Morgan Kaufmann, ISBN: 978-93-80931-91-3

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- 1 M. Berry and G. Linoff, “Mastering Data Mining”, John Wiley and Sons, 2<sup>nd</sup> Edition.
- 2 I.H. Witten and E. Frank, “Data Mining: Practical Machine Learning Tools and Techniques”, Morgan Kaufmann, 4<sup>th</sup> Edition.

<b>Program Name</b>	<b>B. Tech. (Information Technology)</b>	<b>Semester – VII</b>
<b>Course Code</b>	<b>R4IT4002T</b>	
<b>Course Title</b>	<b>Cyber Security</b>	
<b>Prerequisite</b>	<b>Computer Network</b>	

<b>COURSE OUTCOMES: Students will be able to</b>	
1.	Formulate the concept of threats, vulnerability and control.
2.	Demonstrate the fundamentals of security in programs, operating systems, database management systems.
3.	Determine the network security threats and countermeasures.
4.	Analyze the web security and ESAPI security mechanism.

#### **COURSE CONTENTS**

	<b>Hrs</b>	<b>CO</b>
1. <b>Essential for understanding cyber security:</b> Cyber Security Concepts, essential terminologies, open-source tools. Understanding meaning and differences in various terms such as Breaches, Threats, Attacks, Exploits, and others.	4	1
2. <b>Information Security and Cryptography:</b> Various concepts of Cryptography, Symmetric key and Asymmetric key Cryptography. Digital Signatures, Applications of Cryptography. OpenSSL, Hash Values Calculations MD5, SHA, Steganography. Use of open-source tools.	5	1,2
3. <b>Protocols and Cyber Security Vulnerabilities:</b> Hyper Text Transfer Protocol (HTTP) and corresponding cyber security vulnerabilities. Various security attacks related to HTTP. TCP, UDP and corresponding security vulnerabilities. MAC, IPv4, IPv6, DHCP, and security attacks and Open Source/ Free/ Trial Tools: WinAudit, Zap proxy (OWASP), burp suite, DVWA kit. Hands on project and mini project	5	1,2
4. <b>Firewalls:</b> Definition, Types of Firewalls, VPN Security, Security Protocols: - security at the Application Layer- PGP and S/MIME, Security at Transport Layer- SSL and TLS, Security at Network Layer-IPSec.	5	2,3
5. <b>System and Server Security:</b> Introduction to System Security, Server Security, OS Security, Physical Security, Introduction to Networks, Network packet Sniffing, Network Design Simulation. DOS/ DDOS attacks. Asset Management and Audits, Vulnerabilities and Attacks. Intrusion detection and Prevention Techniques, Host based Intrusion prevention Systems, Security Information Management, Network Session Analysis, System Integrity Validation.	6	3,4
6. <b>Malware Concepts:</b> Basics of Malware and its types (Virus, Worms, Trojans, Rootkits, Robots, Adware's, Spywares, Ransom wares, Zombies etc.), Malware Analysis, anti-virus protection. Malware Analysis using machine learning, Understanding malware analysis with the help of various source tools.	6	3,4

7	<b>Web Services and Cyber Laws:</b> Basics of Web Services, SOAP, REST, Cyber laws and forensics, cyber security regulations, cyber forensics basics, some other useful tools. Secure software development, Role of design patterns, Software intensive systems.	5	3,4
8	<b>Advances in the domain</b>	3	4

### **TEXTBOOKS**

1. William Stallings, “Cryptography and Network Security”, Pearson Education/PHI, 2006.
2. Dr. B.B. Meshram, Ms K.A. Shirsath, “TCP/IP and Network Security: Attacks and Defense Mechanisms with Open-Source Tools”, Shroff Publishers & Distributors PVT. LTD, 1<sup>st</sup> Edition, 2017.

### **RECOMMENDED READING**

- 1 Digital Forensics, DSCI - Nasscom, 2012.
- 2 Cyber Crime Investigation, DSCI - Nasscom, 2013
- 3 Nihad Hassan, Rami Hijazi, “Digital Privacy and Security Using Windows: A Practical Guide”, Apress Aug 2017
- 4 Atul Kahate, “Cryptography and Network Security” | 4<sup>th</sup> Edition, McGraw Hill, 2019

<b>Program Name</b>	<b>B. Tech. (Information Technology)</b>	<b>Semester – VII</b>
<b>Course Code</b>	<b>R4IT4002P</b>	
<b>Course Title</b>	<b>Cyber Security Lab</b>	
<b>Prerequisite</b>	<b>Computer Network</b>	

<b>COURSE OUTCOMES: Students will be able to</b>	
1.	Implement the concept of threats, vulnerability and control.
2.	Apply the cryptographic problems.
3.	Implement the security in networks.
4.	Analyze the security at system.

#### **LIST OF EXPERIMENTS:**

	<b>Hrs</b>	<b>CO</b>
1. Install wine / virtual box or any other equivalent software on the host os.	2	1
2. Grab a banner with telnet and perform the task using netcat utility.	2	1
3. Port scanning with nmap, superscan or any other software.	2	1,3
4. Using nmap 1) find open ports on a system 2) find the machines which are active 3) find the version of remote os on other systems 4) find the version of s/w installed on other system.	2	1,3
5. Evaluate cryptographic algorithms	2	2
6. Perform an experiment to demonstrate how to sniff for router traffic by using the tool wireshark.	2	1,3
7. Perform an experiment how to use dumpsec.	2	1,3
8. Perform an wireless audit of an access point / router and decrypt wep and wpa.	2	2
9. Perform an experiment to sniff traffic using arp poisoning.	2	3
10. Install IPCop on a linux system and learn all the function available on the software.	2	3
11. Install jcrypt tool (or any other equivalent) and demonstrate asymmetric, symmetric crypto algorithm, hash and digital/pki signatures.	2	2
12. Demonstrate intrusion detection system (ids) using any tool eg . snort or any other s/w.	2	4
13. Install rootkits and study variety of options.	2	4
14. Generating password hashes with openssl.	2	4
15. Setup a honey pot and monitor the honeypot on network.	2	4

## **TEXTBOOKS**

1. Behrouz Forouzan and Debdeep Mukhopadhyay, “Cryptography and Network Security”, Tata McGraw Hill ,3<sup>rd</sup> Edition.
2. Bernard Menezes, “Network security and cryptography” Cengage learning publications.

## **RECOMMENDED READING**

- 1 Charles Pfleeger, “Security in Computing”, 4<sup>th</sup> Edition, Prentice Hall of India, 2006.
- 2 William Stallings, “Cryptography and Network Security”, 6<sup>th</sup> Edition, Pearson Education, March 2013.
- 3 Dr. B.B. Meshram, Ms K.A. Shirsath, “TCP/IP and Network Security: Attacks and Defense Mechanisms with Open-Source Tools”, Shroff Publishers & Distributors PVT. LTD, 1<sup>st</sup> Edition, 2017.

<b>Program Name</b>	<b>B. Tech. (Information Technology)</b>	<b>Semester – VII</b>
<b>Course Code</b>	<b>R4IT4201T</b>	
<b>Course Title</b>	<b>Software Project Management</b>	
<b>Prerequisite</b>	<b>Software Engineering</b>	

<b>COURSE OUTCOMES: Students will be able to</b>	
1.	Apply key Project Management concepts to Software Projects.
2.	Use Project Integration Management Techniques for Software Projects.
3.	Manage Scope, Time, Cost and Quality of Software Projects.
4.	Illustrate Human Resource Management, Communications Management, Risk Management & Procurement Management Techniques for Software Projects.

#### **COURSE CONTENTS**

	<b>Hrs</b>	<b>CO</b>
1. <b>Introduction to Project Management:</b> Introduction to Project and Project Management, Program and Project Portfolio Management, The Role of the Project Manager, The Project Management Profession.	3	1
2. <b>The Project Management and Information Technology Context:</b> A Systems View of Project Management, Understanding Organizations, Stakeholder Management, Project Phases and the Project Life Cycle, The Context of Information Technology Projects. Recent Trends Affecting Information Technology Project Management.	3	1
3. <b>The Project Management Process Groups:</b> Project Management Process Groups, Mapping the Process Groups to the Knowledge Areas, Developing an IT Project Management Methodology.	3	1
4. <b>Project Integration Management:</b> Introduction to Project Integration Management, Strategic Planning and Project Selection, developing a Project Management Plan, Project Execution, Directing and Managing Project Work, Monitoring and Controlling Project Work, Performing Integrated Change Control, Closing Projects or Phases, Using Software to Assist in Project Integration Management.	3	2
5. <b>Project Scope Management:</b> Planning Scope Management, Collecting Requirements, Defining Scope, Creating the Work Breakdown Structure, Validating Scope, Controlling Scope, Using Software to Assist in Project Scope Management.	3	3
6. <b>Project Time Management:</b> The Importance of Project Schedules, Planning Schedule Management, Defining Activities, Sequencing Activities, Estimating Activity Resources, Estimating Activity Durations, Developing the Schedule, Controlling the Schedule, Using Software to Assist in Project Time Management.	3	3
7. <b>Project Cost Management:</b> The Importance of Project Cost Management, Basic Principles of Cost Management, Planning Cost Management, Estimating Costs, Determining the Budget, Controlling Costs, Using Project Management Software to	3	3

Assist in Project Cost Management.

- |    |  |   |   |
|----|--|---|---|
| 8. | <b>Project Quality Management:</b> Introduction Project Quality Management, Planning Quality Management, Performing Quality Assurance, Controlling Quality, Tools and Techniques for Quality Control, Modern Quality Management, Improving IT Project Quality, Using Software to Assist in Project Quality Management.   | 3 | 3 |
| 9. | <b>Project Human Resource Management:</b> Introduction to Project Human Resource Management, The Importance of Human Resource Management, Keys to Managing People, Developing the Human Resource Plan, Acquiring the Project Team, Developing the Project Team, Managing the Project Team, Using Software to Assist in Human Resource Management.  | 3 | 4 |
| 10 | <b>Project Communications Management:</b> Introduction to Project Communications Management, Keys to Good Communications, Planning Communications Management, Managing Communications, Controlling Communications, Information Distribution, Performance Reporting, Managing Stakeholders, Suggestions for Improving Project Communications, Using Software to Assist in Project Communications. | 4 | 4 |
| 11 | <b>Project Risk Management:</b> The Importance of Project Risk Management, Planning Risk Management, Common Sources of Risk on IT Projects, Identifying Risks, Performing Qualitative Risk Analysis, Performing Quantitative Risk Analysis, Planning Risk Responses, Controlling Risks, Using Software to Assist in Project Risk Management.   | 4 | 4 |
| 12 | <b>Project Procurement Management:</b> The Importance of Project Procurement Management, Planning Procurement Management, Planning Contracting, Conducting Procurements, Controlling Procurements, Closing Procurements, Using Software to Assist in Project Procurement Management.   | 2 | 4 |
| 13 | <b>Advances in the domain</b>  | 2 | 4 |

## TEXTBOOKS

1. Kathy Schwalbe, "Information Technology Project Management", Revised, 7<sup>th</sup> Edition, Cengage Learning.
2. B. Hughes, M. Cotterell, "Software Project Management", Tata McGraw-Hill Education, 5<sup>th</sup> Edition.

## RECOMMENDED READING

- 1 Joseph Phillips, "IT Project Management: On Track from Start to Finish", Mc-Graw Hill Publication, 3<sup>rd</sup> Edition.
- 2 P. Jalote, "Software Project Management in Practice", Pearson Education.
- 3 John M. Nicholas, Herman Steyn, "Project Management for Business and Technology", PHI, 4<sup>th</sup> Edition.

<b>Program Name</b>	<b>B. Tech. (Information Technology)</b>	<b>Semester – VII</b>
<b>Course Code</b>	<b>R4IT4201P</b>	
<b>Course Title</b>	<b>Software Project Management Lab</b>	
<b>Prerequisite</b>	<b>Software Engineering</b>	

<b>COURSE OUTCOMES: Students will be able to</b>	
1.	Demonstrate Project Initiation, Analysis & Design of Software Projects.
2.	Develop, Test, prepare end project documents and Assess Software Projects.
3.	Illustrate Scope, Time, Cost, Quality, Human Resources, Communications & Risks management of Software Projects.
4.	Demonstrate effective project execution and control techniques that result in successful Software Projects.

**LIST OF EXPERIMENTS:**

	<b>Hrs</b>	<b>CO</b>
1. Select a Software Project and Define Project Objectives.	2	1
2. Write a Detailed Problem Statement.	2	1, 2
3. Prepare Project Initiation Documents -	2	2, 3
a. Business Case		
b. Project Charter		
c. Team Contract Scope Statement		
4. Prepare Project Planning Documents-	2	2, 3
a. Estimation Document		
b. Risk Management Plan		
c. Time Management Plan (Schedule)		
d. SQA Plan		
e. SCM Plan Test Plan		
5. Prepare Problem Analysis, Product Design & Testing Documents-	2	3, 4
a. Data modeling- ER diagrams		
b. Functional modeling- Data flow diagrams		
c. Behavioral modeling – State transition diagrams		
d. Database design, File design, Data structures design, Software Architecture design (Modular diagram)		
f. Flowcharts, Algorithms/pseudo code design		
g. User interface design Test cases		
7. Develop Software & Carry out testing using different testing methods.	2	1, 2
8. Prepare End Project Documents -	2	3, 4
a. Milestone report		
b. Summary of project results		
c. Lesson Learned report Client acceptance form		



## **TEXTBOOKS**

1. Kathy Schwalbe, “Information Technology Project Management”, Revised, 7<sup>th</sup> Edition, Cengage Learning.
2. John M. Nicholas, Herman Steyn, “Project Management for Business and Technology”, PHI, 4<sup>th</sup> Edition.

## **RECOMMENDED READING**

- 1 Joseph Phillips, “IT Project Management: On Track from Start to Finish”, Mc-Graw Hill Publication, 3<sup>rd</sup> Edition.
- 2 P. Jalote, “Software Project Management in Practice”, Pearson Education.

<b>Program Name</b>	<b>B. Tech. (Information Technology)</b>	<b>Semester – VII</b>
<b>Course Code</b>	<b>R4IT4202T</b>	
<b>Course Title</b>	<b>Geospatial Programming and Web Application Development</b>	
<b>Prerequisite</b>	<b>NIL</b>	

**COURSE OUTCOMES: Students will be able to**

1.	Understand basic concepts of GIS, GIS models and projection systems.
2.	Learn accurate data acquisition and visualization techniques.
3.	Apply spatial analysis techniques.
4.	Learn about webGIS and MobileGIS.

**COURSE CONTENTS**

	<b>Hrs</b>	<b>CO</b>
1. <b>Geographic Information Systems, Science and Study:</b> Introduction: Why GIS, Science and Technology of problem solving, GISystems, GIScience, GIS applications, GIS Components, Geographic data representation, Geographic data models: Raster and Vector data models.	5	1
2. <b>Geo referencing and projection system:</b> Early measurements, The Geoid, Measuring the Earth: latitude and Longitude, Map projections and coordinate System, Digitizing: Coordinate capture, coordinate transformation, GNSS basics, GNSS control points, Map Projection vs. Transformation, Geo-referencing, satellite-based positioning,	5	1
3. <b>Data acquisition and assimilation:</b> Data Sources: Aerial images, Satellite images, LiDAR, Digital data, remote sensing, Data acquisition methods: Field survey, Control survey, old records, Integration challenges in geospatial systems	5	2
4. <b>Visualizing spatial data:</b> Introduction to maps, visualization process, cartographic toolbox, Maps types, Map scales, Map Generalization, Map boundaries, maps and cartography, Principles of map design, how to map: qualitative, quantitative, terrain elevation, time series, geo visualization, map stories.	5	2
5. <b>Spatial Analysis:</b> Introduction: what is spatial analysis? Selection and Classification, Proximity Functions and Buffering, Fundamental spatial analysis techniques such as overlay, extraction, and interpolation, Raster analysis: Map Algebra, Local Functions, global Functions, terrain analysis	6	3
6. <b>Web GIS:</b> Introduction to Web GIS, Introduction to Mobile GIS, Scripting Languages for GIS	6	4
7. <b>Advances in GIS:</b> Data Standards, Data Quality, Data Accuracy, Advances and Currents developments in GIS, Challenges in GIS	7	2,4

## **TEXTBOOKS**

1. Paul Bolstad, “GIS Fundamentals: A First Text on Geographic Information Systems”-XanEdu (2016)
2. Paul A. Longley, Michael F. Goodchild, David J. Maguire, David W. Rhind, “Geographic information systems and science”, John Wiley & Sons, 4<sup>th</sup> edition 2015.

## **RECOMMENDED READING**

- 1 Michael N. DeMers, “Fundamentals of Geographic Information Systems”, 4<sup>th</sup> edition. Hoboken, NJ: Wiley, 2009.
- 2 Lo, C. P., Yeung, Albert, “Concepts and techniques of geographic information systems”, 2<sup>nd</sup> edition. Upper Saddle River, NJ: Pearson Prentice Hall, 2007.

<b>Program Name</b>	<b>B. Tech. (Information Technology)</b>	<b>Semester – VII</b>
<b>Course Code</b>	<b>R4IT4202P</b>	
<b>Course Title</b>	<b>Geospatial Programming and Web Application Development Lab</b>	
<b>Prerequisite</b>	<b>NIL</b>	

**COURSE OUTCOMES: Students will be able to**

1.	Understand basic properties of QGIS tool.
2.	Learn to create maps, data acquisition in different formats.
3.	Run spatial data analysis techniques.
4.	Develop and Publish web pages for WebGIS and MobileGIS using scripting languages.

**LIST OF EXPERIMENTS:**

	<b>Hrs</b>	<b>CO</b>
1. Understanding QGIS, and other GIS mapping tools	2	1
2. Working with QGIS	2	1
3. Creating digital maps using geospatial objects	2	2
4. Understanding digital data, data collection techniques, and various data formats	2	2
5. Importing various data formats to QGIS to build map and features	2	2
6. Working with basics of spatial data analysis	2	3
7. Working with basics of spatial data analysis	2	3
8. Working with multiple layers of digital maps and complex query analysis	2	3
9. Developing web pages for webGIS	2	4
10. Working with scripting languages for dynamic webGIS contents	2	4
11. Working with scripting languages for dynamic MobileGIS contents	2	4

**TEXTBOOKS**

1. Paul Bolstad, “GIS Fundamentals - A First Text on Geographic Information Systems”-XanEdu (2016)
2. Paul A. Longley, Michael F. Goodchild, David J. Maguire, David W. Rhind, “Geographic information systems and science”, John Wiley & Sons, 4<sup>th</sup> edition 2015.

## **RECOMMENDED READING**

- 1 Michael N. DeMers, “Fundamentals of Geographic Information Systems”, 4<sup>th</sup> edition. Hoboken, NJ: Wiley, 2009.
- 2 Lo, C. P., Yeung, Albert, “Concepts and techniques of geographic information systems”, 2nd edition. Upper Saddle River, NJ: Pearson Prentice Hall, 2007.

<b>Program Name</b>	<b>B. Tech. (Information Technology)</b>	<b>Semester – VII</b>
<b>Course Code</b>	<b>R4IT4203T</b>	
<b>Course Title</b>	<b>Blockchain Technology</b>	
<b>Prerequisite</b>	<b>Nil</b>	

**COURSE OUTCOMES: Students will be able to**

1.	Understand blockchain architecture and requisite crypto foundations and Understand and Resolve security concerns in blockchain
2.	Demonstrate various consensus protocols and their usage for specific applications
3.	Explore blockchain advances and upcoming platforms
4.	Analyze smart contracts and distributed application and design use-case

**COURSE CONTENTS**

	<b>Hrs</b>	<b>CO</b>
1. <b>Introduction and Crypto foundations:</b> Elliptic curve cryptography, ECDSA, Cryptographic hash functions, SHA-256, Merkle Trees, Cryptocurrencies	4	1
2. <b>Bitcoin:</b> Bitcoin addresses, Bitcoin's blockchain, block header, mining, proof of work (PoW) algorithms, difficulty adjustment algorithm, mining pools, transactions, double spending attacks, the 51% attacker, block format, pre-SegWit transaction formats, Bitcoin script, transaction malleability, SegWit transaction formats, smart contracts (escrow, micropayments, decentralized lotteries), payment channels, Lightning network	8	1,3
3. <b>Ethereum:</b> Overview of differences between Ethereum and Bitcoin, block format, mining algorithm, proof-of-stake (PoS) algorithm, account management, contracts and transactions, Solidity language, decentralized applications using Ethereum	4	1,2
4. <b>Smart Contracts</b>	4	4
5. <b>Different Blockchains and Consensus mechanisms</b>	4	2
6. <b>Blockchain and Security:</b> Attacks and countermeasures	4	1
7. <b>-R3, Corda and Hyperledger:</b> System architecture, ledger format, chaincode execution, transaction flow and ordering, private channels, membership service providers, case studies	8	3
8. <b>Advances in the domain</b>	3	4

**TEXTBOOKS**

1. Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly Media, Inc., 2014.
2. Arvind Narayanan, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press (July 19, 2016) ISBN-10: 0691171696

## **RECOMMENDED READING**

- 1 <http://hyperledger-fabric.readthedocs.io/en/latest/>
- 2 <http://www.ethdocs.org/en/latest/>
- 3 Arvind Narayanan, Princeton University Press (July 19, 2016) ISBN-10: 0691171696

<b>Program Name</b>	<b>B. Tech. (Information Technology)</b>	<b>Semester – VII</b>
<b>Course Code</b>	<b>R4IT4203P</b>	
<b>Course Title</b>	<b>Blockchain Technology Lab</b>	
<b>Prerequisite</b>	<b>Nil</b>	

<b>COURSE OUTCOMES: Students will be able to</b>	
1.	Demonstrate the basic concepts of cryptography in Blockchain technology
2.	Implement Ethereum contracts
3.	Analyze distributed applications
4.	Implement consensus algorithms

#### **LIST OF EXPERIMENTS:**

	<b>Hrs</b>	<b>CO</b>
1. Understanding ECDSA	2	1
2. Implement a program to chain the message using hash functions	2	1
3. Analyze the bitcoin blockchain and ethereum blockchain	2	1,2
4. Write a program to implement proof-of-work consensus algorithm	2	4
5. Implement a smart contract to creation of Token	3	2,3
6. Implement a smart contract to election	3	2,3
7. Design a Distributed Application	4	3
8. Configure hyperledger Blockchain	3	4

#### **TEXTBOOKS**

1. V. Saravanan.” An Introduction to Bitcoin,”, Lecture Notes
2. Andreas Antonopoulos, “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, O’Reilly Media, Inc., 2014.

#### **RECOMMENDED READING**

- 1 Arvind Narayanan, “Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction”, Princeton University Press (July 19, 2016) ISBN-10: 0691171696
- 2 Antonopoulos, Andreas M. and Wood, “Mastering Ethereum”, O’Reilly Media, Inc., 2018



<b>Program Name</b>	<b>B. Tech. (Information Technology)</b>	<b>Semester – VII</b>
<b>Course Code</b>	<b>R4IT4204T</b>	
<b>Course Title</b>	<b>Natural Language Processing</b>	
<b>Prerequisite</b>	<b>Machine Learning</b>	

**COURSE OUTCOMES: Students will be able to**

1.	Illustrate stages of NLP and challenges of NLP
2.	Understand Word level analysis, language models syntax analysis of Natural Language.
3.	Understand and Perform semantic analysis, use of Word Vectors and discourse for Sentences.
4.	Study different case studies from various applications of NLP and develop using Classification or other methods.

**COURSE CONTENTS**

	<b>Hrs</b>	<b>CO</b>
1. <b>Introduction to NLP:</b> History of NLP, Generic NLP system, levels of NLP, Knowledge in language processing, Ambiguity in Natural Language, Stages in NLP, Challenges of NLP. Various Applications of NLP- Machine translation, Named Entity Recognition, question answering system, Information retrieval, Text categorization, text summarization, Sentiment Analysis and so on.	3	1
2. <b>Word Level Analysis:</b> Morphology in natural languages, Morphology analysis, Inflectional morphology & Derivational morphology, Regular expression, finite automata, finite state transducers (FST), Morphological parsing with FST, Lexicon free FST - Porter stemmer.	4	2
3. <b>N-gram Language Models:</b> The role of language models, Simple N-gram models. Estimating parameters and smoothing - Laplace Smoothing, Add-k smoothing, Kneser-Ney Smoothing, Web and Stupid Back-off, Perplexity and Entropy, Evaluating language models.	4	2
4. <b>Part of Speech Tagging:</b> Part of Speech Tagging, Tagset for English, Penn TreeBank Tagset for English, Rule-based Part-of-speech Tagging, Stochastic Part-of-speech Tagging, Transformation-Based Tagging, Issues –Multiple tags & words, Unknown words, class-based n-grams, Hidden Markov Models (Forward and Viterbi algorithms and EM training) for sequence labelling task of POS tagging.	4	2
5. <b>Syntactic Analysis:</b> Context Free grammar Constituency, Context free rules & trees, Sentence level construction - Noun Phrase, Verb phrase etc. Need of Parsing, Dependency Parsing, Parsing in case of Ambiguity, Parsing, Different Parsing Algorithms - CFG, V Probabilistic Parsing.	5	2
6. <b>Semantics Analysis:</b> Meaning representation, lexical semantics - sense relations, semantic roles, and primitive decomposition, WordNet - Relations among lexemes & their senses – Homonymy, Polysemy, Synonymy, Hyponymy. Ambiguity in Word	4	3

Senses, Word Sense Disambiguation- Selectional restriction, machine learning approaches, dictionary-based approaches.

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|----|--|---|---|
| 7. | <b>Distributional Semantics:</b> Distributional hypothesis, vector space models, etc. Distributed Representations: Neural Networks (NN), Backpropagation, Softmax, Hierarchical Softmax. Word Vectors: Feedforward NN, Word2Vec, GloVE, Contextualization (ELMo etc.) etc  | 4 | 3 |
| 8. | <b>Discourse Analysis:</b> Pragmatics and Discourse, Ambiguity in Discourse Analysis, Reference resolution, constraints on co-reference, algorithm for pronoun resolution, text coherence, discourse structure in brief.   | 3 | 4 |
| 9. | <b>Text Classification:</b> Preparing Data: Acquiring Text, Text Cleaning, Text Preprocessing with POS tagger, Parsers, Chunkers etc. Statistical analysis of text or sentences. Supervised approach using Classifiers such as Naive Bayes, SVM, Random Forest etc. NN-based Approaches such as LSTM-Based approach using word vectors etc. Dictionary-based or Unsupervised Approaches: Extracting Information using Corpus, evaluating statistical data, Linguistic Properties, WordNet etc. | 4 | 4 |
| 10 | <b>Advances in the domain and Case Studies from various applications of NLP such as</b> Question answering system, Information retrieval, Text categorization, text summarization, Named Entity Recognition, & Sentiment Analysis  | 4 | 4 |

## TEXTBOOKS

1. Dan Jurafsky, James H. Martin, “Speech and Language Processing”, Stanford University, 2017.
2. Christopher D.Manning and Hinrich Schuetze, “Foundations of Statistical Natural Language Processing”, MIT press, 1999.

## RECOMMENDED READING

- 1 Joseph D. Booth, “Natural Language Processing”, Synconfusion, Inc., 2018
- 2 Shuly Wintner, “Formal Language Theory for Natural Language Processing”, ESSLLI, 2001
- 3 Steven Bird, Ewan Klein and Edward Loper, ” Natural Language Processing with Python”, O'Reilly Media, 2009.

<b>Program Name</b>	<b>B. Tech. (Information Technology)</b>	<b>Semester – VII</b>
<b>Course Code</b>	<b>R4IT4204P</b>	
<b>Course Title</b>	<b>Natural Language Processing Lab</b>	
<b>Prerequisite</b>	<b>Machine Learning</b>	

**COURSE OUTCOMES: Students will be able to**

1.	Perform and understand stages of NLP and their application using NLTK toolkit
2.	Use and processing of corpora, word embeddings in NLP experiments.
3.	Access and analyze data from social platforms and perform text classification.
4.	Implement Different approaches such as Supervised, Unsupervised and Knowledge-based approaches to NLP applications

**COURSE CONTENTS**

	<b>Hrs</b>	<b>CO</b>
1. Use of Natural Language Toolkit (NLTK): Computing with Language: Texts and Words, Tokenization, Segmentation, Texts as Lists of Words, Simple Statistic Generation	2	1
2. Accept the Sentence as input and display Part of Speech Tags for the same. Also Perform dependency parsing and list out all dependency relations along with their operands/entities.	2	1
3. A word can be simple or complex. For example, the word 'cat' is simple because one cannot further decompose the word into smaller parts. On the other hand, the word 'cats' is complex, because the word is made up of two parts: root 'cat' and plural suffix '-s'. Develop an Analyser/Generator with Simple User Interface to accept lanua as English / Hindi and a word as input. Now generate the following information for the same. Word, Root, PoS tag, Gender and Person (if noun), Case and Tense (if Verb)	2	1
4. Probability of a sentence can be calculated by the probability of sequence of words occurring in it. We can use Markov assumption, that the probability of a word in a sentence depends on the probability of the word occurring just before it. Such a model is called a first order Markov model or the bigram model. Create a Bigram Language Model using given Corpora and generate the best possible word after a word (given as input).	2	1, 2
5. 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	2	1
6. Develop a Knowledge-based approach for Disambiguating the meaning of an input word from a given sentence.	2	2, 4
7. Experiment to understand and illustrate the word-vectors	2	1, 2

- |    |  |   |      |
|----|--|---|------|
| 8. | Develop a program to extract tweets from twitter platforms, Preprocess the data and store back the cleaned data in a .csv which related to a particular domain or specific hashtag value file. | 2 | 3    |
| 9  | Case study on Text Classification using supervised models  | 4 | 3,4  |
| 10 | Case study on Text classification using Neural Network approach such as LSTM networks.   | 4 | 3, 4 |

### **TEXTBOOKS**

1. Steven Bird, Ewan Klein and Edward Loper, “Natural Language Processing with Python”, O’Reilly Media, 2009.
2. Joseph D. Booth,” Natural Language Processing, SynCFusion”, Inc. , 2018

### **RECOMMENDED READING**

- 1 Dan Jurafsky, James H. Martin,”Speech and Language Processing”, Stanford University, 2017
- 2 Shuly Wintner,” Formal Language Theory for Natural Language Processing”, ESSLLI, 2001
- 3 Nitin Indurkha and Fred J. Damerau,” Handbook of Natural Language Processing”, 2<sup>nd</sup> Edition, Chapman and Hall/CRC Press, 2010.
- 4 Tanveer Siddiqui, U.S. Tiwary.” Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.

<b>Program Name</b>	<b>B. Tech. (Information Technology)</b>	<b>Semester – VII</b>
<b>Course Code</b>	<b>R4IT4205T</b>	
<b>Course Title</b>	<b>Software Architecture</b>	
<b>Prerequisite</b>	<b>Software Engineering</b>	

**COURSE OUTCOMES: Students will be able to**

1.	Identify issues in analysis, implementation and deployment in software architecture.
2.	Apply different Modeling Techniques.
3.	Evaluate different patterns and case study.
4.	Analyze issues in software architecture.

**COURSE CONTENTS**

**Hrs CO**

- |    |  |   |   |
|----|--|---|---|
| 1. | <b>Basic Concepts, Designing Architectures:</b> Concepts of Software Architecture, Models, Processes, Stakeholders, The Design Process, Architectural Conception, Refined Experience in Action: Styles and Architectural Patterns, Architectural Conception in Absence of Experience.  | 6 | 1 |
| 2. | <b>Connectors, Modeling:</b> Connectors in Action: A Motivating Example, Connector, Foundations, Connector Roles, Connector Types and Their Variation Dimensions, Example Connectors, Modeling Concepts, Ambiguity, Accuracy, and Precision, Complex Modeling: Mixed Content and Multiple Views, Evaluating Modeling Techniques, Specific Modeling Techniques. | 6 | 1 |
| 3. | <b>Analysis, Implementation and Deployment:</b> Concepts, Existing Frameworks, Software Architecture and Deployment, Software Architecture and Mobility, Pipes and Filters, Event- based, Implicit Invocation, Layered systems, Repositories Interpreters, Process control. MVC, Peer to peer architecture, 3 tier architecture.                               | 5 | 2 |
| 4. | <b>Applied Architectures and Styles, Designing for Non-Functional Properties:</b><br>Distributed and Networked Architectures, Architectures for Network-Based Applications, Decentralized Architectures, Service-Oriented Architectures and Web Services, Efficiency, Complexity, Scalability and Heterogeneity, Adaptability, Dependability.                  | 5 | 2 |
| 5. | <b>Domain-Specific Software Engineering:</b> Domain-Specific Software Engineering in a Nutshell, Domain-Specific Software Architecture, DSSAs, Product Lines, Micro services, and Architectural Styles, Evaluation of architectures.   | 6 | 3 |
| 6. | <b>Introduction to Pattern. Interface Pattern:</b><br>Interfaces, Adapter, Façade, Composite, Bridge.<br><b>Responsibility Pattern:</b> Responsibility, Singleton, Observer, Mediator, Proxy, Chain of Responsibility, Flyweight.<br><b>Construction Pattern:</b> Construction, Builder, Factory Method, Abstract Factory,                                     | 6 | 4 |

Prototype, Memento.

**Operational Pattern:** Operations, Template Method, State, Strategy, Command, Interpreter.

**Extension Pattern:** Extension, Decorator, Iterator, Visitor.

7. **Advances in the domain and Case Studies**

5 4

**TEXTBOOKS**

- 1 Richard N. Taylor, Nenad Medvidovic and Eric Dashofy, “Software Architecture: Foundations, Theory, and Practice”, Willey India Publication. 3<sup>rd</sup> Edition, 2008.
- 2 Erich Gamma, John Vlissides, Richard Helm and Ralph Johnson, “Design Patterns: Elements of Reusable Object-Oriented Software”, Addison-Wesley, 1994.

**RECOMMENDED READING**

- 1 Stephen T Albin, “The Art of Software Architecture: Design Methods and Techniques”, Wiley Publication, 2<sup>nd</sup> Edition.
- 2 Len Bass, Paul Clements and Rick Kazman, “Software Architecture in Practice,” Addison Wesley, 3<sup>rd</sup> Edition, 2012.
- 3 Mark Richards and Neal Ford, “Fundamentals of Software Architecture”, O'Reilly Media, Inc., January 2020.

<b>Program Name</b>	<b>B. Tech. (Information Technology)</b>	<b>Semester – VII</b>
<b>Course Code</b>	<b>R4IT4205P</b>	
<b>Course Title</b>	<b>Software Architecture Lab</b>	
<b>Prerequisite</b>	<b>Software Engineering</b>	

<b>COURSE OUTCOMES: Students will be able to</b>	
1.	Draw different UML diagrams using software tool.
2.	Analyze the different views of software architecture.
3.	Identify and integrate various architecture and design patterns.
4.	Implement mini project using principles of software architectures.

**LIST OF EXPERIMENTS:**

**Hrs CO**

- |  |   |     |
|--|---|-----|
| 1. Consider an e-commerce application where goods orders are received from customers. Initially these orders are in pending state, after that orders are prepared and dispatched to the appropriate warehouse, simultaneously customer credit limits are checked and orders are confirmed and dispatched. A courier service collects dispatch and transport it to customers during which order status is in-transit. On receipt of goods by order orders is complete. Subsequently, a customer bonus is calculated, which will be offered to him/her as a discount coupon for a specific time period, after which coupon expires. Identify different components and connectors for the above system. Suggest and design an architecture for this system (use UML notations). | 2 | 1   |
| 2. Extend calculator program to implement MVC architecture. Design JFrame to create views, use basic calculator as model and create appropriate controllers.   | 2 | 1,2 |
| 3. Design of the Logical View of the Mini project.   | 2 | 2   |
| 4. System needs to log the messages of the progress of the task in the system for various purposes such as debugging and monitoring progress. The log can be created in different formats like .txt, .html, database, xml, etc. User needs to select the type of the log mechanism required for him at the time of configuring the system.<br>Design the system and draw class diagrams to use factory method pattern.<br>Implement a system in the language of your preference.   | 2 | 2,3 |
| 5. Design of the implementation, process and deployment views for the Mini project   | 2 | 3   |
| 6. Mini Project Implementation: Implementation of the Mini project with emphasis on the inter-process communication mechanism and the software components identified.  | 2 | 4   |

## **TEXTBOOKS**

1. Richard N. Taylor, Nenad Medvidovic and Eric Dashofy, “Software Architecture: Foundations, Theory, and Practice”, Wiley India Publication. 3rd Edition, 2008.
2. Erich Gamma, John Vlissides, Richard Helm and Ralph Johnson, “Design Patterns: Elements of Reusable Object-Oriented Software”, Addison-Wesley, 1994.

## **RECOMMENDED READING**

- 1 Stephen T Albin, “The Art of Software Architecture: Design Methods and Techniques”, Wiley Publication, 2<sup>nd</sup> Edition.
- 2 Len Bass, Paul Clements and Rick Kazman, “Software Architecture in Practice,” Addison Wesley, 3<sup>rd</sup> Edition, 2012.
- 3 Mark Richards and Neal Ford, “Fundamentals of Software Architecture”, O'Reilly Media, Inc., January 2020.



<b>Program Name</b>	<b>B. Tech. (Information Technology)</b>	<b>Semester – VII</b>
<b>Course Code</b>	<b>R4IT4601S</b>	
<b>Course Title</b>	<b>Data Base Management System</b>	
<b>Prerequisite</b>	<b>NIL</b>	

**COURSE OUTCOMES: Students will be able to**

1.	Demonstrate database management systems, architecture and database operations.
2.	Design data models for the real-life systems and logical database design.
3.	Apply normalized database system.
4.	Apply SQL queries for data and database operations and administrations and understand storage and data accessing methodologies, data recovery security transaction processing.

**COURSE CONTENTS**

	<b>Hrs</b>	<b>CO</b>
1. <b>Introduction:</b> Databases and Information Systems, Database System Architecture, Database system concepts: Data modeling, data definition, data dictionary, data manipulation, Database administration function, Levels of abstractions, Data Independence, views, Systems Comparison Of RDBMS, OODBMS, ORDBMS, Database System Applications.	5	1
2. <b>Relational Data Model:</b> Relational Model: Basic concepts. Attributes and domains, concept of integrity and referential constraints, schema diagram, keys, relational query languages, relational operations, relational algebra.	5	2
3. <b>Entity Relationship Model:</b> ER model concepts, Components: Strong & weak entities, relationship, attributes & its types, Integrity constraints, Key constraints, Participation constraints, Extended E-R features: Subclasses and inheritance, Specialization and Generalization, EER to Relational mapping.	5	2
4. <b>Relational Database Design:</b> Basic concepts of normalization, Functional dependencies, Closure of FDs, finding primary keys using FDs, Decomposition using Functional Dependencies: Normal forms: 1NF, 2NF, 3NF, Boyce-Codd Normal Form, 4NF, 5NF.	5	3
5. <b>Introduction to Basic, Intermediate and Advanced SQL:</b> SQL: DDL: Create Modify, Alter, Drop, View definition, etc. DML: SELECT, INSERT, DELETE, Update, Nested Query, SQL with SET operations: Union, Intersect, Except, etc., Aggregate Functions: Group By, Having, SUM, etc., SQL with Logical operations, Nested and Complex Queries, Join Queries. DCL: GRANT, REVOKE, etc., DBA level query. PL/SQL Block: PL/SQL Variables and Data types: PL/SQL Control structures: PL/SQL Cursors and Triggers, PL/SQL Subprograms – Stored Procedures and Functions; Online Analytical Processing Tool (OLAP) - Study of Microstrategy	8	4

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|----|---|---|-------|
| 6. | <b>Transaction Processing &amp; Database Security:</b> Concepts; ACID Properties of Transaction; Serializability and Recoverability; Concurrency control: Lock-based Concurrency Control protocols; Database recovery: database backup, Recovery System, Database security: importance, issues, common threats and challenges, Best Practices: access control, authorization, Common database attacks, data protection tools and platforms. | 5 | 4     |
| 7. | <b>Storage and Indexing Data:</b> Storage structures: Secondary storage devices, buffering of blocks, Basic file systems – File organization – Serial, Sequential, Indexed Sequential, Searching & Indexing. File Organization & Indexing: Clustered Indexing, Primary & secondary indexes.<br>Advances in the domain   | 5 | 4     |
| 8. | <b>Advances in the domain:</b> Introduction to NoSQL & NewSQL Databases   | 1 | 1,2,4 |

### TEXTBOOKS

1. Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database System”, Pearson 7<sup>th</sup> Edition, 2016.
2. Abraham Silberschatz, Henry Korth, Sudarshan, “Database System Concepts”, McGraw-Hill, 7<sup>th</sup> Edition, 2019.

### RECOMMENDED READING

- 1 Michael Mannino, “Database design, Application Development and Administration”, Chicago Business Press, 6<sup>th</sup> Edition, 2017
- 2 Peter Rob and Coronel, “Database systems: Design, Implementation and Management”, Thomson Learning, 5<sup>th</sup> Edition, 2001
- 3 C. J. Date, “Introduction To Database Systems”, Addison Wesley Longman, 7<sup>th</sup> Edition, 2011.
- 4 Raghuram Ramakrishnan, Johannes Gehrke, “Database Management Systems”, McGraw-Hill, 3<sup>rd</sup> Edition, 2014.

<b>Program Name</b>	<b>B. Tech. (Information Technology)</b>	<b>Semester – VII</b>
<b>Course Code</b>	<b>R4IT4602S</b>	
<b>Course Title</b>	<b>Data Analytics</b>	
<b>Prerequisite</b>	<b>NIL</b>	

**COURSE OUTCOMES: Students will be able to**

1.	Demonstrate the data analysis techniques
2.	Demonstrate the concepts behind the descriptive analytics and predictive analytics of data
3.	Understand familiarize with Big Data and its sources
4.	Apply data analysis techniques

**COURSE CONTENTS**

	<b>Hrs</b>	<b>CO</b>
1. <b>Introduction to Data Analysis</b> - Evolution of Analytic scalability, analytic processes and tools, Analysis vs reporting - Modern data analytic tools. Statistical concepts: Sampling distributions, re-sampling, statistical inference, prediction error.	6	1
2. <b>Predictive Analytics</b> – Regression, Decision Tree, Neural Networks. Dimensionality Reduction - Principal component analysis	6	2
3. <b>Descriptive Analytics</b> - Mining Frequent item sets – Market based model – Association and Sequential Rule Mining - Clustering Techniques – Hierarchical – K- Means	6	2,3
4. <b>Introduction to Big data framework</b> - Fundamental concepts of Big Data management and analytics - Current challenges and trends in Big Data Acquisition	6	3
5. <b>Data Analysis Using R</b> - Introduction to R, R Graphical User Interfaces, Data Import and Export, Attribute and Data Types, Descriptive Statistics, Exploratory Data Analysis, Visualization Before Analysis, Dirty Data, visualizing a Single Variable, Examining Multiple Variables, Data Exploration Versus Presentation, Statistical Methods for Evaluation	6	4
6. <b>Popular Big Data Techniques and tools</b> - Map Reduce paradigm and the Hadoop system- Applications Social Media Analytics- Recommender Systems- Fraud Detection.	7	5
7. <b>Advances in the domain</b>	2	4

**TEXTBOOKS**

1. EMC Education Services, “Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data” John Wiley & Sons, 2015.
2. Jaiwei Han, Micheline Kamber, “Data Mining Concepts and Techniques”, Elsevier, 2006.
3. Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, 2007.

## **RECOMMENDED READING**

- 1 Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Business Intelligence and Analytic Trends", John Wiley & Sons, 2013 Challenges and Future Prospects, Springer, 2014.
- 2 Michael Minelli, Michele Chambers, Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", John Wiley & Sons.

<b>Program Name</b>	<b>B. Tech. (Information Technology)</b>	<b>Semester – VII</b>
<b>Course Code</b>	<b>R4IT4603S</b>	
<b>Course Title</b>	<b>Software Engineering</b>	
<b>Prerequisite</b>	<b>NIL</b>	

**COURSE OUTCOMES: Students will be able to**

1.	Demonstrate basic knowledge in Software Engineering.
2.	Plan, gather requirements for, analyze, design, develop and test the software development project
3.	Estimate cost, effort & time, manage risk, prepare project schedule and track it for a software development project.
4.	Analyze the quality of a software & manage its configuration.

**COURSE CONTENTS**

	<b>Hrs</b>	<b>CO</b>
1. <b>Introduction:</b> The Product: Software Characteristics, Applications. The Process: Software Process, Software Process Models, Linear Sequential model, Prototyping model, RAD model, Evolutionary models - Incremental model, Spiral model.	3	1
2. <b>Software project management concepts:</b> Important factors of project management- People, Product, Process, Project.	3	1,2
3. <b>Software Process and Project Metrics:</b> Measures, Metrics, Indicators. Metrics in the process and project domains, Software measurement. Metrics for Software Quality. Integrating metrics.	4	1,2
4. <b>Software Project Planning:</b> Software Scope, Resources, Software project estimation - cost/effort estimation, Decomposition techniques, Empirical estimation models.	4	2,3
5. <b>Risk Analysis and Management:</b> Reactive versus proactive risk strategies, Software risks, Risk identification, Risk projection, Risk mitigation-monitoring-management, RMMM plan.	3	2,3
6. <b>Project Scheduling and Tracking:</b> Defining a task set for the software project, Gantt Chart, Defining a task network, Scheduling.	3	2,3
7. <b>Software Quality Assurance:</b> Software quality assurance, Software reviews, Formal technical reviews, SQA plan.	4	4
8. <b>Software Configuration Management:</b> SCM process, Identification of objects in the software configuration, Version control, Change control, Configuration audit, Status reporting.	3	4
9. <b>Analysis Concepts and Principles:</b> Requirement Analysis, Requirement elicitation for software, Analysis principles, Software prototyping, Requirements Specification.	3	4

10	<b>Analysis Modelling:</b> Data modelling, Functional modelling and information flow, Behavioural modelling.	2	4
11	<b>Design Concepts and Principles:</b> Software design process, Design principles, Design concepts, Effective modular design.	3	2
12	<b>Design Modelling:</b> Data Design. Architectural Design: Software architecture, Mapping requirements into a software architecture. User Interface Design: Human Factor, User interface design process. Component-Level Design: Structured programming design notations.	2	3
13	<b>Software Testing Techniques &amp; Strategies:</b> White-box & Black-box testing techniques. Strategic Approach to Software Testing.	2	4

### TEXTBOOKS

1. Roger Pressman, "Software Engineering", McGraw Hill, 5<sup>th</sup> Edition.
2. Ian Sommerville, "Software Engineering", Pearson Education, 6<sup>th</sup> Edition

### RECOMMENDED READING

- 1 James Peter," Software Engineering an Engineering approach", John Wiley, 1<sup>st</sup> Edition
- 2 W. S. Jawadekar, "Software Engineering", TMH. 1<sup>st</sup> Edition
- 3 R. Mall, "Fundamentals of Software Engineering", Prentice Hall of India, 2<sup>nd</sup> Edition

<b>Program Name</b>	<b>B. Tech. (Information Technology)</b>	<b>Semester – VIII</b>
<b>Course Code</b>	<b>R4IT4011T</b>	
<b>Course Title</b>	<b>Big Data Analytics</b>	
<b>Prerequisite</b>	<b>Data Mining and Warehousing</b>	

**COURSE OUTCOMES: Students will be able to**

1.	Identify different types of data and to select required big data technologies.
2.	Analyze the importance of big data and its analytics.
3.	Build and maintain reliable, scalable, distributed systems with Apache Hadoop.
4.	Apply Hadoop ecosystem components to solve real world problems.

**COURSE CONTENTS**

	<b>Hrs</b>	<b>CO</b>
1. <b>Introduction to Big Data:</b> Data, Characteristics of data and Types of digital data: Unstructured, Semi-structured and Structured, Sources of data, working with unstructured data, Evolution and Definition of big data, Characteristics and Need of big data, Challenges of big data, Data environment versus big data environment, Big Data Analysis Life Cycle.	4	1
2. <b>Big data analytics tools and Technologies:</b> Overview of business intelligence, Characteristics and need of big data analytics, Classification of analytics, Challenges to big data analytics. Analytical operations: Associations rules, classifications, clustering, Mahout ML, etc.	10	2
3. <b>Hadoop foundation for analytics:</b> Features, Hadoop ecosystems, Evolution of Hadoop architectures Hadoop 1.0, Hadoop 2.0, Hadoop3.0, Key aspects and Components of Hadoop 3.0. Hadoop Technology Stack: Hive, Pig, Zookeeper, Sqoop, oozie, flume, etc	12	2,3
4. <b>MapReduce and YARN framework:</b> Introduction to MapReduce, Processing data with MapReduce, Introduction to YARN, Components YARN, Data serialization and Working with common serialization formats, Big data serialization formats.	8	3
5. <b>NoSQL Databases:</b> Schema-less Models, Increasing Flexibility for Data Manipulation- Key Value Stores- Document Stores – Tabular Stores – Object Data Stores Hive – Sharding –Hbase – Analyzing big data with twitter – Big data for E-Commerce Big data for blogs. NoSQL Database Architectures, Case Studies MongoDB and Cassandra, Graph Databases.	8	3,4
6. <b>Introduction to Streams Concepts</b> – Stream Data Model and Architecture – Stream Computing, Sampling Data in a Stream – Filtering Streams – Counting Distinct	10	4

Elements in a Stream – Estimating moments – Counting oneness in a Window – Decaying Window – Real time Analytics Platform (RTAP) applications.  
Case Studies as Spark, Kafka: Features, Components, Architecture, streaming functionalities, Spark QL,

### **TEXTBOOKS**

1. Seema Acharya, Subhashini Chellappan, “Big Data and Analytics”, Wiley, 2016.
- 2 Alex Holmes, “Big Data Black Book”, Dreamtech, 1<sup>st</sup> Edition, 2015.

### **RECOMMENDED READING**

- 1 Minelli, Chambers, Dhiray, “Big Data Big Analytics”, Wiley, Illustrated Edition, 2013.
- 2 Paul Zikopoulos, Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGraw-Hill Osborne Media; 1<sup>st</sup> edition, 2011.



<b>Program Name</b>	<b>B. Tech. (Information Technology)</b>	<b>Semester – VIII</b>
<b>Course Code</b>	<b>R4IT4011P</b>	
<b>Course Title</b>	<b>Big Data Analytics Lab</b>	
<b>Prerequisite</b>	<b>Data Mining and Warehousing</b>	

**COURSE OUTCOMES: Students will be able to**

1.	Build and maintain reliable, scalable, distributed systems with Apache Hadoop.
2.	Apply Hadoop ecosystem components to solve real world problems.
3.	Apply machine learning algorithm for big data analysis.
4.	Design recommended system using Hadoop.

**LIST OF EXPERIMENTS:**

	<b>Hrs</b>	<b>CO</b>
1. Understanding Big Data in real world examples, real time analytics, and design Analysis life cycle for the big data case study.	2	1
2. Set up a pseudo-distributed, single-node Hadoop cluster backed by the Hadoop distributed file system, running on Ubuntu Linux. After successful installation on one node, configuration of a multi-node Hadoop cluster (one master and multiple slaves). MapReduce application for word counting on Hadoop cluster.	2	2,3
3. Unstructured data into NoSQL data and do all operations such as NoSQL query with API.	2	2,3
4. Apply ML algorithms using map reduce.	2	4
5. Page Rank Computation.	2	4
6. Mahout machine learning library to facilitate the knowledge build up in big data analysis.	2	3
7. Recommendation system using Graph Analytics for Big Data on Graph Databases.	2	3
8. Real Time Sentiment Analysis using Apache Spark for Stock Market Predictions or any similar real time requirement case study.	2	4

**TEXTBOOKS**

1. Seema Acharya, Subhashini Chellappan, “Big Data and Analytics”, Wiley, 2016.
2. Alex Holmes, “Big Data Black Book”, Dreamtech, 1<sup>st</sup> Edition, 2015

**RECOMMENDED READING**

- 1 Minelli, Chambers, Dhiray, “Big Data Big Analytics”, Wiley, Illustrated Edition, 2013.
- 2 Paul Zikopoulos, Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGraw-Hill Osborne Media; 1<sup>st</sup> edition, 2011.

<b>Program Name</b>	<b>B. Tech. (Information Technology)</b>	<b>Semester – VIII</b>
<b>Course Code</b>	<b>R4IT4012T</b>	
<b>Course Title</b>	<b>Cloud Computing</b>	
<b>Prerequisite</b>	<b>Nil</b>	

**COURSE OUTCOMES: Students will be able to**

1.	Understand and formulate the basics of cloud computing with its benefits, architecture and measure its value.
2.	Explore the services offered by cloud computing like IAAS, PAAS, SAAS, storage using various application frameworks like MapReduce, HADOOP etc.
3.	Analyze the underlying virtualization technology and implement the same using Open source cloud environment tool.
4.	Evaluate cloud administration, management, and various cloud service providers and explore the security aspects concerning the cloud.

**COURSE CONTENTS**

	<b>Hrs</b>	<b>CO</b>
1. <b>Introduction to Cloud Computing:</b> Roots of Cloud Computing: From mainframe to Cloud, Benefits of Cloud Computing SOA, Web services, Web 2.0, Mashups, Grid computing, Utility computing, Hardware virtualization, Essentials of Cloud characteristics, Challenges, Cloud economics, Role of Networks in Cloud Computing: Cloud types and service models, Cloud computing platforms : Openstack, Open nimbus, Eucalyptus Primary Cloud Service models, Cloud Services brokerage, Primary cloud deployment models, cloud Computing reference model, The greenfield and brownfield deployment options.	4	1,2
2. <b>Virtualization Concepts and Architecture:</b> Introduction, Characteristics of Virtualized environments, Taxonomy of Virtualization techniques, Pros and Cons of Virtualization, Technology examples: Xen, KVM, VMware, Microsoft Hyper-V.	6	3
3. <b>Cloud Computing Platforms:</b> Exploring cloud computing stack – Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Defining Infrastructure as a Service (IaaS), Defining Software as a Service (SaaS), Defining Platform as a Service (PaaS), Defining Identity as a Service (IDaaS), Defining Compliance as a Service (CaaS). Software as a Service – Overview, advantages, limits, Platform as a Service – overview, advantages and functionalities, PaaS application frameworks.	8	2,3
4. <b>Accessing the Cloud:</b> Platforms, WEB applications, WEB APIS, WB Browsers, Google Cloud platform (GCP) Cloud Storage: Overview, Storage providers, Cloud Standards: and cloud storage techniques like MAPREDUCE, HDFS, GFS	4	1,2
5. <b>Cloud Computing at work/Deploying of Cloud:</b> Deployment of cloud. Introduction to cloud environment deployment, Concept of Datacenter, Cloud Datacenter, Deployment of private/public cloud Datacenter using opensource tools like Open stack, Open Nebula. Deployment of various cloud services using open-source tools, Amazon Web Services (AWS), Google Cloud platform (GCP) and various others. Exploring SaaS, PaaS, IaaS,	7	2,3

Company offerings, Industries, Software + services: Overview, Mobile Device Integration, Providers, Microsoft Online Application development: Google, Microsoft, Development Platforms: Google, Sales Force, Azure, Trouble shooting, Application management.

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|----|--|---|---|
| 6. | <b>Cloud Administration:</b> Performance prediction for HPC on Cloud. SLA management: Types of SLA, Life cycle of SLA, Traditional approaches of SLA. service catalog, service ordering process, management and functional interfaces of services, cloud portal and its functions, Management responsibilities, lifecycle management, cloud management products, Cloud management standards.   | 4 | 4 |
| 7. | <b>Security in Cloud Computing:</b> Technologies for Data security, Data security risk, Cloud computing and identity, Digital identity and access management, Content level security, Security-As-A-Cloud Service, Cloud security, Identity and presence protocol standards, Availability management in SaaS, IaaS, PaaS, Access Control, Security Vulnerability, Patch and Configuration Management, Security as a Service of cloud, Future of Security in Cloud computing. | 4 | 4 |
| 8. | <b>Advances in the domain</b>  | 2 | 4 |

#### **TEXTBOOKS**

1. Rajkumar Buyya, T. Selvi Mc-graw Hill, “Mastering cloud computing”, 1<sup>st</sup> Edition, 2017.
2. Gautam Shroff, “Enterprise Cloud Computing: Technology, Architecture, Applications”, Cambridge University press, 2010.

#### **RECOMMENDED READING**

1. Barrie Sosinsky, “Cloud Computing Bible, Wiley & Sons, Illustrated Edition”, 2010.
2. Anthony T. Velte, “Cloud Computing: A Practical Approach”, Tata McGraw Hill, 2009.
3. Tim Mather, Subra Kumarswamy, Shahed latif, “Cloud Security and Privacy –An Enterprise Perspective on Risks and Compliance”, O’Reilly.

<b>Program Name</b>	<b>B. Tech. (Information Technology)</b>	<b>Semester – VIII</b>
<b>Course Code</b>	<b>R4IT4012P</b>	
<b>Course Title</b>	<b>Cloud Computing Lab</b>	
<b>Prerequisite</b>	<b>Nil</b>	

**COURSE OUTCOMES: Students will be able to**

1.	Demonstrate use of virtual machine on virtual machine manager.
2.	Simulate resource allocation in the virtual environment in cloud computing.
3.	Simulate data center allocation, load balancing in cloud computing.
4.	Demonstrate Paas programs in cloud computing.

**LIST OF EXPERIMENTS:**

	<b>Hrs</b>	<b>CO</b>
1. To create virtual machines using virtual box or Vmware on windows or Linux platform and know its various features (Virtualization Concept).	2	1
2. To study and implement logical volumes in physical disk via lvm utility. (allocation of resource)	2	1,2
3. To create x datacenters with x hosts, x VMs, x cloudlets in Cloud Sim	2	2
4. To create x datacenter with x hosts (x per data center) Set storage capacity, ram and cost using Cloud Reports.	2	2
5. To study and perform Equally Spread Current Execution Load Balancing Policy in Cloud Analyst.	2	3
6. To study and perform Throttled Load Balancing Policy in Cloud Analyst	2	3
7. Implement the service model of "Infrastructure as a Service" or private cloud datacenter. Use devstack (Openstack) or Open Nebula or any other open-source framework for IaaS.	2	3
8. Implement "Software as a Service" (SaaS) model using Google Cloud Platform (GCP) or any other.	2	4
9. Implement the service model of "Platform as a Service". Deploy and application on Google App Engine or any other platform providers like AWS	2	4
10. Study and Analysis of Hadoop Distributed File system framework by implementing Similarity Search program or word count program using MapReduce on HADOOP framework	2	3,4

**TEXTBOOKS**

1. Rajkumar Buyya, James Broberg, "A. Goscinski, Mastering cloud computing", 1<sup>st</sup> edition, 2017
2. Gautam Shroff, "Enterprise Cloud Computing: Technology, Architecture, Applications", Cambridge University press, 2010.

## **RECOMMENDED READING**

- 1 Barrie Sosinsky, “Cloud Computing Bible”, Wiley & Sons, Illustrated Edition, 2010.
- 2 Anthony T. Velte, “Cloud Computing: A Practical Approach”, Tata McGraw Hill, 2009.

<b>Program Name</b>	<b>B. Tech. (Information Technology)</b>	<b>Semester – VIII</b>
<b>Course Code</b>	<b>R4IT4301T</b>	
<b>Course Title</b>	<b>Software Testing</b>	
<b>Prerequisite</b>	<b>Software Engineering</b>	

**COURSE OUTCOMES: Students will be able to**

1.	Demonstrate and describe fundamental concepts in software testing such as process, criteria, strategies, methods, and quality parameters.
2.	Evaluate and summarize various software testing issues and their solutions in software for unit, integration, regression, and system testing.
3.	Design and develop project test plan, design test cases, test data, and conduct test operations.
4.	Analyze and report test results for testing defects and quality.

**COURSE CONTENTS**

	<b>Hrs</b>	<b>CO</b>
1. <b>Fundamentals of Testing:</b> Human and errors, Testing and Debugging, Software Quality, Requirement Behavior and Correctness, Fundamentals of Test Process, Psychology of Testing, General Principles of Testing, Test Metrics. A framework for Test and Analysis: Validation and Verification, Degree of Freedom, Varieties of Software	6	1
2. <b>Role of Testing in SDLC:</b> Review of software development models& testing (W Model, V Model) Agile Methodology and its Impact on testing, Levels of Testing: unit testing (JUnit); integration testing; system testing; performance, stress, and configuration testing; regression testing; acceptance testing Object-oriented testing: Problems specific to OO testing adapting classic testing techniques to OO	6	1
3. <b>Approaches to Testing – I:</b> Static Testing, Structured Group Examinations, Static Analysis, Control flow & Data flow, Determining Metrics.	4	2
4. <b>Approaches to Testing – II:</b> Dynamic Testing, Black Box Testing: Equivalence Class Partitioning, Boundary Value Analysis, State Transition Test, Cause Effect Graphing, Decision Table Technique, Use Case Testing. White Box Testing: Statement Coverage, Branch Coverage, Test of Conditions, Path Coverage, Gray Box Testing, Intuitive and Experience Based Testing.	6	3
5. <b>Specialized Testing:</b> Performance Testing: Load, Stress, and Volume. Security Testing, Compatibility Testing, GUI Testing, Control Testing, Smoke Testing, Sanity Testing, Adhoc Testing: Monkey, Exploratory and Random Testing.	6	4
6. <b>Test Metrics &amp; Management:</b> Test Planning, Test Plan, Prioritization Plan, Test Exit Criteria, Cost and economy aspects, Test Activity Management, Incident management, Configuration Management, Test Progress Monitoring and Control.	4	3

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| 7. | <b>Software Quality Assurance and Standards:</b> The Software Quality challenge, what is Software Quality, Software Quality factors, The components of Software Quality Assurance system, Quality Assurance Plan, Quality management standards: The scope of quality management standards, ISO 9001 and ISO 9000-3, Capability Maturity Models – CMM and CMMI assessment methodology. | 5 | 1 |
| 8. | <b>Advances in the domain</b>   | 2 | 4 |

### **TEXTBOOKS**

1. Daniel Galin, Software Quality Assurance. “From theory to implementation, Pearson Education Limited”, 1<sup>st</sup> edition, 2004.
2. Dorothy Graham, Erik Van Veenendaal, Isabel Evans, Rex Black,, “Foundations of Software Testing”, Cengage Learning India Edition, 3rd edition 2015.

### **RECOMMENDED READING**

- 1 William Perry, “Effective Methods for Software Testing”, Willy India Edition, 3<sup>rd</sup> Edition, 2012,
- 2 Michal Young, “Software Testing and Analysis, Process, Principles and Techniques”, University of Oregon ISBN 978-0-471 45593-6.
3. Daniel Galin, “Software Quality Assurance: From theory to implementation”, Pearson Education Limited, 1<sup>st</sup> Edition, 2004

<b>Program Name</b>	<b>B. Tech. (Information Technology)</b>	<b>Semester – VIII</b>
<b>Course Code</b>	<b>R4IT4301P</b>	
<b>Course Title</b>	<b>Software Testing Lab</b>	
<b>Prerequisite</b>	<b>Software Engineering</b>	

**COURSE OUTCOMES: Students will be able to**

1.	Design and formulate a software test process for a software testing project.
2.	Implement identify various software testing problems and solve these problems by designing and selecting software test models, criteria, strategies, and methods.
3.	Implement a test project, design test cases and data, conduct testing operations, manage software problems and defects, generate a testing report.
4.	Analyze and report test results for testing defects and quality.

**COURSE CONTENTS**

	<b>Hrs</b>	<b>CO</b>
1. Perform Verification and Validation and associated umbrella activities related to testing. (Write the test cases for User Authentication for any application. The requirement is username should not be less than or equal to 7 characters. Valid password should be considered as combination of special characters, numbers, capital and small letters.)	2	1
2. Write Master Test Plan for the system with sufficient complexity.	2	2
3. Unit testing of Java Programs using Junit. (Install unit testing framework for java programs, write a simple program and test that program.)	2	2
4. Test suite generation (Apply test suite generation technique to a simple program and write test suites and update them for new test cases.) <b>Hint:</b> Create environment to run multiple test cases, generate test suite with more than one test case, run test suite, and update test suite with more test cases.	2	3
5. Selenium IDE for Web-based testing.	2	3
6. Performance testing using Apache JMeter. (Performance Testing: Load & Stress testing)	2	4
7. Code Coverage of Java Programs. (Tool for Code coverage of Java programs: EclEmma)	2	4

**TEXTBOOKS**

1. Daniel Galin, “Software Quality Assurance: From theory to implementation”, Pearson Education Limited, 1<sup>st</sup> edition, 2004.



2. Dorothy Graham, Erik Van Veenendaal, Isabel Evans, Rex Black,, “Foundations of Software Testing”, Cengage Learning India Edition, 3<sup>rd</sup> Edition 2015.

### **RECOMMENDED READING**

- 1 William Perry, “Effective Methods for Software Testing”, Willy India Edition, 3<sup>rd</sup> Edition, 2012

<b>Program Name</b>	<b>B. Tech. (Information Technology)</b>	<b>Semester – VIII</b>
<b>Course Code</b>	<b>R4IT4302T</b>	
<b>Course Title</b>	<b>Human Computer Interaction</b>	
<b>Prerequisite</b>	<b>Nil</b>	

**COURSE OUTCOMES: Students will be able to**

1.	Apply concepts and guidelines of HCI.
2.	Design and examine interfaces and the interactions among them.
3.	Estimate and apply models and empirical data for system development.
4.	Develop and evaluate interactive systems.

**COURSE CONTENTS**

	<b>Hrs</b>	<b>CO</b>
1. <b>Introduction:</b> Objective, Overview and historical evolution of HCI, Guidelines for HCI: Shneiderman’s eight golden rules, Norman’s seven principles, Norman’s model of interaction, Nielsen’s ten heuristics with example of its use, Heuristic evaluation, Contextual inquiry, Cognitive walkthrough.	6	1
2. <b>Interactive System Design:</b> Concept of usability: definition and elaboration, HCI and software engineering, GUI design and aesthetics, Prototyping techniques.	6	2
3. <b>Model based design and evaluation:</b> Fundamental concepts, basic idea, different types of models, GOMS family of models (KLM and CMN- GOMS), Fitts’ law and Hick-Hyman’s law, Model-based design case studies.	6	2
4. <b>Empirical research methods in HCI:</b> Motivation, issues, research question formulation techniques, experiment design and data analysis.	7	3
5. <b>Task modelling and analysis:</b> Hierarchical Task Analysis (HTA), Engineering task models and Concur Task Tree (CTT).	6	3
6. <b>Dialog Design:</b> Introduction to formalism in dialog design, design using FSM (finite state machines), State charts and (classical) Petri Nets in dialog design.	6	4
7. <b>Advances in the domain</b>	2	4

**TEXTBOOKS**

1. Dix A., Finlay J., Abowd G. D., “Beale R. Human Computer Interaction”, Pearson Education, 3<sup>rd</sup> Edition, 2005.
2. Preece J., Rogers Y., Sharp H., Benyon D., Holland S., Carey T., “Human Computer Interaction: Concepts and Design”, Addison-Wesley, 1994.

## **RECOMMENDED READING**

- 1 B. Shneiderman, P. Catherine, “Designing the User Interface”, Addison Wesley, 6<sup>th</sup> Edition, 2017.

<b>Program Name</b>	<b>B. Tech. (Information Technology)</b>	<b>Semester – VIII</b>
<b>Course Code</b>	<b>R4IT4302P</b>	
<b>Course Title</b>	<b>Human Computer Interaction Lab</b>	
<b>Prerequisite</b>	<b>Nil</b>	

**COURSE OUTCOMES: Students will be able to**

1.	Design and Develop interactive interfaces.
2.	Apply guidelines of HCI, estimate and evaluate models of HCI.
3.	Develop and evaluate interfaces and the interactions
4.	Examine the performance of developed system.

**COURSE CONTENTS**

	<b>Hrs</b>	<b>CO</b>
1. Develop a simple interactive web application for mobile device using learned concepts.	2	1
2. Estimate and apply empirical data, appropriate model and guidelines for hospital monitoring system/University application.	2	2
3. Provide an innovative solution for a better interaction between very busy people and their devices, desktop PCs and home appliances.	2	3
4. Examine Graphics Simulation Real Time Systems or other systems.	2	4
5. Mini Project for the application of HCI concepts	10	2,3,4

**TEXTBOOKS**

1. Dix A., Finlay J., Abowd G. D., Beale R.,” Human Computer Interaction”, Pearson Education, 3<sup>rd</sup> Edition, 2005.
2. Preece J., Rogers Y., Sharp H., Benyon D., Holland S., Carey T., “Human Computer Interaction: Concepts and Design”, Addison-Wesley, 1994.

**RECOMMENDED READING**

- 1 B. Shneiderman, P. Catherine, “Designing the User Interface”, Addison Wesley, 6<sup>th</sup> Edition,2017.

<b>Program Name</b>	<b>B. Tech. (Information Technology)</b>	<b>Semester – VIII</b>
<b>Course Code</b>	<b>R4IT4303T</b>	
<b>Course Title</b>	<b>Social Networking and Analysis</b>	
<b>Prerequisite</b>	<b>Nil</b>	

**COURSE OUTCOMES: Students will be able to**

1.	Understand the fundamentals of Social Network
2.	Demonstrate different segmentation used in Social Network
3.	Identify the different threads and Security holes in Social Network
4.	Analyze different network organizational model

**COURSE CONTENTS**

	<b>Hrs.</b>	<b>CO</b>
1. <b>Introduction:</b> Networks as Information Maps, Leaders and Followers Networks as Conduits.	3	1
2. <b>Basic Network Concepts: Individual Members of Networks:</b> Network, Connections, Propinquity, Homophily, Individual-Level Homophily, Homophily and Collectivises, Dyads and Mutuality, Balance and Triads.	4	1,2
3. <b>Whole Social Networks:</b> Dyads and Triads, Density, Structural Holes, Weak Ties, Popularity or Centrality, Distance, Size of the Interpersonal Environment, The "Small World", Multiplexity, Roles and Positions, Named Positions and Relationships, Informal Positions and Relationships, Informal Relations and Hierarchies.	6	1,2
4. <b>Network Segmentation:</b> Named and Unnamed Network Segments, Primary Groups, Cliques, and Clusters, Segmenting Networks from the Point of View of the Observer, Segmenting Groups on the Basis of Cohesion, Resistance to Disruption, Structural Similarity and Structural Equivalence, Core/Periphery Structures.	6	1,2
5. <b>The Psychological Foundations of Social Networks:</b> Getting Things Done, Community and Support, Safety and Affiliation, Effectiveness and Structural Holes, Safety and Social Networks, Effectiveness and Social Networks, Cultural Differences in Safety, Effectiveness, and Rank, Motivations and Practical Networks, Motivations of Corporate Actors, Cognitive Limits on Individual Networks.	7	3
6. <b>Small Groups, Leadership, and Social Networks: The Basic Building Blocks:</b> Primary Groups and Informal Systems: Propositions, Pure Informal Systems, How to Find Informal Systems, Asymmetric Ties and the Influence of the External System, Formalizing the System.	7	3,4
7. <b>Organizations and Networks:</b> The Contradictions of Authority, Emergent Networks in Organizations, The Factory Floor, Information-Driven Organizations, Inside the Box, Outside the Box, or Both, Bridging the Gaps: Trade-offs between Network Size, Diversity, and Social Cohesion.	4	2,4

8. **Advances in the domain**

2 4

**TEXTBOOKS**

1. Song Yong, “Social Network Analysis Methods and Examples”, SAGE Publications, Inc, November 2016
2. Charles Kadushin, “Understanding Social Networks, Theories, Concepts, and Findings”, Oxford University Press January 2012.

**RECOMMENDED READING**

- 1 Stephen P Bergatti, Martin G Everett, Jaffery C Johnson, “Analyzing Social Networks”, SAGE 2013
2. Christina Prell, “Social Network Analysis: History, Theory and Methodology”, SAGE 2011

<b>Program Name</b>	<b>B. Tech. (Information Technology)</b>	<b>Semester – VIII</b>
<b>Course Code</b>	<b>R4IT4303P</b>	
<b>Course Title</b>	<b>Social Networking and Analysis Lab</b>	
<b>Prerequisite</b>	<b>Nil</b>	

**COURSE OUTCOMES: Students will be able to**

1.	Demonstrate the fundamentals of Social Network
2.	Analyze different segmentation used in Social Network
3.	Identify the different threads and Security holes in Social Network
4.	Analyze different network organizational model

**COURSE CONTENTS**

	<b>Hrs</b>	<b>CO</b>
1. Introduction to R : The R environment. statnet package for social network analysis. Basic transformation and visualization tools. Lab: Loading, manipulating, visualizing and saving network data in R.	4	1,2,3
2. Metrics: Measures of centrality. PageRank, Hubs and Authorities. Betweenness. Transitivity, Reciprocity. Structural balance. Homophily and assortativity. Lab: Computing and displaying graph metrics in R.	4	2,3,4
3. Graph partitioning. Spectral partitioning. Modularity and modularity maximization. Lab: Calculating and comparing clustering approaches.	4	3,4

**TEXTBOOKS**

1. Song Yong, “Social Network Analysis Methods and Examples”, SAGE Publications, Inc, November 2016
2. Charles Kadushin, ” Understanding Social Networks”, Theories, Concepts, and Findings”, Oxford University Press, January 2012.

**RECOMMENDED READING**

- 1 Stephen P Bergatti, Martin G Everett, Jaffery C Johnson, “Analyzing Social Networks”, SAGE 2013
- 2 Christina Prell, “Social Network Analysis: History, Theory and Methodology”, SAGE 2011

<b>Program Name</b>	<b>B. Tech. (Information Technology)</b>	<b>Semester – VIII</b>
<b>Course Code</b>	<b>R4IT4304T</b>	
<b>Course Title</b>	<b>Service Oriented Architecture</b>	
<b>Prerequisite</b>	<b>Software Engineering</b>	

**COURSE OUTCOMES: Students will be able to**

1.	Identify key issues service-oriented architecture and apply BPM to industry applications.
2.	Design XML Schema for various components of web services for applications.
3.	Design services with emphasis on security at different levels.
4.	Apply Architecture governance and management to case studies.

**COURSE CONTENTS**

	<b>Hrs</b>	<b>CO</b>
1. <b>Service –Oriented Architecture (SOA) Overview:</b> Introduction to Service oriented computing, Goals and Service-oriented Computing, Goals and Benefits of Service oriented computing, Service orientation challenges, effects and solutions.	5	1
2. <b>Architectural details of SOA:</b> SOA Reference Architecture, Business Architecture, Business Process Models, Business Process Management and Modeling, Conditional Business Process Models, Organizing Services.	6	1
3. <b>Service Definition in SOA:</b> Service Identification, Service Specification, Services Realization, Service Life Cycle, The Service Design Process, and Service Inventory.	4	2
4. <b>Web Service Components and Protocols:</b> XML-RPC, SOAP, WSDL, and UDDI.	6	3
5. <b>Designing and implementing services:</b> Designing service interfaces, implementing interface, business and resource layers, Service Composition implementation.	6	4
6. <b>SOA Security:</b> SOA Security Goals and Fundamentals, Web Service Security Standards and Specifications, Securing the Communications Layer, Message-Level Security, and Data-Level Security.	6	3
7. <b>SOA Governance:</b> SOA Management and Governance, Service Life Cycle and SOA governance, Practical SOA Governance.	4	4
8. <b>Advances in the domain</b>	2	4

**TEXTBOOKS**

1. Thomas Erl, “Service-Oriented Architecture: Analysis and Design for Services and Microservices” Prentice Hall, 2017
2. Marc J. Balcer, Kevin T. Smith, Boris Lublinsky, Michael Rosen, “Applied SOA: Service-Oriented Architecture and Design Strategies”, Wiley India, 2008.



## **RECOMMENDED READING**

- 1 Thomas Erl, "SOA with REST: Principles, Patterns & Constraints for Building Enterprise Solutions with REST", Prentice Hall, 1<sup>st</sup> Edition, 2013
- 2 Ramarao Kanneganti, Prasad Chodavarapu, "SOA Security", Dream Tech Press, 2008.
3. Thomas Erl, "SOA Principles of Service Design", Pearson Education, 1<sup>st</sup> Edition, 2008.

<b>Program Name</b>	<b>B. Tech. (Information Technology)</b>	<b>Semester – VIII</b>
<b>Course Code</b>	<b>R4IT4304P</b>	
<b>Course Title</b>	<b>Service Oriented Architecture Lab</b>	
<b>Prerequisite</b>	<b>Software Engineering</b>	

**COURSE OUTCOMES: Students will be able to**

1.	Demonstrate and map the XML Parser into & create web services.
2.	Design web services.
3.	Implement and integrate web Services.
4.	Design and analyze SOAP parsers.

**LIST OF EXPERIMENTS:**

	<b>Hrs.</b>	<b>CO</b>
1. Write an XML Parser that can read an XML file with the given XML schema and display the data.	2	1
2. Develop a web service for finding factorial of three numbers.	2	2
3. Develop a web service client which uses a division web service from a different project.	2	2
4. To create a web service client which uses a factorial web service from a different project.	2	3
5. Composition of two Web services.	2	3
6. Composition of three Web services.	2	4
7. Write a program to retrieve the data from SOAP request.	2	4
8. Write a program to retrieve the data from SOAP response.	2	1
9. Write a program for parsing WSDL.	2	1
10. Write a program using JSON, REST	2	2

**TEXTBOOKS**

1. Thomas Erl, "Service-Oriented Architecture: Analysis and Design for Services and Microservices" Prentice Hall, 2017
2. Marc J. Balcer, Kevin T. Smith, Boris Lublinsky, Michael Rosen, "Applied SOA: Service-Oriented Architecture and Design Strategies", Wiley India, 2008.

## **RECOMMENDED READING**

- 1 Thomas Erl, “SOA with REST: Principles, Patterns & Constraints for Building Enterprise Solutions with REST”, Prentice Hall, 1<sup>st</sup> Edition, 2013.
- 2 Ramarao Kanneganti, Prasad Chodavarapu, “SOA Security”, Dream Tech Press, 2008.
- 3 Thomas Erl, “SOA Principles of Service Design”, Pearson Education, 1<sup>st</sup> Edition, 2008.

<b>Program Name</b>	<b>B. Tech. (Information Technology)</b>	<b>Semester – VIII</b>
<b>Course Code</b>	<b>R4IT4305T</b>	
<b>Course Title</b>	<b>Soft Computing</b>	
<b>Prerequisite</b>	<b>Artificial Intelligence</b>	

**COURSE OUTCOMES: Students will be able to**

1.	Analyze various neural network algorithms.
2.	Design artificial neural networks of the Backpropagation, Hopfield, RBF and SOM for particular applications.
3.	Justify the applicability of fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
4.	Apply genetic algorithms for solving problems.

**COURSE CONTENTS**

	<b>Hrs.</b>	<b>CO</b>
1. <b>Artificial Neural Network:</b> Fundamental Concept, Evolution of Neural Networks, McCulloch-Pitts Neuron, Basic Models of Artificial Neural Network, Important Terminologies of ANNs, Learning and Adaptation, Learning rules.	3	1
2. <b>Supervised Learning Network:</b> Single layer perceptron classifiers: Models, features, discriminant functions, non-parametric training, Discrete perceptron algorithm, continuous perceptron algorithm, Perception Networks. Multilayer Feedforward Network: Linearly non separable pattern classification, delta learning rule, error back propagation training and learning factors.	6	1,2
3. <b>Single Layer Feedback Networks, Associative Memory Networks:</b> Training Algorithm of Pattern Association, Auto associative Memory Network, Heteroassociative Memory Network, Bidirectional Associative Memory, Hopfield Networks, and Interactive Auto associative Memory Network.	5	1,2
4. <b>Unsupervised Learning Network:</b> Fixed Weight Competitive Nets, Kohonen Self-Organizing Feature Maps, Learning Vector Quantization, Counter propagation Networks, Adaptive Resonance Theory Network	4	1,2
5. <b>Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets:</b> Classical Sets (Crisp Sets), Fuzzy Sets, Cartesian Product of Relation, Classical relation, Fuzzy Relations, Tolerance and Equivalence Relations, Non-interactive Fuzzy Sets, Features of the Membership Functions. <b>Defuzzification, Fuzzy Arithmetic and Fuzzy Measures:</b> Lambda-Cuts for Fuzzy Sets (Alpha-cuts), Lambda Cuts for Fuzzy Relations, Defuzzification Methods, Fuzzy Arithmetic, Extension principles, Fuzzy Measures, Measures of Fuzziness, Fuzzy Integrals, Truth Values and Tables in Fuzzy Logic Fuzzy Propositions, Formation of Rules, Decomposition of Rules, Aggregation of Fuzzy Rules, Fuzzy Reasoning, Fuzzy Inference Systems.	7	3

6.	<b>Systems, Overview of Fuzzy Expert Systems. Fuzzy Decision Making and Fuzzy Logic Control Systems:</b> Individual Decision Making, multiperson decision making, multiobjective decision making, Multiattribute decision making, Fuzzy Bayesian decision making, Control System Design, Architecture and operation of FLC system, FLC System Models, Application of FLC Systems.	4	3
7.	<b>Genetic Algorithm:</b> Biological Background, Traditional Optimization & Search Techniques, Genetic Algorithm and Search Space, Genetic Algorithm vs Traditional Algorithms, Basic Terminologies in Genetic Algorithm, Simple GA, General Genetic Algorithm, Operators in Genetic Algorithm, Stopping Condition for Genetic Algorithm flow, constraints in Genetic Algorithm, Problem Solving	4	4
8.	<b>Applications of Soft Computing:</b> Optimization of Travelling Salesman Problem and Genetic Algorithm Approach, Soft computing Based Hybrid Fuzzy Controllers, Soft Computing Based Rocket Engine Control, Applications in the field of Audio, Image, Video and Big Data.	4	2,3,4
9	<b>Advances in the domain</b>	2	2,3,4

### TEXTBOOKS

1. S.N. Sivanandam and S.N. Deepa, “Principles of Soft Computing”, Wiley India Pvt. Ltd., 2<sup>nd</sup> Edition, 2011.
2. Timothy J. Ross, “Fuzzy Logic with Engineering Applications”, A John Wiley and Sons, Ltd., Publication, 3<sup>rd</sup> Edition, 2010.

### RECOMMENDED READING

- 1 Fakhreddine O. Karray And Clarence De Silva, “Soft Computing and Intelligent Systems Design (Theory, Tools and Applications)”, Pearson Education, 1<sup>st</sup> Edition, 2009.
- 2 J. M. Zurada, “Introduction to Artificial Neural Systems”, Jaico Publishing Company, 1st Edition, ISBN: 81-7224-650-1

<b>Program Name</b>	<b>B. Tech. (Information Technology)</b>	<b>Semester – VIII</b>
<b>Course Code</b>	<b>R4IT4305P</b>	
<b>Course Title</b>	<b>Soft Computing Lab</b>	
<b>Prerequisite</b>	<b>Artificial Intelligence</b>	

**COURSE OUTCOMES: Students will be able to**

1.	Design various neural network algorithms.
2.	Develop artificial neural networks of the Back-prop, Hopfield, RBF and SOM for particular applications.
3.	Implement the applicability of fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
4.	Apply genetic algorithms for solving problems.

**COURSE CONTENTS**

	<b>Hrs</b>	<b>CO</b>
1. To perform classification of logic functions using single layer perceptron algorithm.	2	1
2. To perform Hebbian learning rule and understand neural network learning process.	2	1
3. To perform clustering on data set using competitive learning rule	2	1
4. To solve classification problem with the help of Radial Basis Function.	2	1
5. To perform classification / recognition using any error back-propagation algorithm.	2	2
6. To perform character recognition using Hopfield network.	2	2
7. To implement a hetro-associator using binary associative memory.	2	2
8. To study various membership functions used in fuzzy logic and calculate degree of membership for particular element in set.	2	3
9. To implement FKBC for calculating	2	3
1. Wash time of washing machine if dirt and grease values are known		
2. Break power for locomotive if speed and distance values are known		
10. To implement Genetic Algorithm to minimize $(x) = x^2$ .	2	4
11. To implement Fuzzy ANN Solution.	2	4

**TEXTBOOKS**

1. S.N. Sivanandam and S.N. Deepa, "Principles of Soft Computing", Wiley India Pvt. Ltd., 2<sup>nd</sup> Edition, 2011.
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", John Wiley and Sons, Ltd., Publication, 3<sup>rd</sup> Edition, 2010.

## **RECOMMENDED READING**

- 1 Fakhreddine O. Karray and Clarence De Silva, “Soft Computing and Intelligent Systems Design (Theory, Tools and Applications)”, Pearson Education, 1<sup>st</sup> Edition, 2009.
- 2 J. M. Zurada, “Introduction to Artificial Neural Systems”, Jaico Publishing Company, 1<sup>st</sup> Edition, 1994.

<b>Program Name</b>	<b>B. Tech. (Information Technology)</b>	<b>Semester – VIII</b>
<b>Course Code</b>	<b>R4IT4401S</b>	
<b>Course Title</b>	<b>Multicore Technologies</b>	
<b>Prerequisite</b>	<b>Parallel Computing</b>	

**COURSE OUTCOMES: Students will be able to**

1.	Understanding in multicore, many core architectures
2.	Analyze parallel programming environments using threads and alternative solutions.
3.	Design and apply algorithms perspective for multicore and many architectures.
4.	Exploring supercomputing architecture.

**COURSE CONTENTS**

	<b>Hrs</b>	<b>CO</b>
1. <b>Introduction to Multi-Core and Many core Architecture:</b> Parallel Computing Platforms, Parallel Computing in Microprocessors, Single-Core Processor Architecture Fundamentals, Evolution of Multi-core CPUs, Recent Evolution of NVIDIA GPUs, Fermi Streaming Multiprocessor Architecture, ATI Radeon 5000 Series Architecture, VLIW Stream Core (SC), Processor Generation / Cores Per Socket, Evolution of Intel Multicore Processors series.	6+2	1
2. <b>System Overview of Threading:</b> Defining Threads, System View of Threads, Threading above the Operating System, Application Programming Models and Threading. Threading on Multi- Core Processors Hardware-based Threading, Threading from Intel, Hyper-Threading Technology, Difference between Multiprocessor and Hyper-Threading Technology, Hyper-Threading Technology Architecture. Virtualization.	6+2	1
3. <b>File System Architectures:</b> Introduction to Grid, Cluster, Job Management Systems, File Systems: Shared File Systems (e.g., NFS), Parallel File Systems (e.g., GPFS, PVFS, Lustre).	4+2	3
4. <b>High Performance Interconnect: Topology:</b> Fat-Tree, Dragonfly, Torus, Hypercube, HyperX, etc. <b>High speed Interconnect:</b> InfiniBand, high speed ethernet, etc. <b>Protocol</b> etc.	4+2	3
5. <b>Concepts of Multicore Programming:</b> Designing for Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, Characteristics of Tasks and Interactions, Parallel Algorithm Models, <b>Combining OpenMP and MPI:</b> Steps for building a hybrid cluster, MPI routines, differences in OpenMP and MPI, Examples like Searching, Sorting, and Linear System Equations, Dense Matrix Algorithms, Graph Algorithms, Search Algorithms for Discrete Optimization Problems, Dynamic Programming.	6+2	2



6. **Concepts of Manycore Programming:** Data Parallelism, Data-Parallel Execution Mode, CUDA Memories, Data Parallelism, CUDA Program Structure, A Vector Addition Kernel, Device Global Memory and Data Transfer, Kernel Functions and Threading, Cuda Thread Organization, Mapping Threads to Multidimensional Data, Matrix-Matrix Multiplication—A More Complex Kernel, Synchronization and Transparent Scalability, Assigning Resources to Blocks, Querying Device Properties, Importance of Memory Access Efficiency, CUDA Device Memory Types, A Strategy for Reducing Global Memory Traffic, A Tiled Matrix Matrix Multiplication Kernel, Memory as a Limiting Factor to Parallelism, Warps and Thread Execution, Global Memory Bandwidth, Dynamic Partitioning of Execution Resources, Instruction Mix and Thread Granularity. Example: Matrix algorithm. Hybrid computing, Pitfalls and issues of Many-core Programming. 6+2 2
7. **Case Study: Supercomputing Architectures:** Interconnect Family, Operating System Family, INDIA@TOP500, Green500, **performance benchmarks: Graph500.** **Research Recommendations:** Rethinking programming models, System Software, Rethinking architecture, Power efficiency, Energy Constraints, Future Computational Challenges. 6+2 4

## TEXTBOOKS

1. Shameem Akhter, Jason Roberts, “Multi-Core Programming: Increasing Performance through Software Multi-threading”, Intel Press, April 2006.
2. Ananth Grama, “An Introduction to Parallel Computing: Design and Analysis of Algorithms”, Pearson publication, 2009.

## RECOMMENDED READING

- 1 Michael J Quinn, “Parallel Programming in C with MPI and OpenMP”, Tata McGraw-Hill 2011.
- 2 Barbara Chapman, “Using OpenMP. Portable Shared Memory Parallel Programming”, The MIT Press Cambridge, Massachusetts London, England 2008.
- 3 David B. Kirk and Wen-mei W. Hwu, “Programming Massively Parallel Processors A Hands-on Approach Second Edition”, Elsevier 2013.
- 4 Peter S. Pacheco, “An Introduction to Parallel Programming”, Morgan Kaufmann, Elsevier Series, 1st Edition, 2011.
- 5 Bhujade Moreshwar R., “Parallel Computing”, New Age International Pvt. Ltd., 2008.
- 6 Hawang Kai and Briggs F. A., “Computer Architecture and Parallel Processing”, Tata McGraw Hill, 1984.
- 7 John L Hennessy, David A Patterson, “Computer Architecture: A Quantitative Approach, Morgan Kaufmann”, 6<sup>th</sup> Edition, 2017.

<b>Program Name</b>	<b>B. Tech. (Information Technology)</b>	<b>Semester – VIII</b>
<b>Course Code</b>	<b>R4IT4402S</b>	
<b>Course Title</b>	<b>Advanced Database Engineering</b>	
<b>Prerequisite</b>	<b>Database Management Systems</b>	

**COURSE OUTCOMES: Students will be able to**

1.	Summarize and illustrate concepts and working of parallel database system and Distributed database systems.
2.	Analyze key characteristics of data warehouse and apply design methodologies of data warehouse for OLTP.
3.	Design XML database and query data from semi-structured data models.
4.	Discuss advance databases such as Cloud databases, Hadoop databases, and NoSQL processing, and application of modern tools for cloud computing environment.

**COURSE CONTENTS**

	<b>Hrs</b>	<b>CO</b>
1. <b>Parallel Databases:</b> Introduction, I/O Parallelism, Inter-query and Intra-query Parallelism, Inter-operational and Intra-operational Parallelism, Design of Parallel systems.	6+2	1
2. <b>Distributed Databases:</b> Homogeneous and Heterogeneous databases, Storing data in distributed DBMS, Distributed catalog management.	8+2	1
3. <b>Distributed Transactions:</b> Distributed Transactions and Query processing, Distributed Concurrency and recovery.	6+2	2
4. <b>Data Warehouse and OLAP:</b> Decision support, Data warehousing, Creating and maintaining a warehouse. OLAP: Multidimensional data model, OLAP queries, Database design for OLAP, Implementation techniques for OLAP bitmap indexes, Join indexes, Views and decision support, Top N Queries, Online aggregation.	8+2	3
5. <b>XML:</b> Structure of XML data, XML document schema, Querying and transformation, API to XML, Storage of XML data, XML applications.	6+2	4
6. <b>Advanced Topics:</b> Hadoop / Map Reduce, No SQL databases.	6+2	3

**TEXTBOOKS**

1. R. Elmasri, and S. Navathe, “Fundamentals of Database Systems, Benjamin Cummings”, Pearson, 7<sup>th</sup> Edition, 2016.
2. Abraham Silberschatz, Henry F. Korth, S. “Sudarshan, Database system concepts”, McGraw Hill International Edition, 7<sup>th</sup> Edition, 2019.

## **RECOMMENDED READING**

- 1 Rob Coronel, “Database systems: Design Implementation and Management”, Thomson Learning Press, 5<sup>th</sup> Edition, 2006.
- 2 J. D. Ullman, “Principles of Database Systems”, Galgotia Publication, 2<sup>nd</sup> Edition, 1999.
- 3 Raghu Ramkrishnan, Johannes Gehrke, “Database Management Systems”, McGraw Hill International Editions, 3<sup>rd</sup> Edition, 2014.

<b>Program Name</b>	<b>B. Tech. (Information Technology)</b>	<b>Semester – VII</b>
<b>Course Code</b>	<b>R4IT4403S</b>	
<b>Course Title</b>	<b>Internet of Things</b>	
<b>Prerequisite</b>	<b>NIL</b>	

**COURSE OUTCOMES: Students will be able to**

1.	Understand digital transformation.
2.	Understand the IoT infrastructure and its applications.
3.	Analyze the system and use appropriate architecture, and protocols for a given scenario.
4.	Understand the use of cloud platform and its framework for the development of IoT applications.

**COURSE CONTENTS**

	<b>Hrs</b>	<b>CO</b>
1. <b>Introduction to Digital Transformation:</b> What is digital disruption? Examples of Digital Disruption. Waves of Digital Disruption, Why Digital Disruption, examples, what are the emerging digital technologies? 2016 Top 10 Tech Trends, The Digital Technology Stack, Digital Innovation. The SMAC (Social, Mobile, Analytics, Cloud) Stack	6+2	1
2. <b>Introduction to IoT:</b> Future of IoT, Some Interesting IoT Projects, IoT Applications Retail, Healthcare & Agriculture, IoT Challenges, IoT Reference Architecture.	4+2	1
3. <b>IoT Physical Devices &amp; Endpoints:</b> Hardware and software concepts of Microcontrollers and Microprocessors. Study and usage of Prototyping boards like - Arduino, Intel Edison, Raspberry pi etc. (from software and hardware perspective). Study and usage of various types of sensors and actuators such as temperatures sensor, light sensor, Rotary angle sensor, buzzer, LED etc., IoT devices, IoT gateways.	10+2	3
4. <b>Programming of IoT Devices:</b> Basic study of programming languages like C & Python used for programming IoT devices. Other programming languages used for IoT.	6+2	3
5. <b>Different aspects of IoT system:</b> Characteristics of IoT, Physical Design of IoT: Things in IoT, IoT Protocols, Logical Design of IoT: IoT Functional Blocks, IoT Communication Models, IoT Communication APIs, IoT Enabling Technologies: Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems, IoT levels, IoT and M2M, A generic design methodology for Internet of Things.	8+2	4
6. <b>IoT Servers and Cloud:</b> An introduction to the use of cloud platforms and frameworks for developing IoT applications, Data Analytics for IoT.	4+2	4
7. <b>Advances in the domain</b>	2	4

## **TEXTBOOKS**

1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things: A Hands-on Approach”, Universities Press, 2015.
2. John Boxall, “Arduino Workshop A Hands-On Introduction with 65 Projects”, No Starch Press, Inc. San Francisco, CA USA, 2013.

## **RECOMMENDED READING**

- 1 Stephanie Moyerman, “Getting Started with Intel Edison”, Published by Maker Media, Inc., San Francisco, 2016. CA 94111.

<b>Program Name</b>	<b>B. Tech. (Information Technology)</b>	<b>Semester – VIII</b>
<b>Course Code</b>	<b>R4IT4404S</b>	
<b>Course Title</b>	<b>Virtual Reality</b>	
<b>Prerequisite</b>	<b>Nil</b>	

<b>COURSE OUTCOMES: Students will be able to</b>	
1.	Apply knowledge of geometry in virtual reality
2.	Visualize perception in virtual reality
3.	Interpret lights and optics.
4.	Explore tracking systems

#### **COURSE CONTENTS**

	<b>Hrs</b>	<b>CO</b>
1. <b>Introduction:</b> Course mechanics, Goals and VR definitions, Historical perspective, Birds-eye view (general) Birds-eye view (general), Birds-eye view (hardware), Birds-eye view (software), Birds-eye view (sensation and perception).	4+1	1
2. <b>Geometry of Virtual Worlds:</b> Geometric modelling, transforming models, Matrix algebra and 2D rotations, 3D rotations and yaw, pitch, and roll, 3D rotations and yaw, pitch, and roll, Axis-angle representations Quaternions Converting and multiplying rotations, Converting and multiplying rotations, Homogeneous transforms, The chain of viewing transforms, Eye transforms, Eye transforms, Canonical view transform, Viewport transform, Viewport transform.	6+2	2
3. <b>Light and Optics:</b> Three interpretations of light, Refraction, Simple lenses, Diopters, Imaging properties of lenses, Lens aberrations, Optical system of eyes.	4+1	3
4. <b>Visual Physiology:</b> Photoreceptors, Sufficient resolution for VR, Light intensity, Eye movements, Eye movements, Eye movement issues for VR, Neuroscience of vision.	5+2	3
5. <b>Visual Perception:</b> Depth perception, Depth perception, Motion perception, Frame rates and displays, Frame rate.	4+1	3
6. <b>Tracking Systems:</b> Overview, Orientation tracking, Tilt drift correction, Yaw drift correction, Tracking with a camera, Perspective n-point problem, Filtering, Lighthouse approach.	4+1	4
7. <b>Visual Rendering:</b> Visual Rendering-Overview, Visual Rendering-overview, Shading models, Rasterization, Pixel shading, VR-specific problems, Distortion shading, Post-rendering image warp.	4+1	4
8. <b>Audio:</b> Physics and physiology, Auditory perception, Auditory localization, Rendering, Specialization and display, Combining other senses.	4+1	4

9	<b>Interfaces:</b> Interface's overview, Locomotion, Manipulation, System control, Social interaction, Evaluation of VR Systems.	4+1	4
10	<b>Advances in the domain</b>	2	4

### **TEXTBOOKS**

1. George Mather, "Foundations of Sensation and Perception: Psychology Press", 3<sup>rd</sup> Edition, 2016.
2. Peter Shirley, Michael Ashikhmin, Steve Marschner, "Fundamentals of Computer Graphics", A K Peters/CRC Press, 3<sup>rd</sup> Edition, 2009.

### **RECOMMENDED READING**

- 1 Jason Jerald, "The VR Book Human-Centered Design for Virtual Reality", NextGen Interactions

<b>Program Name</b>	<b>B. Tech. (Information Technology)</b>	<b>Semester – VIII</b>
<b>Course Code</b>	<b>R4IT4405S</b>	
<b>Course Title</b>	<b>Distributed Algorithms</b>	
<b>Prerequisite</b>	<b>Algorithms and Operating Systems</b>	

**COURSE OUTCOMES: Students will be able to**

1.	Demonstrate the knowledge of various aspects of distributed paradigms.
2.	Apply the synchronization for distributed applications.
3.	Design and apply distributed algorithms for the distributed systems.
4.	Utilize fault tolerance techniques for optimization of system performance.

**COURSE CONTENTS**

	<b>Hrs</b>	<b>CO</b>
1. <b>Theoretical foundations:</b> introduction, limitations of a distributed system, Lamport's logical clocks, vector clocks, causal ordering of messages, Global state reordering algorithm, Cuts of a distributed computation, Termination detection: Computation trees and forests, web-based solutions. Other solutions.	4+1	1
2. <b>Distributed mutual exclusion:</b> Lamport's algorithm, Ricart-Agrawala Algorithm, Maekawa algorithm, Suzuki-Kasami algorithm, Raymond's tree-based algorithm.	4+1	1
3. <b>Routing Algorithms and Deadlock-free packet switching:</b> Destination-based routing, All-pairs shortest path algorithm, Net change algorithm, Routing with compact routing tables, Hierarchical routing, and introduction to packet-switching and deadlock in packet-switching network, structured solution, and unstructured solutions. Distributed deadlock detection: centralized algorithms, distributed algorithms.	8+2	2
4. <b>Election Algorithm:</b> Introduction, Ring Networks, Arbitrary network, The Karachi-Kuttan-Moran Algorithm, Introduction to anonymous networks, A probabilistic election algorithm, two snapshot algorithms, preliminaries of sense of direction and orientation, Election in rings and choral rings, computing in hypercube and complexity related issues	7+2	2,3
5. <b>Synchrony in Networks:</b> Leader Election in synchronous networks, Synchronizer algorithm, Application: Breadth-First Search, Shortest Paths, Minimum Spanning Tree.	5+1	2,3
6. <b>Failure recovery and fault tolerance:</b> Classification of failures, Checkpoints, Synchronous checkpointing and recovery, Asynchronous checkpointing and recovery, Commit protocols, Voting protocols, Dynamic voting protocols, robust algorithms, stabilizing algorithms, The Coordinated Attack Problem ,Algorithms for Byzantine Failures	7+2	4
7. <b>Asynchronous Shared Memory Model:</b> Shared Memory Systems, Environment Model. <b>Mutual Exclusion:</b> Asynchronous Shared Memory Model, The Problem, Dijkstra's Mutual Exclusion Algorithm, The Bakery Algorithm. <b>Resource Allocation:</b> The Problem, Nonexistence of Symmetric Dining Philosophers	4+2	4



## Algorithms, Right-Left Dining Philosophers Algorithm

### 8. **Advances in the domain**

2 4

### **TEXTBOOKS**

1. Ajay D. Kshemkalyani and Mukesh Singhal, “Distributed Computing: Principles”, Algorithms, and Systems, Cambridge, 2010.
2. Mukesh Singhal , Niranjan Shivaratri, “Advanced concepts in operating systems”, Indian Edition, 2017.

### **RECOMMENDED READING**

- 1 Lynch, Nancy A. Lynch, “Distributed Algorithms”, The Morgan Kaufmann Series, MIT Press, 1996.
- 2 Gerard Tel, “Introduction to Distributed Algorithms”, Cambridge University Press, 2<sup>nd</sup> edition, 2000.
- 3 George F. Coulouris, Jean Dollimore, Tim Kindberg, “Distributed Systems: Concepts and Design”, Pearson Education, 5<sup>th</sup> Edition, 2011.
- 4 Wan J. Fokkink, “Distributed Algorithms: An Intuitive Approach”, MIT Press, 2019.