



## **B. Tech. in Information Technology**

### **Third Year [TE] Syllabus**

**For students of**

*Academic Year 2021-22*

*Department of Information Technology*

**Ramrao Adik Institute of Technology**

**Bachelor of Technology in Information Technology**  
**Semester-V**

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
<b>ITC501</b>	<b>Computer Networks</b>	03		-	03		-	03
<b>ITDLO50101</b>	<b>DLO1</b>	03		-	03		-	03
<b>ITDLO50201</b>	<b>DLO2</b>	03		-	03		-	03
<b>ILOT50101</b>	<b>Institute Level Open Elective Technical ILOT1</b>	03		-	03		-	03
<b>ILON50102</b>	<b>Institute Level Open Elective Non-Technical ILON1</b>	03		-	03		-	03
<b>ITL501</b>	<b>Computer Networks Lab</b>		02			01		01
<b>ITDL0L50101</b>	<b>DLO1 Lab</b>		02			01		01
<b>ITDL0L50201</b>	<b>DLO2 Lab</b>		02			01		01
<b>ITL502</b>	<b>Professional Communication and Ethics</b>		04 (02T + 02P)			02		02
<b>ITL503</b>	<b>Skill Based Lab III: Web Programming Lab</b>	-	02	-	-	01	-	01
<b>ITMP501</b>	<b>Mini Project III</b>		04			02		02
<b>*HBSO501</b>	<b>Financial Accounting(Online)</b>	-	-	-		-	-	01*
	<b>Total</b>	<b>15</b>	<b>16</b>	<b>-</b>	<b>15</b>	<b>08</b>	<b>-</b>	<b>23</b>

## Evaluation Scheme Semester-V

[illegible]

Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/Oral Credit	Tutorial Credits	Total Credits
ITC501	Computer Networks	03	02	-	03	01	-	04

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam					
ITC501	Computer Networks	20	20	20	20	60	25	--	25	150

### Course Objectives:

1. To understand the state of the art in network, network architecture, and networked systems, layering concepts in computer networks.
2. To have knowledge of Application layer paradigms and protocols in different applications.
3. Acquire knowledge of Transport layer paradigms and protocols.
4. Gain core knowledge of Network layer routing protocols and IP addressing.
5. To develop a strong understanding of the core concepts of Data Link layer.
6. To understand the Physical layer

### Course Outcomes: At the end of the course learner will able to

1. Understand about working of layered approach, Intranet, LAN, WAN, MAN and different topologies.
2. Understand the applications used at Application layer
3. Analyze, design and build simple networks and internetworks apart from acquiring due conceptual understanding of the popular TCP/IP Network Architecture.
4. Implement network protocols and analyze its performance.
5. Understand concept and implementation of Data link layer using different protocols.
6. Explain and describe the common networking media and signal representation.

### Prerequisites:

1. Computer Organization and Architecture

<b>Sr. No.</b>	<b>Module</b>	<b>Detailed Content</b>	<b>Hours</b>	<b>CO Mapping</b>
1	Overview Of Computer Networks And Network Models	Definition, Network Categories, Network Components, Categories of networks. Layers and Services, Applications, Network models:- Need of layered architecture, layers in the OSI model and TCP/IP protocol suite.	5	CO1
2	Application Layer	Providing Services, Application-Layer Paradigms, Client Server Paradigm, Standard Client-Server Applications, Peer-to-Peer Paradigm, Socket Programming. Issues and vulnerabilities related with this layer.	6	CO2
3	Transport Layers	Process-to-process delivery, User datagram protocol and its operation, TCP – services and features, segment, TCP connection, flow control and error control. Congestion control and Quality of Service. Email:- SMTP, MIME, POP3, IMAP – HTTP – DNS- SNMP – Telnet. Issues and vulnerabilities related with this layer.	8	CO3
4	Network Layer	Logical addressing:- IPv4 Addresses- classful and classless addressing, Network address translation and Subnetting, IPv6 addresses. Internet Protocol – IPv4 datagram and fragmentation, IPv6 advantages and packet format and extension headers. Interior and exterior routing protocols. Issues and vulnerabilities related with this layer.	8	CO4
5	Data Link Layer	Error detection and correction:- Types of errors, parity check, cyclic redundancy check, checksum and Hamming code procedure. Data link control – Framing, ARQ protocols, HDLC and Point-to-point protocol. Multiple Access communication, Wired LANs- Ethernet, Token ring and FDDI. Wireless LAN – IEEE 802.11 and Bluetooth. Connecting devices- Hubs, Repeaters, Bridges, Switches and Routers. Issues and vulnerabilities related with this layer.	6	CO5
6	Physical Layer And Media	Data and signals:- Analog and digital signals, data rate limits and performance. Analog-to-digital and Digital-to-analog conversions, multiplexing, spread spectrum and Transmission media. Issues and vulnerabilities related with this layer.	6	CO6

**Text Books:**

1. Bhushan Trivedi, “Computer Networks”, Oxford University Press.
2. Behrouz A. Forouzan, Forouzan Mosharrat , Computer Networks A Top down Approach, Mc Graw Hill education.
3. Andrew S Tanenbaum, Computer Networks -, 4th Edition, Pearson Education.

**Reference Books:**

1. William Stallings, “Data and Computer Communications”, Eighth Edition, Pearson Education, 2007.
2. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Fourth Edition, Morgan Kaufmann Publishers Inc., 2007.
3. James F. Kurose, Keith W. Ross, “Computer Networking, A Top-Down Approach Featuring the Internet”, Third Edition, Addison Wesley, 2005.

**In-Semester Assessment:** Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is hands on network problem solving using Packet Tracer.

There will be a mid semester Examination on 50-60% of the syllabus.

**End-Semester Examination:**

1. Question paper will comprise of total six questions.
2. All question carry equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four question need to be solved.

**In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/ Oral Credit	Tutorial Credits	Total Credits
ITL501	Computer Networks Lab	--	2		--	1	--	1

Subject Code	Subject Name	Examination Scheme							
		Theory Marks					Term Work	Practical & Oral	Total
		In-Sem Evaluations				End Sem Exam			
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam				
ITL501	Computer Networks Lab	--	--	--	--	--	25	25	50

#### Lab Description:

The lab offers an integrated educational process in the field of information and communication technologies emphasizing the issue of computer networks, their design, administration and management.

#### Lab Objectives:

1. To understand the state of the art in network, network architecture, and networked systems, layering concepts in computer networks.
2. To have knowledge of Application layer paradigms and protocols in different applications.
3. Acquire knowledge of Transport layer paradigms and protocols.
4. Gain core knowledge of Network layer routing protocols and IP addressing.
5. To develop a strong understanding of the core concepts of Data Link layer.
6. To understand the Physical layer

**Lab Outcomes (LO):** At the end of the course learner will able to

1. Understand about working of layered approach, Intranet, LAN, WAN, MAN and different topologies.
2. Understand the applications used at Application layer
3. Analyze, design and build simple networks and internetworks apart from acquiring due conceptual understanding of the popular TCP/IP Network Architecture.
4. Implement network protocols and analyze its performance.
5. Understand concept and implementation of Data link layer using different protocols.
6. Explain and describe the common networking media and signal representation.

**Prerequisites:** Computer Organization and Architecture and programming language

Sr. No.	Detailed Syllabus	Hours	LO Mapping
1	<ol style="list-style-type: none"> <li>1. Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute. Capture ping and traceroute PDUs using a network protocol analyzer and examine.</li> <li>2. Describe various Network Topology and Networking Hardware</li> </ol>	4	LO1
2	<ol style="list-style-type: none"> <li>1. Write a HTTP web client program to download a web page using TCP sockets.</li> <li>2. Applications using TCP sockets like: <ul style="list-style-type: none"> <li>• Echo client and echo server</li> <li>• Chat</li> <li>• File Transfer</li> </ul> </li> <li>3. Configuration of TELNET/SSH, FTP, HTTP server for given scenario.</li> </ol>	6	LO2
3	<ol style="list-style-type: none"> <li>1. Demonstration of network sniffing using wireshark tool.</li> <li>2. Demonstration of network scanning using nmap tool.</li> <li>3. Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.</li> </ol>	6	LO3
4	<ol style="list-style-type: none"> <li>1. Design scenario of IP addressing for different classes using router configuration.</li> <li>2. Implementation of Distance Vector/ Link State Routing algorithm.</li> </ol>	4	LO4



5	<ol style="list-style-type: none"> <li>1. Implementation of sliding window protocol.</li> <li>2. Simulation of error correction code (like CRC).</li> </ol>	4	LO5
6	<ol style="list-style-type: none"> <li>1. Study of different types of Network cables and Practically implement the cross-wired cable and straight through cable using clamping tool.</li> </ol>	2	LO6

### **Text Books:**

1. Bhushan Trivedi, "Computer Networks", Oxford University Press.
2. Behrouz A. Forouzan, Forouzan Mosharrat , Computer Networks A Top down Approach, Mc Graw Hill education.

### **Reference Books:**

1. William Stallings, "Data and Computer Communications", Eighth Edition, Pearson Education, 2007.
2. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Fourth Edition, Morgan Kaufmann Publishers Inc., 2007.
3. James F. Kurose, Keith W. Ross, "Computer Networking, A Top-Down Approach Featuring the Internet", Third Edition, Addison Wesley, 2005.
4. Andrew S Tanenbaum, Computer Networks -, 4th Edition, Pearson Education.

### **Term Work:**

Term Work shall consist of at least 10 to 12 practical based on the above list.  
Also Term work Journal must include at least 2 assignments.

**Term Work Marks:** 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

**Oral & Practical Exam:** An Oral & Practical exam will be held based on the above syllabus.

Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/ Oral Credit	Tutorial Credits	Total Credits
ITCDLO5011	Web Development	03		-	03		-	

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam					
ITCDLO5011	Web Development	20	20	20	20	60			--	100

#### Course Description:

This course provides an in-depth knowledge of web-development technologies that uses HTML5, CSS3 and advanced JavaScript. It also explores students with both front-end and back-end technologies, to learn mobile web development and also how to deploy web applications. This course also makes students to understand how to build web applications quickly with less code using Flask Framework.

#### Course Objectives:

1. To learn and understand Web scripting languages.
2. To explore the Front -end web development skills.
3. To explore the Back-end web development skills.
4. To understand and learn Mobile web development.
5. To understand and learn Web application deployment.
6. To build web applications quickly and with less code using Flask framework.

#### Course Outcomes: At the end of the course learner will able to

1. Demonstrate the use of web scripting languages
2. Develop web application with Front End Technologies.
3. Develop web application with Back End Technologies.
4. Develop mobile website using JQuery Mobile.
5. Deploy web application on cloud using AWS.
6. Apply Flask web development framework to build web applications with less code.

#### Prerequisites:

- Skill Based LabI: Java (OOPM) Programming Lab
- Skill Based Lab II: Python Programming Lab

Sr. No.	Module	Detailed Content	Hours	CO Mapping
1	Advanced JavaScript:	JSON - JSON Create, Key-Value Pair, JSON Access, JSON Array, JS Arrow Functions, JS Callback Functions, JS Promises, JS Async-Await Functions, JS Error Handling	6	CO1
2	Front End Technologies	<p><b>Front-End Frameworks:</b> What is web framework? Why Web Framework? Web Framework Types. MVC: What is MVC, MVC Architecture, MVC in Practical, MVC in Web Frameworks.</p> <p><b>AngularVersion 10+:</b> Angular CLI, Angular Architecture, Angular Project Structure, Angular Lifecycle, Angular Modules, Angular Components, Angular Data Binding, Directives and Pipes, Angular Services and Dependency Injections (DI), Angular Routers, Angular Forms.</p> <p><b>ReactJS:</b> Introduction to ReactJS, React Components, Inter Components Communication, Components Styling, Routing, Redux- Architecture, Hooks- Basic hooks, useState() hook, useEffect() hook, useContext() hook.</p>	8	CO2

3	Back End Technologies	<p><b>Node.JS:</b> Introduction to Node.JS, Environment Setup, Node.JS Events, Node.JS Functions, Node.JS Built-in Modules, File System, NPM, Install External Modules, Handling Data I/O in Node.JS, Create HTTP Server, Create Socket Server, Microservices- PM2.</p> <p><b>ExpressJS:</b> Introduction to ExpressJS, Configure Routes, Template Engines, ExpressJS as Middleware, Serving Static Files, REST HTTP Method APIs, Applying Basic HTTPAuthentication, Implement Session Authentication.</p> <p><b>MongoDB:</b> NoSQL and MongoDB Basics, MongoDB-Node.JS Communication, CRUD Operations using Node.JS, Mongoose ODM for Middleware, Advanced MongoDB</p>	8	CO3
4	Mobile Web Development	<p><b>Mobile-First:</b> What is Mobile-First? What is Mobile Web? Understanding Mobile Devices and Desktop.</p> <p><b>jQuery Mobile:</b> Introduction to the jQuery Mobile Framework, Set-up jQuery Mobile, Pages, Icons, Transitions, Layouts Widgets, Events, Forms, Themes, Formatting Lists, Header and Footer, CSS Classes, Data Attributes, Building a Simple Mobile Webpage.</p>	7	CO4
5	Web Application Deployment	<p><b>Cloud:</b> AWS Cloud, AWS Elastic Compute, AWS Elastic Load Balancer and its types, AWS VPC and Component of VPC, AWS storage, Deploy Website or Web Application on AWS, Launch an Application with AWS Elastic Beanstalk.</p>	5	CO5
6	Flask	<p><b>Flask:</b> Introduction, Flask Environment Setup, App Routing, URL Building, Flask HTTP Methods, Flask Request Object, Flask cookies, File Uploading in Flask</p>	5	CO6

#### Text Books:

1. Kogent Learning Solutions Inc, Web Technologies: HTML, JAVASCRIPT, PHP, JAVA, JSP, XML and AJAX, Blackbook, Dreamtech Press, Second Edition, ISBN: 9788177228496.

2. Raymond Camden, Andy Matthews, JQuery Mobile Web Development Essentials, Packt Publishing, Second Edition, 9781782167891
3. Miguel Grinberg, “Flask Web Development: Developing Web Applications with Python”, O’Reilly

**Reference Books:**

1. “Web Technologies: Black Book”, Dreamtech publication
2. Dr. Hiren Joshi, Web Technology and Application Development, DreamTech, First, ISBN:978-93- 5004-088-1
3. Steven M. Schafer, “HTML, XHTML and CSS”, Wiley India Edition, Fourth Edition, 978- 81- 265- 1635-3

**In-Semester Assessment:** Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project. There will be a mid-semester Examination on 40-50% of the syllabus.

**End-Semester Examination:**

1. Question paper will comprise of total six question.
2. All question carry equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four question need to be solved.

**In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical /Oral Credit	Tutorial Credits	Total Credits
ITLDLO 5011	Web Development Lab		02	-		02	-	02

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam					
ITLDLO5011	Web Development Lab	-	-	-	-	-	25	25	--	50

#### Lab Description:

This course provides an in-depth knowledge of web-development technologies that uses HTML5, CSS3 and advanced JavaScript. It also explores students with both front-end and back-end technologies, to learn mobile web development and also how to deploy web applications. This course also makes students to understand how to build web applications quickly with less code using Flask Framework.

#### Lab Objectives:

1. To understand basic concepts of web programming and scripting languages.
2. To learn Version Control Environment.
3. To learn front end technologies and back-end technologies.
4. To understand mobile web development.
5. To comprehend web application deployment.

#### Lab Outcomes: On completion of lab, learner will be able to:

1. Develop Static and Dynamic responsive website using technologies HTML5, CSS3, advanced Javascript.
2. Create Version Control Environment.
3. Develop an application using front end and backend technologies.
4. Develop mobile website using JQuery Mobile.
5. Deploy web application on cloud using AWS.

#### Prerequisites:

- Skill Based LabI: Java (OOPM) Programming Lab
- Skill Based Lab II: Python Programming Lab

<b>Sr. No.</b>	<b>Module</b>	<b>Detailed Content</b>	<b>Hours</b>	<b>CO Mapping</b>
1	Web Programming and Scripting Languages	<p>a) Create a responsive web page which shows the ecommerce/college/exam admin dashboard with sidebar and statistics in cards using HTML, CSS and Bootstrap.</p> <p>b) Write a JavaScript Program to get the user registration data and push to array/local storage with AJAX POST method and data list in new page.</p>	4	LO1
2	Front End Technologies	<p>a. Create version control account on GitHub and using Git commands to create repository and push your code to GitHub.</p> <p>b. Create Docker Container Environment (NVIDEIA Docker or any other).</p> <p>c. Create an Angular application which will do following actions: Register User, Login User, Show User Data on Profile Component</p>	5	LO2
3	Back End Technologies	<p>a. Create a Node.JS Application which serves a static website.</p> <p>b. Create four API using Node.JS, ExpressJS and MongoDB for CRUD Operations on assignment 2. C.</p>	5	LO3
4	Mobile Web Development	Create a simple Mobile Website using jQuery Mobile	2	LO4
5	Web Application Deployment	Deploy/Host Your web application on AWS VPC or AWS Elastic Beanstalk. Mini Project	4	LO5
6	Flask	<p>a. Design Feedback Form using Flask.</p> <p>b. Design Weather App using Flask.</p> <p>c. Design Portfolio Website using Flask.</p>	6	LO6

**Text Books:**

1. Kogent Learning Solutions Inc, Web Technologies: HTML, JAVASCRIPT, PHP, JAVA, JSP, XML and AJAX, Blackbook, Dreamtech Press, Second Edition, ISBN: 9788177228496.
2. Raymond Camden, Andy Matthews, JQuery Mobile Web Development Essentials, Packt Publishing, Second Edition, 9781782167891
3. Miguel Grinberg, “Flask Web Development: Developing Web Applications with Python”, O’Reilly

**Reference Books:**

1. “Web Technologies: Black Book”, Dreamtech publication
2. Dr.Hiren Joshi, Web Technology and Application Development, DreamTech, First,ISBN:978-93- 5004-088-1
3. Steven M. Schafer, “HTML, XHTML and CSS”, Wiley India Edition, Fourth Edition,978-81-265- 1635-3

**Evaluation Scheme:****Term work Evaluation:**

Term Work shall consist of write ups of experiments performed in the laboratory based on the above list, but not limited to it. Also, Term work may include a mini project report if a mini project is assigned as part of the lab.

**Practical and Oral Evaluation:**

Oral & Practical exams will be conducted based on the experiments performed in the laboratory.



Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/ Oral Credit	Tutorial Credits	Total Credits
ITCDLO5012	Artificial Intelligence	04	--	-	04	--	-	04

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam					
ITCDLO5012	Artificial Intelligence	20	20	20	20	60	--	--	--	100

#### Prerequisites:

- Basic knowledge of Statistics and modelling
- Good Analytical Skills
- Strong knowledge of Mathematics
- Data structures and Analysis of Algorithms

#### Course Description:

Artificial intelligence (AI) is a research field that studies how to realize the intelligent human behaviors on a computer. The ultimate goal of AI is to make a computer that can learn, plan, and solve problems autonomously

#### Course Objectives:

1. To make students understand the concepts of intelligence, knowledge representation
2. To impart basic proficiency in representing difficult real life problems in a state space representation so as to solve them using AI techniques like searching
3. To make students understand the concepts Uncertainty and role of AI in Uncertainty.
4. To Understand students concept of planning in AI
5. To introduce advanced topics of AI

**Course Outcomes:** At the end of the course learner will able to

1. Demonstrate knowledge of the building blocks of AI as presented in terms of intelligent agents

2. Analyze and formalize the problem as a state space, graph, design heuristics and select amongst different search or game based techniques to solve them.
3. Formulate and solve problems with uncertain information using Bayesian approaches
4. Attain the capability to plan various real life problem using planning concepts of AI
5. Design chat bots or ML algorithm implementation and learn significance of advance AI topics for advance AI systems

<b>Sr. No.</b>	<b>Module</b>	<b>Detailed Content</b>	<b>Hours</b>	<b>CO Mapping</b>
1	<b>Basics of Artificial Intelligence</b>	Introduction to AI, AI Problems and AI techniques, Solving problems by searching, Problem Formulation. State Space  Representation Structure of Intelligent agents,  Types of Agents, Agent Environments PEAS representation for an Agent.	6	CO1
2	<b>Searching algorithm and state space search</b>	Uninformed Search: DFS, BFS, Uniform cost search, Depth Limited Search, Iterative Deepening.  Informed Search: Heuristic functions, Hill Climbing, Best First Search, A*,  Constraint Satisfaction Programming: Crypto Arithmetic, Map Coloring, N-Queens.  Adversarial Search: Game Playing, Min-Max Search, AlphaBeta Pruning	8	CO2
3	<b>Uncertain Knowledge and Reasoning</b>	Uncertainly, Representing Knowledge in an Uncertain Domain, Conditional Probability, Joint Probability, Bays theorem, Belief Networks, Simple Inference in Belief Networks.	8	CO3
4	<b>Planning</b>	Partial Ordered planning, Hierarchical Planning, Conditional Planning, STRIP	7	CO4
5	<b>Advanced Artificial</b>	Language Models, Natural Language for Communication: Syntactic Analysis, Chatbots  Augmented Grammars and Semantic	10	CO4, CO6

	<b>Intelligence Concepts</b>	Interpretation, Machine Translation. Machine Learning Concepts: Unsupervised Learning (K Means Clustering, Hierarchical Clustering, Association Rules), Supervised learning (Logistic Regression, Decision Tree, Support Vector Machine) and reinforcement learning (Q learning)  Topics related to Narrow AI and Explainable AI.		
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### **Text Books:**

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 3rd Edition, PHI 2009.
2. Nils J Nilsson, Principles of Artificial Intelligence, Illustrated Reprint Edition, Springer Heidelberg, 2014
3. Nils J. Nilsson, Quest for Artificial Intelligence, First Edition, Cambridge University Press, 2010

### **Reference Books:**

1. Efraim Turban, Jay E. Aronson, Ting-Peng Liang: Decision Support Systems and Intelligent Systems, VII Edition, Prentice-Hall of India.

### **Evaluation Scheme:**

#### **1. In-Semester Assessment:**

- Assessment consists of two Internal Assessments (IA1, IA2) out of which; one should be compulsory class test (on minimum 02 Modules) and the other is a class test / assignment on case studies / course project.
- Mid Semester Examination (MSE) will be based on 40-50% of the syllabus.

#### **2. End-Semester Examination:**

- Question paper will comprise of full syllabus.
- In the question paper, weightage of marks will be proportional to the total number of lecture hours as mentioned in the syllabus.

Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/Oral Credit	Tutorial Credits	Total Credits
ITLDLO5012	Artificial Intelligence Lab	-	02	-	-	01	-	01

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam					
ITLDLO5012	Artificial Intelligence Lab	--	--	--	--	--	25	--	25	50

#### Prerequisites:

- Basic Understanding of any Programming Language.

#### Lab Objectives: Students will try:

1. Introduce the concepts of a Rational Intelligent Agent and the different types of Agents that can be designed to solve problems.
2. To impart basic proficiency in representing difficult real life problems in a state space representation so as to solve them using AI techniques.
3. To make students understand various AI methods like searching and game playing and how to apply them to solve real applications
4. To explain to students the basic issues of knowledge representation and Logic so as to build inference engines
5. To impart a basic understanding of some of the more advanced topics of AI such as planning.
6. To understand Bayes networks, natural language processing and introduce concept of cognitive computing.

#### Lab Outcomes: Students will be able to:

1. Design the building blocks of an Intelligent Agent using PEAS representation.
2. Analyze and formalize the problem as a state space, graph, design heuristics and select amongst different search or game based techniques to solve them.
3. Develop intelligent algorithms for constraint satisfaction problems and also design Intelligent systems for Game Playing.

4. Attain the capability to represent various real life problem domains using logic based techniques and use this to perform inference or planning.
5. Formulate and solve problems with uncertain information using Bayesian approaches
6. Apply concept Natural Language processing and cognitive computing for creation of domainspecific ChatBots.

<b>Sr. No.</b>	<b>Module</b>	<b>Detailed Content</b>	<b>Hours</b>	<b>CO Mapping</b>
1	<b>Introduction to AI</b>	Tutorial exercise for a) Design of Intelligent System using PEAS. b) Problem Definition with State Space Representation	4	LO1
2	<b>Searching Algorithms</b>	Implementation of Uninformed and Informed Search Algorithms	6	LO2
3	<b>Uncertain Knowledge and Reasoning and ML</b>	Machine learning algorithm to be implemented and one research paper to be taken as case study to understand application of AI with ML	4	LO3
4	<b>Knowledge base agent</b>	a) Assignment on Predicate Logic, for forward and backward reasoning and Resolution. b) Design of a Planning system using STRIPS. c) Practical implementation using Chatbot technologies.	4	LO4
5	<b>AI: Mini project</b>	<b>Mini project</b> Construction of a domain specific Chabot using Natural Language Processing techniques.	8	LO4, LO5

		( Applications can include : Medical Diagnosis, Personal Shopping Assistant, Travel Agent ,Trouble shooting etc.)		
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**Text Books:**

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 2nd Edition, Pearson Education.
2. Judith S. Hurwitz, Marcia Kaufman, Adrian Bowles, Cognitive Computing and Big Data Analytics, Wiley India

**References:**

1. George Luger, .AI-Structures and Strategies for Complex Problem Solving., 4/e, 2002, Pearson Education.
2. John Kelly , Steve Hamm, Smart Machines - IBM' s Watson and the Era of Cognitive Computing Columbia Business School Publishing

**Evaluation Scheme:**

**Term work Evaluation:**

Term Work shall consist of write ups of experiments performed in the laboratory based on the above list, but not limited to it. Also, Term work will include a mini project report is assigned as part of the lab.

**Practical and Oral Evaluation:**

Oral & Practical exams will be conducted based on the experiments performed in the laboratory.

Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/Oral Credit	Tutorial Credits	Total Credits
ITCDLO5013	Data Science Fundamentals	03	--	-	03	--	-	03

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam					
ITCDLO5013	Data Science Fundamentals	20	20	20	20	60	--	--	--	100

### Course Objectives:

1. To provide insights on data handling tools.
2. To describe the statistical concepts.
3. To learn the data visualization techniques.
4. To understand data preprocessing techniques.
5. To understand supervised learning concepts.
6. To understand unsupervised learning concepts.

**Course Outcomes:** At the end of the course learner will able to

1. Handle the data in R environment.
2. Perform statistical analysis of data.
3. Demonstrate the data through visual representation.
4. Apply data preprocessing techniques on data sets.
5. Design and implement supervised learning models for given data set.
6. Design and implement unsupervised learning models for given data set.

### Prerequisites:

Applied Mathematics III

Applied Mathematics IV

Sr. No.	Module	Detailed Content	Hours	CO Mapping
1	Data Science Basics with R	<ol style="list-style-type: none"> <li>1. What is data science, knowing data science process</li> <li>2. R packages for data science</li> <li>3. Data sets, Data objects, Data Storytelling</li> <li>4. Handling data in R: basic data types, built in methods</li> <li>5. vectors, lists, data frames, importing and exporting data in R</li> <li>6. Descriptive, Predictive and Perspective problems</li> <li>7. Brief on Data and Cyber Laws</li> </ol>	5	CO1
2	Descriptive Statistics and Linear Algebra	<ol style="list-style-type: none"> <li>1. Statistical tools for Data science</li> <li>2. Frequency distribution, computing absolute relative frequencies</li> <li>3. Basic statistical description of data: central tendency,</li> <li>4. Dispersion, variation, correlation, five number summary of data.</li> <li>5. Linear algebra: vectors and matrices</li> <li>6. Probability: Dependence and Independence, Conditional Probability</li> <li>7. Bayes's Theorem, Random Variables</li> </ol>	7	CO2
3	Data Visualization	<ol style="list-style-type: none"> <li>1. Graphic Displays of Statistical Descriptions of Data: bar charts, line graphs, multiple line graphs</li> <li>2. Pie charts, histograms,</li> <li>3. Understanding and plotting scatterplots</li> <li>4. Density plots, box plots</li> <li>5. Exploratory data analysis with datasets</li> </ol>	7	CO3
4	Feature Engineering	<ol style="list-style-type: none"> <li>1. Attribute types: nominal, ordinal</li> <li>2. Measuring similarity and dissimilarity, matrix representation of similarity and dissimilarity</li> <li>3. Preprocessing need, Major tasks in preprocessing, data cleaning</li> </ol>	6	CO4



		4. Data integration, data reduction 5. Data discretization by binning		
5	Supervised Learning	1. Basic concepts of classification 2. Simple Linear Regression 3. Multiple Linear Regression, Logistic Regression 4. Decision tree: basic concepts 5. Attribute selection measures 6. Tree induction, tree pruning 7. Naïve Bayesian classifier 8. Metrics for evaluating performance of classifier: accuracy, precision, recall, error measures, cross validation	8	CO5
6	Unsupervised Learning	1. Cluster analysis 2. Partitioning methods 3. k means 4. k medoids 5. hierarchical methods: Agglomerative 6. Divisive, BIRCH	6	CO6

**Text Books:**

1. Data Mining Concepts and Techniques, Third Edition, Jiawei Han, Micheline Kamber, Jian Pei, Morgan Kaufmann
2. Data Science for Business, Foster Provost and Tom Fawcett, O'Reilly. Copyright © 2013

**Reference Books:**

1. An Introduction to Statistical Learning with Applications in R , Gareth James
2. Trevor Hastie, Robert Tibshirani, Springer

**In-Semester Assessment:** Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project. There will be a mid semester Examination on 40-50% of the syllabus.

**End-Semester Examination:**

1. Question paper will comprise of total six question.
2. All question carry equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four question need to be solved.

**In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/Oral Credit	Tutorial Credits	Total Credits
ITLDLO5013	Data Science Fundamentals Lab	--	02	--	--	01	-	01

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam					
ITLDLO5013	Data Science Fundamentals Lab	--	--	--	--	--	25	25	--	50

### Lab description:

This lab has focus on the data science fundamentals experimentation in R programming. This lab will give learners the practical exposé of data science concepts implementation. It covers data preprocessing, data visualization through different visualization tools, implementation of classification techniques, implementation of clustering techniques and the statistical analysis of data.

### Lab objectives:

1. To introduce the basic concepts of R programming in context of data science.
2. To demonstrate data visualization techniques
3. To understand and implement data preprocessing techniques.
4. To model the classifiers for wide variety of data.
5. To model the clustering techniques for wide variety of data
6. To analysis the data for selected case study

### Lab outcomes:

On completion of the lab, students will be able to:

1. Use R programming for data analysis and interpretation.
2. Use the data analysis tools.

3. Apply data preprocessing techniques.
4. Design the classifiers for given data.
5. Apply clustering techniques to given data.
6. Investigate the case study in data science domain.

Software requirement: R programming

<b>Experiment No.</b>	<b>Detailed Contents</b>	<b>Hours</b>	<b>LO Mapping</b>
1	Getting familiar with R: Data types, input output methods, built in functionalities, conditional statements, looping constructs, functions	2	LO1
2	Matrices, data frames, importing and exporting data in R	2	LO1
3	Find the statistical description of the given data	2	LO1
4	Data visualization through plots (bar, pie, line graphs, histograms)	2	LO2
5	Scatter plots, density plots and box plots	2	LO2
6	Implementation data Smoothing technique (Binning)	2	LO3
7	Implementation of Data preprocessing technique (handling missing values)	2	LO3
8	Implementation of simple linear regression, multiple linear regression and logistic regression	2	LO4
9	Implementation of decision tree classifier. Performance evaluation of decision tree classifier	2	LO4
10	Implementation of naïve Bayesian classifier. Performance evaluation of naïve Bayesian classifier	2	LO4
11	Implementation of K means clustering, Hierarchical Clustering algorithm	2	LO5
12	Case study on data science	4	LO6

**Text Books:**

1. Data Mining Concepts and Techniques, Third Edition, Jiawei Han, Micheline Kamber, Jian Pei, Morgan Kaufmann.
2. Data Science for Business, Foster Provost and Tom Fawcett, O'Reilly. Copyright © 2013

**Reference Books:**

1. An Introduction to Statistical Learning with Applications in R , Gareth James
2. Trevor Hastie, Robert Tibshirani, Springer

**Term work Evaluation:** Term Work shall consist of write ups of experiments performed in the laboratory based on the above list, but not limited to it.

**Practical and Oral Evaluation:** Practical exam will be conducted based on the experiments performed in the laboratory.

Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/ Oral Credit	Tutorial Credits	Total Credits
ITCDLO5014	Network Programming	03	-	-	03	-	-	03

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg.of 2 IAs	Mid Sem Exam					
ITLDLO5014	Network Programming	20	20	20	20	60	-	-	-	100

## Description

Network Programming involves writing programs that communicate with other programs across a computer network. There are many issues that arise when doing network programming which do not appear when doing single program applications. However, JAVA makes networking applications simple due to the easy-to-use libraries. In general, applications that have components running on different machines are known as distributed applications and usually they consist of client/server relationships.

## Course Objectives:

- 1) To understand the approach of the transport layer.
- 2) To understand the concept of Sockets and Socket Programming.
- 3) Become familiar IPv4 and IPv6 Interoperability.
- 4) To understand the concept of name and address conversation
- 5) Get an exposure to broadcasting and multicasting.
- 6) To understand randomized rocket sockets.

**Course Outcomes:** At the end of the course learner will able

- 1) To implement various approaches to the transport layer.

- 2) To implement the Sockets and Socket Programming.
- 3) To understand the concept of IPv4 and IPv6 Interoperability.
- 4) To implement the name and address conversion of domain
- 5) To implement broadcasting and multicasting.
- 6) To build randomized routing sockets.

**Prerequisites:**

- Skill based lab
- Operating System
- Data Structure

<b>Sr. No</b>	<b>Module</b>	<b>Detailed Syllabus</b>	<b>Hours</b>	<b>CO Mapping</b>
1	The Transport Layer	TCP and UDP with policy control, TCP Connection Establishment and Termination, TIME_WAIT State, Port Numbers, Concurrent Servers, Buffer Sizes and Limitations.	08	CO1
2	Sockets and Socket Programming	Introduction, Socket Address Structures, Value-Result Arguments, Byte Ordering Functions, Byte Manipulation Functions, socket Function. TCP Client-Server: TCP Echo Server, TCP Echo Client, Normal Termination, Connection abort before accept return, Termination of server process, Crashing of Server Host, Crashing and Rebooting of Server Host, Shutdown of Server Host. UDP Sockets: UDP Echo server, UDP Echo Client, Lost Datagrams, Lack of flow control with UDP.	07	CO2
3	IPv4 and IPv6 Interoperability	IPv4 Client, IPv6 Server, IPv6 Client, IPv4 Server, IPv6 Address Testing Macros, IPV6_ADDRFORM Socket Option ICMPv4 and ICMPv6	06	CO3
4	Name and Address Conversions	Domain Name System, Functions. Advanced Name and Address Conversions: Functions and Implementation	06	CO4



5	Multicasting and Broadcasting	Broadcast Addresses, Unicast versus Broadcast, Multicasting : Multicast Addresses, Multicasting versus Broadcasting on A LAN, Multicasting on a WAN, Multicast Socket Options, Simple Network Time Protocol, SNTP.	06	CO5
6	Routing Sockets	Datalink Socket, Address Structure, Reading and Writing, Interface Name and Index Functions, data link access, raw socket (creation input, output)	06	CO6

**Text Books:**

1. Richard Stevens, Bill Fenner, "UNIX network programming Volume-1- The Sockets Networking API", 3rd edition.
2. W. Richard Stevens, "Advanced Programming in the Unix Environment", Addison Wesley.

**Reference Books:**

1. UNIX Internals– "A new Frontier", PHI

**Evaluation Scheme:**

**1. In-Semester Assessment:**

- a. Assessment consists of two Internal Assessments (IA1, IA2) out of which; one should be a compulsory class test (on minimum 02 Modules) and the other is a class test / assignment on case studies / course project.
- b. Mid Semester Examination (MSE) will be based on 40-50% of the syllabus.

**2. End-Semester Examination:**

- Question paper will comprise a full syllabus.
- In the question paper, weightage of marks will be proportional to the total number of lecture hours as mentioned in the syllabus.

Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical /Oral Credit	Tutorial Credits	Total Credits
ITLDLO5014	Network Programming Lab	--	2		--	1	--	1

Subject Code	Subject Name	Examination Scheme							
		Theory Marks					Term Work	Practical & Oral	Total
		In-Sem Evaluations				End Sem Exam			
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam				
ITLDLO5014	Network Programming Lab	--	--	--	--	--	25	25	50

### Lab Description:

The main objective of the proposed Advanced Network Programming Lab is to introduce students to the latest Networking tools and computational tools. The training of these tools will be useful to develop rigorous applications in the engineering domain.

### Lab Objectives:

1. To design and deploy Computer Networks.
2. To introduce tools for Network Traffic Analysis and Network Monitoring.
3. To practice Network Programming using Linux System Calls.
4. To implement client server applications in the UNIX environment while exploring OS features.
5. To Generate Socket Programming in Python environment
6. To enable students to develop applications of advanced Network Programming for real world problems.

### Lab Outcomes (LO): At the end of the course learner will able to

1. To design and deploy Computer Networks.
2. To introduce tools for Network Traffic Analysis and Network Monitoring.
3. To practice Network Programming using Linux System Calls.
4. To implement client server applications in the UNIX environment while exploring OS features.
5. To Generate Socket Programming in Python environment
6. To enable students to develop applications of advanced Network Programming for real world problems.

**Software requirement:** Packet tracer

**List of Experiments:**

<b>Sr. No.</b>	<b>Module</b>	<b>Detailed Syllabus</b>	<b>Hours</b>	<b>LO Mapping</b>
1	The Transport Layer	1. Design and configure a network with multiple subnets with wired and wireless LANs using required network devices.	4	LO1
2	Sockets and Socket Programming	1. Implementation of Connection-Oriented Service using standard ports. 2. Implementation of Connection-Less Service using standard ports 3. Implementation of Connection-Oriented Iterative Echo-Server, date and time, character generation using user-defined ports 4. Implementation of Connectionless Iterative Echo-server, date and time, character generation using user-defined ports.	8	LO2
3	IPv4 and IPv6 Interoperability	1. Implement Web Server using sockets. 2. Advanced Socket System Calls : Programs to demonstrate the usage of Advanced socket system calls like getsockopt(),setsockopt(),getpeername(),getsockname(),readv() and writev()).	4	LO3
4	Name and Address Conversions	1. Configuration of DNS server. 2. Configuration of DHCP server	4	LO4
5	Multicasting and Broadcasting	1. Implementation of Ping service	2	LO5

6	Network Analysis	Using Python Write the Network programming and Network Analysis a) Building a Port Scanner b) Analyzing Network Traffic c) Introduction to scapy d) Banner Grabbing	4	LO6
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**Text Books:**

1. Richard Stevens, Bill Fenner, "UNIX network programming Volume-1- The Sockets Networking API", 3rd edition.
2. W. Richard Stevens, "Advanced Programming in the Unix Environment", Addison Wesley.

**Reference Books:**

1. UNIX Internals– "A new Frontier", PHI

**Term Work:**

Term Work shall consist of at least 10 to 12 practical based on the above list. Also Term work Journal must include at least 2 assignments.

**Term Work Marks:** 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

**Oral Exam:** An Oral exam will be held based on the above syllabus.

Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/Oral Credit	Tutorial Credits	Total Credits
ITCDLO5021	Computer Graphics and Virtual Reality	03	--	01	03	--	01	04

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		Test I	Test II	Avg. of 2 Tests	MSE					
ITCDLO5021	Computer Graphics And Virtual Reality	20	20	20	20	60	--	--	--	100

### Prerequisites:

- Engineering Mathematics

### Course Description

Computer graphics is one of the fundamental aspects of any computing system. Its primary role is to render the digital content (0's and 1's) in a human-comprehensible form on the computer screen. The rendering follows a series of stages, collectively known as the graphics pipeline. The topics covered include clipping, scan conversion, 3D and 2D transformation. It also introduces the concepts of virtual reality. The emphasis is on creating a working graphics system from the ground up, but modern protocols and applications are also discussed and utilized.

### Course Objectives:

1. To equip students with the fundamental knowledge and basic technical competence in the field of computer graphics.
2. To provide an understanding of how to scan, convert the basic geometrical primitives and transform the shapes so as to fit them as per picture definition.
3. To emphasize on implementation aspect of Computer Graphics Algorithms.
4. To provide an understanding of 2D and 3D transformations.

5. To comprehend and analyze the fundamentals of animation using different tools.
6. To prepare the student for advanced areas like Virtual Reality and professional avenues in the field of Computer Graphics.

**Course Outcomes:** At the end of the course learner will be able to:

1. Understand the basic concepts of computer graphics and demonstrate various algorithms for scan conversion.
2. Design and implement various filled area primitives, curve generation, and Fractals.
3. Acquire knowledge about 2D geometric transformations, viewing, clipping, and applying it on graphical objects.
4. Acquire knowledge about 3D geometric transformations, and applying it on graphical objects and also to understand the fundamentals of animation.
5. To define the fundamentals of virtual reality and its related technologies. And to understand a typical graphics pipeline
6. To understand programming in virtual reality and VR modeling techniques.

Sr. No.	Module	Detailed Syllabus	Hours	CO
1	Introduction to Computer Graphics and Scan Conversion of Graphics	<ul style="list-style-type: none"> <li>• Introduction and applications of computer graphics, Input and Output Devices, Raster scan system, and Random Scan Systems.</li> <li>• Scan Conversion of point, line using Digital differential analyzer &amp; Bresenham's algorithm, Circle using midpoint approach.</li> </ul>	6	CO1
2	Filled area Primitives and Curve Generation	<ul style="list-style-type: none"> <li>• Area filling: Inside/Outside Test, Scan line, Polygon Fill Algorithm: Boundary Fill and Flood Fill algorithm(4 Connected and 8 Connected)</li> <li>• Aliasing and Antialiasing Techniques</li> <li>• Curve Generation: Bezier and B-Spline curves.</li> <li>• Introduction to fractals: generation procedure, classification, dimensions, and Koch Curve.</li> </ul>	6	CO2
3	Two Dimensional viewing and Clipping algorithms	<ul style="list-style-type: none"> <li>• Basic Geometrical 2D transformations: Translation, Rotation, Scaling, Reflection, Shear, its homogeneous matrix representation, and Composite transformation.</li> <li>• Viewing Pipeline: View Coordinate reference frame, Window to viewport transformation.</li> <li>• Point clipping</li> </ul>	6	CO3

		<ul style="list-style-type: none"> <li>Line clipping: Cohen Sutherland Algorithm, Liang Barsky algorithms.</li> <li>Polygon clipping: Sutherland Hodgeman polygon clipping and Weiler Atherton.</li> <li>Text Clipping</li> </ul>		
4	Three Dimensional transformations, 3D viewing, and Key Frame Animation	<ul style="list-style-type: none"> <li>Three Dimensional transformations: Translation, Scaling, Rotations, Reflection, Shearing</li> <li>Composite Transformation.</li> <li>Three Dimensional Viewing Pipeline, Viewing transformation, Projections: Parallel(Oblique and orthographic), Perspective</li> <li>Key Frame Animation, Animation Sequence, Motion Control Methods, Morphing, Warping(Only Mesh Warping)</li> </ul>	7	CO4
5	Introduction to Virtual Reality	<ul style="list-style-type: none"> <li>Virtual Reality : Basic Concepts , Classical Components of VR System , Types of VR Systems</li> <li>Types of VR Systems, Three Dimensional Position Trackers, Navigation and Manipulation Interfaces,</li> <li>Gesture Interfaces, Graphical Display, sound Displays, and Haptic Feedback . Input Devices ,Graphical Rendering Pipeline</li> <li>Haptic Rendering Pipeline, Open GL rendering pipeline. Applications of Virtual Reality.</li> </ul>	7	CO5
6	VR Modelling and Programming	<ul style="list-style-type: none"> <li>Geometric Modeling: Virtual Object Shape, Object Visual Appearance.</li> <li>Kinematics Modeling: Object Position, Transformation Invariants, Object Hierarchies,</li> <li>Physical Modeling: Collision Detection, Surface Deformation, Force Computation.</li> <li>Behavior Modeling.</li> <li>Programming through VRML/X3D: Defining and Using Nodes and Shapes, VRML Browsers,</li> <li>Java 3D, OpenCV for augmented reality</li> </ul>	7	CO6

### Text Books:

1. Donald Hearn and M. Pauline Baker, "Computer Graphics", Pearson Education.
2. R. K Maurya, "Computer Graphics with Virtual Reality", Wiley India.

**Reference Books:**

1. Steven Harrington, “Computer Graphics”, McGraw Hill.
2. Rogers, “Procedural Elements of Computer Graphics”, Tata McGraw Hill.
- 3 .F.S. Hill , Stephen M. Kelley , “Computer Graphics using Open GL” Prentice Hall

**Evaluation Scheme:****1. In-Semester Assessment:**

- Assessment consists of two Internal Assessments (IA1, IA2) out of which; one should be a compulsory class test (on minimum 02 Modules) and the other is a class test/assignment on case studies/course project.
- Mid Semester Examination (MSE) will be based on 40-50% of the syllabus.

**2. End-Semester Examination:**

- Question paper will comprise of the full syllabus.
- In the question paper, the weightage of marks will be proportional to the total number of lecture hours as mentioned in the syllabus.



Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/Oral Credit	Tutorial Credits	Total Credits
ITLDLO5021	Computer Graphics and Virtual Reality Lab	-	2	-	-	1	-	01

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam					
ITLDLO5021	Computer Graphics and Virtual Reality Lab	--	--	--	--	--	25	--	25	50

#### Prerequisites:

- Any programming language

#### Lab Descriptions:

The objective of the Computer Graphics And Virtual Reality Laboratory is to introduce various graphics algorithms to render the geometrical primitives such as line, circle, polygon etc. It covers the fundamentals of 2D and 3D transformations of objects. It also includes the study of projections, clipping algorithms, and animation. This lab is helpful to the students to also understand the virtual reality system.

#### Lab Objectives:

- Learn basic graphics functions in any programming language.
- Learn to use graphics functions to implement scan conversion, circle, and polygon filling algorithms.
- Understand 2D transformations of objects.
- Understand 3D parallel and perspective projections.
- Learn line clipping and polygon clipping algorithms.
- To understand programming in virtual reality.

**Lab Outcomes:** At the end of the course learner will be able to

1. Implement graphics functions.
2. Implement various scan conversion, circle, and polygon filling algorithms.
3. Implement 2D transformations such as scaling, translation, and rotation.
4. Implement 3D transformations on parallel and perspective projections.
5. Implement line clipping and polygon clipping algorithms.
6. Implement VRML functions and be able to use JAVA 3D APIs

**Software requirement: Turbo C , JDK, OpenGL**

Sr. No.	Detailed Contents	Hours	LO Mapping
1	Study basics of Computer graphics functions.	2	LO1
2	Implementation of Line Drawing algorithms: DDA, Bresenham and using them generating a line with different styles like dotted, dashed, centered and thick line	4	LO2
4	Implementation of Circle generation algorithm: Midpoint and using it generating concentric circles.	2	LO2
5	Implementation of polygon filling algorithms such as flood fill and Boundary fill algorithm.	4	LO2
6	Program for performing Two Dimensional Transformations: Translation, Scaling, Rotation, Reflection, Shear by using a homogeneous Matrix representation, use of a function for matrix multiplication is desirable, so as to perform the composite transformation.	2	LO3
7	Program to perform a projection of a 3D object on Projection Plane: Parallel and Perspective	2	LO4
8	Implementation of Polygon Clipping Algorithm: Sutherland Hodgman.	2	LO5
9	Implementation of Line Clipping Algorithm: Cohen Sutherland, Liang Basky	4	LO5
10	Introduction to VRML and JAVA 3D APIs.	4	LO6

**Text Books:**

1. Donald Hearn and M. Pauline Baker, “Computer Graphics”, Pearson Education.
2. R. K Maurya, “Computer Graphics with Virtual Reality”, Wiley India.

**Reference Books:**

1. Steven Harrington, “Computer Graphics”, McGraw Hill.
2. Rogers, “Procedural Elements of Computer Graphics”, Tata McGraw Hill.
- 3 .F.S. Hill , Stephen M. Kelley , “Computer Graphics using Open GL” Prentice Hall

**Evaluation Scheme:****Term work Evaluation:**

Term Work shall consist of write-ups of experiments performed in the laboratory-based on the above list, but not limited to it. Also, term work may include a mini project report if a mini project is assigned as part of the lab.

**Practical and Oral Evaluation:**

Oral & Practical exams will be conducted based on the experiments performed in the laboratory.

Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/Oral Credit	Tutorial Credits	Total Credits
ITCDLO5022	Fundamentals of Machine Learning	03	--	--	03	--	--	03

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam					
ITCDLO5022	Fundamentals of Machine Learning	20	20	20	20	60	--	--	--	100

#### Prerequisites:

- Fundamentals of programming
- Set theory

#### Course Descriptions:

Fundamentals of Machine Learning is one of the most comprehensive and state-of-the-art courses offered in Information Technology. This course covers supervised and unsupervised kind of learning. Neural network fundamentals and perceptron learning mechanism also covered so as to enable students to develop applications with machine learning techniques and deep learning techniques. This course advances the knowledge and futuristic skillsets of students.

#### Course Objectives:

1. To understand basics of machine learning.
2. To construct decision tree for specific problems.
3. To be able to build recommendation systems.
4. To be able to utilize SVM for classification purpose.

5. To be competent users of Deep Learning.
6. To have a sense of computational learning.

**Course Outcomes:** At the end of the course learner will able to

1. Classify problems in supervised and unsupervised module.
2. Explain bias and variance used for decision making.
3. Demonstrate recommendations systems.
4. Apply SVM to classify data.
5. Know about deep learning.
6. Apply computational learning theory of complex problems.

Sr. No.	Module	Detailed Content	Hours	CO Mapping
1	Introduction to Machine Learning	Introduction: Basic definitions, types of learning, Supervised, Unsupervised and reinforcement learning. hypothesis space and inductive bias, evaluation, cross-validation.	6	CO1
2	Probability Theory and Bayes Rule	Probability theory and Bayes rule. Naive Bayes learning algorithm. Parameter smoothing. Generative vs. discriminative training. Bayes nets and Markov nets for representing dependencies.  Instance-Based Learning, feature reduction, Collaborative filtering based recommendation.	6	CO2
3	Regression and Decision Tree	Linear regression, Linear Classification Perceptron Algorithm, Bias and Variance, Decision trees, overfitting ,Bayesian Learning, Naïve Bayesian classification.	7	CO3
4	Support Vector Machine	Logistic Regression, Support Vector Machine, Kernel function and Kernel SVM. Maximum margin linear separators. Quadratic programming solution to finding maximum margin separators. Kernels for learning non-linear functions.	6	CO4

5	Neural Network fundamentals	Neural network: Models of artificial neuron, basic logic gates implementation using artificial neurons, feedforward and feedback network, Perceptron, multilayer network, backpropagation, introduction to deep neural network.	8	CO5
6	Unsupervised Learning Learning algorithms	concept of cluster, clustering applications, k-means clustering, K medoids clustering, hierarchical clustering	6	CO6

### **Text Books:**

- 1) Shai Shalev-Shwartz and Shai Ben-David. Understanding Machine Learning: From Theory to Algorithms (UML), Cambridge University Press, 2014
- 2) Mehryar Mohri, Afshin Rostamizadeh and Ameet Talwalkar. Foundations of Machine Learning (FOML), MIT Press, 2012
- 3) Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997.
- 4) Introduction to Machine Learning Edition 2, by Ethem Alpaydin

### **Reference Books:**

- 1) Hal Daumé III, A Course in Machine Learning (CIML), 2017 (freely available online)
- 2) Kevin Murphy, Machine Learning: A Probabilistic Perspective (MLAPP), MIT Press, 2012
- 3) Christopher Bishop, Pattern Recognition and Machine Learning (PRML), Springer, 2007.
- 4) David G. Stork, Peter E. Hart, and Richard O. Duda. Pattern Classification (PC), Wiley-Blackwell, 2000
- 5) Ian Goodfellow and Yoshua Bengio and Aaron Courville. Deep Learning (DL), MIT Press, 2016 (individual chapters freely available online)
- 6) Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning (ESL), Springer, 2009 (freely available online)

**In-Semester Assessment:** Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project. There will be a mid semester Examination on 40-50% of the syllabus.

### **End-Semester Examination:**

1. Question paper will comprise of total six question.
2. All question carry equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3

then part (b) will be from any module other than module 3)

4. Only Four question need to be solved.

**In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/Oral Credit	Tutorial Credits	Total Credits
ITLDLO5022	Fundamentals of Machine Learning Lab	--	2		--	1	--	1

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA 1	IA 2	Avg . of 2 IAs	Mid Sem Exam					
ITLDLO5022	Fundamentals of Machine Learning Lab	--	--	--	--	--	25	25	--	50

### Prerequisites:

Basics of Python Programming

### Lab Description

Machine Learning is the discipline of designing algorithms that allow machines (e.g., a computer) to learn patterns and concepts from data without being explicitly programmed. This course will be an introduction to the design (and some analysis) of machine learning algorithms, with a modern outlook focusing on recent advances, and examples of real-world applications of machine learning algorithms.

### Lab Objectives:

1. Learn the basics of Mathematics for Machine Learning.
2. To understand and practice data visualization techniques and analytical methods for solving real life problems based on statistical analysis.



3. To learn supervised machine learning techniques to solve complex real-world problems.
4. To learn unsupervised machine learning techniques to solve complex real-world problems.
5. To understand and evaluate performance of algorithms.
6. To map the elements of machine learning to perceive information.

**Lab Outcomes (LO):** At the end of the course learner will able to

1. Implement Mathematical models for Machine Learning
2. Analyse the data using different statistical techniques and visualise the outcome using different types of plots.
3. Analyse and apply the supervised machine learning techniques like Classification, Regression or Support Vector Machine on data for building the models of data and solving the problems.
4. Apply the different unsupervised machine learning algorithms like Clustering, Decision Trees, Random Forests or Association to solve the problems.
5. Evaluate the performance of algorithms
6. Design and develop an application that can have machine learning techniques to solve the real-world problem

Sr. No.	Detailed contents	Hours	LO Mapping
1	Implementation of probability theory concepts	2	LO1
2	Working with vectors, linear algebra with vectors.	2	LO1
3	Data Visualisation with Matplotlib and Seaborn	2	LO1
4	Plotting Line Plots, Bar Plots, Histograms Density Plots, Paths, 3D plot, Stream plot, Logarithmic plots, Pie chart, Scatter Plots and Imagevisualization using Matplotlib	2	LO2
5	Plotting scatter plot, box plot, Violin plot, swarm plot, Heatmap, Bar Plot using seaborn	2	LO2
6	Statistics using python: Computation of Correlation, Central Tendency, Variability, Hypothesis testing, Anova, z-test, t-test and chi-square test.	2	LO2
7	Implementation of simple Linear Regression and multiple linear regression	2	LO3

8	Implementation of logic gates using neural network and Implementation of logistic Regression	2	LO3
9	Implementation and performance evaluation of decision Tree algorithm	2	LO3,LO5
10	Implementation and performance evaluation of naïve Bayesian algorithm	2	LO3, LO5
11	1. Implementation of K means clustering and k medoids 2. Performance evaluation of k means clustering	2	LO4, LO5
12	Implementation of Support Vector Machine on a dataset and its performance evaluation	4	LO5, LO6

#### **Text Books:**

1. Ethem ALPAYDIN, “Introduction to Machine Learning”, 3<sup>rd</sup> Edition, The MIT Press.
2. T. Hastie, R. Tibshirani, J. Friedman, “The Elements of Statistical Learning: Data Mining, Inference and Prediction”, Wiley Publication.
3. Frank Kane, “Hands-On Data Science and Python Machine Learning”, Packt publication.

#### **References:**

1. Armando Fandango, “Python Data Analysis”, Second Edition, Packt publication.
2. Alberto Boschetti, Luca Massaron, “Python Data Science Essentials Second Edition”, Packt Publishing

**Term work Evaluation:** Term Work shall consist of write ups of experiments performed in the laboratory based on the above list, but not limited to it. Also, Term work may include a mini project report if a mini project is assigned as part of the lab.

**Practical and Oral Evaluation:** Practical exam will be conducted based on the experiments performed in the laboratory.

Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/ Oral Credit	Tutorial Credits	Total Credits
ITCDLO5023	Data Warehousing and mining	03	--	01	03	--	01	04

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA 2	Avg . of 2 IAs	Mid Sem Exam					
ITCDLO5023	Data Warehousing and Mining	20	20	20	20	60	--	-	--	100

### Course Description:

This course helps the students to understand the overall architecture of a data warehouse and methods for data gathering and data pre-processing using OLAP tools. The different data mining models and techniques will be discussed in this course. Data mining and data warehousing applications in bioinformatics will also be explored.

### Course Objectives:

1. To introduce the concept of data warehouse data Mining as an important tool for enterprise data management and as a cutting-edge technology for building competitive advantage.
2. To enable students to effectively identify sources of data and process it for data mining.
3. To make students well versed in all data mining algorithms, methods of evaluation.
4. To impart knowledge of tools used for data mining
5. To provide knowledge on how to gather and analyze large sets of data to gain useful business

### Course Outcomes:

At the end of the course learner will able to:

1. Understand warehousing architectures and tools for systematically organizing large database and use their data to make strategic decisions.
2. Organize and prepare the data needed for data mining using pre preprocessing techniques. Perform exploratory analysis of the data to be used for mining.
3. Implement the appropriate data mining method like classification
4. Create, populate with data, and extract useful information from a data warehouse
5. Measure the performance of Clustering algorithms using large data sets
6. Characterize the kinds of patterns that can be discovered by association rule mining

Sr. No	Module	Detailed Syllabus	Hours
1	Introduction to Data Warehousing and On line Analytical Processing (OLAP)	Data Warehouse features, Data Warehouse Architecture, Data Mart, Data Warehouse Schema, Need for Online Analytical Processing; OLTP V/s OLAP; OLAP and Multidimensional Analysis; Hypercube; OLAP Operations in Multidimensional Data Model; OLAP Models: MOLAP, ROLAP, HOLAP, DOLAP;	8
2	Introduction to data mining , Data Exploration ,Data Preprocessing	What is Data Mining; Knowledge Discovery in Database (KDD), What can be Data to be Mined, Related Concept to Data Mining, Data Mining Technique, Application and Issues in Data Mining, Types of Attributes; Statistical Description of Data; Data Visualization; Measuring similarity and dissimilarity. Why Preprocessing? Data Cleaning; Data Integration; Data Reduction: Attribute subset selection, Histograms, Clustering and Sampling; Data Transformation & Data Discretization: Normalization, Binning, Histogram Analysis and Concept hierarchy generation.	8
3	Classification	Basic Concepts; Classification methods: 1. <b>Decision Tree Induction:</b> Attribute Selection Measures, Tree pruning. 2. <b>Bayesian Classification:</b> Naïve Bayes' Classifier. Prediction: Structure of regression models; Simple linear regression, Multiple linear regressions. <b>Model Evaluation &amp; Selection:</b> Accuracy and Error measures, Holdout, Random Sampling, Cross Validation, Bootstrap; Comparing Classifier performance using ROC Curves. <b>Combining Classifiers:</b> Bagging, Boosting, Random Forests.	6
4	ETL Process	Challenges in ETL Functions; Data Extraction; Identification of Data Sources; Extracting Data: Immediate Data Extraction, Deferred Data Extraction; Data Transformation: Tasks Involved in Data Transformation, Data Loading: Techniques of Data Loading, Loading the	3

5	Clustering	<b>Cluster Analysis:</b> Basic Concepts, Partitioning Methods: K-Means, K-Medoids ; Hierarchical Methods: Agglomerative, Divisive, BIRCH, Density-Based Methods: DBSCAN, OPTICS. Outliers Types, Challenges	6
6	Mining Frequent Pattern and Association Rule	Market Basket Analysis, Frequent Item sets, Closed Item sets, and Association Rules; Frequent Pattern Mining, Efficient and Scalable Frequent Item set Mining Methods, The Apriori Algorithm for finding Frequent Item sets Using Candidate Generation, Generating Association Rules from Frequent Item sets, Improving the Efficiency of Apriori, A pattern growth approach for mining Frequent Item sets; Mining Frequent item sets using vertical data formats; Mining closed and maximal patterns; Introduction to Mining Multilevel Association Rules and Multidimensional Association Rules; From Association Mining to Correlation Analysis, Pattern Evaluation Measures; Introduction to Constraint-Based Association Mining.	8

#### **Text books:**

1. Han and Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann, 3rd Edition, 2012.
2. ReemaThareja, "Data Warehousing", Oxford Higher Education, 1st Edition, 2009.
3. VikramPudi&Radha Krishna, "Data Mining", Oxford Higher Education, 2009.
4. Michael Berry and Gordon Lin off , "Data Mining Techniques", 2nd Edition Wiley Publications, 2011.

#### **Reference Books:**

- 1) Randall Matignon, "Data Mining using SAS enterprise miner ", Wiley Student edition.
- 2) Alex Berson , S. J. Smith, "Data Warehousing, Data Mining & OLAP" , McGraw Hill.
- 3) Vikram Pudi & Radha Krishna, "Data Mining", Oxford Higher Education.
- 4) Daniel Larose, "Data Mining Methods and Models", Wiley India.

#### **Evaluation Scheme:**

##### **1. In-Semester Assessment:**

- a. Assessment consists of two Internal Assessments (IA1, IA2) out of which; one should be compulsory class test (on minimum 02 Modules) and the other is a class test / assignment on case studies / course project.
- b. Mid Semester Examination (MSE) will be based on 40-50% of the syllabus.

##### **2. End-Semester Examination:**

- Question paper will comprise of full syllabus.
- In the question paper, weightage of marks will be proportional to the total number of lecture hours as mentioned in the syllabus.

Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/ Oral Credit	Tutorial Credit s	Total Credits
ITLDLO 5023	Data Warehousing and Mining Lab	--	02	--	--	0 1	--	01

Subject Code	Subject Name	Examination Scheme							
		Theory Marks					Term Work	Practical & Oral Oral	Total
		In-Sem Evaluations				End Sem Exam			
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam				
ITLDLO5023	Data Warehousing and mining Lab	--	--	--	--	--	25	25	50

### Lab Description:

This is a course to enable students to use various data structures in programming. The objective of the course is to teach programming (with an emphasis on problem solving) and introduce elementary data structures.

### Lab Objectives:

1. To introduce the concept of data warehouse data Mining as an important tool for enterprise data management and as a cutting-edge technology for building competitive advantage.
2. To enable students to effectively identify sources of data and process it for data mining.
3. To make students well versed in all data mining algorithms, methods of evaluation.
4. To impart knowledge of tools used for data mining
5. To provide knowledge on how to gather and analyze large sets of data to gain useful business

### Lab Outcomes: At the end of the course learner will be able to

1. Understand warehousing architectures and tools for systematically organizing large database and use their data to make strategic decisions.
2. Organize and prepare the data needed for data mining using pre preprocessing techniques. Perform exploratory analysis of the data to be used for mining.
3. Implement the appropriate data mining method like classification

4. Create, populate with data, and extract useful information from a data warehouse
5. Measure the performance of Clustering algorithms using large data sets
6. Characterize the kinds of patterns that can be discovered by association rule mining

**Prerequisites:**

RDBMS

**Hardware & Software Requirements:**

<b>Hardware Requirement:</b>	<b>Software requirement:</b>
<b>PC i3 processor and above</b>	<b>Python, R</b>

<b>Sr. No.</b>	<b>Detailed Contents</b>	<b>Hours</b>	<b>LO Mapping</b>
1	To Creation dimensional table and Fact table of an sales data mart	04	LO1
2	Implementation using tools and techniques like python,R 1. Data exploration 2. Data preprocessing	04	LO2
3	To Study and Implement Naive-Bayesian Algorithm	02	LO3
4	Implementation of Decision Tree Algorithm Using ID3.	02	LO3
5	Extraction, Transformation and Loading (ETL) process for sales data mart.	02	LO4
6	Study of tools used in ETL pipeline.	02	LO4
7	To Study and Implement clustering 1. k-means algorithm Insert an element 2. Agglomerative clustering	04	LO5
8	To Study and Implement of Association rule mining: Apriori Algorithm	02	LO6
9	Study and Implement Nearest neighbors algorithm /FP tree	02	LO6
10	Case Study on Fraud detection, Market Segmentation etc.	02	LO2,LO3,LO4,LO5,LO6

**Text books:**

1. Han and Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann, 3rd Edition, 2012.
2. ReemaThareja, "Data Warehousing", Oxford Higher Education, 1st Edition, 2009.
3. VikramPudi&Radha Krishna, "Data Mining", Oxford Higher Education, 2009.
4. Michael Berry and Gordon Lin off , "Data Mining Techniques", 2nd Edition Wiley Publications, 2011.

**Reference Books:**

- 1) Randall Matignon, "Data Mining using SAS enterprise miner ", Wiley Student edition.
- 2) Alex Berson , S. J. Smith, "Data Warehousing, Data Mining & OLAP" , McGraw Hill.
- 3) Vikram Pudi & Radha Krishna, "Data Mining", Oxford Higher Education.
- 4) Daniel Larose, "Data Mining Methods and Models", Wiley India.

**Term work Evaluation:**Term Work shall consist of write ups of experiments performed in the laboratory based on the above list, but not limited to it. Also, Term work may include a mini project report if a mini project is assigned as part of the lab.

**Practical and Oral Evaluation:**Oral & Practical exams will be conducted based on the experiments performed in the laboratory.



Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/Oral Credit	Tutorial Credits	Total Credits
ITCDLO5024	Cryptography	03	--	-	03	--	-	03

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam					
ITCDLO5024	Cryptography	20	20	20	20	60	--	--	--	100

### Description

Cryptography is becoming increasingly important to enhance security in connection with data storage and communication and various kinds of electronic transactions. This course aims to give students: an overview of basic cryptographic concepts and methods a good knowledge of some commonly used cryptographic primitives and protocols a sound understanding of theory and implementation, as well as limitations and vulnerabilities an appreciation of the engineering difficulties involved in employing cryptographic tools to build secure systems.

### Course Objectives:

1. Summarize the main goals of cryptography and illustrate number theory behind it.
2. Describe goals and design principles for and common structures of secret key primitives such as block and stream ciphers and message authentication codes.
3. Explain how basic public key primitives can be defined based on the difficulty of mathematical problems such as the discrete logarithm problem or factoring and analyse variants of these systems.
4. Explain the various roles of hash functions as parts of other cryptographic primitives and protocols and the requirements this places on hash functions.
5. Explain authentication mechanism and different protocols.
6. Exemplify when various notions of security, such as information- theoretic, computational, provable and practical security, are applicable and describe the security guarantees provided.

**Course Outcomes:** After completion of the course, student should be able to:

1. To understand cryptosystem and mathematics behind it.
2. To apply the knowledge of different symmetric key cryptographic algorithm.
3. To apply the knowledge of public key cryptographic algorithm.
4. To apply the principles of Cryptographic Hash Functions and Digital Signature.
5. To apply the authentication mechanism in different applications.

6. To apply the knowledge of Network Security and Public Key Infrastructure.

**Prerequisites:**

1. Discrete Mathematics
2. Engineering Mathematics- IV
3. Computer Networks

Sr. No.	Module	Detailed Content	Hours	CO Mapping
1	Basic Concepts of Number Theory and Finite Fields	Computer Security, Information Security, CIA Triad, Cryptography, Cryptosystem, Cryptanalysis, Security Threats and Attacks, Security Services, Security Mechanisms, Divisibility and the divisibility algorithm, Euclidean algorithm, Modular arithmetic, Groups, Rings and Fields, Finite fields of the form $GF(p)$ , Polynomial arithmetic, Finite fields of the form $GF(2^n)$ . Pseudo-Random-Sequence Generators and Stream Ciphers: Linear Congruential Generators, Linear Feedback Shift Registers, Design and analysis of stream ciphers, Stream ciphers using LFSRs	6	CO1
2	Classical Encryption Techniques	Classical Encryption Techniques: Substitution Techniques: Caesar, monoalphabetic, Playfair, Hill, Polyalphabetic ciphers, One-time pad, Transposition Techniques: Rail Fence Cipher Modern Ciphers: Block vs. Stream Ciphers, Symmetric vs. Asymmetric Cipher, Steganography, Modes of Block Cipher Encryptions, Feistel Cipher Structure, Substitution Permutation Network (SPN) Symmetric Key Algorithm: DES, Double DES, Triple DES, IDEA, AES	6	CO2
3	Public-Key Cryptosystems	Number Theory: Prime Numbers, Fermat's Theorem, Euler's Theorem, Primality Testing, Miller-Rabin Algorithm, Extended Euclidean Theorem, Discrete Logarithms Public Key Cryptosystems, Applications of Public Key Cryptosystems, Distribution of public key, Distribution of secret key by using public key cryptography, Diffie-	8	CO3

		Helman Key Exchange, Man-in-the-Middle Attack, RSA Algorithm, Elgamal Cryptographic System, ECC.		
4	Cryptographic Hash Functions and Digital Signature	Message Authentication, Message Authentication Functions, Message Authentication Codes, Hash Functions, Properties of Hash functions, Applications of Hash Functions , Message Digests: MD5 Secure Hash Algorithms: SHA-1 and SHA-256 Digital Signatures: Direct Digital Signatures, Arbitrated Digital Signature, Digital Signature Standard: The DSS Approach, Digital Signature Algorithm, Digital Signature Standard: The RSA Approach	8	CO4
5	Authentication	Authentication System, Password Based Authentication, Dictionary Attacks, Challenge Response System, Biometric System, Needham-Schroeder Scheme, Kerberos Protocol	7	CO5
6	Network Security and Public Key Infrastructure	Overview of Network Security, Digital Certificates and X.509 certificates, Certificate Life Cycle Management, PKI trust models, PKIX, Email Security: Pretty Good Privacy (PGP), Secure Socket Layer (SSL) and Transport Layer Security (TLS), IP Security (IPSec), Firewalls and their types	4	CO6

#### **Text/Reference Books:**

1. Cryptography and Network Security, Atul Kahate, Tata Mc Graw Hill.
2. Behrouz A. Ferouzan, "Cryptography & Network Security", Tata Mc Graw Hill.
3. Lawrence C. Washington and Wade Trappe ,Introduction to Cryptography: With Coding Theory, ISBN-13: 9780134876917, Pearson p.
4. Bernard L. Menezes, Ravinder Kumar, "Cryptography and Network Security", Cengage Publication

**In-Semester Assessment:** Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project. There will be a mid semester Examination on 40-50% of the syllabus.

**End-Semester Examination:**

1. Question paper will comprise of total six question.
2. All question carry equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four question need to be solved.

**In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/Oral Credit	Tutorial Credits	Total Credits
ITLDLO5024	Cryptography Lab	--	02	-	--	01	--	02

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam					
ITLDLO5024	Cryptography Lab	--	--	--	--	--	25	--	25	50

### Description

Cryptography is becoming increasingly important to enhance security in connection with data storage and communication and various kinds of electronic transactions. This course aims to give students: an overview of basic cryptographic concepts and methods a good knowledge of some commonly used cryptographic primitives and protocols a sound understanding of theory and implementation, as well as limitations and vulnerabilities an appreciation of the engineering difficulties involved in employing cryptographic tools to build secure systems.

### Course Objectives:

1. Summarize the main goals of cryptography and illustrate number theory behind it.
2. Describe goals and design principles for and common structures of secret key primitives such as block and stream ciphers and message authentication codes.
3. Explain how basic public key primitives can be defined based on the difficulty of mathematical problems such as the discrete logarithm problem or factoring and analyse variants of these systems.
4. Explain the various roles of hash functions as parts of other cryptographic primitives and protocols and the requirements this places on hash functions.
5. Explain authentication mechanism and different protocols.
6. Exemplify when various notions of security, such as information- theoretic, computational, provable and practical security, are applicable and describe the security guarantees provided.

**Course Outcomes:** After completion of the course, student should be able to:

1. To understand cryptosystem and mathematics behind it.
2. To apply the knowledge of different symmetric key cryptographic algorithm.
3. To apply the knowledge of public key cryptographic algorithm.
4. To apply the principles of Cryptographic Hash Functions and Digital Signature.
5. To apply the authentication mechanism in different applications.
6. To apply the knowledge of Network Security and Public Key Infrastructure.

**Prerequisites:**

1. Discrete Mathematics
2. Engineering Mathematics- IV
3. Computer Networks

Sr. No.	Module	Detailed Content	Hours	CO Mapping
1	Basic Concepts of Number Theory and Finite Fields	<ol style="list-style-type: none"> <li>1. Study and analysis of different cryptic attack and their methodology.</li> <li>2. Analysis of cryptographic theorem.</li> </ol>	4	CO1
2	Classical Encryption Techniques	<ol style="list-style-type: none"> <li>1. Break the Mono-alphabetic Substitution Cipher and provide prevention technique.</li> <li>2. Implementation of One-Time Pad and Perfect Secrecy</li> <li>3. Implementation of Steganography to hide information behind the image .</li> <li>4. Implementation of DES and AES algorithm with S-box and p-box specification.</li> </ol>	6	CO2
3	Public-Key Cryptosystems	<ol style="list-style-type: none"> <li>1. Implementation of man in middle attack on DH algrothm.</li> <li>2. Implementation of RSA algorithm.</li> <li>3. Implementation of Elgamal Cryptographic System</li> </ol>	6	CO3
4	Cryptographic Hash Functions and	<ol style="list-style-type: none"> <li>1. Implementation of Digital Signature with RSA Approach</li> </ol>	4	CO4

	Digital Signature	2. Implementation of SHA algorithm.		
5	Authentication	1. Implementation of biometric fingerprint scanning for authentication. 2. Implementation of Challenge Response System for secure communication	4	CO5
6	Network Security and Public Key Infrastructure	1. Generation of X.509 certificates. 2. Implementation of pretty good privacy protocol(PGP) .	2	CO6

**Text books and References:**

- 1) Cryptography and Network Security, Atul Kahate, Tata Mc Graw Hill.
- 2) Behrouz A. Ferouzan, "Cryptography & Network Security", Tata Mc Graw Hill.
- 3) Lawrence C. Washington and Wade Trappe ,Introduction to Cryptography: With Coding Theory, ISBN-13: 9780134876917,Pearson p.
- 4) Bernard L. Menezes, Ravinder Kumar, "Cryptography and Network Security", Cengage Publication

**Evaluation Scheme:**

**Term work Evaluation:**

Term Work shall consist of write ups of experiments performed in the laboratory based on the above list, but not limited to it. Also, Term work may include a mini project report if a mini project is assigned as part of the lab.

**Practical and Oral Evaluation:**

Oral exam will be conducted based on the experiments performed in the laboratory.

Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/Oral Credit	Tutorial Credits	Total Credits
ITL502	Professional Communication and Ethics		04(02T+02P)	-		02	-	02

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam					
ITL502	Professional Communication and Ethics	--	--	--	--	--	25	--	25	50

### Course Objectives:

1. Discern and develop an effective style of writing important technical/business documents.
2. Investigate possible resources and plan a successful job campaign.
3. Analyze personal traits, interests, values, aptitudes and skills.
4. Understand the dynamics of professional communication required for career enhancement.
5. Develop creative and critical thinking required for effective workplace communication.
6. Understand what it means to act with integrity and have a personal code of ethics for regulating organizational behaviour.

### Course Outcomes:

#### Learners will be able to:

1. Plan and prepare effective business/ technical documents which will in turn provide solid foundation for their future managerial roles.
2. Strategize their personal and professional skills to build a professional image and meet the demands of the industry.
3. Gain expertise in preparing job search documents meeting the industry trends.



4. Merge successful in professional project presentations, group discussions and result oriented agreeable solutions in group communication situations.
5. Apply critical and creative thinking to overcome workplace challenges by understanding professional relationships.
6. Apply codes of ethical conduct, personal integrity and norms of organizational behaviour.

<b>Sr. No.</b>	<b>Module</b>	<b>Detailed Content</b>	<b>Hours (T + P)</b>	<b>CO Mapping</b>
1	ADVANCED TECHNICAL WRITING	Purpose and Classification of Reports Parts of a Long Formal Report Language, Formatting and Referencing of a Report Definition, Purpose & Types of Proposals Parts of a Memorandum Format Proposal Technical Paper Writing	7 + 7	CO1
2	EMPLOYMENT SKILLS	Group Discussions Cover Letter & Resume Personal Interviews	5 + 5	CO2
3	MANAGING BUSINESS MEETINGS AND DOCUMENTATION	Understanding Business Meetings Planning & Scheduling Meetings Meeting Documentation	2 + 2	CO3
4	TECHNICAL/ BUSINESS PRESENTATION SKILLS	Effective Presentation Strategies Ways to Make Effective Slides	3 + 3	CO4

5	DEVELOPING INTERPERSONAL SKILLS & WORK ETHICS	Interpersonal Skills & Organisational Behaviour  Intellectual Property Rights	7 + 7	CO5
6.	Etiquette and Manners	<ul style="list-style-type: none"> <li>• Social Etiquette               <ol style="list-style-type: none"> <li>1. Shaking Hands</li> <li>2. Exchanging Business Cards</li> <li>3. Introducing Self/Colleague/Classmate</li> </ol> </li> <li>• Cubical Etiquette</li> <li>• Dining Etiquette</li> <li>• Responsible Use of Social Media</li> </ul> Email Etiquette	2+ 2	CO5

### **LIST OF ASSIGNMENTS FOR TERMWORK**

1. Cover Letter and Resume
2. Short Proposal
3. Meeting Documentation (Notice, Agenda & Minutes)
4. Writing a Technical Paper/ Analysing an existing Technical Paper
5. Case Studies on Corporate Ethics
6. Questionnaire/ MCQ Test on IPR
7. Self-assessment questionnaires on any interpersonal skills mentioned in Module 5
8. Aptitude test (Verbal Ability)

**Note :**

1. The project report Main Body should be minimum 25 pages (excluding Front and Back matter).
2. The group size for the final report presentation should not be less than 5 students or exceed 7 students.
3. Keep the same students in a group for both the proposal presentation and the final report presentation so as to encourage better team dynamics.
4. There will be an Internal examination for the final report submission and project presentation.

**Evaluation Scheme:****Term work Evaluation:**

Term Work shall consist of write ups of experiments performed in the laboratory based on the above list, but not limited to it. Also, Term work will include a mini project report is assigned as part of the lab.

**Practical and Oral Evaluation:**

Oral & Practical exams will be conducted based on the experiments performed in the laboratory.

Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/ Oral Credit	Tutorial Credits	Total Credits
ITSL501	Web Programming Lab	--	2		--	2	--	4

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam					
ITSL501	Web Programm ing Lab	--	--	--	--	--	25	25	--	50

### Prerequisites:

- Skill Based LabI: Java(OOPM) Programming Lab
- Skill Based Lab II: Python Programming Lab

### Lab Description

Today's world is driven by web-based applications. The rationale behind this course is to impart the knowledge of web programming among students of information technology. This course covers web programming for both client-side and server-side to develop complete web-based applications for various requirements.

### Lab Objectives: Student will learn

1. To orient students to Web Server fundamentals.
2. To design and create web pages using HTML5 and CSS3.
3. To create web pages and provide client-side validation using JavaScript.
4. To create dynamic web pages using server-side scripting PHP.
5. To create dynamic web pages using server-side scripting PHP and MySQL database

6. To design AJAX application with PHP.

**Lab Outcomes (LO):** At the end of the lab learner will able

1. To understand the fundamentals of web server.
2. To understand the design of responsive web pages using HTML5 and CSS3.
3. To understand the importance of client-side validation using JavaScript.
4. To understand the design of dynamic web pages using server-side scripting.
5. To understand concept of containerization and analyze the Containerization of OS images and deployment of applications over Docker.
6. To understand AJAX application with PHP.

**Software requirement:** Windows OS for Client machines, XAMPP web server, Visual studio code editor.

Sr. No.	Detailed Syllabus	Hours	LO Mapping
1	<b>Introduction to Web Server XAMPP:</b> <ul style="list-style-type: none"><li>• Installation and Setting of XAMPP in Windows OS.</li><li>• Installation of WordPress Using XAMPP</li></ul>	2	LO1
2	<b>HTML5 and CSS3: Client-Side Scripting</b> <ul style="list-style-type: none"><li>• Design a web page using different text formatting tags.</li><li>• Design a web page with links to different pages and allow navigation between web pages.</li><li>• Design a web page demonstrating all Style sheet types.</li><li>• Design a web page demonstrating different semantics</li><li>• Design a web page with different tables.</li><li>• Design a web page with a form that uses all types of controls.</li><li>• Design a web page embedding with multimedia features.</li></ul>	6	LO2
3	<b>JavaScript:</b> <ul style="list-style-type: none"><li>• Design a web page that prints factorial/Fibonacci series.</li><li>• Design a form and validate all the controls placed on the form using Java Script.</li><li>• Write a JavaScript program to display all the prime numbers between 1 and 100.</li><li>• Write a JavaScript program to accept a number from the user and display the sum of its digits.</li><li>• Write a java script program to design simple calculator.</li></ul>	6	LO3

	<ul style="list-style-type: none"> <li>• Design a web page demonstrating different conditional statements.</li> <li>• Design a web page demonstrating different looping statements.</li> </ul>		
4	<b>PHP:Server-SideScripting:</b> <ul style="list-style-type: none"> <li>• Write a PHP Program to accept a number from the user and print it factorial.</li> <li>• Write a PHP program to accept a number from the user and print whether it is prime or not.</li> <li>• Write a PHP code to find the greater of 2 numbers. Accept the no. from the user.</li> <li>• Write a PHP program to demonstrate different string functions.</li> <li>• Write a PHP program to create one dimensional array.</li> </ul>	4	LO4
5	<b>Advanced PHP and MySQL:</b> <ul style="list-style-type: none"> <li>• Write a PHP program to create a database named “College”. Create a table named “Student” with following fields (sno, sname, percentage). Insert 3 records of your choice. Display the names of the students whose percentage is between 35 to 75 in a tabular format.</li> <li>• Design a PHP page for authenticating a user</li> </ul>	5	LO5
6	<b>Introduction to AJAX:</b> <ul style="list-style-type: none"> <li>• Create an PHP Ajax application</li> </ul>	3	LO6

#### Text Book:

1. Ben Frain, Responsive Web Design with HTML5 and CSS3, PACKT Publication.
2. HTML 5 Black Book: Kogent Learning solutions
3. “Learning PHP 5”, David Sklar, O’Reilly Publication
4. Rich Internet Application AJAX and Beyond WROX press

#### Reference Book:

1. “Web Technologies: Black Book”, Dreamtech publication
2. Christopher Schmitt, Kyle Simpson, HTML5 Cookbook, By O’Reilly Media
3. Deven Shah, Advanced Internet Technologies, Dreamtech publication

**Evaluation Scheme:****Term work Evaluation:**

Term Work shall consist of write ups of experiments performed in the laboratory based on the above list, but not limited to it. Also, Term work may include a mini project report if a mini project is assigned as part of the lab.

**Practical and Oral Evaluation:**

Oral & Practical exams will be conducted based on the experiments performed in the laboratory.

Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/Oral Credit	Tutorial Credits	Total Credits
ITMP501	Mini Project III	--	4		--	2	--	2

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg. of 2 Ias	Mid Sem Exam					
ITMP501	Mini Project III	--	--	--	--	--	25	--	25	50

### Course Description:

Mini project III is to help students to develop practical knowledge and ability about tools and techniques in order to solve real-life problems related to industry and computer science research areas. Students should select a problem statement from the following domains:

- Artificial Intelligence,
- Machine Learning,
- Computer Graphics, and Virtual Reality,
- Computer networks.
- Data Science

### Evaluation Scheme:

#### Term work Evaluation:

Term Work will be based on 2 mock presentations of the project and a mini-project report. Two reviews will be conducted for continuous assessment. The first shall be for the finalization of the problem and the proposed solution second shall be for implementation of the project.



**Practical and Oral Evaluation:**

Oral exams will be conducted based on the implemented project. Mini Project shall be assessed through a presentation and demonstration of mini-project to a panel of Internal and External Examiner.

**Bachelor of Technology in Information Technology  
Semester VI**

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
<b>ITC601</b>	<b>Cloud Infrastructure</b>	03		-	03		-	03
<b>ITDLO60101</b>	<b>DLO3</b>	03		-	03		-	03
<b>ITDLO60201</b>	<b>DLO4</b>	03		-	03		-	03
<b>ILOT60101</b>	<b>Institute Level Open Elective Technical ILOT2</b>	03	-	-	03	-	-	03
<b>ITL601</b>	<b>Cloud Infrastructure Lab</b>		02			01		01
<b>ITDL0L60101</b>	<b>DLO3 Lab</b>		02			01		01
<b>ITDL0L60201</b>	<b>DLO4 Lab</b>		02			01		01
<b>ITL602</b>	<b>Skill Based Lab IV: Devops Lab</b>	-	04	-	-	02	-	02
<b>ITMP601</b>	<b>Mini Project IV</b>	-	04	-	-	02	-	02
<b>*HBSO601</b>	<b>Economics for manager(online)</b>	-	-	-	--	-	-	01*
	<b>Total</b>	<b>12</b>	<b>14</b>	<b>-</b>	<b>12</b>	<b>07</b>	<b>-</b>	<b>19</b>

**Evaluation Scheme  
Semester-VI**

Course Code	Course Name	IA1	IA2	AVG	MSE	ESE	Exam Hrs	TW	Pr	Or	Total
<b>ITC601</b>	<b>Cloud Infrastructure</b>	<b>20</b>	<b>20</b>	<b>20</b>	<b>20</b>	<b>60</b>	<b>02</b>	<b>--</b>	<b>--</b>		<b>100</b>

[illegible]

Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/Oral Credit	Tutorial Credits	Total Credits
ITC601	Cloud Infrastructure	03	--	--	03	--	--	03

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		Test I	Test II	Avg. of 2 Tests	MSE					
ITC601	Cloud Infrastructure	20	20	20	20	60	--	--	--	100

#### Prerequisites:

- Operating System
- Computer Networks

#### Course Description:

The course presents a top-down view of cloud computing that provide students with a sound foundation of the cloud computing so that they are able to start using and adopting cloud computing services and tools in their real-life scenarios. Students will study state-of-the-art solutions for cloud computing. This course gives students an insight into the basics of cloud computing along with virtualization, cloud platforms, data storage, security, and advanced cloud enabling technologies. Cloud Computing and its infrastructure is one of the fastest growing domains from a while now.

#### Course Objectives:

1. To provide students with the fundamentals and essentials of cloud computing.
2. To learn basics of virtualization and its importance.
3. To provide students a sound foundation of the cloud computing so that they are able to start using and adopting cloud computing services and tools in their real-life scenarios.
4. To understand cloud storage and security aspects.
5. To understand application development for cloud.
6. To be exposed to cloud enabling technologies.

#### Course Outcomes:

On completion of the course, students will be able to—

**CO1:** Understand the main concepts, key technologies and fundamentals of cloud computing.

**CO2:** Understand cloud enabling technologies and virtualization.

**CO3:** Analyze various cloud programming models and apply them to solve problems on the cloud.

**CO4:** Explain data storage and major security issues in the cloud.

**CO5:** Understand application development for cloud.

**CO6:** Understand trends in cloud enabling technologies.

Sr. No.	Module	Detailed Syllabus	Hours	CO
1	<b>Introduction to Cloud Computing and analytics</b>	<b>Cloud Computing and analytics</b> Origins and Influences, Basic Concepts and Terminology, Goals and Benefits, Risks and Challenges, Roles and Boundaries, Cloud Characteristics, Cloud Delivery Models, Cloud Deployment Models, Federated Cloud/Intercloud, Types of Clouds. Cloud Analytics.	6	CO1
2	<b>Virtualization</b>	<b>Virtualization</b> Structures/Tools and Mechanisms, Types of Hypervisors, Virtualization of CPU, Memory, and I/O Devices, Implementation level of virtualization, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation.	7	CO2
3	<b>Cloud Platforms and Standards</b>	<b>Amazon web services:</b> Compute services Storage Services Communication Services Additional services Google AppEngine: Architecture and core concepts, Application life cycle, Cost model Microsoft Azure: Azure core concepts, SQL Azure, Windows Azure platform appliance.  <b>Standards :</b> The Open Cloud Consortium, Open Virtualization Format, Standards for Application.	6	CO3
4	<b>Cloud Data storage and security</b>	<b>Cloud file systems:</b> GFS and HDFS, BigTable, HBase and Dynamo Cloud data stores: Datastore and Simple DB, Cloud Storage-Overview, Cloud Storage Providers.  <b>Securing the Cloud:</b> General Security Advantages of Cloud-Based Solutions,	7	CO4

		Introducing Business Continuity and Disaster Recovery. Disaster Recovery- Understanding the Threats.		
5	<b>Application Development for Cloud</b>	<b>Developing cloud applications:</b> versus on-premise, modifying traditional application for deployment in the cloud, Development phases and management, Using Agile software development for cloud application, Developing synchronous and asynchronous cloud application, Application Security in Cloud.	7	CO5
6	<b>Advanced Cloud Enabling Technologies</b>	<p><b>The Future of Cloud TV,</b> Future of Cloud-Based Smart Devices, Home-Based Cloud Computing, Mobile Cloud, Autonomic Cloud Engine, Multimedia Cloud, Energy Aware Cloud Computing, Jungle Computing.</p> <p><b>Docker at a Glance:</b> Process Simplification, Broad Support and Adoption, Architecture, Getting the Most from Docker, The Docker Workflow</p> <p><b>Cloud Analytics</b> Analysis of data from the cloud applications.</p>	6	CO6

#### Text Books:

1. Thomas Erl, Zaigham Mahmood and Ricardo Puttini, Cloud Computing: Concepts, Technology & Architecture, Pearson, ISBN :978 9332535923, 9332535922, 1 st Edition
2. Anthony T. Velte Toby J. Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", 2010, The McGraw-Hill
3. Kailash Jayaswal, Jagannath Kallakurchi, Donald J. Houde, Cloud Computing Black Book, Wiley Dreamtech, ISBN:9789351194187.
4. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, Mastering Cloud Computing: Foundations and Applications Programming, McGraw Hill, ISBN: 978 1259029950, 1259029956.

#### Reference Books:

1. Srinivasan, J. Suresh, Cloud Computing: A practical approach for learning and implementation, Pearson, ISBN :9788131776513.
2. Kris Jamsa, Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business Models, Mobile, Security, and More, Jones and Bartlett, ISBN :9789380853772.

#### Evaluation Scheme:

**1. In-Semester Assessment:**

- a. Assessment consists of two Internal Assessments (IA1, IA2) out of which; one should be compulsory class test (on minimum 02 Modules) and the other is a class test / assignment on case studies / course project.
- b. Mid Semester Examination (MSE) will be based on 40-50% of the syllabus.

**2. End-Semester Examination:**

- Question paper will comprise of full syllabus.
- In the question paper, weightage of marks will be proportional to the total number of lecture hours as mentioned in the syllabus.

Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/Oral Credit	Tutorial Credits	Total Credits
ITL601	Cloud Infrastructure Lab	-	2	-	-	1	-	01

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam					
ITL601	Cloud Infrastructure Lab	--	--	--	--	--	25	--	25	50

#### Prerequisites:

- Operating system
- Web Development
- Computer Networks

#### Course Descriptions:

The main objective of the cloud infrastructure laboratory is to make students learn how to design and develop the process involved in creating a cloud-based application. This course also helps to simulate a cloud scenario using CloudSim. The course also helps to understand and how to develop web applications in cloud.

#### Lab Objectives:

1. To develop web applications in cloud.
2. To learn to launch web application
3. To Simulate a cloud scenario using CloudSim.
4. To learn the design and develop a process involved in creating a cloud-based application.
5. To learn to launch virtual machine.
6. To understand GAE standard environment.

**Lab Outcomes:** At the end of the course learner will able to

1. Create web applications in cloud.
2. Launch or deploy web application.
3. Simulate a cloud scenario using CloudSim.
4. Design and develop a process involved in creating a cloud-based application.



5. Launch virtual machine.
6. Understand GAE standard environment.

**Hardware Configuration for server:** Intel or AMD Multi Core processors (like i3/i5/i7/Quad core/Octa core) with Intel VT-X or AMD-V support, 6 GB RAM, 500 GB Harddisk, Gigabit Ethernet (GbE) network interface card (NIC)

**Software requirement:** Server OS for Physical Sever like Windows/Ubuntu, OpenSSH client or putty, Vmware Workstation, Oracle VirtualBox ,Built-in web browser

Sr. No.	Detailed Contents	Hours	LO Mapping
1	Install Google App Engine. Create hello world app and other simple web applications using python/java	2	LO1
2	Use GAE launcher to launch the web applications.	2	LO2
3	Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.	4	LO3
4	Find a procedure to transfer the files from one virtual machine to another virtual machine. <b>Case Studies:</b> Data storage security in private cloud	4	LO3
5	Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version). <b>Case Studies:</b> Tools for building private cloud	4	LO4
6	Design and deploy a web application in a PaaS environment	2	LO5
7	<b>Mini Project:</b> Design and develop custom Application using SalesforceCloud.	4	LO5
8	Design an Assignment to retrieve, verify, and store user credentials using Firebase Authentication, the Google App Engine standard environment, and Google Cloud Data store.	4	LO6

#### Text Books:

1. Thomas Erl, ZaighamMahmood and Ricardo Puttini, Cloud Computing: Concepts, Technology & Architecture, Pearson, ISBN :978 9332535923, 9332535922, 1st Edition
2. Anthony T. Velte Toby J. Velte, Robert Elsenpeter, “Cloud Computing: A Practical Approach”, 2010, The McGraw-Hill

**Reference Books:**

1. Srinivasan, J. Suresh, Cloud Computing: A practical approach for learning and implementation, Pearson, ISBN :9788131776513.
2. Kris Jamsa, Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business Models, Mobile, Security, and More, Jones and Bartlett, ISBN :9789380853772.

**Evaluation Scheme:****Term work Evaluation:**

Term Work shall consist of write ups of experiments performed in the laboratory based on the above list, but not limited to it. Also, Term work will include a mini project report is assigned as part of the lab.

**Practical and Oral Evaluation:**

Oral & Practical exams will be conducted based on the experiments performed in the laboratory.

Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/Oral Credit	Tutorial Credits	Total Credits
ITCDLO6011	UI/UX Framework Development	03	--	--	03	--	--	03

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam					
ITCDLO6011	UI/UX Framework Development	20	20	20	20	60	--	--	--	100

#### Prerequisites:

- Software Engineering
- Basic Knowledge of designing tools and languages like HTML , Java etc

#### Course Descriptions:

The course will impart knowledge on the different aspects of User-Interface Design, emphasizing SER and machine interaction as an emerging paradigm. The course will emphasize on understanding of user experience and cognition, which are the key factor to achieve user-friendly Interface Design. The course will give basic user interface design principles and techniques, Standards, Guidelines, Evaluation Techniques used for interface development.

#### Course Objectives:

1. To stress the importance of good interface design
2. To understand the importance of human psychology as well as social and emotional aspect in designing good interfaces.
3. To learn the techniques of data gathering, establishing requirements, analysis and data interpretation.

4. To learn the techniques for prototyping and evaluating user experiences.
5. To understand interaction design process.
6. To bring out the creativity in each student – build innovative applications that are usable, effective and efficient for intended user

**Course Outcomes:** At the end of the course learner will able to

1. Students will be able to identify and criticize bad features of interface designs.
2. Students will be able to predict good features of interface designs.
3. Students will be able to illustrate and analyze user needs and formulate user design specifications.
4. Students will be able to interpret and evaluate the data collected during the process.
5. Students will be able to evaluate designs based on theoretical frameworks and methodological approaches.
6. Students will be able to produce/show better techniques to improve the user interaction design interfaces.

Sr. No.	Module	Detailed Content	Hours	CO Mapping
1	Introduction to Interaction Design	Introduction: Good and Poor Design, What is Interaction Design, The User Experience, The Process Of Interaction Design, Interaction Design and the User Experience.	06	CO1,
2	Understanding and Conceptualizing Interaction Cognitive aspects and Social, Emotional Interaction	Understanding the Problem Space and Conceptualizing Design, Conceptual Model, Interface Types. Cognitive aspects, Social Interaction and the Emerging Social Phenomena, Emotions and the User Experience, Expressive and Frustrating Interfaces, Persuasive Technologies	08	CO3
3	Data Gathering, Establishing Requirements, Analysis, Interpretation and Presentation	Establishing Requirements, Five Key Issues, Techniques for Data Gathering, Data Analysis Interpretation and Presentation, Task Description and Task Analysis	08	CO4
4	Process of Interaction Design,	Interaction Design Process, Prototyping and Conceptual Design, Interface Metaphors and Analogies	06	CO4

	Prototyping, Construction.			
5	Design rules and Industry standards	Design principles, Principles to support Usability, Standards and Guidelines, Golden rules and Heuristics, ISO/IEC standards.	05	CO5
6	Evaluation Techniques and Framework	The Why, What, Where and When Of Evaluation, Types of Evaluation, case studies, DECIDE Framework, Usability Testing, conducting experiments, Field studies, Heuristic Evaluation and walkthroughs, Predictive models.	06	CO6

**Text Books:**

- Interaction Design, by J. Preece, Y. Rogers and H. Sharp. ISBN 0-471-49278-7.
- Human Computer Interaction, by Alan Dix, Janet Finlay, Gregory D Abowd, Russell Beale
- Alan Cooper, Robert Reimann, David Cronin, “About Face3: Essentials of Interaction design”, Wiley publication
- Wilbert O. Galitz, “The Essential Guide to User Interface Design”, Wiley publication.

**Reference Books:**

- The UX Book, by Rex Hartson and Pardha S Pyla.
- Donald A. Norman, “The design of everyday things”, Basic books.
- Jeff Johnson, “Designing with the mind in mind”, Morgan Kaufmann Publication.

**In-Semester Assessment:** Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is Tutorial on course project applying topics studied in syllabus. There will be a mid semester Examination on 40-50% of the syllabus.

**End-Semester Examination:**

1. Question paper will comprise of total six question.
2. All question carry equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four question need to be solved.

**In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/Oral Credit	Tutorial Credits	Total Credits
ITCDLO6011	User Interaction Design lab	--	02	--	--	01	-	01

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam					
ITCDLO6011	User Interaction Design lab	--	--	--	--	--	25	25	--	50

#### Prerequisites:

- Software Engineering
- Basic Knowledge of designing tools and languages like HTML , Java etc

#### Lab Descriptions:

The course will impart knowledge on the different aspects of User-Interface Design, emphasizing SER and machine interaction as an emerging paradigm. The course will emphasize on understanding of user experience and cognition, which are the key factor to achieve user-friendly Interface Design. The course will give basic user interface design principles and techniques, Standards, Guidelines, Evaluation Techniques used for interface development.

#### Lab Objectives:

1. To understand good interface design and bad interface design with examples
2. To give examples of human psychology as well as social and emotional aspects in designing good interfaces.
3. To learn the techniques of data gathering, establishing requirements, analysis and data interpretation.
4. To learn the techniques for prototyping and evaluating user experiences.
5. To understand the interaction design process, standards and guidelines.
6. To bring out the creativity in each student – build innovative applications that are usable, effective and efficient for intended user

**Lab Outcomes:** At the end of the course learner will able to

1. Students will be able to identify and criticize bad features of interface designs.
2. Students will be able to predict good features of interface designs.
3. Students will be able to illustrate and analyze user needs and formulate user design specifications.
4. Students will be able to interpret and evaluate the data collected during the process.
5. Students will be able to evaluate designs based on theoretical frameworks and methodological approaches.
6. Students will be able evaluate user interfaces.

<b>Sr. No.</b>	<b>Module</b>	<b>Detailed Content</b>	<b>Hours</b>	<b>CO Mapping</b>
01	Introduction to Interaction Design	Identify the Problem definition for real life project. Identify Good and Poor Design in project.	04	LO1
02	Introduction to Interaction Design	The User Experience, The Process Of Interaction Design, Interaction Design and the User Experience relevant to project should be illustrated in document.	02	LO1
03	Understanding and Conceptualizing Interaction	Illustrating the Problem Space and drawing, Conceptual Model and finalizing Interface Types for Project	02	LO2
04	Cognitive aspects and Social, Emotional Interaction	Illustrate Cognitive aspects, Social Interaction and the Emerging Social Phenomena, Emotions and the User Experience, Expressive and Frustrating Interfaces, Persuasive Technologies relevant to your project	02	LO2
05	Data Gathering, Establishing Requirements, Analysis.	Perform and apply appropriate Requirements and Data Gathering techniques and Data Analysis technique for Project	02	LO3
06	Interpretation and Presentation	Task Description and Task Analysis to be performed for project.	02	LO3
07	Process of Interaction Design.	Interaction Design Process to be performed for project.	02	LO4

08	Prototyping, Construction.	Prototyping and Conceptual Design, Interface Metaphors and Analogies to be designed for project.	02	LO4
09	Design rules	Apply and illustrate how Design principles, Principles to support Usability are done for your respective projects	02	LO5
10	Industry standards	Apply and illustrate how Standards and Guidelines are implemented for your respective projects	02	LO5
11	Evaluation Techniques Framework	Illustrate the Why, What, Where and When Of Evaluation, Types of Evaluation done for project	02	LO6
12	Evaluation Techniques Framework	Apply and illustrate how Usability Testing, conducting experiments, Field studies, Heuristic Evaluation and walkthroughs, Predictive models done for project.	02	LO6

**Text Books:**

- Interaction Design, by J. Preece, Y. Rogers and H. Sharp. ISBN 0-471-49278-7.
- Human Computer Interaction, by Alan Dix, Janet Finlay, Gregory D Abowd, Russell Beale
- Alan Cooper, Robert Reimann, David Cronin, “About Face3: Essentials of Interaction design”, Wiley publication
- Wilbert O. Galitz, “The Essential Guide to User Interface Design”, Wiley publication.

**Reference Books:**

- The UX Book, by Rex Hartson and Pardha S Pyla.
- Donald A. Norman, “The design of everyday things”, Basic books.
- Jeff Johnson, “Designing with the mind in mind”, Morgan Kaufmann Publication.

**Term work Evaluation:**

Term Work shall consist of write ups of experiments performed in the laboratory based on the above list, but not limited to it.

**Practical and Oral Evaluation:**

Practical exam will be conducted based on the experiments performed in the laboratory.



Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/Oral Credit	Tutorial Credits	Total Credits
ITCDLO6012	Image Processing	03	--	01	03	--	01	04

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		Test I	Test II	Avg. of 2 Tests	MSE					
ITCDLO6012	Image Processing	20	20	20	20	60	--	--	--	100

### Prerequisites:

- Engineering Mathematics

### Course Description

Digital image processing deals with the processing of images that are digital in nature. The study of the subject is motivated by the application which requires the improvement of pictorial information for human perception i.e. enhancing the quality of the image so that the image will have a better look. This course will introduce various image processing techniques, algorithms that will be helpful in building various projects.

### Course Objectives:

1. To understand fundamental concepts of the image processing system.
2. To get familiar with the image enhancement techniques and image restoration techniques to improve the subjective and objective quality of images.
3. To analyze images in the frequency domain using various transforms.
4. To understand and implement the fundamental concepts of describing and representing the image through image segmentation and representation.
5. To categorize various compression techniques.
6. To understand different image morphological methods.

### Course Outcomes: At the end of the course learner will be able to:

1. Understand the digital image fundamentals
2. Understand the image enhancement and image restoration techniques.

3. Understand the different image transforms.
4. Understand different image segmentation algorithms.
5. Understand different image compression techniques
6. Understand different image morphological methods

Sr. No.	Module	Detailed Syllabus	Hours	CO
1	Digital Image Fundamentals	<ul style="list-style-type: none"> <li>Image Definition, Steps and Components of Digital Image Processing,</li> <li>Image Sensing and Acquisition,</li> <li>Image Sampling and Quantization,</li> <li>Relationships between pixels –Adjacency, Connectivity and Distance,</li> <li>Color image fundamentals – RGB, HSI models.</li> </ul>	6	CO1
2	Image Enhancement and Image Restoration	<ul style="list-style-type: none"> <li>Point Processing Techniques: Image Negative, Bit Plane Slicing, Gray Level Slicing, Contrast Stretching, Clipping, Thresholding, Dynamic Range Compression.</li> <li>Mask Processing Techniques: Filtering in Spatial Domain, Average Filter, Weighted Average Filter, Order Statistic Filter: Min, Max, Median Filter. Histogram Processing: Histogram Equalization</li> <li>Image Restoration: Noise models</li> <li>Frequency Domain: Introduction to Fourier Transform Smoothing and Sharpening frequency domain filters –Ideal, Butterworth and Gaussian filters, Low-pass and High Pass Filters, Homomorphic filtering,</li> </ul>	6	CO2
3	Image Transforms	<ul style="list-style-type: none"> <li>Introduction to Fourier Transform,</li> <li>2D transforms – Discrete Fourier Transform, Fast Fourier Transform, Walsh-Hadamard Transform,</li> </ul>	6	CO3
4	Image Segmentation	<ul style="list-style-type: none"> <li>Edge detection, Edge linking via Hough transform,</li> <li>Region-based segmentation – Region growing, Region splitting and merging,</li> <li>Image Segmentation Based on thresholding (Global, Local)</li> </ul>	7	CO4
5	Image Compression	<ul style="list-style-type: none"> <li>Introduction, Redundant and Irrelevant Data</li> </ul>	7	CO5

		<ul style="list-style-type: none"> <li>• Lossless Compression: Run-Length Encoding, Huffman Coding, Arithmetic Coding, LZW Coding,</li> <li>• Lossy Compression: Fidelity Criterion, Improved Gray scale Quantization, Symbol-Based Coding, Bit-Plane Coding, Vector Quantization.</li> </ul>		
6	Morphological Image Processing	<ul style="list-style-type: none"> <li>• Introduction, Arithmetic, and Logical Operations.</li> <li>• Morphological processing- erosion and dilation, opening, closing, boundary extraction, Thinning, Thickening, Skeletonization, HIT or MISS transformation.</li> </ul>	7	CO6

### Text Books:

1. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", Addison - Wesley Publishing Company, 3e, 2007.
2. William K. Pratt, "Digital Image Processing", John Wiley, 4e, 2007.
3. S. Jayaraman, S. Esakkirajan and T. Veerakumar, "Digital Image Processing", MGH Publication, 2016.

### Reference Books:

1. S. Sridhar, "Digital Image Processing," Oxford University Press, 2e, 2016.
2. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing using MATLAB," Pearson Education
3. Anil K. Jain, "Fundamentals of Digital Image Processing," PHI, 1995.

### Evaluation Scheme:

#### 1. In-Semester Assessment:

- a. Assessment consists of two Internal Assessments (IA1, IA2) out of which; one should be a compulsory class test (on minimum 02 Modules) and the other is a class test/assignment on case studies/course project.
- b. Mid Semester Examination (MSE) will be based on 40-50% of the syllabus.

#### 2. End-Semester Examination:

- Question paper will comprise of the full syllabus.
- In the question paper, the weightage of marks will be proportional to the total number of lecture hours as mentioned in the syllabus.

Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/Oral Credit	Tutorial Credits	Total Credits
ITLDLO6012	Image Processing Lab	-	2	-	-	1	-	01

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam					
ITLDLO6012	Image Processing Lab	--	--	--	--	--	25	--	25	50

#### Prerequisites:

- Any programming language

#### Lab Descriptions:

The objective of the Image Processing Laboratory is to familiarize students with the implementation in MATLAB or Python of the basic techniques for handling images. Also, students will be able to implement algorithms for image enhancement, restoration, coding, and compression. Students should be able to identify the problem and apply the concepts of Image processing in different areas of pattern recognition and computer vision.

#### Lab Objectives:

- Understand the relevant aspects of digital image representation and their practical implications
- Understand the basics of point processing techniques and image enhancement algorithms to build the various applications.
- Study different noise models and their filtering techniques in the spatial and frequency domain.
- To interpret image segmentation and representation techniques.
- To understand various compression algorithms and analyze their applications.
- To understand morphological operations and analyze their applications.

**Lab Outcomes:** At the end of the course learner will be able to

1. To represent images in different file formats and their practical implications.
2. Implement point processing techniques, and image enhancement algorithms.
3. Implement various filtering techniques in the spatial and frequency domain.
4. Implement region-based and boundary-based segmentation.
5. Analyze various compression algorithms.
6. Implement morphological operations such as opening, closing, and erosion dilation.

**Software requirement: MATLAB, Python**

<b>Sr. No.</b>	<b>Detailed Contents</b>	<b>Hours</b>	<b>LO Mapping</b>
1	Write a program to read and write an image and perform following conversions:  RGBtgray  RGBtoHSV	2	LO1
2	Write a program to perform Point Processing in spatial domain:  a. Negation of the Image b. Thresholding of an image c. Contrast Stretching of an image d. Bit Plane Slicing	4	LO2
4	Program to perform Histogram Equalization and Specification	2	LO2
5	Program to perform Image enhancement for following functions:  a. Smoothing b. Sharpening c. High Boost filtering	4	LO2
6	Program to perform Filtering in spatial domain for Noise Removal  a. Low Pass Filtering b. High Pass Filtering c. Median filtering	2	LO3
7	Program to perform Filtering in frequency domain  a. Low pass filter b. High pass filter	2	LO3

8	Program to perform Image Segmentation by local and global methods.	2	LO4
9	Program to perform Data compression using Huffman coding.	4	LO5
10	Program for morphological image operations-erosion, dilation, opening & closing.	4	LO6

### **Text Books:**

1. Donald Hearn and M. Pauline Baker, "Computer Graphics", Pearson Education.
2. R. K Maurya, "Computer Graphics with Virtual Reality", Wiley India.

### **Reference Books:**

#### **Text Books:**

1. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", Addison - Wesley Publishing Company, 3e, 2007.
2. William K. Pratt, "Digital Image Processing", John Wiley, 4e, 2007.
3. S. Jayaraman, S. Esakkirajan and T. Veerakumar, "Digital Image Processing", MGH Publication, 2016.

#### **Reference Books:**

1. S. Sridhar, "Digital Image Processing," Oxford University Press, 2e, 2016.
2. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing using MATLAB," Pearson Education
3. Anil K. Jain, "Fundamentals of Digital Image Processing," PHI, 1995.

### **Evaluation Scheme:**

#### **Term work Evaluation:**

Term Work shall consist of write-ups of experiments performed in the laboratory-based on the above list, but not limited to it. Also, term work may include a mini project report if a mini project is assigned as part of the lab.

#### **Practical and Oral Evaluation:**

Oral will be conducted based on the experiments performed in the laboratory.

Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/Oral Credit	Tutorial Credits	Total Credits
ITCDO 6013	Big Data Analytics	03	02	-	03	01	--	04

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam					
ITCDO6013	Big Data Analytics	20	20	20	20	60	25	25	--	150

### Course Description:

Big data analytics is the use of analytic techniques for very large amount of data sets that include structured, semi-structured and unstructured data, from different sources, and in different sizes from terabytes to zettabytes. This course gives idea about how the huge amount of data can be handled using Hadoop structure. It is useful for understand concept of data streams, Link Analysis, Social Mining Graphs and its real life applications. It gives idea about the different options for importing or loading data into HDFS data sources such as relational databases, data warehouses, and web server logs.

### Course Objectives:

1. To explore the fundamental concepts of big data analytics.
2. To introduce the tools required to manage and analyze big data like Hadoop, NoSql Map-Reduce.
3. To learn to use various techniques for mining data stream and social network graphs.
4. To learn to use various Big data mining algorithms
5. To learn to use big data in social network and recommendation system.

### Course Outcomes:

At the end of the course learner will able to

1. Understand the motivation of big data system and identify the main sources of Big Data in the real world.
2. An ability to use frameworks like Hadoop, NOSQL to efficiently store retrieve and process big data for analytics.
3. Implement several data intensive tasks using the MapReduce Paradigm.
4. Apply algorithms to analyze big data like streams, Web Graphs and Social Media data.
5. Apply various algorithms for Classifying, clustering and finding associations in big Data
6. Apply Link analysis algorithms and implement successful recommendation engines for various big data use cases.

**Prerequisites:** Database Management System.

Sr. No.	Module	Detailed Syllabus	Hours	CO Mapping
1	Introduction	Introduction to Big Data, Big data: Why and Where Big Data, characteristics and Dimensions of Scalability, Types of Big Data, Business Intelligence vs. Big Data, Big Data Challenges, Examples of Big Data in Real Life.	5	CO1
2	NO SQL Data Management	<p><b>.What is NoSQL?</b> Introduction to NoSQL, NoSQL v/s Relational Database, No SQL data architecture patterns: Key-value stores, Graph stores, Column family stores, Document stores.</p> <p>NO SQL Database- Mongo DB: Introduction, Features, Data types, Mongo DB Query language, Create, Read Update and Delete(CRUD) operations, Projection, Limiting Records, Sorting Records, Arrays, Indexing, Aggregation, Replication, Sharding.</p> <p>Cassandra: Introduction, Features, Components, Data types, Collections Cassandra Query Language (CQL), CRUD operations, Keyspace, Cassandra Shell Commands.</p>	7	CO2
3	Hadoop and MapReduce	Hadoop: Introduction to Hadoop, Features, Advantages, Hadoop vs. SQL, Hadoop Core Components, Hadoop Ecosystem, CAP Theorem,	6	CO3



		<p>BASE Concept. Analyzing big data with a Shared Nothing</p> <p>Map Reduce: Mapper, Reducer, Combiner, Partitioner, Details of MapReduce Execution, Coping with Node Failures, Job Scheduling, shuffle and sort, task execution , MapReduce types, input formats, output formats, Grouping and Aggregation by MapReduce, Matrix Multiplication,</p>		
4	Mining Big Data Streams and Social Network Graphs	<p><b>Mining Big Data Streams</b>  Stream Data Model – Sampling Data in the Stream – Filtering, Filtering Streams: The Bloom Filter, Counting Distinct Elements in a Stream: The Count-Distinct Problem, The Flajolet-Martin Algorithm, Estimating Moments. Counting Oneness in a Window: The Datar-Gionis-Indyk-Motwani Algorithm, Decaying Window, Real time Analytics Platform (RTAP) Applications Case Studies. Real Time Sentiment Analysis, Stock Market Predictions.</p> <p><b>Mining Social- Network Graphs</b>  Social Networks as Graphs, Clustering of Social Network Graphs, Direct Discovery of Communities, SimRank, Counting triangles using Map-Reduce</p>	7	CO4
5	Big Data Mining Algorithms	<p><b>Frequent Itemsets</b>  Memory Basic Algorithm of Park, Chen, and Yu. The SON Algorithm and MapReduce.</p> <p><b>Classification Algorithms:</b>  Parallel Decision trees, Overview SVM classifiers, Parallel SVM, KNearest Neighbor classifications for Big Data, One Nearest Neighbour.</p> <p><b>Clustering Algorithms:</b> CURE Algorithm. Canopy Clustering, Clustering with MapReduce</p>	8	CO5
6	Link Analysis and Recommendation System	<p><b>Link Analysis</b>  PageRank Definition, Structure of the web, dead ends, Using Page rank in a search engine, PageRank Iteration Using MapReduce, Topic sensitive Page Rank, link Spam, Hubs and Authorities, HITS Algorithm.</p>	6	CO6

		<b>Recommendation System:</b> A Model for Recommendation Systems, Content-Based Recommendations, Collaborative Filtering.		
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### **Text Books:**

1. Anand Rajaraman and Jeff Ullman “Mining of Massive Datasets”, Cambridge University Press.
2. Alex Holmes “Hadoop in Practice”, Manning Press, Dreamtech Press..
3. Professional NoSQL Paperback, by Shashank Tiwari, Dreamtech Press
4. MongoDB: The Definitive Guide Paperback, Kristina Chodorow (Author), Michael Dirolf, O'Reilly Publications

### **Reference Books:**

1. Tom White “Hadoop: The Definitive Guide” Third Edition, O’reilly Media, 2012.
2. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGrawHill Publishing, 2012.
3. Bill Franks , “Taming The Big Data Tidal Wave: Finding Opportunities In Huge Data Streams With Advanced Analytics”, Wiley.
4. Paul Zikopoulos, Chris Eaton, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data’, McGraw Hill Education

**In-Semester Assessment:** Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project. There will be a mid semester Examination on 40-50% of the syllabus.

### **End-Semester Examination:**

1. Question paper will comprise of total six question.
2. All question carry equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four question need to be solved.

**In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/Oral Credit	Tutorial Credits	Total Credits
ITCDO6013	Big Data Analytics		02	-		01	--	01

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam					
ITLDO6013	Big Data Lab						25		25	50

### Lab Description:

The objective of this lab is to educate students in all aspects of large and distributed information system. This lab should enable the students to learn different NoSQL databases and Map Reduce techniques for solving Big Data Problems. Various algorithms are implemented by using MapReduce techniques.

### Lab Objectives:

1. To explore the fundamental concepts of big data analytics.
2. To introduce the tools required to manage and analyze big data like Hadoop, NoSql Map-Reduce.
3. To learn to use various techniques for mining data stream and social network graphs.
4. To learn to use various Big data mining algorithms
5. To learn to use big data in social network and recommendation system.

### Lab Outcomes: At the end of the course learner will able to

1. Understand the motivation of big data system and identify the main sources of Big Data in the real world.
2. An ability to use frameworks like Hadoop, NOSQL to efficiently store retrieve and process big data for analytics.
3. Implement several data intensive tasks using the MapReduce Paradigm.
4. Apply algorithms to analyze big data like streams, Web Graphs and Social Media data.

5. Apply various algorithms for Classifying, clustering and finding associations in big Data.
6. Apply Link analysis algorithms and implement successful recommendation engines for various big data use cases.

**Prerequisites:**

- 1) Java, Python

**Hardware & Software Requirements:**

<b>Hardware Requirement:</b>  <b>PC i3 processor and above</b>	<b>Software requirement:</b>  Virtual Machine, Hadoop Frame work, NOSQL and MongoDB Compilers
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<b>Sr. No.</b>	<b>Module</b>	<b>Detailed Content</b>	<b>Hours</b>	<b>LO Mapping</b>
1	Introduction	Installation of Hadoop on single node	02	LO1
2	NO SQL Data Management	Programming exercises on Hadoop Using Hive, Pig, Hbase Sqoop  NOSQL, MongoDB	06	LO2
3	Hadoop and MapReduce	<ol style="list-style-type: none"> <li>1. Write MapReduce program to analyse time-temperature statistics and generate report with max/min temperature.</li> <li>2. Implementation of Matrix Multiplication with Hadoop Map Reduce.</li> <li>3. Write MapReduce program to count distinct words from given file.</li> </ol>	06	LO3
4	Mining Big Data Streams and Social Network Graphs	<ol style="list-style-type: none"> <li>1. Implemen Analytics on data streams using MapReduce</li> <li>2. Implement Social Network Analysis Algorithms using MapReduce</li> </ol>	04	LO4

5	Big Data Mining Algorithms	<ol style="list-style-type: none"> <li>1. Implement Frequent Item set Mining using MapReduce</li> <li>2. Implement Clustering algorithms using MapReduce</li> <li>3. Implement Classification Algorithms Algorithms using MapReduce.</li> </ol>	06	LO5
6	Link Analysis and Recommendation System	<b>Mini Project:</b> Implement Big data mini project based on real time data	02	LO6

#### **Text Books:**

1. Anany Levitin, —Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education, 2012.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2007.

#### **Reference Books:**

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, “Introduction to Algorithms”, Third Edition, PHI Learning Private Limited, 2012.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, “Data Structures and Algorithms”, Pearson Education, Reprint 2006.
3. Donald E. Knuth, “The Art of Computer Programming”, Volumes 1 & 3 Pearson Education, 2009. Steven S. Skiena, “The Algorithm Design Manual”, Second Edition, Springer, 2008.
4. Harsh Bhasin, —Algorithms Design and Analysis, Oxford university press, 2016.
5. S. Sridhar, —Design and Analysis of Algorithms, Oxford university press, 2014.

#### **Evaluation Scheme:**

##### **Term work Evaluation:**

Term Work shall consist of write ups of experiments performed in the laboratory based on the above list, but not limited to it. Also, Term work may include a mini project report if a mini project is assigned as part of the lab.

##### **Practical and Oral Evaluation:**

Oral & Practical exams will be conducted based on the experiments performed in the laboratory.

Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/Oral Credit	Tutorial Credits	Total Credits
ITCDLO6014	IoT and its Applications	03		-	03	--	-	03

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam					
ITCDLO6014	IoT and its Applications	20	20	20	20	60			--	100

### Course Description:

The Internet is evolving to connect people to physical things and also physical things to other physical things all in real time. It is becoming the Internet of Things (IoT). The course enables student to understand the basics of Internet of things and protocols. It introduces some of the application areas where Internet of Things can be applied.

### Course Objectives:

1. To introduce IoT basics, technology and its applications
2. To understand evolution from M2M to IoT from market and architectural perspectives.
3. To gain knowledge of sensors, microcontrollers and their interfacing.
4. To study different IoT protocols for communication.
5. To study different challenges in IoT application development.
6. To study different IoT applications.

### Course Outcomes: At the end of the course learner will able to

1. Understand IoT basics, technology and its applications.
2. Understand the evolution from M2M to IoT.
3. Explore and learn sensors, microcontrollers and their interfacing.
4. Analysis and evaluate protocols used in IoT for communication.
5. Understand different challenges in IoT application development
6. To design different applications of IoT for society.

### Prerequisites:

Computer Organization & Architecture, Computer Networks,

<b>Sr. No.</b>	<b>Module</b>	<b>Detailed Content</b>	<b>Hours</b>	<b>CO Mapping</b>
1	Introduction to IoT	Introduction, Application areas of IoT, Characteristics of IoT, Things in IoT, IoT stack, Enabling technologies, IoT challenges, IoT levels, IoT and cyber physical system, IoT and WSN	5	CO1
2	M2M to IoT	M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies.  M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.	8	CO2
3	Sensors, Microcontrollers and their Interfacing:	Sensor interfacing, Types of sensors, Controlling sensors, Microcontrollers, ARM	7	CO3
4	Protocols for IoT	Messaging and Transport Protocols-MQTT, CoAP, BLE, LiFi  Addressing and Identification Protocols- IPv4, IPv6, URI	7	CO4
5	Challenges, Domain specific applications of IoT	Design challenges, Development challenges, Security challenges, Home automation, Industry applications, Surveillance applications, Other IoT applications	6	CO5
6	Application Building with IoT	IFTTT, Case studies: smart perishable tracking with IoT and sensors, smart Healthcare system, smart lavatory maintenance system, Water quality	6	CO6

		monitoring system, smart warehouse monitoring, IoT in retail sector, smart driver assistance system.		
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### **Text Books:**

1. Internet of Things ( A Hands-on-Approach) by Arshdeep Bhaga and Vijay Madiseti
2. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, “From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence”, 1st Edition, Academic Press, 2014.
3. Internet of Things by S. K. Vasudevan, Abhishek S Nagarjan, RMD Sundaram.

### **Reference Books:**

1. The Internet of Things (MIT Press) by Samuel Greengard.
2. Raj Kamal, “Internet of Things: Architecture and Design Principles”, 1st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224)
3. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applications and Protocols”, Wiley, 2012.

**In-Semester Assessment:** Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project. There will be a mid semester Examination on 50-60% of the syllabus.

### **End-Semester Examination:**

1. Question paper will comprise of total six question.
2. All question carry equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four question need to be solved.

**In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**



Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/ Oral Credit	Tutorial Credits	Total Credits
ITLDLO6014	IoT and its Applications Lab		02	-		01		01

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam					
ITLDLO6014	IoT and its Applications Lab						25	25	--	50

#### Lab Objectives:

1. Acquainting students with Arduino Board and Arduino IDE
2. Working with Arduino board and sensors
3. Interfacing of networking module with Arduino.
4. Acquainting students with Raspberry Pi
5. Interfacing of hardware with Raspberry Pi

#### Lab Outcomes: At the end of the course learner will able to

1. Use of Arduino Board and Arduino IDE.
2. Design and implement sensors with Arduino board.
3. Interface networking module with Arduino.
4. Use Raspberry Pi
5. Interfacing of hardware with Raspberry Pi

#### Prerequisites:

Computer Networks, Python programming, C programming.

Sr. No.	Detailed Content	Hours	CO Mapping
1	<ul style="list-style-type: none"> <li>Understanding Arduino UNO Board and Components.</li> <li>Installing and work with Arduino IDE</li> </ul>	4	LO1

	<ul style="list-style-type: none"> <li>Blinking LED sketch with Arduino</li> </ul>		
2	<ul style="list-style-type: none"> <li>Using Pulse Width Modulation</li> <li>LED Fade Sketch and Button Sketch</li> <li>Analog Input Sketch (Bar Graph with LEDs and Potentiometer)</li> <li>Working with DHT/IR/Gas or Any other Sensor</li> <li>Spinning a DC Motor and Motor Speed Control Sketch</li> </ul>	6	LO2
3	<ul style="list-style-type: none"> <li>Interfacing Arduino with Bluetooth/Zigbee/wifi</li> <li>Interfacing Arduino with Cloud (Thingspeak API)</li> </ul>	6	LO3
4	<ul style="list-style-type: none"> <li>Getting started with Raspberry Pi</li> <li>Install Raspian on your SD card</li> <li>Linux basic commands.</li> </ul>	6	LO4
5	<ul style="list-style-type: none"> <li>Understanding the connectivity of Raspberry-Pi with IR sensor.</li> <li>Interfacing of Camera with Raspberry Pi</li> </ul>	4	LO5

#### **Text Books:**

1. Vijay Madiseti and ArshdeepBahga, — “Internet of Things (A Hands-on-Approach)”, 1 st Edition, VPT, 2014.
2. J. Biron and J. Follett, "Foundational Elements of an IoT Solution", O'Reilly Media, 2016.
3. Keysight Technologies, “The Internet of Things: Enabling Technologies and Solutions for Design and Test”, Application Note, 2016.
4. Simon Monk, “Programming the Raspberry Pi: Getting Started with Python”, January 2012, McGraw Hill Professional.

#### **Reference Books:**

1. Eben Upton and Gareth Halfacree, “Raspberry Pi User Guide”, August 2016, 4th edition, John Wiley & Sons
2. Alex Bradbury and Ben Everard, “Learning Python with Raspberry Pi”, Feb 2014, JohnWiley & Sons
3. Michael Margolis, “Arduino Cookbook”, First Edition, March 2011, O'Reilly Media, Inc Publications).

**Term Work:**

Term Work shall consist of write ups of experiments performed in the laboratory based on the above syllabus, but not limited to it.

**Practical and Oral Evaluation:** Oral & Practical exams will be conducted based on the experiments performed in the laboratory.

<b>Subject Code</b>	<b>Subject Name</b>	<b>Theory Hrs</b>	<b>Practical Hrs</b>	<b>Tutorial Hrs</b>	<b>Theory Credit</b>	<b>Practical/ Oral Credit</b>	<b>Tutorial Credits</b>	<b>Total Credits</b>
ITCDLO6021	Game Development	03	--	-	03	--	-	04

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg .of 2 IAs	Mid Sem Exam					
ITCDLO6021	Game Development	20	20	20	20	60	- -	--		100

### Prerequisites:

- C Programming.

### Course Description:

Game Development program provide a focus on video game design and development, imaginary storytelling, and production needs of the modern gaming industry, Graduates of the Game Design program will have hands-on skills to pursue a career creating content for everything from home computers and mobile devices, to emerging platforms like cloud gaming. Studies include game software development as well as production processes used by top studios to design and produce best-selling games. The capstone project for this program is the design and development of a real-world video game application.

### Course Objectives:

1. To equip students with the fundamental knowledge and basic technical competence in the field of game development.
2. To provide an understanding of how to implement and coding basics.
3. To emphasize on aspect of game visualization.

**Course Outcomes:** At the end of the course learner will able to

1. Understand the basic concepts of animation
2. Understand and implement game scripting and coding.
3. Acquire knowledge about game visualization and documentation.
4. Understand the basic concepts of modeling and game analysis.
5. Ability to understand game interface Design.
6. Explore free game engines for beginners.

Sr. No.	Module	Detailed Content	Hours	CO Mapping
1	Basic Animation	Introduction to The Game, Photoshop & Flash, Game Analysis Centipede	6	CO1
2	Game Scripting & Coding	Game Programming Language, source code program, C>Game and Graphic Code, UX and UI Design	5	CO2
3	Game Visualization	Game Idea: Visualization & Story Telling, Game Development & Documentation, Game Design Documents, Character Designing, Flash Based Game Designing	8	CO3
4	Character Make	Modeling, Texturing & Lighting Games, Rigging & Animation for Games, Augmented Reality	6	CO4
5	Game Planning	Theft Auto III, Game Interface Designing, FX for Games, sound for games, Game Analysis: The Sims	8	CO5
6	Game Engines	Game Engines, System and Development	6	CO6

**Text Books:**

Game Development Essentials: An Introduction, Third Edition, Jeannie Novak.

**Reference Books:**

1. Game Programming Patterns by Robert Nystrom.
2. Foundations of Game Engine Development, Volume 1: Mathematics

**Evaluation Scheme:**

**1. In-Semester Assessment:**

- a. Assessment consists of two Internal Assessments (IA1, IA2) out of which; one should be compulsory class test (on minimum 02 Modules) and the other is a class test / assignment on case studies / course project.
- b. Mid Semester Examination (MSE) will be based on 40-50% of the syllabus.

**2. End-Semester Examination:**

- Question paper will comprise of full syllabus.
- In the question paper, weightage of marks will be proportional to the total number of lecture hours as mentioned in the syllabus.

Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/Oral Credit	Tutorial Credits	Total Credits
ITLDDL O6021	Game Development Lab		02	-		01	--	01

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam					
ITLDLO6021	Game Development Lab						25		25	50

### Lab Description:

This course should enable the students to learn how to design and develop games. The objective of this course is to focus on design and art of animation and games. Students get to learn the basic of game and animation program, modeling and design skills.

### Lab Objectives:

1. To explore the fundamental concepts of game designing using flash/Photoshop.
2. To introduce game scripting and UX/UI Design.
3. To learn game visualization and documentation techniques.
4. To implement 3D game design.
5. To learn to use FX for Game Development.

### Lab Outcomes: At the end of the course learner will able to

1. Understand the basic concepts of game Designing.
2. An ability to use graphics code for scripting and apply UX/UI Design.
3. An ability to do gaming visualization and documentation.
4. Explore 3D game Design
5. Apply texturing, rigging and animation in 3D character modeling
6. Apply FX for game development

**Prerequisites:**

- 1) Java, C,C++,C#

**Hardware & Software Requirements:**

<b>Hardware Requirement:</b>	<b>Software requirement:</b>
PC i3 processor and above	Unity or other game development software

Sr. No.	Module	Detailed Content	Hours	LO Mapping
1	Introduction	Design a game application in Photoshop/flash	02	LO1
2	Game Scripting	a.Programming Exercise on Game Scripting b.Programming on UX and UI Design	06	LO2
3	Game Visualization	a. Game Idea: Visualization & Story Telling b. Game Development & Documentation	06	LO3
4	3D Game Design	Implement 3D game Design	02	LO4
5	3D character Modeling	Design 3D character modeling using texturing, rigging and animation	06	LO5
6	FX for Games	Implement FX for games development	04	LO6

**Text Books:**

Game Development Essentials: An Introduction,Third Edition, Jeannie Novak.

**Reference Books:**

- 1) Game Programming Patterns by Robert Nystrom
- 2) Foundations of Game Engine Development, Volume 1: Mathematics



**Evaluation Scheme:****Term work Evaluation:**

Term Work shall consist of write ups of experiments performed in the laboratory based on the above list, but not limited to it. Also, Term work will include a mini project report is assigned as part of the lab.

**Practical and Oral Evaluation:**

Oral & Practical exams will be conducted based on the experiments performed in the laboratory.

Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/Oral Credit	Tutorial Credits	Total Credits
ITDLO6022	Natural Language Processing	03		-	03		-	04

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam					
ITDLO6022	Natural Language Processing	20	20	20	20	60		--		100

#### Prerequisites:

- Artificial Intelligence
- Understand general Python
- Data structure & Algorithms
- Theory of computer science

#### Course Description:

Natural language processing (NLP) is one of the most important technologies of the information age. Understanding complex language utterances is also a crucial part of artificial intelligence. Applications of NLP are everywhere because people communicate most everything in language: web search, advertisement, emails, customer service, language translation, radiology reports, etc. The course provides a deep excursion into cutting-edge research in deep learning applied to NLP.

#### Course Objectives:

1. To understand Natural Language Processing and to learn how to apply basic algorithms in this field.
2. To get acquainted with the basic concepts and algorithmic description of the main language levels: morphology, syntax, semantics, and pragmatics.
3. To design and implement application based on classification of text using NLP.
4. To understand semantic of a text using NLP models.

5. To implement various language models.
6. To design systems that uses NLP techniques with the help of Deep Learning models.

**Course Outcomes:** At the end of the course learner will able to

1. Learn about basics of the field of natural language processing.
2. Have a sense of the capabilities and limitations of current natural language technologies.
3. Learn NLP classification model using Machine Learning Techniques
4. Learn semantics of the text using NLP.
5. Be able to Design, implement and test algorithms for NLP problems
6. Learn real world NLP application using Deep Learning Techniques.

Sr. No.	Module	Detailed Content	Hours	CO Mapping
1	<b>Introduction to Natural Language Processing</b>	Basics of NLP, Stages, Challenges and application of NLP, Ambiguity in Natural Language	5	CO1
2	<b>Word Level and Syntactic Analysis</b>	Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Contextfree Grammar-Constituency-Parsing-Probabilistic Parsing	7	CO2
3	<b>Text Classification</b>	Introduction to Text Classification ,Machine Learning Overview, Classification Metrics, Confusion Matrix, Text Feature Extraction Overview	6	CO3
4	<b>Semantics Analysis</b>	Lexical Semantics, Attachment for fragment of English- sentences, noun phrases, Verb phrases, prepositional phrases, Relations among lexemes & their senses –Homonymy, Polysemy, Synonymy, Hyponymy, WordNet, Robust Word Sense Disambiguation (WSD), Dictionary based approach	7	CO4
5	<b>Topic Modeling</b>	Overview of Topic Modeling, Latent Dirichlet Allocation Overview, Non-negative Matrix Factorization Overview with python.	6	CO5

6	<b>Deep Learning for NLP</b>	Introduction to Deep Learning for NLP, The Basic Perceptron Model, Introduction to Neural Networks, Keras Basics, Recurrent Neural Network Overview ,LSTMs, GRU, and Text Generation, Text Generation with LSTMs with Keras and Python.	8	CO6
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#### **Text Books:**

1. Speech and Language Processing, Written by Daniel Jurafsky and James Martin.
2. Daniel Jurafsky, James H. Martin —Speech and Language Processing| Second Edition, Prentice Hall, 2008.
3. Christopher D.Manning and Hinrich Schutze, — Foundations of Statistical Natural Language Processing —, MIT Press, 1999

#### **Reference Books:**

1. Siddiqui and Tiwary U.S., Natural Language Processing and Information Retrieval, Oxford University Press (2008).
2. Taming Text: How to Find, Organize, and Manipulate, Grant Ingersoll, Thomas Morton and Drew Farris
3. Daniel M Bikel and Imed Zitouni — Multilingual natural language processing applications| Pearson, 2013
4. Steven Bird, Ewan Klein, Natural Language Processing with Python, O'Reilly

#### **Evaluation Scheme:**

##### **1. In-Semester Assessment:**

- a. Assessment consists of two Internal Assessments (IA1, IA2) out of which; one should be compulsory class test (on minimum 02 Modules) and the other is a class test / assignment on case studies / course project.
- b. Mid Semester Examination (MSE) will be based on 40-50% of the syllabus.

##### **2. End-Semester Examination:**

- Question paper will comprise of full syllabus.
- In the question paper, weightage of marks will be proportional to the total number of lecture hours as mentioned in the syllabus.

Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/Oral Credit	Tutorial Credits	Total Credits
ITLDLO6022	Natural Language Processing LAB	-	02	-	-	01	-	01

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam					
ITLDLO6022	Natural Language Processing LAB	-	-	-	-	-	25	--	25	50

### Lab Description:

Natural Language is the language written or spoken by humans in their daily life. Natural Language Processing is an interdisciplinary field dealing with human-computer interaction and computer aided processing of human language. It combines major concepts from computer science, artificial intelligence, and linguistics.

### Lab Objectives:

1. To explore fundamentals of word analysis
2. To Explore word generation techniques
3. To understand morphology of a word analysis
4. To Understand n-grams and smoothing
5. To Understand biagram table
6. Understand POS Tagging
7. Understand concept of chunking

### Lab Outcomes: At the end of the course learner will able to

1. Understand morphological features of word
2. Learn about generation of word forms
3. Understand use of add-Delete table for word
4. To apply add-one smoothing on sparse bigram table.
5. Understand POS Tagging using Markov model.
6. Understand POS Tagging using Viterbi decoding

7. Ability to use concept of chunking

<b>Sr. No.</b>	<b>Module</b>	<b>Detailed Content</b>	<b>Hours</b>	<b>CO Mapping</b>
<b>1</b>	<b>Word Analysis</b>	To analyze morphological features of a word	2	LO1
<b>2</b>	<b>Word Generation</b>	To generate word forms from root and suffix information.	2	LO2
<b>3</b>	<b>Morphology</b>	To understand the morphology of a word by the use of Add-Delete table.	2	LO3
<b>4</b>	<b>N-Grams</b>	To learn to calculate bigrams from a given corpus and calculate probability of a sentence.	2	LO4
<b>5</b>	<b>N-Grams Smoothing</b>	To learn how to apply add-one smoothing on sparse bigram table.	2	LO5
<b>6</b>	<b>POS Tagging - Hidden Markov Model</b>	To calculate emission and transition matrix which will be helpful for tagging Parts of Speech using Hidden Markov Model.	4	LO6
<b>7</b>	<b>POS Tagging -Viterbi Decoding</b>	To find POS tags of words in a sentence using Viterbi decoding.	2	LO6

<b>8</b>	<b>Building POS Tagger</b>	The experiment is to know the importance of context and size of training corpus in learning Parts of Speech	4	LO6
<b>9</b>	<b>Chunking</b>	To understand the concept of chunking and get familiar with the basic chunk tagset.	2	LO7
<b>10</b>	<b>Building Chunker</b>	To know the importance of selecting proper features for training a model and size of training corpus in learning how to do chunking.	4	L07

#### **Text Books:**

1. Speech and Language Processing, Written by Daniel Jurafsky and James Martin.
2. Daniel Jurafsky, James H. Martin — Speech and Language Processing|| Second Edition, Prentice Hall, 2008.
3. Christopher D. Manning and Hinrich Schutze, — Foundations of Statistical Natural Language Processing —, MIT Press, 1999

#### **Reference Books:**

1. Siddiqui and Tiwary U.S., Natural Language Processing and Information Retrieval, Oxford University Press (2008).
2. Taming Text: How to Find, Organize, and Manipulate, Grant Ingersoll, Thomas Morton and Drew Farris
3. Daniel M Bikel and Imed Zitouni — Multilingual natural language processing applications|| Pearson, 2013
4. Steven Bird, Ewan Klein, Natural Language Processing with Python, O'Reilly

**Evaluation Scheme:****Term work Evaluation:**

Term Work shall consist of write ups of experiments performed in the laboratory based on the above list, but not limited to it. Also, Term work will include a mini project report is assigned as part of the lab.

**Practical and Oral Evaluation:**

Oral & Practical exams will be conducted based on the experiments performed in the laboratory.



Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/ Oral Credit	Tutorial Credits	Total Credits
ITCDL O6023	Business Intelligence	03	--	--	03	--	--	03

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg.of 2 IAs	Mid Sem Exam					
ITCDLO6023	Business Intelligence	20	20	20	20	60	--	--	--	100

### Prerequisite:

Database Management System

Data Science Fundamentals

### Course Description:

This course covers the essence of business intelligence techniques and their application on the data. The course starts with introduction and covers the topics: data analysis, data visualization, dashboard representation and future of the business intelligence. This is the most suitable course for data analysts and data scientists.

### Course Objectives:

1. To introduce concepts of business intelligence
2. To analysis data and to draw conclusions
3. To demonstrate data visualization
4. To design dashboard and its performance measurement
5. To explore data modeling capabilities

6. To present future of business intelligence

### Course Outcomes:

At the end of the course learner will able to:

1. Understand concepts of business intelligence
2. Analysis data in target environment
3. Apply data visualization techniques to data sets
4. Develop dashboard for business enterprise
5. Model the data and extract the summary
6. Understand future of business intelligence

Sr. No	Module	Detailed Syllabus	Hours	CO mapping
1	Introduction to Business Intelligence	BI concept, BI architecture, BI in today's perspective, BI Process, Applications of BI like Financial analysis, statistical analysis, sales analysis, CRM, result pattern and ranking analysis, Balanced Scorecard, BI in Decision Modelling: Optimization, Decision making under uncertainty. Ethics and business intelligence.	6	CO1
2.	Data Analysis	Exercises using to work on histograms, regression, linear, logistic, decision tree, naïve Bayesian, clustering: k means, medoids, hierarchical and text analysis.	8	CO2
3	Data Visualization and Dashboard Design	Responsibilities of BI analysts by focusing on creating data visualizations and dashboards. Importance of data visualization, types of basic and composite charts	6	CO3
4	Performance Dashboard	Measuring, Monitoring and management of Business, KPIs and dashboard, the types of dashboards, the common characteristics of Enterprise dashboard, design of enterprise dashboards, and the common pitfalls of dashboard design.	6	CO4
5	Modelling and Analysis	ETL, data cubes, pivote, roll up drill down, Exploring Modeling capabilities to solve business problems, summarize and present selected data, introduction to business metrics and KPIs, creating cubes	7	CO5

6	Future of Business Intelligence	Emerging Technologies, Machine Learning, Predicting the Future with the help of Data Analysis, BI Search & Text Analytics – Advanced Visualization – Rich Report, Future beyond Technology.	6	CO6
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### Text books:

1. Efraim Turban, Ramesh Sharda, Dursun Delen, “Decision Support and Business Intelligence Systems”, 9th Edition, Pearson
2. Carlo Vercellis, “Business Intelligence: Data Mining and Optimization for Decision Making”, Wiley Publications, 2009
3. David Loshin Morgan, Kaufman, “Business Intelligence: The Savvy Manager’s Guide”, Second Edition, 2012

### Reference Books:

1. Larissa T. Moss, S. Atre, “Business Intelligence Roadmap: The Complete Project Lifecycle of Decision Making”, Addison Wesley, 2003
2. “Business Intelligence – Grundlagen und praktische Anwendungen: Eine Einführung in die IT” by Hans-Georg Kemper and Henning Baars

### Supplementary Resources:

Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.

- a) <http://www.pentaho.com/>
- b) <https://www.edx.org/course/introduction-data-analysis-using-excel-microsoftdat205x-2>
- c) <https://www.ibm.com/developerworks/library/os-weka2/>
- d) <http://www.saedsayad.com/>
- e) [http://www.cs.ccsu.edu/~markov/ccsu\\_courses/datamining-3.html](http://www.cs.ccsu.edu/~markov/ccsu_courses/datamining-3.html)
- f) <https://cognitiveclass.ai/>

### Evaluation Scheme:

#### 1. In-Semester Assessment:

- a. Assessment consists of two Internal Assessments (IA1, IA2) out of which; one should be compulsory class test (on minimum 02 Modules) and the other is a class test / assignment on case studies / course project.
- b. Mid Semester Examination (MSE) will be based on 40-50% of the syllabus.

## 2. End-Semester Examination:

- Question paper will comprise of full syllabus.
- In the question paper, weightage of marks will be proportional to the total number of lecture hours as mentioned in the syllabus.

Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/Oral Credit	Tutorial Credits	Total Credits
ITLDLO6023	Business Intelligence Lab	--	02	--	--	01	--	01

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam					
ITDL06023	Business Intelligence Lab	--	--	--	--	--	25	--	25	50

### Lab Description:

Business intelligence lab gives hands-on experience on data modelling techniques. This lab covers the practical sessions based on data import and export, ETL process, classification and clustering techniques. The tools used for the practical session includes R/Python/Power BI/spreadsheets.

### Lab Objectives:

1. To introduce the basic concepts of Business Intelligence.
2. To demonstrate BI techniques on variety of data.
3. To develop classification and clustering algorithms for given sets of data.
4. To design performance dashboard.
5. To analyze and visualize the data.
6. To give hands-on-experience on power BI.

**Lab Outcomes:** At the end of the course learner will able to:

1. Understand the business intelligence concept
2. Apply BI techniques on applications

3. Implement classification and data clustering techniques
4. Implement performance dashboard
5. Understand data analysis and visualization techniques
6. Perform data analytics with power BI

**Prerequisites: PYTHON**

**Hardware & Software Requirements: PYTHON/R/POWER BI/spreadsheets**

Sr. No.	Detailed Contents	Hours	LO
1	Import the legacy data from different sources and load in the target system.	2	LO1
2	Perform the Extraction Transformation and Loading (ETL) process	2	LO1
3	Create the cube with suitable dimension and fact tables	2	LO2
4	Demonstration of BI techniques ETL on Application Financial Analysis.	2	LO2
5	Demonstration of BI techniques ETL on Application Student result pattern and ranking analysis	2	LO2
6	Implementation of Classification process using data set	2	LO3
7	Implementation of Clustering techniques process using k-means algorithm on Mobile phone Static Data set	2	LO3
8	Demonstration of Performance Dashboard: Measuring, Monitoring and management of Business	4	LO4
9	Data Analysis and Visualization	4	LO5
10	Hands-on with power BI	4	LO6

**Text books:**

1. Sabherwal, R. and Becerra-Fernandez, I.(2011). Business Intelligence: Practices, Technologies and Management. John Wiley.
2. Turban,E. and Volonino, L.(2011). Information Technology for Managment: Improving Strategic and Operational Performance. 8th edn.Wiley

**Reference Books:**

1. Avison, D. and Fitzgerald, G. (2006). Information Systems development: Methodologies, techniques and tools. 4th ed. McGraw-Hill.
2. Anderson-Lehman, R., Watson, H.J., Wixom, B.H., & Hoffer, J.A., 2004, Continental Airlines Flies High with Real-Time Business Intelligence, MIS Quarterly Executive, 3, 4, pp 163-176
3. Gangadharan, G.R., & Swami, N., 2004, Business Intelligence Systems: Design and Implementation Strategies, Proceedings of the 2nd International conference on Technology Interfaces, June 7-10, Cavtat, Croatia, pp 139-144

**Term work Evaluation:** Term Work shall consist of write ups of experiments performed in the laboratory based on the above list, but not limited to it. Also, Term work may include a mini project report if a mini project is assigned as part of the lab.

**Practical and Oral Evaluation:** Oral exam will be conducted based on the experiments performed in the laboratory.

Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/ Oral Credit	Tutorial Credits	Total Credits
ITCDLO6024	OS Exploitation and Security	03	--	-	03	--	-	03

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam					
ITCDLO6024	OS Exploitation and Security	20	20	20	20	60	--	--	--	100

### Description

Describe the architecture, file systems, and basic commands for multiple operating systems including Windows, Mac/OS, Linux and Mobile. This course provides an introduction to operating system basics with the intent of giving a student a deeper understanding of various operating systems. The Operating System Security is an ideal course for anyone charged with securing Operating systems. From securing a desktop, to the high availability options available on the platform, to directory services options, this course is going to be a swift overview of Windows 2008, Linux and Sun Solaris.

### Course Objectives:

1. Describe goals and design principles of system architecture and security policy of operating system.
2. Analyzing existing exploits and the basic concepts and challenges of securing the Operating Systems
3. Study different security breaching and security standards of Linux OS.
4. Describe the different security breaching and security standards of server OS.
5. Describe security challenges in Mobile platform security.
6. Describe various notions of security, threats in mobile platform.

**Course Outcomes:** After completion of the course, student should be able to:

1. To understand system architecture and security policy.
2. To demonstrate different security threats and prevention mechanism in windows OS

3. To demonstrate different security threats and prevention mechanism in Linux OS
4. To demonstrate different security threats and prevention mechanism in server OS
5. To demonstrate different security threats and prevention mechanism in Mobile OS platform
6. To demonstrate different security attacks and detection techniques on mobile OS.

**Prerequisites:**

1. Operating System
2. Computer Networks

Sr. No.	Module	Detailed Content	Hours	CO Mapping
1	System Design and security policy	Object Oriented Design and Underlying Principles of Security Architecture of windows and Linux OS General Windows 2008 Security, Attacking Window System Information, Physical Security, Securities Policies, User Rights Assignment	4	CO1
2	Windows Operating System Security Basics	Operating System: Version of OS,Patches and Service Packs, Checking for hot fixes and service packs, Using hfnetchk, Software Inventory, Alternative OS Support, Drives and file systems, NTFS, FAT, Introduction to Access Control Principle of least privilege, Shares and Share Security, File/Folder permissions and Encryption Security, IIS Security: ODBC connections security,, IIS installation location, IIS components, Services required for IIS,FPSE (Front Page Server Extensions) Security, ACLs on virtual directories, Sample files and websites, Script mappings Internet Explorer Security, Window vulnerability detection and exploitation. Active directory: Integrated Zones, Sites, domains and organizational units, AD Groups, AD redundancy, Group Policy Objects, Registry Security, event log configuration, Backup procedures, Virus Protection	8	CO2
3	Linux Operating System Security Basics	User and Group Security: Check Local User ,Accounts and Group Accounts, Check password security, Startup files in /etc/rc.d,	8	CO3



		<p>Network services, Critical network files, NFS Security</p> <p>Users and Groups: Procedure of adding / removing users, User security policy, Securing root, List of users, Password and Account Policy,/etc/shadow and /etc/passwd files, Cracking user passwords, Group membership, The wheel group, User quotas</p> <p>File System Security: List of File System, Using lsof, Determine disk usage, UNIX file permission, SUID and SGID files, Umask, Permissions on critical files and folders File integrity mechanisms – Tripwire, MD5</p>		
4	Server OS	<p>Physical Security : EEPROM Security, GUI Security</p> <p>OS: Identify Vendor and Version, Basic Security Module (BSM), Security patches, Logging</p> <p>Network security: Network Interfaces, Network connections, Unix Services /etc/inetd.conf, Startup files in /etc/rc.d, network files, Network services, NFS Security, Banners, : SMTP Security, FTP Security, Apache Security</p> <p>Backup and Emergency Procedures</p> <p>Automated Security Testing, NMAP, Nessus, BFI Languard, BSM, Solaris Security Toolkit – JASS</p> <p>Linux Security: Linux Boot Loader Security, Linux kernel security, RPM Security, Xinetd features, SSH Security, CGI Security, Secure HTTP Server</p>	4	CO4
5	Mobile platform security models: Android and iOS	<p>macOS Auditing, file system, Security architecture, Recovery Platforms, App market, Mobile Malware Threats, Android security model , Apple iOS security model, mobile application exploitation and vulnerability detection in Android and iOS. Windows mobile security model, Security attacks on mobile device.</p> <p>Privacy monitoring in mobile device.</p>	8	CO5
6	Mobile threats and malware	Types of malware, life cycle of malware, Exploitation techniques and fuzzing, bug	7	CO6

		detection, prevention techniques of malware attack.		
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**Text/Reference Books:**

1. Micheal D. Bauer, “Linux server security 2<sup>nd</sup> Edition”, O’Reilly
2. Wenliang Du ,Computer Security, A Hands-on Approach, CreateSpace Independent Publishing Platform; 1 edition.
3. Android Security Internals: An In-Depth Guide to Android's Security Architecture Paperback – 14 October 2014
4. Darril Gibson, Microsoft Windows Security Essentials (Essentials (John Wiley))

**In-Semester Assessment:** Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project. There will be a mid semester Examination on 40-50% of the syllabus.

**End-Semester Examination:**

1. Question paper will comprise of total six question.
2. All question carry equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four question need to be solved.

**In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/Oral Credit	Tutorial Credits	Total Credits
ITLDLO6024	OS Exploitation and Security Lab	--	02	-	--	0 1	--	02

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam					
ITLDLO6024	OS Exploitation and Security Lab	--	--	--	--	--	25	25	--	50

### Description

Cryptography is becoming increasingly important to enhance security in connection with data storage and communication and various kinds of electronic transactions. This course aims to give students: an overview of basic cryptographic concepts and methods a good knowledge of some commonly used cryptographic primitives and protocols a sound understanding of theory and implementation, as well as limitations and vulnerabilities an appreciation of the engineering difficulties involved in employing cryptographic tools to build secure systems.

### Course Objectives:

1. Summarize the main goals of cryptography and illustrate number theory behind it.
2. Describe goals and design principles for and common structures of secret key primitives such as block and stream ciphers and message authentication codes.
3. Explain how basic public key primitives can be defined based on the difficulty of mathematical problems such as the discrete logarithm problem or factoring and analyse variants of these systems.
4. Explain the various roles of hash functions as parts of other cryptographic primitives and protocols and the requirements this places on hash functions.
5. Explain authentication mechanism and different protocols.
6. Exemplify when various notions of security, such as information- theoretic, computational,

provable and practical security, are applicable and describe the security guarantees provided.

**Course Outcomes:** After completion of the course, student should be able to:

1. To understand cryptosystem and mathematics behind it.
2. To apply the knowledge of different symmetric key cryptographic algorithm.
3. To apply the knowledge of public key cryptographic algorithm.
4. To apply the principles of Cryptographic Hash Functions and Digital Signature.
5. To apply the authentication mechanism in different applications.
6. To apply the knowledge of Network Security and Public Key Infrastructure.

**Prerequisites:**

1. Discrete Mathematics
2. Engineering Mathematics- IV
3. Computer Networks

Sr. No.	Module	Detailed Content	Hours	CO Mapping
1	System Design and security policy	<ol style="list-style-type: none"> <li>1. Man-in-the-Middle Attack (Windows + Linux Client)</li> <li>2. Experimenting with password-cracking utilities, attempting dictionary, hybrid, and brute-force attacks..</li> </ol>	7	CO1
2	Windows Operating System Security Basics	<ol style="list-style-type: none"> <li>1. Break the Mono-alphabetic Substitution Cipher and provide prevention technique.</li> <li>2. Researching System Vulnerabilities (Internet - access CVE database of vulnerabilities)</li> <li>3. Intercepting and Sniffing Network Traffic</li> <li>4. Sniffing Network Traffic in Windows</li> </ol>	8	CO2
3	Linux Operating System Security Basics	<ol style="list-style-type: none"> <li>4. Configure a Proxy in Linux</li> <li>5. Create a Monitoring System Using Certificates and SSL</li> </ol>	6	CO3
4	Server OS	<ol style="list-style-type: none"> <li>3. Demonstration of Web Server Exploits</li> </ol>	6	CO4

		4. Use vulnerability scanner to inspect Windows Server vulnerabilities. 5. Demonstration of E-mail System Exploits		
5	Mobile platform security models: Android and iOS	3. Study of detection and prevention of security attack on Mobile OS 4. Study security model of Mobile OS	6	CO5
6	Mobile threats and malware	3. Denial of Service Exploits-Windows Denial of Service SMBDie 4. Experimenting with Trojans (installing, deploying, controlling).	6	CO6

### **Text books and References:**

1. Micheal D. Bauer, "Linux server security 2<sup>nd</sup> Edition", O'Reilly
2. Wenliang Du ,Computer Security, A Hands-on Approach, CreateSpace Independent Publishing Platform; 1 edition.
3. Android Security Internals: An In-Depth Guide to Android's Security Architecture Paperback – 14 October 2014
4. Darril Gibson, Microsoft Windows Security Essentials (Essentials (John Wiley))

### **Evaluation Scheme:**

#### **Term work Evaluation:**

Term Work shall consist of write ups of experiments performed in the laboratory based on the above list, but not limited to it. Also, Term work may include a mini project report if a mini project is assigned as part of the lab.

#### **Practical and Oral Evaluation:**

Practical exam will be conducted based on the experiments performed in the laboratory.

Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/ Oral Credit	Tutorial Credits	Total Credits
ITL602	DevOps Lab	--	2		--	2	--	4

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg . of 2 IAs	Mid Sem Exam					
ITL602	DevOps Lab	--	--	--	--	--	25	25	--	50

### Prerequisites:

- Software Engineering
- Operating System
- Skill Based LabI: Java(OOPM) Programming Lab
- Skill Based Lab II: Python Programming Lab
- Computer Networks

### Lab Description

This Lab is the stepping stone to a career which is rich in work of app development, web development, data sciences, machine learning and artificial intelligence. With the necessary prerequisites of software installation ability and some experience in programming and Linux, one can make great strides in their career with the support of DevOps course. The Lab is designed to offer deep insights and knowledge into various tools such as Ansible, Puppet, Nagios, Jenkins and Docker. With the adept learning of DevOps syllabus, a student will be able to become a trained practitioner in the integration and monitoring of software throughout their development cycle.

**Lab Objectives: Student will learn**

1. To understand DevOps practices which aims to simplify Software Development Life.
2. To be aware of different Version Control tools like GIT, CVS or Mercurial
3. To Integrate and deploy tools like Jenkins and Maven, which is used to build, test and deploy applications in DevOps environment
4. To be familiarized with selenium tool, which is used for continuous testing of applications deployed.
5. To use Docker to Build, ship and manage applications using containerization
6. To understand the concept of Infrastructure as a code and install and configure Ansible tool.

**Lab Outcomes (LO):** At the end of the course learner will able

1. To understand the fundamentals of DevOps engineering and be fully proficient with DevOps terminologies, concepts, benefits, and deployment options to meet your business requirements.
2. To obtain complete knowledge of the “version control system” to effectively track changes augmented with Git and GitHub.
3. To understand the importance of Jenkins to Build and deploy Software Applications on server environment.
4. Understand the importance of Selenium and Jenkins to test Software Applications.
5. To understand concept of containerization and Analyze the Containerization of OS images and deployment of applications over Docker.
6. To Synthesize software configuration and provisioning using Ansible.

**Hardware Requirement:** Intel Core i3/i5/i7 Processor with Intel VT-X support, 8 GB RAM, 500 GB Harddisk, Gigabit Ethernet (GbE) network interface card (NIC)

**Software requirement:** Windows or Linux Desktop OS for Client machines, Ubuntu Server OS for One Server, JDK 1.8 or higher, OpenSSH.

**Other Requirement:** Internet Connection for each PC with at least 2 MBPS bandwidth.

Sr. No.	Detailed Syllabus	Hours	LO Mapping
1	<b>Introduction to DevOps:</b> <ul style="list-style-type: none"><li>• Learn about the concept of DevOps and the practices and principles followed to implement it in any company's software development life cycle.</li><li>• Understand why DevOps evolved as a prominent culture in most of the modern-day startups to achieve agility in the software development process</li></ul>	2	LO1

2	<b>Version Control System:</b> <ul style="list-style-type: none"> <li>• GIT Installation, Version Control, Working with remote repository</li> <li>• GIT Cheat sheet</li> <li>• Create and fork repositories in GitHub</li> <li>• Apply branching, merging and rebasing concepts.</li> <li>• Implement different Git workflow strategies in real-time scenarios</li> <li>• Understand Git operations in IDE</li> </ul>	4	LO2
3	<b>Continuous Integration using Jenkins:</b> <ul style="list-style-type: none"> <li>• To perform Continuous Integration using Jenkins by building and automating test cases using Maven / Gradle / Ant.</li> <li>• Introduction to Jenkins (With Architecture)</li> <li>• Introduction to Maven / Gradle / Ant</li> <li>• Jenkins Management Adding a slave node to Jenkins</li> <li>• Build the pipeline of jobs using Maven / Gradle / Ant in Jenkins, create a pipeline script to deploy an application over the tomcat server</li> </ul>	5	LO3
4	<b>Continuous Testing with Selenium:</b> <ul style="list-style-type: none"> <li>• Introduction to Selenium</li> <li>• Installing Selenium</li> <li>• Creating Test Cases in Selenium WebDriver</li> <li>• Run Selenium Tests in Jenkins Using Maven</li> </ul>	2	LO4
5	<b>Continuous Deployment: Containerization with Docker:</b> <ul style="list-style-type: none"> <li>• Introduction to Docker Architecture and Container Life Cycle</li> <li>• Understanding images and containers</li> <li>• Create and implement docker images using Dockerfile.</li> <li>• Container Lifecycle and working with containers.</li> <li>• To Build, deploy and manage web or software application on Docker Engine.</li> <li>• Publishing image on Docker Hub</li> </ul>	6	LO5
6	<b>Continuous Deployment: Configuration Management with Ansible:</b> <ul style="list-style-type: none"> <li>• To install and configure Software Configuration Management using Chef/Puppet/Ansible or Saltstack.</li> </ul>	7	LO6



	<ul style="list-style-type: none"> <li>• To Perform Software Configuration Management and provisioning using Chef/Puppet/Ansible or Saltstack.</li> </ul>		
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**Text Book:**

1. Karl Matthias & Sean P. Kane, Docker: Up and Running, O'Reilly Publication.
2. Len Bass, Ingo Weber, Liming Zhu, "DevOps, A Software Architects Perspective", Addison Wesley, Pearson Publication.
3. John Ferguson Smart," Jenkins, The Definitive Guide", O'Reilly Publication.

**Reference Book:**

1. Sanjeev Sharma and Bernie Coyne," DevOps for Dummies", Wiley Publication
2. Httermann, Michael, "DevOps for Developers", A press Publication.
3. Joakim Verona, "Practical DevOps", Pack publication

**Evaluation Scheme:**

**Term work Evaluation:**

Term Work shall consist of write ups of experiments performed in the laboratory based on the above list, but not limited to it. Also, Term work may include a mini project report if a mini project is assigned as part of the lab.

**Practical and Oral Evaluation:**

Oral & Practical exams will be conducted based on the experiments performed in the laboratory.

Subject Code	Subject Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/Oral Credit	Tutorial Credits	Total Credits
ITMP601	Mini Project IV	--	4		--	2	--	2

Subject Code	Subject Name	Examination Scheme								
		Theory Mark					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam					
ITMP601	Mini Project IV	--	--	--	--	--	25	--	25	50

The Mini project IV is to help students to develop practical knowledge and ability about tools and techniques in order to solve real-life problems related to industry and computer science research areas. Students should select a problem statement from the following domains:

- Natural Language Processing
- Internet of Things(IOT)
- Image Processing
- Network Security
- Game Development

The students should develop proper documentation, work prototype, and conduct proper testing and analysis of the models developed during the mini-project.

#### **Evaluation Scheme:**

##### **Term work Evaluation:**

Term Work will be based on 2 mock presentations of the project and a mini-project report. Two reviews will be conducted for continuous assessment. The first shall be for the finalization of the problem and the proposed solution second shall be for implementation of the project.

##### **Practical and Oral Evaluation:**

Oral exams will be conducted based on the implemented project. Mini Project shall be assessed through a presentation and demonstration of mini-project to a panel of Internal and External Examiner.