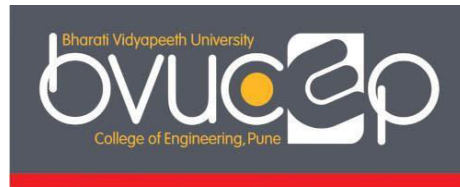




**Bharati Vidyapeeth**  
(Deemed to be University)  
Pune, India

**College of Engineering, Pune**



**B.Tech. (Information Technology)**  
**Program Curriculum (2021 Course)**



**BHARATI VIDYAPEETH  
(DEEMED TO BE UNIVERSITY),  
COLLEGE OF ENGINEERING, PUNE**

**Department of Information Technology**

**VISION OF THE UNIVERSITY:**

Social Transformation Through Dynamic Education

**MISSION OF THE UNIVERSITY:**

- To make available quality education in different areas of knowledge to the students as per their choice and inclination.
- To offer education to the students in a conducive ambiance created by enriched infrastructure and academic facilities in its campuses.
- To bring education within the reach of rural, tribal, and girl students by providing them substantive fee concessions and subsidized hostel and mess facilities.
- To make available quality education to the students of rural, tribal, and other deprived sections of the population.

**VISION OF THE INSTITUTE**

To be a world-class Institute for Social Transformation through Dynamic Education.

**MISSION OF THE INSTITUTE**

- To provide quality technical education with advanced equipment, qualified faculty members, infrastructure to meet the needs of the profession and society.
- To provide an environment conducive to innovation, creativity, research, and entrepreneurial leadership.
- To practice and promote professional ethics, transparency, and accountability for social community, economic and environmental conditions.

## **VISION OF THE DEPARTMENT**

To be a leading Programme, transforming students into skilled IT professionals.

## **MISSION OF THE DEPARTMENT**

- Amplify the student's technical skills by conducting continuing education programs, organizing and participating in various technical events.
- Provide comprehensive support in synchronization with industry to achieve professional and technological excellence.
- Provide an environment for effective social and ethical skills.

### **Program Educational Objectives:**

**PEO1:** Cultivate IT graduates for industry, pertaining to Information Technology solutions.

**PEO2:** Practice technical competency and teamwork abilities.

**PEO3:** Exhibit social responsibilities by following ethical practices in graduates' professional pursuits.

### **Program Specific Outcomes**

At the end of the program, Graduates will be able to

- **PSO 1:** Use knowledge of core and allied courses for developing a computer-based system to deliver a quality product for real-world problems of society.
- **PSO 2:** Apply modern IT tools and techniques for perusing student's professional career by practicing effective communication with team members.
- **PSO 3:** Develop time-bound, cost-effective and sustainable solutions by following professional ethics.

## **Program Outcomes**

1. Apply knowledge of Mathematics and Computer Science to analyze computer-based information systems.
2. Apply logical and programming skills to identify, formulate and analyze for solving computational problems.
3. Examine complex problems by a diagnosis of available information to provide an appropriate conclusion.
4. Design applications with suitable consideration of societal needs.
5. Use functional skills of modern IT tools and techniques for modeling and implementation.
6. Play the role of a team player to accomplish a common goal.
7. Convey technological concepts through significant documentation and presentation skills.
8. Demonstrate professional conduct by following norms of the Engineering practice.
9. Apply Software Engineering methodologies for sustainable development.
10. Follow ethical and legal practices related to the functioning of the IT industry.
11. Apply management skills and techniques for creating time-bound and cost-effective projects.
12. Exhibit lifelong learning by upgrading to state-of-the-art IT practices and technology.

## Curriculum Preamble

The curriculum 2021 is formed such that it will develop different abilities in a student. It a combination of blended teaching learning process in which both online and offline teaching is a part of the curriculum. In order to develop affection towards the discipline a student has selected, core discipline courses are included right from first year. This will also help to give the overall idea about the branch

/ discipline to the student.

Interaction with the industry is increased in this curriculum by introducing two new concepts –

### **1. Vocational Course and**

### **2. Industry Taught Course.**

Vocational Course (VC), a student will able to develop a specific skill set from the relevant people/ agency from the industry. This will add in gaining new skill sets required by the industry. Such Vocational Courses are included from Semester III to Semester VI of the curriculum. Department also design vocational course relevant for the discipline, which add practical knowledge to students. The vocational courses should be discipline specific. 4 vocational courses and 8 credits are integrated with curriculum.

**Industry Taught Courses (ITC)** are the courses which will be taught by the people from industry who are experts in the relevant field, either partially or fully. This will provide a scope to students to gain the latest knowledge as used in industry and also to have direct one on one interaction with the industry. This will develop a confidence among the students. Such teaching by industry experts will be as per their availability, if required online and other than official college hours also. Thus, there is a blend of online and offline teaching, knowledge from academicians as well as from industry. Total six Industry Taught Courses are included in the curriculum.

**Industry Internship** of 60 days at the end of Semester VI integrated with curriculum, will also add to the interaction with the industry. A student will avail his training in industry or on site or in any design office or research organization as allotted to him/by the institute. A separate logbook will be maintained by the student during this period duly signed daily by the competent authority.

**Project Based Learning** is a part of almost each course of the curriculum. Small projects on relevant topics will be allotted to the students as a part of term-work

of that course. This will inculcate the habit of applying the knowledge learnt to solve practical problems.

**Two Projects** are included in two stages, one in third year (Sem V and Sem VI) and the second in final year (Sem VII and Sem VIII). Improvement in Research, thinking ability and application of theoretical knowledge to develop practical ideas is the main purpose of these projects.

**Publication of a research paper** is the outcome expected from the Project work and as a motivation, separate credits are allotted for this. Students are expected to write research article based on Project-I in standard journals in final year. Guide for Project -I will help in writing the research article.

To develop the self studying, self-learning skills, each student has to join the **MOOC/NPTEL** courses and will get the certification of the respective course. This will also give him/her a chance to get the knowledge from teachers from well known institutes of national repute. Three such

MOOC/NPTEL courses are included each in Semester III, Semester V and Semester VII and separate credits are allotted to it.

Various new courses are introduced in the curriculum thereby introducing the current and latest technology to students. Basic Science and Engineering Science course contents are designed to match the requirement of the specific disciplines.

Number of software related to that branch/ discipline are included as part of the curriculum. This will help the students to get good placement.

Few soft courses are introduced to non-circuit branches. This will give a soft feel to such branches and also to inculcate confidence among the students.

In addition to technical abilities, a student needs to be developed as a good human being. For this, he will complete social activities in Semester IV and Sem VIII.

Thus Curriculum-2021 satisfies the requirements of National Education Policy- 2021.

## COURSE COMPONENTS OF UNDERGRADUATE ENGINEERING PROGRAMME

<b>Sr. No.</b>	<b>Category</b>	<b>Number of Courses</b>
1	Basic Science Course (BSC)	05
2	Engineering Science Course (ESC)	03
3	Core Course (CC)	36
4	Elective Course (EC)	02
5	Project (PROJ)	02
6	Internship (INT)	01
7	Vocational Course (VC)	04
8	Massive Open Online Course (MOOC)	02
9	Research Paper Publication (Research)	01
10	Social Activities (SA)	02
11	Mandatory Course (MC)	01
<b>TOTAL</b>		<b>59</b>

## CORRELATION BETWEEN GRADUATE ATTRIBUTES AND PROGRAMME OUTCOMES

Graduate Attributes/ Program Outcomes	a	b	c	d	e	f	g	h	i	j	k	l
<b>Engineering Knowledge</b>	✓											
<b>Problem Analysis</b>		✓										
<b>Design/Development of Solutions</b>			✓									
<b>Conduct Investigations of Complex Problems</b>				✓								
<b>Modern Tool Usage</b>					✓							
<b>The Engineer and Society</b>						✓						
<b>Environment and Sustainability</b>							✓					
<b>Ethics</b>								✓				
<b>Individual and Teamwork</b>									✓			
<b>Communication</b>					8					✓		
<b>Project Management and Finance</b>											✓	
<b>Life-long Learning</b>												✓

**CREDIT DISTRIBUTION TO COURSE COMPONENTS OF UNDERGRADUATE  
ENGINEERING PROGRAMME**

<b>Sr. No.</b>	<b>Category</b>	<b>Breakup of Credits</b>
1	Basic Science Course (BSC)	20
2	Engineering Science Course (ESC)	15
3	Core Course (CC)	139
4	Elective Course (EC)	10
5	Project (PROJ)	09
6	Internship (INT)	03
7	Vocational Courses (VC)	04
8	Massive Open Online Course (MOOC)	04 (Add On)
9	Research Paper Publication (Research)	02 (Add On)
10	Social Activities (SA)	04 (Add On)
11	Mandatory Course (MC)	Non-Credit
<b>TOTAL</b>		<b>200</b>

Program: B.TECH. (Information Technology)

Semester - VII CBCS 2021 Course

Sr. No.	Course Code	Name of Course	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
			L	P	T	ESE	IA	TW	OR	PR	Total	L	P	T	Total
1		Project Planning & Management	3	-	-	60	40	-	-	-	100	3	-	-	3
2		Web Services*	4	2	-	60	40	25	-	25	150	4	1	-	5
3		Business Intelligence	4	2	-	60	40	25		25	150	4	1	-	5
4		Elective - I	4	2	-	60	40	25	25	-	150	4	1	-	5
5		Information Technology Laboratory -V	-	2	-	-	-	25		25	50	-	1	-	1
6		Project Stage - I	-	2	-	-	-	50	50		100	-	3	-	3
8		Internship	-	-	-	-	-	-	50	-	50	-	3	-	3
<b>Total</b>			<b>15</b>	<b>10</b>	<b>-</b>	<b>240</b>	<b>160</b>	<b>150</b>	<b>125</b>	<b>75</b>	<b>750</b>	<b>15</b>	<b>10</b>	<b>-</b>	<b>25</b>

**\*Industry Taught Course - V**

**Elective - I**

1. Software Architecture
2. Information Retrieval
3. User Experience
4. Storage Area Network

Program: B.TECH. (Information Technology)

Semester - VIII CBCS 2021 Course

Sr. No.	Course Code	Name of Course	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
			L	P	T	ESE	IA	TW	OR	PR	Total	L	P	T	Total
1		Information Security	4	2	-	60	40	25	-	25	150	4	1	-	5
2		Elective - II	4	2	-	60	40	25	25	-	150	4	1	-	5
3		Internet of Things*	4	2	-	60	40	25	-	25	150	4	1	-	5
4		Data Engineering	3	-	-	60	40	-	-	-	100	3	-	-	3
5		Information Technology Laboratory-VI	-	2	-	-	-	25	-	25	50	-	1	-	1
6		Project Stage - II	-	4	-	-	-	50	100		150	-	6		6
		<b>Total</b>	<b>15</b>	<b>12</b>	<b>-</b>	<b>240</b>	<b>160</b>	<b>150</b>	<b>125</b>	<b>75</b>	<b>750</b>	<b>15</b>	<b>10</b>	<b>-</b>	<b>25</b>
		<b>#Research Paper Publication</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>

\*Industry Taught Course - VI

# Add-on Course

**Elective - II**

1. Semantic Web Mining
2. Social Analytics in Digital Marketing
3. Management Information System
4. Cyber security

# B.Tech. (Information Technology)

## Semester-VII

**B.Tech (IT) Semester-VII**  
**Subject: Project Planning and Management**

TeachingScheme	ExaminationScheme	CreditAllotted
Theory :03Hrs/ Week	EndSemesterExamination :60Marks	Theory :03
	InternalAssessment :40Marks	Practical:0
	<b>Total Marks: 100</b>	<b>Total Credits: 03</b>

**CourseObjectives:**

- 1) To make them understand the concepts of Project Management for planning to execution of projects
- 2) To make them understand the feasibility analysis in Project Management and network analysis tools for cost and time estimation.

**Course Prerequisites:**

**Students should have knowledge of**

Object Oriented Software Engineering

**Course Outcome:**

**Students will be able to:**

- 1) Understand the basic concepts of project management.
- 2) Apply selection criteria and select an appropriate project from different options.
- 3) Write work break down structure for a project and develop a schedule based on it.
- 4) Identify opportunities and threats to the project and decide an approach to deal with them strategically.
- 5) Use Earned value technique and determine & predict status of the project.
- 6) Capture lessons learned during project phases and document them for future reference

<b>UNIT-I</b>	<b>Project Management Foundation:</b>	<b>(6 Hours)</b>
	Definition of a project, Project Vs Operations, Necessity of project management, Triple constraints, Project life cycles (typical & atypical) Project phases and stage gate process. Role of project manager, Negotiations and resolving conflicts, Project management in various organization structures, Project Lifecycle <sup>161</sup> and IT development, Agile Project Management	
<b>UNIT-II</b>	<b>Project Human Resource Management and Stakeholder Management</b>	<b>(6 Hours)</b>
	Introduction, Organization and Project Planning, Formal Organization , Project Team, Multidisciplinary Teams, Project Environment, Project Leadership, Leadership Styles, Ethics in project, Role of project manager, IT Governance	

<b>UNIT-III</b>	<b>Project Planning and Scheduling:</b>	<b>(6 Hours)</b>
	Work Breakdown structure (WBS) and linear responsibility chart, Interface Co-ordination and concurrent engineering, Project cost estimation and budgeting, Top down and bottoms up budgeting, Networking and Scheduling techniques. PERT, CPM, GANTT chart, Introduction to Project Management Information System (PMIS)	
<b>UNIT-IV</b>	<b>Planning Projects:</b>	<b>(6 Hours)</b>
	Crashing project time, Resource loading and levelling, Goldratt's critical chain, Project Stakeholders and Communication plan Risk Management in projects: Risk management planning, Risk identification and risk register, Qualitative and quantitative risk assessment, Probability and impact matrix. Risk response strategies for positive and negative risks	
<b>UNIT-V</b>	<b>Executing and Controlling</b>	<b>(6 Hours)</b>
	Team Management, Communicating and Engaging with all stakeholders of the project, Controlling project earned value techniques for measuring your completed work, Using milestone for measurement, change request and scope creep	
<b>UNIT-VI</b>	<b>Closing the Project:</b>	<b>(6 Hours)</b>
	Customer acceptance; Reasons of project termination, Various types of project terminations (Extinction, Addition, Integration, Starvation), Process of project termination, completing a final report; doing a lessons learned analysis; acknowledging successes and failures; Project management templates and other resources; Managing without authority; Areas of further study	
<b>AssignmentList:</b>		
1)	Explore the various Agile Models	
2)	Create a SRS of a system under development	
3)	Prepare a project plan of a system using applicable tool	
4)	Discuss the applications and limitations of Gantt chart.	
5)	<b>Conduct Risk analysis for system under development</b>	
<b>TextBooks:</b>		
1)	Prasanna Chandra; Projects- Planning, Analysis, Selection, Financing, Implementation and Review', VI Edition, Tata Mc Graw Hill, 8th Edition 2015.	
<b>ReferenceBooks:</b>		
1)	Jack T. Marchewka, Information Technology Project Management, 4 <sup>th</sup> edition Wiley India, 2009	
2)	John M. Nicholas, Project Management for Business and Technology, 3 <sup>rd</sup> edition Pearson Education	

## Web Services

<b>Web Services</b>					
<u>Teaching Scheme</u>		<u>Examination Scheme</u>		<u>Credit Scheme</u>	
	<b>Hours/Week</b>		<b>Marks</b>		<b>Credits</b>
<b>Lecture:</b>	<b>04 Hours/Week</b>	<b>University Examination:</b>	<b>60 Marks</b>		
<b>Practical:</b>	<b>02 Hours/Week</b>	<b>Internal Assessment:</b>	<b>40 Marks</b>	<b>Theory</b>	<b>04</b>
		<b>Term Work</b>	<b>25 Marks</b>	<b>Practical</b>	<b>01</b>
		<b>Practical</b>	<b>25 Marks</b>		
		<b>Total</b>	<b>150 Marks</b>	<b>Total</b>	<b>05</b>
<b>Course Objective:</b>					
To Understand Web Services with different technologies and applications.					
<b>Prerequisite:</b>					
Distributed Computing, XML, HTTP, TCP/IP concepts.					
<b>Course Outcomes:</b> On completion of the course, students will have the ability to:					
1. Create and consume Web services					
2. Implement with appropriate framework components in creation of web services solution					
3. Reuse of XML schemes					
4. Understand the principles of SOA					
5. Understand Web Services Building Blocks					
6. Security and configuration issues for enterprise systems					
<b>Unit I :- Introduction</b>					<b>08 Hours</b>
Evolution and Emergence of Web Services – Evolution of distributed computing. Core distributed computing technologies – client/server, CORBA, JAVA RMI, Micro Soft DCOM, MOM, Challenges in Distributed Computing, Introduction to Web Services – The definition of web services, basic operational model of web services, tools and technologies enabling web services, benefits and challenges of using web services.					
<b>Unit II :- Architecture</b>					<b>08 Hours</b>
Web Service Architecture – Web services Architecture and its characteristics, core building blocks of web services, standards and technologies available for implementing web services, web services communication, basic steps of implementing web services.					
<b>Unit III :- Document Structure</b>					<b>08 Hours</b>
Brief Over View of XML – XML Document structure, XML namespaces, Defining structure in XML documents, Reuse of XML schemes, Document navigation and transformation. SOAP : Simple Object Access Protocol, Inter-application communication and wire protocols, SOAP as a messaging protocol, Structure of a SOAP message, SOAP envelope, Encoding, Service Oriented Architectures, SOA revisited, Service roles in a SOA, Reliable messaging. Brief Overview of JSON – JSON Schema, JSON Web Service functionality, differences between SOAP and JSON.					

<b>Unit IV :- WSDL introduction</b>	<b>08 Hours</b>
Describing Web Services – WSDL introduction, non functional service description, WSDL1.1 Vs WSDL 2.0, WSDL document, WSDL elements, WSDL binding, WSDL tools, WSDL port type, limitations of WSDL.	
<b>Unit V :- UDDI Architecture</b>	<b>08 Hours</b>
Registering and Discovering Services : The role of service registries, Service discovery, Universal Description, Discovery, and Integration, UDDI Architecture, UDDI Data Model, Interfaces, UDDI Implementation	
<b>Unit VI :- Security Considerations</b>	<b>08 Hours</b>
SOA and web services security considerations, Network-level security mechanisms, Application-level security topologies, XML security standards, Semantics and Web Services, The semantic interoperability problem, The role of metadata, Service metadata, Overview of .NET and J2EE, SOA and Web Service Management, Managing Distributed System, Enterprise management Framework, Standard distributed management frameworks, Web service management, Richer schema languages, WS-Metadata Exchange.	
<b>Textbooks</b>	
1. Web Services & SOA Principles and Technology, Second Edition, Michael P. Papazoglou.	
2. Developing Java Web Services, R. Nagappan, R. Skoczylas, R.P. Sriganesh, Wiley India.	
3. Developing Enterprise Web Services, S. Chatterjee, J. Webber, Pearson Education.	
<b>Reference Books</b>	
1. XML, Web Services, and the Data Revolution, F.P.Coyle, Pearson Education.	
2. Building web Services with Java, 2nd Edition, S. Graham and others, Pearson Education.	
3. Java Web Services, D.A. Chappell & T. Jewell, O'Reilly, SPD.	
4. McGovern, et al., "Java web Services Architecture", Morgan Kaufmann	
<b>List of Assignments</b>	164
1. Explain How Web Services Work	
2. Explain Application Programming Interface Types & Example	
3. Explain Web Services Architecture	
4. Explain SOAP web service	
5. Explain RESTful web services.	
6. Explain Web Services Description Language with Example	
<b>List of Laboratory Exercises</b>	
1. Write a program to implement to create a simple web service that converts the temperature from Fahrenheit to Celsius and vice a versa.	
2. Write a program to implement the operation can receive request and will return a response in two ways. a) One - Way operation b) Request – Response	

3. Write a program to implement business UDDI Registry entry.	
4. Develop client which consumes web services developed in different platform.	
5. Write a JAX-WS web service to perform the following operations. Define a Servlet / JSP that consumes the web service.	
6. Define a web service method that returns the contents of a database in a JSON string. The contents should be displayed in a tabular format.	
7. Define a RESTful web service that accepts the details to be stored in a database and performs CRUD operation.	
8. Implement a typical service and a typical client using WCF.	
9. Use WCF to create a basic ASP.NET Asynchronous JavaScript and XML (AJAX) service.	
10. Demonstrates using the binding attribute of an endpoint element in WCF.	
<b>Project Based Learning</b>	
<ol style="list-style-type: none"> <li>1. Rapid Document Conversion example pdf to word, excel to word</li> <li>2. Email system</li> <li>3. Website Development</li> <li>4. Serverless web App</li> <li>5. Real time data processing applications. (blood bank , attendance system etc)</li> <li>6. chat bots</li> </ol>	
<b>Syllabus for Unit Tests:</b>	
Unit Test -1	Unit - I, Unit - II, Unit - III
Unit Test -2	Unit - IV, Unit - V, Unit - VI

<b>Business Intelligence</b>				
<b><u>TEACHING SCHEME</u></b>		<b><u>EXAMINATION SCHEME</u></b>		<b><u>CREDIT SCHEME</u></b>
<b>Lecture:</b>	4 Hours/Week	<b>End Semester Examination:</b> 60 Marks	<b>Theory</b>	4
<b>Practical:</b>	2 Hours/Week	<b>Continuous Assessment:</b> 40 Marks		
		<b>Termwork:</b> 25 Marks	<b>Practical:</b>	1
		<b>Practical:</b> 25 Marks		
<b>Total : 150 Marks</b>			<b>Total Credits: 5</b>	
<b>Course Overview</b>				
This course provides an overview of the field of Business Intelligence and its applications in modern organizations. Students will learn the basics of data warehousing, data mining, and predictive analytics, and explore various tools and technologies used for BI.				
<b>Prerequisite:</b>				
<ol style="list-style-type: none"> <li>1. Basic understanding of database management systems</li> <li>2. Knowledge of statistics and data analysis</li> <li>3. Basic programming skills in any language.</li> <li>4. Understanding of data structures, algorithms and computer science fundamentals</li> </ol>				
<b>Course Outcomes:</b>				
<ol style="list-style-type: none"> <li>1. Understanding of BI concepts: student will gain an understanding of the concepts of business intelligence and how it helps organizations make data-driven decisions.</li> <li>2. Data Analytics: Students will learn how to collect, process, and analyse large amounts of data from various sources, such as databases, spreadsheets, and other data sources.</li> <li>3. Data Warehousing: Students will learn about the concepts of data warehousing and how to design and implement a data warehouse to support business intelligence.</li> <li>4. Data Mining: Students will learn how to apply data mining techniques to identify patterns, relationships, and insights in data.</li> <li>5. Business Intelligence Tools: Students will learn how to use various BI tools to extract insights from data.</li> <li>6. Problem Solving: Students will learn how to apply BI techniques and tools to solve real-world business problems.</li> </ol>				
166				
<b>Unit I: Introduction and Data Pre-processing:</b>				<b>06 Hours</b>
<b>Introduction:</b> Challenges of decision making, what is business intelligence (BI)? Need for BI. Drawing insights from data: DIKW pyramid, levels of decision making. <b>Data Pre-processing:</b> Data quality, Pre-processing operations: combining values into one, sub setting, sorting, transforming scale, determining percentiles, removing noise, removing inconsistencies, transformations, standardizing, normalizing min-max normalization, z-score standardization.				
<b>Unit II: Data Warehousing and Enterprise reporting:</b>				<b>06 Hours</b>
<b>Data Warehousing:</b> What is a data warehouse, need for a data warehouse, architecture, data marts, OLTP vs OLAP, Multidimensional Modelling: Star and snowflake schema, Data cubes, OLAP operations, Data Cube Computation and Data Generalization, Data Lake <b>Enterprise Reporting:</b> Metrics, Measurement, Measures, KPIs, Dashboards, Reports, Scorecards				

<b>Unit III Inferential Statistics:</b>	<b>06 Hours</b>
Inferential Statistics: Role of probability in analytics, probability distributions and their characteristics. Need for sampling, generating samples, sampling, and non-sampling error. Sampling Distribution of Mean, Standard Error. Estimation: Point and Interval Estimates, Confidence Intervals, level of confidence, sample size, ETL (extract, transform and load), regression analysis, market basket analysis, analysis of variance (ANOVA), and chi-square tests.	
<b>Unit IV Data Modelling, visualization.</b>	<b>06 Hours</b>
Data Modelling and visualization: Logic driven modelling, data driven modelling, basic what-if spreadsheet models, Role of visualization in analytics, techniques of visualization. data modelling and visualization in financial analysis. <b>Data Visualization using Tools:</b> Introduction to <a href="#">tools</a> for visualization, data import, and management, data type and operations, Different types of data visualizations, dashboards, data storytelling, understanding the concepts of dynamic/interactive data visualization and report generation.	
<b>Unit V: Time Series Analysis and Forecasting:</b>	<b>06 Hours</b>
<b>Introduction to Time Series Analysis and Forecasting:</b> Time series patterns, forecast accuracy, moving averages and exponential smoothing, casual models, using regression analysis for forecasting, ARIMA models. <b>Prescriptive/Optimization Analytics:</b> Overview of simulation and risk analysis, Linear Optimization Models (linear programming), Integer Linear Optimization models (integer programming), Non-linear optimization models (portfolio theory), Decision Analysis.	
<b>Unit VI: Business Intelligence Applications:</b>	<b>06 Hours</b>
Big data, Three Vs of big data, Big data applications, Data analytics, business analytics, ERP and Business Intelligence, BI Applications in CRM, BI Applications in Marketing, BI Applications in Logistics and Production, Role of BI in Finance, BI Applications in: Stock market analysis, Forensics, Banking.	
<b>Textbooks</b>	
1. "Data Science for Business" by Foster Provost and Tom Fawcett, published by O'Reilly Media. 167	
2. "Business Intelligence: A Managerial Approach" by Fred S. Siebert, published by Pearson.	
3. "Business Intelligence: The Savvy Manager's Guide" by Dylan Jones, published by Apress.	
4. "Fundamentals of Business Analytics", by R. N. Prasad, Seema Acharya, Wiley-India	
5. "Business Analytics for managers", Wolfgang Jank	
<b>Reference Books</b>	
6. "Data Warehousing for Dummies" by Thomas C. Hammergren, published by John Wiley & Sons.	
7. "Data-Driven: Creating a Data Culture" by Hilary Mason and DJ Patil, published by John Wiley & Sons.	
<b>List of Assignments</b>	
1. Create a presentation demonstrating the features and functionality of any BI tool.	

2. Design a galaxy schema for a set of business processes of a chosen organization and document the schema design along with a detailed explanation of the business processes and their interrelationships.	
3. Conduct Hypothesis Testing and Chi-square test on a given dataset to test the significance of the data and draw conclusions based on the results obtained	
4. Perform what-if analysis on a given dataset to identify potential outcomes and optimize decision-making. Document the analysis process and share the results.	
5. Utilize Hive for data analysis in a Big Data environment, including data manipulation, transformation, and querying. Document the analysis process.	
6. Conduct analysis using various OLAP cube operations, including drill-down, roll-up, slice-and-dice, and pivoting.	
7. Create a dashboard for an organization that showcases the relevant data and KPIs. Include visualizations, graphs, and tables that highlight the key performance indicators.	
8. Perform regression analysis on a dataset to predict the value of the dependent variable.	
9. Conduct prescriptive/optimization analysis on a suitable dataset to identify optimal solutions that optimize the desired outcomes.	
10. Case Study: Select any application of Business Intelligence and prepare analysis report.	
<b>Syllabus for Unit Tests:</b>	
Unit Test -1	Unit - I, Unit - II, Unit - III
Unit Test -2	Unit - IV, Unit - V, Unit - VI

<b>Elective-I Software Architecture</b>		
<b><u>TEACHING SCHEME:</u></b>	<b><u>EXAMINATION SCHEME:</u></b>	<b><u>CREDIT SCHEME</u></b>
Lectures: 4 Hours / Week	End Semester Examination : 60 Marks	Theory : 04
	Continuous Assessment : 40 Marks	
	Total: 100 Marks	Total: 04
<b>Course Pre-requisites:</b>		
Software Engineering, Object-oriented Programming		
<b>Course Objectives:</b>		
	Course objective is to understand the need, design approaches for software architecture and develop appropriate architectures for various case studies	
<b>Course Outcomes:</b>		
The students will be able to		
1.	Describe the Fundamentals of software architecture, qualities, and terminologies.	
2.	Express the analysis and design of a system using UML.	
3.	Apply object-oriented design techniques for behavior modeling.	
4.	Create UML package, component, and deployment diagrams to express the architectural structure of a system	
5.	Select appropriate architectural styles.	
6.	Apply principles of software architectures for enterprise application development.	
<b>Topics covered</b>		
<b>UNIT - I</b>	<b>Software Architecture:</b> Definition, Architecture and Agile, Requirements and software architecture: Quality attributes NFRs and FR, Software Architecture and Components, Multiple views of software architecture.	<b>(06 Hours)</b>
<b>UNIT - II</b>	<b>Software architecture using UML diagrams:</b> Overview of the UML Notation, Static Modelling	<b>(06 Hours)</b>
<b>UNIT -III</b>	<b>Behaviour modelling:</b> UML Sequence diagram and Activity diagram State diagram,	<b>(06 Hours)</b>
<b>UNIT -IV</b>	<b>UML component, Package, and deployment diagram:</b> Implementation architecture: component diagram, Hardware architecture deployment diagram	<b>(06 Hours)</b>
<b>UNIT - V</b>	<b>Architectural Styles:</b> Documenting Software Architectural Patterns Abstract Data Types and Object-Oriented, Main Program and Subroutine, Databases, Layered Systems, Client Server n-Tier, Interpreters, Pipes and Filters, Event-Based, Process Control, MVC style	<b>(06 Hours)</b>
<b>UNIT -VI</b>	<b>Software Architecture Case Study:</b> Client/Server Software Architecture Case Study: The design of a client/server system that consists of a bank server and several ATM clients. The design of the banking service is an example of a sequential object-oriented design. <b>Service-Oriented Architecture Case Study:</b> Online Shopping System	<b>(06 Hours)</b>

<b>Sample list of projects for project based learning:</b>	
1.	Draw the behavioral view diagram : State-chart diagram, Activity diagram for thermostat cooling system
2.	Draw the behavioral view diagram : State-chart diagram, Activity diagram for thermostat boiler system
3.	Draw implementation view diagram: Component diagram for the library management system.
4.	Draw implementation view: component diagram for Electronic Cash Counter/Point of sale
5.	Draw deployment diagram for the safe home system.
6.	Draw deployment diagram for the E-shopping system.
7.	Perform static modeling for web based Leave Management Tool.
8.	Perform static modeling for web based student attendance Management Tool
<b>Text Books:</b>	
1.	Hassan Gomaa, “Software Modeling and Design: UML, Use Cases, Patterns, and Software Architectures”, Cambridge University Press; Illustrated edition (21 February 2011), ISBN-10: 0521764149
2.	Bernd Bruegge Allen H. Dutoit “Object Oriented Software Engineering using UML,patterns and Java”, Third Edition, Pearson Education
3.	G. Booch, J.Rumbaugh, J. Jacobson, The Unified Modeling Language –User Guide Addison – Wesley
<b>Reference Books:</b>	
1.	Bass, L., P. Clements, & R. Kazman, “Software Architecture in Practice”, 2 Ed, Prentice-Hall.
2.	Kai Qian Jones, Software Architecture Design Illuminated, Bartlett Publishers Canada, 2010
3.	R.S Pressman, Software Engineering: A Practitioner’s Approach, 5/e, Mc Graw Hill International Edition
4.	Ion Gorton, Essentials of software Architecture , Second Edition, Springer-verlag, 2011
<b>Syllabus for Unit Test:</b>	
Unit Test -1	UNIT – I,II and III
Unit Test -2	and UNIT – IV ,V and VI

<b>Elective-I: Information Retrieval</b>					
<b>Teaching Scheme</b>		<b>Examination Scheme</b>		<b>Credit Scheme</b>	
	<b>Hours/Week</b>		<b>Marks</b>		<b>Credits</b>
<b>Lecture</b>	<b>04</b>	<b>University Examination</b>	<b>60</b>	<b>Theory</b>	<b>04</b>
		<b>Internal Assessment</b>	<b>40</b>		
<b>Practical</b>	<b>02</b>	<b>Term Work</b>	<b>25</b>	<b>Practical</b>	<b>01</b>
		<b>Oral</b>	<b>25</b>		
<b>Total</b>	<b>06</b>	<b>Total</b>	<b>150</b>	<b>Total</b>	<b>05</b>
<b>Course Objective:</b>					
<p>This course aims at giving students a knowledge of Information Retrieval along with its applications in terms of the following:</p> <ul style="list-style-type: none"> <li>• To understand the basics of Information Retrieval.</li> <li>• Learn to evaluate information retrieval systems</li> <li>• To understand the theoretical basis behind the standard models of IR (Boolean, Vector-space)</li> <li>• To understand the use of performance evaluation metric for IR</li> <li>• To understand the standard methods for Web indexing and retrieval</li> </ul>					
<b>Prerequisite:</b>					
<ul style="list-style-type: none"> <li>• Students must have the minimal concept of Data Base Management Systems</li> <li>• They must also have the concept of different types of algorithms used for searching data</li> <li>• They must also have the minimal knowledge of Natural language such as thesaurus, synonyms etc. to understand the concept of retrieving the textual information because text is the main data type used in Information Retrieval Systems</li> </ul>					
<b>Course Outcomes:</b>					
On completion of the course, students will have the ability to:					
1. Describe the objectives of information retrieval systems.					
2. Describe models like vector-space, probabilistic and language models to identify the similarity of query and document 171					
3. Understand relevance feedback in vector space model and Boolean retrieval model					
4. Understand query, document, and phrase translation.					
5. Design the method to build inverted index.					
6. Design and implement a recommender system.					
<b>Unit I Introduction to information retrieval systems:</b>					<b>08 Hours</b>
Goals and history of IR, Objectives of Information Retrieval Systems, The impact of the web on IR, Data vs Information Retrieval, Logical view of the documents, Relationship to Database Management Systems, Architecture of IR System					

<b>Unit II Basic IR Models:</b> Classes of Retrieval Model, overview of text retrieval model: Boolean retrieval model, Term weighting mechanism – TF, IDF, TF-IDF weighting, Cosine Similarity, Vector space model	
<b>Unit III Text properties, operations and preprocessing:</b>	<b>08 Hours</b>
Tokenization, Text Normalization, Stop-word removal, Morphological Analysis, Word Stemming (Porter Algorithm), Case folding, Lemmatization, Word statistics (Zipf's law, Heaps' Law), Index term selection, Inverted indices, Positional Inverted index,	
<b>Unit IV Text Categorization:</b>	<b>08 Hours</b>
Categorization algorithms: Rocchio, nearest neighbor, and naive Bayes. Applications to information filtering and organization	
<b>Unit V Text classification &amp; Text clustering</b>	
The text classification problem, Naive Bayes text classification, k- nearest neighbors, Support vector Machine, Feature Selection, Vector-space clustering, K-means algorithm	
<b>Unit VI Evaluation of IR:</b>	<b>08 Hours</b>
Performance metrics: Precision, Recall, F-Measure, MAP (Mean Average Precision), Known-item Search Evaluation, Evaluations on benchmark text collections. <b>Recommender System:</b> personalization, Collaborative filtering recommendation, Content-based recommendation	
<b>Textbooks:</b>	
1. Introduction to Information Retrieval. Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schuetze, Cambridge University Press, 2007. 2. Modern Information Retrieval. Baeza-Yates Ricardo and Berthier Ribeiro-Neto. 2nd edition, Addison-Wesley, 2011. 3. Information Retrieval: Implementing and Evaluating Search Engines. Stefan Buttcher, Charlie Clarke, Gordon Cormack, MIT Press, 2010.	
<b>Reference Books:</b>	
1. Christopher D Manning, Prabhakar Raghavan, Hinrich Schuetze, An Introduction to Information Retrieval By Cambridge University Press, England, 2009. 2. Introduction to Information Retrieval. Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schuetze, Cambridge University Press, 2007.	
<b>List of Assignments</b>	
1. Introduction to information retrieval 2. Implementation of inverted index 3. Implementation of Boolean retrieval model 4. Study of various data structure for fast accessing of the data (Hash table, B-trees, sparse lists)	

5.To find out cosine similarity using Tf and IDf	
6..Study of Zip’s law .: Statistical and Mathematical study	
<b>Project Based Learning</b>	
<ol style="list-style-type: none"> <li>1. Implementation of various classification algorithm on text.</li> <li>2. Implementation of various Clustering algorithm on text</li> <li>3. Implementation of sremming Porter stemmer algorithm.</li> </ol>	
<b>Syllabus for Unit Tests:</b>	
Unit Test -1	Unit – I, Unit – II, Unit – III
Unit Test -2	Unit – IV, Unit – V, Unit – VI

<b>Elective-I: User Experience</b>					
<b>Teaching Scheme</b>		<b>Examination Scheme</b>		<b>Credit Scheme</b>	
	<b>Hours/Week</b>		<b>Marks</b>		<b>Credits</b>
<b>Lecture:</b>	<b>04 Hours/Week</b>	<b>University Examination:</b>	<b>60 Marks</b>		
<b>Practical:</b>	<b>02 Hours/Week</b>	<b>Internal Assessment:</b>	<b>40 Marks</b>	<b>Theory</b>	<b>04</b>
		<b>Term Work</b>	<b>25 Marks</b>	<b>Practical</b>	<b>01</b>
		<b>Oral</b>	<b>25 Marks</b>		
		<b>Total</b>	<b>150 Marks</b>	<b>Total</b>	<b>05</b>
<b>Course Objective:</b>					
This course aims at giving students a knowledge of					
<ul style="list-style-type: none"> <li>• User Interface and Experience</li> <li>• Trends in UX</li> <li>• Emerging Technologies in UX</li> </ul>					
<b>Prerequisite:</b>					
<ul style="list-style-type: none"> <li>• Basic knowledge about concept of Human Computer Interaction</li> <li>• Basic knowledge designing languages and tools</li> </ul>					
<b>Course Outcomes:</b> On completion of the course, students will have the ability to:					
1. Understand the Concept User Interface and Experience					
2. To understand the user's interaction with the environment, people and culture. To take part in different UX domains and societies					
3. Exploring different user research methodologies ensuring appropriate solution					
4. The tools for user research become familiar					
5. Practice to learn the tools required to design wireframes and prototypes.					
<b>Unit I</b>					
Introduction to UX Design Evolution of UX Design, Processes and Methodologies, Tools and Technology in UX Design, Multiple Domains and Trends in UX Design					<b>06 Hours</b>
<b>Unit II</b>					
Technology in experience design Technology for digital experience, Technological feasibility and viability, Details of Internet of Things, Augmented reality and virtual reality, ATM, KIOSK.					<b>06 Hours</b>
<b>Unit III</b>					
UX Design Advance: UX methodologies, Heuristic evaluation, Understanding product UX lifecycle.					<b>06 Hours</b>
<b>Unit IV</b>					
UX & Digitalization Understand by case studies how technology and digitalization is transforming different industry segments BFSI, manufacturing, retail, automotive, media, FMCG, logistics, oil & gas.					<b>06 Hours</b>

<b>Unit V</b>	<b>06 Hours</b>
Business, UX & Design management Business UX : Understanding How a UX approach can help any business, The Business Value of UX Design, Strategy building, Aspects of key guidelines in UX business	
<b>Unit VI</b>	<b>06 Hours</b>
Design Management: What is design management, Different types, Taking Charge of Processes and People The Evolution of Design Management, Areas of Design Management, Why Does Design Management Matter?, Where Does Design Management Fall Within Businesses?	
<b>Textbooks</b>	
<ol style="list-style-type: none"> <li>1. Sketching the User experiences - Bill Buxton</li> <li>2. Augmented Reality: Principles and Practice - Dieter Schmalstieg</li> </ol>	
<b>Reference Books</b>	
<ol style="list-style-type: none"> <li>1. Augmented Reality: An emerging technologies guide - Gregory Kipper and Joseph Rampolla</li> </ol>	
<b>List of Assignments</b>	
<ol style="list-style-type: none"> <li>1. Describe aspects of user interaction and cognition as they relate to UX.</li> <li>2. Explain the role and importance of Standards, Technologies, and Guidelines in the UX process.</li> <li>3. Describe methods including experiment design, application, and the ethical process</li> <li>4. Select and apply appropriate methods for analysing a design</li> <li>5. Select and apply the relevant descriptive statistical tests associated with UX Engineering;</li> <li>6. Analyse and critique UX work, experimental studies, and computer interfaces</li> <li>7. Analyse problems associated with different designs and suggests solutions for their resolution.</li> </ol>	
<b>Project Based Learning</b>	
<ul style="list-style-type: none"> <li>• Select any current example and apply appropriate methods for analysing designs</li> </ul>	
175	
<b>Syllabus for Unit Tests:</b>	
Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

<b>ELECTIVE-I: STORAGE AREA NETWORK</b>					
<b>Teaching Scheme</b>		<b>Examination Scheme</b>		<b>Credit Scheme</b>	
	<b>Hours/Week</b>		<b>Marks</b>		<b>Credits</b>
<b>Lecture</b>	<b>04</b>	<b>University Examination</b>	<b>60</b>	<b>Theory</b>	<b>04</b>
<b>Practical</b>	<b>02</b>	<b>Internal Assessment</b>	<b>40</b>		
		<b>Term Work</b>	<b>25</b>	<b>Practical</b>	<b>01</b>
		<b>Oral</b>	<b>25</b>		
<b>Total</b>	<b>06</b>	<b>Total</b>	<b>150</b>	<b>Total</b>	<b>05</b>
<b>Course Objective:</b>					
The aim of this course is to help the students to attain the following industry identified competency through various teaching learning experience-.					
1. Ability to demonstrate the storage area networks and their products Ability to provide the mechanisms for the backup/recovery.					
<b>Prerequisite:</b>					
1. Computer Networks, Operating System, Cloud Computing.					
<b>Course Outcomes:</b> On completion of the course, students will have the ability:					
1. To understand Storage Area Networks characteristics and components.					
2. To study the basics of Intelligent Storage Systems.					
3. To use, interpret and examine various SAN technologies.					
4. To evaluate different SAN management strategies to fulfill business continuity requirements.					
5. To classify the applications as per their requirements and select relevant SAN solutions.					
6. To apply Security and management concepts/techniques for Storage Infrastructure.					
<b>Unit I</b>					<b>08 Hours</b>
<b>Introduction to Storage System :</b> Storage Area Networks Architecture Overview: Creating Network for storage; Hardware devices: Fibre Channel Switch, Host Bus Adaptors, Putting the Storage in SANs, Fabric Operation from a hardware perspective, SAN hardware considerations, Evolution of storage architecture, key data center elements, virtualization, and cloud computing, virtual storage provisioning.					
<b>Unit II</b>					<b>08 Hours</b>
<b>Data Protection and Intelligent disk subsystems:</b> Intelligent Disk Subsystem - architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels, JBOD, Storage virtualization using RAID and different RAID levels. Compare and contrast integrated and modular storage systems.					
<b>Intelligent Storage Systems:</b> Components of an Intelligent Storage System, Types of Intelligent Storage Systems. Fibre Channel Storage Area Networks - Fibre Channel: Overview, The SAN and Its Evolution, Components of FC SAN, NAS, and IP-SAN.					

<b>Unit III</b>	<b>08 Hours</b>
<p><b>Storage Networking technologies and Virtualization:</b>  Fibre Channel SAN components, connectivity options, and topologies including access protection mechanism ‘zoning’, FC protocol stack, addressing and operations, Network Attached Storage (NAS) - components, protocol and operations.</p> <p><b>Virtualization:</b> Definition of Storage virtualization: Implementation Considerations: Storage virtualization on Block or file levels; Storage virtualization on various levels of the storage network; Symmetric and Asymmetric storage virtualization in the network.</p>	
<b>Unit IV</b>	<b>08 Hours</b>
<p><b>Backup, Archive, and Replication :</b>  Information availability and business continuity solutions in both virtualized and non-virtualized environments. Business continuity terminologies, planning and solutions, Clustering and multipathing architecture to avoid single points of failure, Backup and recovery - methods, targets and topologies, Data de-duplication and backup in virtualized environment, Fixed content and data archive, Local replication in classic and virtual environments, Remote replication in classic and virtual environments, Three-site remote replication and continuous data protection.</p>	
<b>Unit V</b>	<b>08 Hours</b>
<p><b>Cloud Computing Characteristics:</b>  Definition of Cloud computing, Characteristics of Cloud computing, Cloud Enabling Technologies, Cloud Service Models, Cloud Deployment Models, Cloud Computing Infrastructure, Cloud Challenges and Cloud Adoption Considerations. Steps involved in transitioning from Classic data center to Cloud computing environment Services and deployment models, Cloud infrastructure components, Cloud migration considerations.</p>	
<b>Unit VI</b>	<b>08 Hours</b>
<p><b>Securing and Managing Storage Infrastructure:</b>  Framework and domains of storage security along with covering security. Implementation at storage networking. Security threats, and countermeasures in various domains Security solutions for FC-SAN, IP-SAN and NAS environments, Security in virtualized and cloud environments, Monitoring and managing various information infrastructure components in classic and virtual environments, Information lifecycle management (ILM) and storage tiering, Cloud service management activities.</p>	
<b>Textbooks</b>	
1. Storage Virtualization, Author: Clark Tom, Publisher: Addison Wesley Publishing Company ISBN : 9780321262516	
2. Information Storage and Management, Author :EMC Education Services, Publisher: Wiley ISBN: 9781118094839	

3. EMC Education Services, "Information Storage and Management", Wiley India Publications, 2009. ISBN: 9781118094839.

### **Reference Books**

1. Ulf Troppens, Wolfgang Muller-Friedt, Rainer Wolafka, Storage Networks Explained Wiley Publication.

2. Paul Massiglia, Richard Barker, "Storage Area Network Essentials: A Complete Guide to Understanding and Implementing SANs Paperback", 1st Edition, Wiley India Publications, 2008

3. G. Somasundaram, Alok Shrivastava, Information Storage and Management, EMC Education services, Wiley Publication.

4. Marc Farley : Building Storage Networks, 2nd Edition, Tata McGrawHill, Osborne, 2001.

5. Meeta Gupta : Storage Area Network Fundamentals, 2nd Edition, Pearson Education Limited, 2002.

### **List of Laboratory Exercises**

1. Configuring a Storage Area Network (SAN) using iSCSI technology.

2. Setting up a Network Attached Storage (NAS) environment.

3. Implementing a storage tiering strategy in a SAN environment.

4. Investigating the use of compression and deduplication in a SAN environment.

5. Exploring the use of Storage Virtualization techniques in a SAN environment

6. Studying the role of Storage Resource Management (SRM) tools in a SAN environment.

7. Evaluating the security features of SAN and implementing secure data access

8. Studying the impact of network topology on SAN performance.

9. Exploring the use of flash storage in a SAN environment and evaluating its performance.

### **Project Based Learning**

1. Evaluating the performance of SAN using various benchmarking tools.

2. Configuring and using Snapshots and Remote Replication in a SAN environment.

3. Investigating the impact of network congestion on SAN performance and implementing congestion control techniques.

4. Implementing a backup and recovery strategy in a SAN environment.

5. Studying the role of object storage in a SAN environment and evaluating its performance.

6. Exploring the use of cloud storage services in a SAN environment and evaluating their performance.

7. Evaluating the impact of network latency on SAN performance and implementing optimization techniques.

8. Evaluating the impact of different caching algorithms on SAN performance.

9. Implementing disaster recovery and business continuity in a SAN environment.

10. Evaluating the impact of different types of disk arrays on SAN performance.

<b>Syllabus for Unit Tests:</b>	
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Unit Test -1	Unit – I, Unit – II, Unit – III
Unit Test -2	Unit – IV, Unit – V, Unit – VI

## Subject : Information Technology Laboratory –V

Teaching Scheme	Examination Scheme	Credit Allotted
Practical : 02 Hrs/Week	Term Work:25 Marks	Total Credits: 01
	Prat/Oral : 25 Marks	
<b>Total: 02 Hours</b>	<b>Total: 50 Marks</b>	

### Course Objectives:

To provide students foundation knowledge of DevOps environment, supportive automation tools, scripting language and hands on assignments to understand the DevOps workflow.

### Course Prerequisites:

Students should have prior knowledge of software development life cycle, basics of cloud computing and Linux operating system.

### Course Outcome:

#### Students will be able to:

- 1) Understand the benefits of DevOps over other software development processes
- 2) Interpret working of the DevOps workflow
- 3) Apply cloud computing services in DevOps environment
- 4) Implement Linux commands in DevOps environment
- 5) Implement Shell scripting for DevOps
- 6) Perform various Git commands associated with version controlling

UNIT-I	Introduction to DevOps	
	DevOps: concepts, history of DevOps, objectives, difference between DevOps and traditional Software Development Life Cycle and Agile Model, benefits of working in a DevOps environment, roles, responsibilities and skills of a DevOps Engineer	
UNIT-II	DevOps Architecture	
	Continuous Development, Continuous Integration, Continuous Testing, Continuous Deployment, Continuous Monitoring, Continuous Feedback, Continuous Operations, DevOps Pipeline, DevOps principles, overview of DevOps Automation Tools, Benefits of the DevOps lifecycle	

<b>UNIT-III</b>	<b>Cloud Computing Services</b>	
	Concept, Cloud Computing services, DevOps linking with cloud computing, Public Clouds: Amazon Web Services, Microsoft Azure, Google Cloud Services AWS: AWS DevOps Architecture, AWS CloudFormation, AWS EC2, AWS CloudWatch, AWS CodePipeline	
<b>UNIT-IV</b>	<b>LINUX Basic and Admin</b>	
	Linux OS Introduction, Importance of Linux in DevOps, Linux Basic Command Utilities, Linux Basic Command Utilities, Linux Administration, Environment Variables, Networking, Linux Server Installation, RPM and YUM Installation	
<b>UNIT-V</b>	<b>Shell Scripting for DevOps</b>	
	Introduction, Variables, Flow Controls, Loops, Functions, Lists, Manipulating Strings, Reading and Writing Files, Positional Parameters	
<b>UNIT-VI</b>	<b>Version Control with Git</b>	
	Version control architecture- introduction, features, benefits Source code management, Virtual private network, Types of version control systems. Git: Git Installation, commonly used commands in Git, Git workflow, Git branching and Merging, Working with Remote repository	
<b>Assignment List:</b>		
1)	Open free tier account for AWS and launch EC2 instance of t2.micro.	
2)	Create AMI and take EBS snapshot of EBS volume.	
3)	Configure AWS CloudWatch	
4)	Launch EC2 instance and attach EBS volume to instance	
5)	Create user and group of a user and assign permission to them.	
6)	Create a new file using Vi editor and combine file using Linux command and apply links on that file (hard links and soft links).	
7)	Write shell script for calculator function. And understand the difference between different types of variables (environmental, special, and local variable).	
8)	Write shell script for the httpd server to launch one application (create html file on web server).	
9)	Create git repository and manage branches using branching strategies.	
10)	Solve merge conflict problem and understand the difference between pull, fetch and revert command by creating new git remote repository.	
<b>Text Books:</b>		
1)	Jennifer Davis and Ryn Daniels, <a href="#">Effective DevOps</a> , O'Reilly Publisher, 2022	
2)	Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation" by Jez Humble and David Farley:	
<b>Reference Books:</b>		
1)	The Phoenix Project: A Novel about IT, DevOps, and Helping Your Business Win" by Gene Kim, Kevin Behr, and George Spafford	
2)	Infrastructure as Code: Managing Servers in the Cloud" by Kief Morris	

# B.Tech. (Information Technology)

## Semester-VIII

<b>Information Security</b>					
<b>Teaching Scheme</b>		<b>Examination Scheme</b>		<b>Credit Scheme</b>	
	<b>Hours/Week</b>		<b>Marks</b>		<b>Credits</b>
<b>Lecture:</b>	<b>04</b> Hours/Week	<b>University Examination:</b>	<b>60 Marks</b>	<b>Theory</b>	<b>04</b>
<b>Practical:</b>	<b>02</b> Hours/Week	<b>Internal Assessment:</b>	<b>40 Marks</b>		
		<b>Term Work</b>	<b>25 Marks</b>	<b>Practical</b>	<b>01</b>
		<b>Practical</b>	<b>25 Marks</b>		
<b>Total : 06 Hours/Week</b>		<b>Total</b>	<b>150 Marks</b>	<b>Total</b>	<b>05</b>
<b>Course Objective:</b>					
1. To understand the basics of Information Security					
2. To know the legal, ethical, and professional issues in Information Security					
3. To know the aspects of risk management					
4. To become aware of various standards in this area					
5. To know the technological aspects of Information Security					
<b>Prerequisite:</b>					
Fundamentals of Computer Networks					
<b>Course Outcomes:</b> On completion of the course, students will have the ability to:					
1. Discuss the basics of information security					
2. Illustrate the legal, ethical and professional issues in information security					
3. Understand Information Security Policies.					
4. Become aware of various security threats.					
5. Design and implementation of security in OS and web applications.					
6. Understand current trends in information security.					
<b>Unit I INTRODUCTION</b>					
Introduction to Information Security: Attacks, Vulnerability, Security Goals, Security Services and mechanisms. Critical Characteristics of Information, Components of an Information System, Securing the Components, Balancing Security and Access. Need of Information Security, Basic Principles of Confidentiality, Integrity, Policies, Procedures, Guidelines, Standards Administrative Measures and Technical Measures, People, Process, Technology					<b>08 Hours</b>
<b>Unit II SECURITY ELEMENTS</b>					
Authorization and Authentication - Types, Policies and techniques, Security Certification, Security Monitoring and Auditing, Security Requirements Specifications, Security Policies and Procedures, Firewalls, IDS, Log Files, Access Control, Trusted Computing and multilevel security, Security models, Trusted Systems, Software security issues, Physical and infrastructure security, Human factors, Security awareness, training , Email and Internet use policies.					<b>08 Hours</b>
<b>Unit III INFORMATION SECURITY POLICIES</b>					
Introduction to Information Security Policies, Importance and need of Policies, Data security consideration, Backups, Archival storage and disposal of data,					<b>08 Hours</b>

Intellectual Property rights and Policies, Incident Response and Forensics, Management Responsibilities.	
<b>Unit IV SECURITY THREATS</b>	<b>08 Hours</b>
Threat Management: Threat Modelling, Sources of security threats, Threat identification, Threat Analysis, Target Assets and vulnerabilities, Consequences of threats, E-mail threats, Web threats, Threat awareness Intruders and Hackers, Insider threats, Risk Assessment, Forensic Analysis, Vulnerability sources and assessment tools.	
<b>Unit V SECURITY IN OS and WEB APPLICATIONS</b>	<b>08 Hours</b>
<b>Windows and Linux security:</b> Types of Audits in Windows Environment, Server Security, Active Directory (Group Policy), Anti-Virus, Mails, Malware, End point protection, Shadow Passwords, SUDO users, etc.  <b>Web Application Security:</b> OWASP, Common Issues in Web Apps, What is XSS, SQL injection, CSRF, Password Vulnerabilities, SSL, CAPTCHA, Session Hijacking, Local and Remote File Inclusion, Audit Trails, Web Server Issues, etc	
<b>Unit VI CURRENT TRENDS</b>	<b>08 Hours</b>
Current Trends in information Security, Cloud Computing: benefits and Issues related to info Sec. Standards available for InfoSec: Cobit, Cadbury, ISO 27001, OWASP, OSSTMM, etc - An Overview, Certifiable Standards	
<b>Textbooks</b>	
1. Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Vikas Publishing House, New Delhi, 2003	
2. William Stallings and Lawrie Brown, "Computer Security: Principles and Practice", Prentice Hall, 2008.	
<b>Reference Books</b>	
1. Nina Godbole, Information Systems Security-Security Management, Metrics, Frameworks and Best Practices, Wiley, 2009 184	
2. Swiderski, Frank and Syndex, "Threat Modeling", Microsoft Press, 2004.	
<b>List of Experiments</b>	
1. Write a program to Analyze Cyber Threats and Attacks in Data Traffic	
2. Write a program to examine Security Attack Impact on User Privacy	
3. Write a program for Assessing Correlation of multi-layered Security Approaches and Protocols	
4. Write a program for Network visualization Strategies for Attack Detection	
5. Write a program for analysis of Normal and Abnormal Network Pattern in Traffic	
6. Write a program to implement SQL injection	
7. A case study on security in web application	
8. A case study on latest trends in information security	

<b>Project Based Learning</b>	
1.	<a href="#"><u>Graphical Password Authentication System using Intuitive Approach</u></a>
2.	<a href="#"><u>Online Transaction Fraud Detection using Backlogging on E-Commerce Website</u></a>
3.	<a href="#"><u>Secure File Sharing Using Access Control</u></a>
4.	<a href="#"><u>Blockchain-based Transaction and Settlement System</u></a>
5.	<a href="#"><u>Blockchain based Personal Identity Security System</u></a>
6.	<a href="#"><u>Signature verification System using Python</u></a>
7.	<a href="#"><u>Electronic Voting System using Blockchain</u></a>
8.	<a href="#"><u>Three Level Image Password Authentication</u></a>
9.	<a href="#"><u>Android Text Encryption Using Various Algorithms</u></a>
10.	<a href="#"><u>E Authentication System Using QR Code &amp; OTP</u></a>
11.	<a href="#"><u>Detecting Phishing Websites Using Machine Learning</u></a>
12.	<a href="#"><u>Card Payment Security Using RSA</u></a>
13.	<a href="#"><u>Detecting Data Leaks via Sql Injection Prevention on an E-Commerce</u></a>
14.	<a href="#"><u>School Security System (SSS) using RFID</u></a>
<b>Syllabus for Unit Tests:</b>	
Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

<b>INTERNET OF THINGS</b>					
<b>Teaching Scheme</b>		<b>Examination Scheme</b>		<b>Credit Scheme</b>	
	<b>Hours/Week</b>		<b>Marks</b>		<b>Credits</b>
<b>Lecture</b>	<b>04</b>	<b>University Examination</b>	<b>60</b>	<b>Theory</b>	<b>04</b>
<b>Practical</b>	<b>02</b>	<b>Internal Assessment</b>	<b>40</b>		
		<b>Term Work</b>	<b>25</b>	<b>Practical</b>	<b>01</b>
		<b>Practical</b>	<b>25</b>		
<b>Total</b>	<b>06</b>	<b>Total</b>	<b>150</b>	<b>Total</b>	<b>05</b>
<b>Course Objective:</b>					
The aim of this course is to help the students to attain the following industry identified competency through various teaching learning experience-					
<ol style="list-style-type: none"> <li>1. To Provide a strong foundation of fundamentals of Internet of Things and need of IoT Security.</li> <li>2. To design and implement application of IoT using various sensors.</li> <li>3. To detailed understanding of present scope of Internet of Things with case studies.</li> </ol>					
<b>Prerequisite:</b>					
1. Computer networking, Embedded systems, Cloud Computing.					
<b>Course Outcomes:</b> On completion of the course, students will have the ability:					
1. To understand the fundamentals about IoT.					
2. To understand the working of Embedded IoT devices.					
3. To use IoT protocol to upload sensor data and to control devices.					
4. To study the basics of Cloud Platforms for IOT and supporting services.					
5. To apply Security concepts/techniques for IoT applications.					
6. To design and implement IoT system for real time applications.					
<b>Unit I</b>					<b>08 Hours</b>
<b>Introduction to Internet of and Things (IoT):</b> Understanding IoT fundamentals, IOT Architecture and protocols, IoT World Forum (IoTWF) standardized Architecture, Physical design of IoT, Logical Design of IoT, Various Platforms for IoT, Overview of IoT components and IoT Communication Technologies and Models, IoT Communication API's, IoT Issues and Challenges- Planning, Costs and Quality ,Security and Privacy, Risks, Interdependencies of IoT and cloud computing, Web of things.					
<b>Unit II</b>					<b>08 Hours</b>
<b>Embedded IoT devices:</b> Sensors and actuators for IoT applications, IoT components and implementation, IoT system building blocks ,Programming of NodeMCU and Raspberry PI, Implementation of IoT with Edge devices, Reading sensor data and transmit to cloud, Controlling devices through cloud using mobile application and web application, Types and configurations of gateways, Specifications of IoT gateways, RFID					

<b>Unit III</b>	<b>08 Hours</b>
<b>IoT PROTOCOLS:</b> IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.11ah, Network Layer/ Internet layer: IP versions, Constrained Nodes and Constrained Networks, Transport layer protocols, Application Layer Protocols: Hypertext transfer protocol (HTTP), Systematic HTTP access methodology, Web Socket, Constrained application protocol CoAP), Message Queue Telemetry Transport Protocol (MQTT), XMPP, DDS, AMQP CoAP and MQTT.	
<b>Unit IV</b>	<b>08 Hours</b>
Cloud Platforms for IOT: Virtualization concepts and Cloud Architecture, Cloud computing, benefits, Cloud services — SaaS, PaaS, IaaS, Cloud providers & offerings, Study of IOT Cloud platforms, ThingSpeak API and MQTT, Interfacing ESP8266 with Web services. Computing Using a Cloud Platform for IoT/M2M Applications/Services, Everything as a service and Cloud Service Models.	
<b>Unit V</b>	<b>08 Hours</b>
<b>IoT Security:</b> Vulnerabilities Security Requirements and Threat Analysis, Misuse Cases, IoT Security Components, Key Management, Update Management, Challenges in IoT security, Tomography, and Layered Attacker Model, Identity Management and Establishment, Access Control, and Secure Message Communication, Security Models, IoT Security Protocols. Security in Service Management,	
<b>Unit VI</b>	<b>08 Hours</b>
<b>IoT Applications and case study</b> Broad categories of IoT applications: Consumer IoT, Commercial IoT, Industrial IoT, Infrastructure IoT, Military Things (IoMT), IoT applications in home, infrastructures, other IoT electronic equipments, Industry 4.0 concepts. <b>IoT Case studies:</b> Home automation with IoT, River water pollution monitoring, Smart city street light control and monitoring, Health care monitoring, Voice Apps on IoT device.	
<b>Textbooks</b>	
1. Arshdeep Bahga, Vijay Madiseti, “Internet of Things – A hands-on approach”, Universities Press, ISBN: 0: 0996025510, 13: 978-0996025515.	
2. Raj Kamal, Internet of Things: Architecture and Design Principle” , ISBN-13: 978-93-5260-522-4, McGraw Hill Education (India) 2017.	
3. Lyla B. Das, “Embedded Systems: An Integrated Approach” Pearson , ISBN: 9332511675, 9789332511675	
4. Orchestrating and Automating Security for the Internet of Things: Delivering Advanced Security Capabilities from Edge to Cloud for IoT, by Anthony Sabella, Rik IronsMcClean, Marcelo Yannuzzi, Publisher: Cisco Press, Release Date: June 2018, ISBN:	

9780134756936
5. Securing the Internet of Things, Shancang Li Li Da Xu, Syngress, 2017, Elsevier, ISBN: 978-0-12-804458-2
6. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017.
<b>Reference Books</b>
1. Internet of Things: A Hands-on Approach, By Arshdeep Bahga and Vijay Madisetti Lee, Heather Schneider, Robbie Schell, Mobile Applications: Architecture, Design, and Development, Prentice Hall, April 2004, ISBN-13: 978-0131172630
2. Lyla B. Das, “Embedded Systems: An Integrated Approach” Pearson , ISBN: 9332511675, 9789332511675
3. Internet of Things: Architecture, Design Principles And Applications, Rajkamal, McGraw Hill HigherEducation.
4. Fei Hu, “Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations “, ISBN: 9781498723183, CRC Press, 2016. 6.
5. The Internet of Things – Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi and Wiley, 2012.
6. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applications and Protocols”, Wiley, 2012, ISBN:978-1-119-99435-0.
7. David Hanes, IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, Cisco Press, ISBN-13: 978-1-58714-456-1, ISBN-10: 1-58714-456-5, 2017.
<b>List of Assignments</b>
1. With neat diagram, explain simplified IOT architecture.
2. Getting started with NodeMCU, Arduino with ESP8266 and ESP32 in the Arduino IDE.
3. Familiarization with the concept of IOT, Arduino / Raspberry Pi and perform necessary software installation.
4. Explain with neat diagram, The oneM2M IoT Standardized Architecture.
5. Identify and analyse the security and privacy issues in IoT, particularly the issue of securing its wireless system.
6. List out the different IOT applications and importance of IOT in present scenario.
<b>List of Laboratory Exercises</b>
1. Excercise on Eclipse IoT Project.
2. Exercise on smart object API Gateway service reference implementation in IoT
3. Toolkit.
4. Study and Install IDE of Arduino and different types of Arduino.
5. Experiment on HTTP-to-CoAP semantic mapping Proxy in IoT Toolkit.
6. Experiment on application framework and embedded software agents for IoT Toolkit.
7. Study and Configure Raspberry Pi.
8. Installing Windows 10 IoT Core on Raspberry Pi.

9. Experiment on connectivity of Raspberry Pi with existing system components.	
10. IoT based Web Controlled Home Automation using Raspberry Pi	
11. Implementation of Interfacing Raspberry Pi with RFID.	
<b>Project Based Learning</b>	
1. Internet of things enabled real time water quality monitoring system.	
2. Controlling Raspberry Pi with WhatsApp.	
3. Smart city IoT applications	
4. Turn your smartphone into an IoT device using the IBM Watson IoT platform cloud-hosted service.	
5. Implement a communication technology for IoT enable devices in a home network.	
6. Fingerprint Sensor interfacing with Raspberry Pi.	
7. Building Google Assistant with Raspberry Pi.	
8. Design a system to control the traffic signals through IOT	
<b>Syllabus for Unit Tests:</b>	
Unit Test -1	Unit – I, Unit – II, Unit – III
Unit Test -2	Unit – IV, Unit – V, Unit – VI

<b>DATA ENGINEERING</b>					
<u>Teaching Scheme</u>		<u>Examination Scheme</u>		<u>Credit Scheme</u>	
	<b>Hours/Week</b>		<b>Marks</b>		<b>Credits</b>
<b>Lecture:</b>	<b>03 Hours/Week</b>	<b>University Examination:</b>	<b>60 Marks</b>		
<b>Practical:</b>	--	<b>Internal Assessment:</b>	<b>40 Marks</b>	<b>Theory</b>	<b>03</b>
				<b>Practical</b>	<b>--</b>
		<b>Total</b>	<b>100 Marks</b>	<b>Total</b>	<b>03</b>
<b>Course Objective:</b> Get a concise overview of the entire data engineering landscape					
<b>Prerequisite:</b> Concepts of Querying, Data Warehousing, Data mining					
<b>Course Outcomes:</b> On completion of the course, students will have the ability to:					
1. Understand the data architecture and data engineering life cycle					
2. Understand the source systems					
3. Deduce various data storage systems for data engineering					
4. Understand the ingestion phase of data engineering life cycle					
5. Interpret the transformation and serving phase of data engineering life cycle					
6. Recognise the future of data engineering					
<b>Unit I</b> Data engineering described					<b>06 Hours</b>
What is data engineering? Data engineering skills and activities, data engineers inside an Organisation, What is the data engineering life cycle? The data life cycle versus the data engineering life cycle, Designing good Data Architecture					
<b>Unit II</b> Source systems					<b>06 Hours</b>
Data generation in source systems: How is data created? Source systems in detail, source systems practical details, Undercurrents and their impact on source systems					
<b>Unit III</b> Storage					<b>06 Hours</b>
Raw ingredients of data storage, Data storage systems, Data engineering storage abstractions, Big trends in storage					
<b>Unit IV</b> Ingestion					<b>06 Hours</b>
What is data injection? Why to inject data? Key engineering considerations for the injection phase, batch injection consideration, message and stream injection consideration					
<b>Unit V</b> Transformation and serving					<b>06 Hours</b>
Queries, modelling and transformations Serving data for Analytics machine learning and reverse ETL: General considerations for serving data, analytics, machine learning, ways to serve data for analytics and machine learning, reverse ETL					
<b>Unit VI</b> Security privacy and the future of data engineering					<b>06 Hours</b>
Security and privacy: People, Processes, Technology The future of data engineering: Decline of complexity and rise of easy to use data tools, The cloud scale data OS and improved interoperability, Enterprisey data engineering, Moving beyond the modern data stack towards the live data stack					
<b>Textbooks</b>					

1. Joe Reis, Matt Houseley, “Fundamentals of Data Engineering: Plan and Build Robust Data Systems”, O’Reilly publication, 1 <sup>st</sup> Edition, 2022	
<b>Reference Books</b>	
1. Tobias Macey, “97 Things Every Data Engineer Should Know: Collective Wisdom from the Experts”, O’Reilly Media, 2021	
2. Andreas Kretz , “The Data Engineering Cookbook Mastering The Plumbing Of Data Science”, 2019	
<b>List of Assignments</b>	
1. Compare the types of Data Architectures	
2. Case study of data engineering using AWS	
3. Case study of SAPRK as an ETL tool	
4. Study of any one data ingestion tool and its architecture	
5. Analysis of security in data engineering: Threats, Challenges, Considerations and best practices	
6. Comparison of storage mechanism for various types of data engineering scenarios	
<b>Project Based Learning</b>	
Implement any of the following or similar project using any data engineering tools such as but not limited to: SPARK, AZURE, AWS, Python etc	
1. Predicting flight delays	
2. Data pipeline	
3. Creating a data lake	
4. Creating an enterprise data hub	
5. Streaming analytics on fraud detection	
6. In-game events auto-adjustment of complexity levels, target advertising, etc	
7. Dataset analysis for any application such as airline, twitter, etc	
<b>Syllabus for Unit Tests:</b>	
Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

<b>ELECTIVE-II: SEMANTIC WEB MINING</b>					
<b>Teaching Scheme</b>		<b>Examination Scheme</b>		<b>Credit Scheme</b>	
	<b>Hours/Week</b>		<b>Marks</b>		<b>Credits</b>
<b>Lecture</b>	<b>04</b>	<b>University Examination</b>	<b>60</b>	<b>Theory</b>	<b>04</b>
<b>Practical</b>	<b>02</b>	<b>Internal Assessment</b>	<b>40</b>		
		<b>Term Work</b>	<b>25</b>	<b>Practical</b>	<b>01</b>
		<b>Oral</b>	<b>25</b>		
<b>Total</b>	<b>06</b>	<b>Total</b>	<b>150</b>	<b>Total</b>	<b>05</b>
<b>Course Objective:</b>					
<ol style="list-style-type: none"> <li>1. Understand a detailed overview of the data mining process and techniques, specifically those that are relevant to Web mining.</li> <li>2. Understand the basics of Information retrieval and Web search with special emphasis on web crawling.</li> <li>3. Apply the use of machine learning approaches for Web Content Mining.</li> <li>4. Understand the role of hyper links in web structure mining.</li> <li>5. Learn the various aspects of web usage mining.</li> </ol>					
<b>Prerequisite:</b>					
<ol style="list-style-type: none"> <li>1. Concepts of data mining, Concepts of Web Technology/Web Engineering</li> </ol>					
<b>Course Outcomes:</b> On completion of the course, students will have the ability:					
<ol style="list-style-type: none"> <li>1. Build a sample search engine using available open source tools.</li> <li>2. Identify the different components of a web page that can be used for mining</li> <li>3. Apply machine learning concepts to web content mining.</li> <li>4. Implement Page Ranking algorithm and modify the algorithm for mining information.</li> <li>5. Design a system to harvest information available on the web to build recommender systems.</li> <li>6. Analyse social media data using appropriate data/web mining techniques and modify an existing search engine to make it personalized.</li> </ol>					
<b>Unit I : Introduction</b>					<b>08 Hours</b>
<p>Introduction – Web Mining – Theoretical background –Algorithms and techniques – Association rule mining – Sequential Pattern Mining -Information retrieval and Web search – Information retrieval Models-Relevance Feedback- Text and Web page Pre-processing – Inverted Index – Latent Semantic Indexing – Web Search – Meta-Search – Web Spamming. The Syntactic and the Semantic Web, Logics of the Semantic Web. The world of the semantic web-WWW-Meta data-Search engine-Search engine for traditional web-Semantic web-Search engine for semantic web-Traditional web to semantic web.</p>					
<b>Unit II : Semantic Web Technology</b>					<b>08 Hours</b>
<p>RDF,- Elements of RDF, Basic Syntax and Fundamental rules of RDF-Aggregation-Distributed information-RDFS-core elements of RDFS-Ontology-Taxonomy-Inferencing based on RDF schema.</p> <p><b>OWL:</b> OWL syntax, OWL and RDF semantics, OWL document, Using OWL to</p>					

define classes-Set operators-Enumerations-Define properties, ontology, matching- Three faces of OWL-Validate OWL. <b>Swoogle:</b> FOAF-Semantic markup-Issues-prototype system-Design of Semantic web search engine-Discovery and indexation-prototype system-case study.	
<b>Unit III : Web Content Mining &amp; Semantic Web Services</b>	<b>08 Hours</b>
Web Content Mining – Supervised Learning – Decision tree - Naïve Bayesian Text Classification -Support Vector Machines - Ensemble of Classifiers. Unsupervised Learning - K-means Clustering - Hierarchical Clustering –Partially Supervised Learning – Markov Models - Probability-Based Clustering - Evaluating Classification and Clustering – Vector Space Model – Latent semantic Indexing – Automatic Topic Extraction - Opinion Mining and Sentiment Analysis – Document Sentiment Classification. Introduction to web services- SOA, Limitations of web services. Semantic web services-OWL- S-Upper ontology-WSDL-S,OWL-S to UDDI mapping ,Design of the search engine, implementations.	
<b>Unit IV : Web Link Mining</b>	<b>08 Hours</b>
Link mining, common link mining tasks, link-based object ranking Web Link Mining – Hyperlink based Ranking – Introduction -Social Networks Analysis- Co-Citation and Bibliographic Coupling - Page Rank -Authorities and Hubs -Link-Based Similarity Search - Enhanced Techniques for Page Ranking - Community Discovery – Web Crawling -A Basic Crawler Algorithm- Implementation Issues- Universal Crawlers- Focused Crawlers- Topical Crawlers- Evaluation - Crawler Ethics and Conflicts - New Developments	
<b>Unit V : Structured Data Extraction</b>	<b>08 Hours</b>
Structured Data Extraction: Wrapper Generation – Preliminaries- Wrapper Induction- Instance-Based Wrapper Learning - Automatic Wrapper Generation: Problems - String Matching and Tree Matching - Multiple Alignment - Building DOM Trees - Extraction Based on a Single List Page and Multiple pages- Introduction to Schema Matching - Schema-Level Match -Domain and Instance- Level Matching – Extracting and Analysing Web Social Networks.	
<b>Unit VI : Web Usage Mining &amp; Semantic Web Applications</b>	<b>08 Hours</b>
Web Usage Mining - Click stream Analysis -Web <sup>193</sup> Server Log Files - Data Collection and Pre-Processing - Cleaning and Filtering- Data Modelling for Web Usage Mining - The BIRCH Clustering Algorithm -Affinity Analysis and the A Priori Algorithm – Binning. Discovery and Analysis of Web Usage Patterns – Modelling user interests –Probabilistic Latent Semantic Analysis – Latent Dirichlet Allocation Model– Applications- Collaborative Filtering- Recommender Systems – Web Recommender systems based on User and Item – PLSA and LDA Models . Semantic Web applications and services, Semantic Search, e-learning, Semantic Bioinformatics, Knowledge Base ,XML Based Web Services, Creating an OWL-S Ontology for Web Services, Semantic Search Technology, Web Search Agents and Semantic Methods.	

### Textbooks

1. Bing Liu, “Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data (Data-Centric Systems and Applications)”, Springer; 2nd Edition 2009.
2. Guandong Xu, Yanchun Zhang, Lin Li, “Web Mining and Social Networking: Techniques and Applications”, Springer; 1st Edition. 2010.
3. “Thinking on the Web” - Berners Lee, Godel and Turing, Wiley inter science, 2008.
4. “Social Networks and the Semantic Web”, Peter Mika, Springer, 2007.
5. Foundations of Semantic Web Technologies, by Pascal Hitzler, Markus Krötzsch, Sebastian Rudolph, Publisher: Chapman and Hall; 1st edition (August 6, 2009).
6. Semantic Web Programming, by John Hebel, Matthew Fisher, Ryan Blace, Andrew Perez-Lopez, and Mike Dean (Foreword). Publisher: Wiley; 1 edition (April 13, 2009).

### Reference Books

1. Zdravko Markov, Daniel T. Larose, “Data Mining the Web: Uncovering Patterns in Web Content, Structure, and Usage”, John Wiley & Sons, Inc., 2007.
2. Soumen Chakrabarti, “Mining the Web: Discovering Knowledge from Hypertext Data”, Morgan Kaufmann; edition 2002.
3. Adam Schenker, “Graph-Theoretic Techniques for Web Content Mining”, World Scientific Pub Co Inc , 2005.
4. Min Song, Yi Fang and Brook Wu, “Handbook of research on Text and Web mining technologies”, IGI global, information Science Reference – imprint of :IGI publishing, 2008.

### Journals

1. Journal of Web Semantics, Elsevier, [http://www.elsevier.com/wps/find/journaldescription.cws\\_home/671322/description](http://www.elsevier.com/wps/find/journaldescription.cws_home/671322/description)
2. International Journal On Semantic Web and Information Systems, IGI Global, <https://www.igi-global.com/journal/international-journal-semantic-web-information/1092>
3. Semantic Web – Interoperability, Usability, Applicability, <http://www.semantic-web-journal.net/>

### Resources

1. W3C Semantic Web Activity, <http://www.w3.org/2001/sw/>
2. semanticweb.org, <http://semanticweb.org>
3. SemWebCentral, <http://www.semwebcentral.org/>
4. W3Schools, <http://www.w3schools.com/>
5. John F. Sowa's Ontology pages: <http://www.jfsowa.com/ontology/>
6. The Semantic Web in Ten Passages, <http://www.dfki.uni-kl.de/~boley/sw10pass/sw10pass-en.htm>

**List of Laboratory Exercises**

1. Discuss the Meta-Search and Web Spamming concepts in detail.
2. Determine the location of a resource with the help of ontologies and reasoning using router
3. Steps in designing a search engine. Take a case study of designing your own search engine.
4. Design a crawler program to list out the URL's on the page, modify the program for again crawl those founded URL's to find more URL's using High speed computer ( Hint : call the **crawl\_site** function to **crawl** a **URL** ).
5. Write a Script/ program to perform Analysis of User's Browsing Behavior and Their Categorization Using Markov Chain Model.
6. Applications of Semantic Web, Web Search Agents

**Project Based Learning**

Study, Analysis, Design, Development, Testing and Launching of a Search Engine  
 This project should be distributed among groups of 5 students each, with any of the task defined above.

**Syllabus for Unit Tests:**

Unit Test -1	Unit – I, Unit – II, Unit – III
Unit Test -2	Unit – IV, Unit – V, Unit – VI

<b>Elective-II: Social Analytics in Digital Marketing</b>					
<b>Teaching Scheme</b>		<b>Examination Scheme</b>		<b>Credit Scheme</b>	
	<b>Hours/Week</b>		<b>Marks</b>		<b>Credits</b>
<b>Lecture:</b>	<b>04 Hours/Week</b>	<b>University Examination:</b>	<b>60 Marks</b>		
<b>Practical:</b>	<b>02 Hours/Week</b>	<b>Internal Assessment:</b>	<b>40 Marks</b>	<b>Theory</b>	<b>04</b>
		<b>Term Work</b>	<b>25 Marks</b>	<b>Practical</b>	<b>01</b>
		<b>Oral</b>	<b>25 Marks</b>		
		<b>Total</b>	<b>150 Marks</b>	<b>Total</b>	<b>05</b>
<b>Course Objective:</b>					
This course aims at giving students a knowledge of					
<ul style="list-style-type: none"> <li>• Social Media Analytics</li> <li>• Digital Marketing</li> </ul>					
<b>Prerequisite:</b>					
<ul style="list-style-type: none"> <li>• Basic knowledge of Social media sites/ apps</li> <li>• Basic knowledge of Digital Marketing tools</li> </ul>					
<b>Course Outcomes:</b> On completion of the course, students will have the ability to:					
1. Understand the Concept of Social media					
2. Understand the concept of Social media analytics					
3. Analyse various types of social media platforms.					
4. Understanding the concept of Digital marketing					
5. Analyse and understanding use of social media analytics in digital marketing					
6. Understanding the effectiveness of different social media tools/apps in social media analytics					
<b>Unit I</b>					<b>06 Hours</b>
Introduction to Social Media Analytics (SMA): The social media landscape, Need for SMA; SMA in Small organizations; SMA in large organizations; Application of SMA in different areas					
<b>Unit II</b>					<b>06 Hours</b>
Network fundamentals and models: 196 The social networks perspective - nodes, ties and influencers, Social network and web data and methods. Graphs and Matrices- Basic measures for individuals and networks. Information visualization					
<b>Unit III</b>					<b>06 Hours</b>
Making connections: Link analysis. Random graphs and network evolution. Social contexts: Affiliation and identity. Web analytics tools and techniques: Clickstream analysis, A/B testing, online surveys, Use of Google Analytics; Web crawling and Indexing; Natural Language Processing Techniques for Micro-text Analysis					

<b>Unit IV</b>	<b>06 Hours</b>
Facebook Analytics: Introduction, parameters, demographics. Analyzing page audience. Reach and Engagement analysis. Postperformance on FB, Use of Facebook Business Manager; Social campaigns. Measuring and Analyzing social campaigns, defining goals and evaluating outcomes, Network Analysis. (LinkedIn, Instagram, YouTube Twitter etc	
<b>Unit V</b>	<b>06 Hours</b>
Processing and Visualizing Data, Influence Maximization, Link Prediction, Collective Classification. Applications in Advertising and Game Analytics (Use of tools like Unity30 / PyCharm). Introduction to Python Programming, Collecting and analyzing social media data; visualization and exploration	
<b>Unit VI</b>	<b>06 Hours</b>
Analyzing Social media campaign: Analyzing the social media of any ongoing campaigns and present the findings.	
<b>Textbooks</b>	
<ol style="list-style-type: none"> <li>1. Mathew Ganis, Avinash Koivrkar :Social Media Analytics IBM Press</li> <li>2. Jim Sterne Social Media Metrics Wiley</li> </ol>	
<b>Reference Books</b>	
<ol style="list-style-type: none"> <li>1. Oliver Blanchard Social Media ROI Que Publishing Latest 4</li> <li>2. Marshall Sponder, Gorah F. Khan Digital Analytics for Marketing Routledge 2017 / 1st 5</li> <li>3. Marshall Sponder Social Media Analytics McGraw Hill Latest 6</li> <li>4. Tracy L. Tuten, Michael R. Solomon Social Media Marketing Sage 2</li> </ol>	
<b>List of Assignments</b>	
<ol style="list-style-type: none"> <li>1. Enlist and describe different social media platforms.</li> <li>2. Describe the use of social media for any business</li> <li>3. Describe the different types of data commonly found on social platforms</li> <li>4. Understand the ethical sensitivities in obtaining and operating on social data</li> <li>5. Use a social platform API to obtain data and understand the structure of those data</li> <li>6. Explain and discuss the importance of Social Media Analytics.</li> <li>7. Evaluate effectiveness of different social media campaigns using various analytical tools.</li> <li>8. Examine how different industries across the globe are using social media analytics</li> </ol>	
<b>Project Based Learning</b>	
<ol style="list-style-type: none"> <li>1. Analyzing the social media of any ongoing campaigns and present the findings.</li> </ol>	
<b>Syllabus for Unit Tests:</b>	
Unit Test -1	Unit - I, Unit - II, Unit - III
Unit Test -2	Unit - IV, Unit - V, Unit - VI

<b>Elective-II: Management Information System</b>					
<b>Teaching Scheme</b>		<b>Examination Scheme</b>		<b>Credit Scheme</b>	
	<b>Hours/Week</b>		<b>Marks</b>		<b>Credits</b>
<b>Lecture</b>	<b>04</b>	<b>University Examination</b>	<b>60</b>	<b>Theory</b>	<b>04</b>
		<b>Internal Assessment</b>	<b>40</b>		
<b>Practical</b>	<b>02</b>	<b>Term Work</b>	<b>25</b>	<b>Practical</b>	<b>01</b>
		<b>Oral</b>	<b>25</b>		
<b>Total</b>	<b>06</b>	<b>Total</b>	<b>150</b>	<b>Total</b>	<b>05</b>
<b>Course Objective:</b>					
This course aims at giving students a knowledge of Information Management along with its applications in terms of the following: <ul style="list-style-type: none"> <li>• To understand the basics of Management Information System.</li> <li>• Learn to evaluate information Management systems</li> <li>• To describe the role of information technology and decision support systems in business and record the current issues with those of the firm to solve business problems.</li> <li>• To provide the theoretical models used in database management systems to answer business questions.</li> </ul>					
<b>Prerequisite:</b>					
<ul style="list-style-type: none"> <li>• Students must have the minimal concept of Data Base Management Systems</li> <li>• They must also have the concept of different types of algorithms used for searching data</li> <li>• To knowledge of DBMS</li> </ul>					
<b>Course Outcomes:</b> On completion of the course, students will have the ability to:					
1. Describe the objectives of Management information systems.					
2. Relate the basic concepts and technologies used in the field of management information systems					
3. Outline the role of the ethical, social, and security issues of information systems					
4. Understand query, document, and phrase translation.					
5. Apply the understanding of how various information systems like DBMS work together to accomplish the information objectives of an organization					
6. Design and implement a recommender system.98					
<b>Unit I</b> Management information system in a digital firm:					<b>08 Hours</b>
Goals and history of MIS, Objectives of Management Information System, MIS concept - Definition –Role of the MIS.System View of Business, Process of MIS.Development of MIS within in organization.					
<b>Unit - System analysis and design:</b> <b>Implementation and controlling of management</b> Information System Approach and Introduction to Information System. Management as a control system. Impact of the MIS-MIS and the user. Need for system analysis. System analysis of a new requirements. System analysis of the existing system					

<b>Unit III Technology of information system:</b>	<b>08 Hours</b>
Data process- Transaction and application process Information system process; Unified communication and network. Computer Operation Of Manual Information System. Conversion of manual to Computer Based System. Resources and Components of Management information System.	
<b>Unit IV Data base management system:</b>	<b>08 Hours</b>
Objectives of data base approach. Characters of database Management systems Integration and Automation of Business Function and Developing. Components of DBMS packages. Data models.	
<b>Unit V - Management Information system applications</b>	
MIS applications, DSS – GDSS - DSS applications in E enterprise. Types of Applications. Features of Management System. e, E-communication, Business Process Engineering. Inout Output Design.	
<b>Unit VI Architecture AND Design of IS:</b>	<b>08 Hours</b>
Architecture Development and maintenance of Information System, Factor of Success and failure, Value and Risk of MIS.	
<b>Textbooks:</b>	
<ol style="list-style-type: none"> <li>1. Management Information Systems: Managing the Digital Firm" by Kenneth C Laudon.</li> <li>2. "Management Information System: Conceptual Foundations - Structure and Development" by Gordon Davis and Margrethe Olson</li> <li>3. "Management Information Systems: Managerial Perspectives" by D P Goyal</li> </ol>	
<b>Reference Books:</b>	
<ol style="list-style-type: none"> <li>1. Jawadkar, W.S., “Management Information Systems”, Tata McGraw Hill Private Limited, New Delhi, 2009</li> <li>2. Mahadeo Jaiswal, Monika Mital: “Management Information System”, Oxford University Press, New Delhi, 2008.</li> </ol>	
<ol style="list-style-type: none"> <li>1. Introduction to Management information System 199</li> <li>2. Explain Types of Information.</li> <li>3. Discuss Why do we need Computer Based System</li> <li>4. Steps to Avail Management Information Systems (MIS) Assignment Help By Academic Expert.</li> <li>5. Computer Operation Of Manual Information System.</li> <li>6. Architecture Development and maintenance of Information System,</li> </ol>	
<b>Project Based Learning</b>	
<ol style="list-style-type: none"> <li>1. Implementation Management as a control system</li> <li>2. Implementation Transaction and application process Information system</li> </ol>	

3. Implementation Resources and Components of Management information System.	
<b>Syllabus for Unit Tests:</b>	
Unit Test -1	Unit – I, Unit – II, Unit – III
Unit Test -2	Unit – IV, Unit – V, Unit – VI

<b>Elective-II Cyber Security</b>					
<b>Teaching Scheme</b>		<b>Examination Scheme</b>		<b>Credit Scheme</b>	
	<b>Hours/Week</b>		<b>Marks</b>		<b>Credits</b>
<b>Lecture:</b>	<b>04 Hours/Week</b>	<b>University Examination:</b>	<b>60 Marks</b>		
<b>Practical:</b>	<b>02 Hours/Week</b>	<b>Internal Assessment:</b>	<b>40 Marks</b>	<b>Lecture</b>	<b>04</b>
		<b>Term Work &amp; Oral</b>	<b>50 Marks</b>	<b>Practical</b>	<b>01</b>
		<b>Total</b>	<b>150 Marks</b>	<b>Total</b>	<b>05</b>
<b>Course Objective:</b>					
To understand threats and vulnerabilities to security.					
To understand Information security models					
To understand laws for cyber security					
This programme aims to help the learners to navigate the foundations and skills necessary to build a career in the field of cyber security.					
<b>Prerequisite:</b>					
Basics of security					
Knowledge of networking					
<b>Course Outcomes:</b> On completion of the course, students will have the ability to:					
1. Understand Information security and it's threats.					
2. Understand cyber vulnerability and network security					
3. Discuss authentication tools and information security models					
4. Implement various security methods for web and mobiles.					
5. Understand cyber crimes					
6. Understand cyber security laws					
<b>Unit I Introduction to Information Security and Potential Threats</b>					
					<b>08 Hours</b>
Introduction to Cyber Space, Cyber Security and Information Systems, Cyber Attacks and their Classification, Types of Malware and Threats.					
<b>Unit II Cyber Vulnerability and Network Security</b>					
					<b>08 Hours</b>
Assessment of Vulnerability, Intrusion Detection and Prevention Systems, Internet Protocols, Operating System Security and Network Security.					
<b>Unit III User Authentication Tools and Information Security Models</b>					
					<b>08 Hours</b>
User Authentication Methods, Information Security Models and Security Mechanisms, Biometric Systems and Biometric Authentication Processes.					
<b>Unit IV Web and Mobile App security Methods</b>					
					<b>08 Hours</b>
Web Security and Email Security, Security of Mobile Devices and Cloud Space, Social Media Security and IoT Security					
<b>Unit V Cyber Crimes and Digital Forensic Science</b>					
					<b>08 Hours</b>
Cyber Crimes, Scams and Frauds, Digital Forensic Investigation Methods, Cyber Trails, Branches of Digital Forensics, Reporting, Management of Evidence					
<b>Unit VI Laws for Cyber Security</b>					
					<b>08 Hours</b>

Jurisdiction of Cyber Crime, Information Technology Act 2000 and its Amendments, Validity of Digital Communication Evidences (Call Records /Emails/SMS), RBI Act and IPR Act	
<b>Textbooks</b>	
1. William Stallings, Computer Security: Principles and Practices, Pearson 6 Ed, ISBN 978-0-13-335469-0	
2. Nina Godbole, Sunit Belapure , Cyber Security- Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley India Pvt.Ltd, ISBN- 978-81-265-2179-1	
<b>Reference Books</b>	
1. Bruce Schneier , Applied Cryptography- Protocols, Algorithms and Source code in C, Algorithms, Wiley India Pvt Ltd, 2nd Edition, ISBN 978-81-265-1368-0.	
2. CK Shyamala et al., Cryptography and Security, Wiley India Pvt. Ltd, ISBN-978-81-265-2285-9.	
<b>List of Experiments</b>	
1. Write a program to perform web security audit.	
2. Write a program for Biometric authentication process.	
3. Write a program to examine SQL injection attack.	
4. Write a program to perform online and offline attacks of password cracking.	
5. Evaluate network defense tools for DOS attack.	
6. Evaluate network defense tools for IP spoofing.	
7. A Case study on Cyber Crime.	
8. A Case study on scams and Frauds.	
<b>Project Based Learning</b>	
1. <a href="#">Keylogging</a>	
2. <a href="#">Packet Sniffing</a>	
3. <a href="#">Breaking Caesar Cipher</a>	
4. <a href="#">SQL Injection</a>	
5. <a href="#">Hacking an Offline Device</a>	
6. <a href="#">Encrypting Images</a>	
7. <a href="#">Online Fund Transfers with DES Encryption</a>	
8. <a href="#">Detection and Intimation of Theft</a>	
9. <a href="#">Card Payment Security Using RSA</a>	
10. <a href="#">Detecting Data Leaks via Sql Injection Prevention on an E-Commerce</a>	
<b>Syllabus for Unit Tests:</b>	
Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

**Subject : ITL-VI**

<b>Teaching Scheme</b>	<b>Examination Scheme</b>	<b>Credit Allotted</b>
<b>Theory : 00 Hrs/Week</b>	<b>End Semester Examination : 00 Marks</b>	<b>Theory :00</b>
<b>Practical : 02 Hrs/Week</b>	<b>Internal Assessment : 50 Marks</b>	<b>Practical : 01</b>
	<b>Term Work:25 Marks</b>	
	<b>Practical : 25 Marks</b>	
<b>Total: 02 Hours/Week</b>	<b>Total :100 Marks</b>	<b>Total Credits: 01</b>

**Course Objectives:**

- 1) Design solution to deploy the application.**
- 2) Apply the configuration management mechanisms.**

**Course Prerequisites:**

**Students should have knowledge of**  
Agile methodology, Basic Linux

**Course Outcome:**

**Students will be able to:**

- 1) Understand the Agile using DevOps
- 2) Apply Amazon AWS for containerization.
- 3) Analyze monitoring and logging using Kibana
- 4) Implement the CICD approach.
- 5) Perform the configuration management with Ansible.
- 6) Apply the kubernetes for Orchestration.

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<b>UNIT-I</b>	<b>Dev Ops Essentials</b>	<b>(08 Hours)</b>
	Introduction to advances in Dev Ops, Linux commands and bash scripting which are frequently used by DevOps engineers.	
<b>UNIT-II</b>	<b>Containerization</b>	<b>(08 Hours)</b>
	Introduction to Containerization, concepts of docker and the difference between docker and VM. commands in docker and deployment of a monolithic application using Docker with AWS VM using AWS ECS service. setup and configure jobs on Jenkins	

<b>UNIT-III</b>	<b>Monitoring and logging</b>	<b>(08 Hours)</b>
	containerise applications at scale. Handling scalability issues with web applications by configuring load balancers, deciding server's geographical location, Application Monitoring using Kibana/ELK cluster. Site Reliability.	
<b>UNIT-IV</b>	<b>CICD</b>	<b>(08 Hours)</b>
	Automated Testing using Selenium and Jenkins, continuous integration, Tool, Applications using Maven, SonarQube. Continuous deployment using Amazon AWS.	
<b>UNIT-V</b>	<b>System Provisioning and Configuration Management</b>	<b>(08 Hours)</b>
	Introduction to Configuration Management via tools like Ansible and Terraform.	
<b>UNIT-VI</b>	<b>Orchestration using Kubernetes</b>	
	Orchestrate multiple docker containers using an orchestration tool like Kubernetes. Installation, component, architecture, creating deployment, volumes, secret and creation of CICD pipeline involving kubernetes.	<b>(08 Hours)</b>
<b>Assignment List:</b>		
1)	Implement all Linux command by deploying on VM	
2)	Use Amazon AWS for containerization.	
3)	Create Azure Pipeline	
4)	Deploy the application using Nexus.	
5)	Deploy Application using SonarQube.	
6)	Use Amazon AWS for	
7)	Implement Kibana for monitoring and logging.	
8)	Implement the configuration management using Ansible.	
9)	Deploy Docker Container app using Kubernetes.	
10)	Design and deploy project using Microsoft Azure.	
<b>Text Books:</b>		
1)	DevOps Tools from Practitioner's Viewpoint Deepak Gaikwad, Willey.	
2)	Docker for Developers: Develop and run your application with Docker containers using DevOps tools for continuous delivery Richard McGuire, Pact.	
3)	Hands-on DevOps with Linux, Mitesh Soni, bpb.	
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<b>Reference Books:</b>		
1)	AWS Certified DevOps Engineer - Professional Certification and Beyond: Pass the DOP-C01 exam and prepare for the real world using case studies and real-life examples, Adam Book.	
2)	Automated Deep Learning Using Neural Network Intelligence: Develop and Design PyTorch and TensorFlow Models Using Python, Ivan Gridin.	
3)	Agile Model-Based Systems Engineering Cookbook: Improve system development by applying proven recipes for effective agile systems engineering , Dr. Bruce, Pacto	