

**ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY AND SCIENCES (A)**  
**(UGC Autonomous)**  
**Approved by AICTE, Affiliated to Andhra University, Accredited by**  
**N.B.A. & NAAC with 'A' Grade**  
**(Estd : 2001)**



**2022 - 23**

**Academic Regulations (R19-CSE) Curriculum & Syllabi**

**(IV Year II Semester)**

**DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING**

## DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

### VISION

Our vision is to emerge as a world class Computer Science and Engineering department through excellent teaching and strong research environment that responds swiftly to the challenges of changing computer science technology and addresses technological needs of the stakeholders.

### MISSION

To enable our students to master the fundamental principles of computing and to develop in them the skills needed to solve practical problems using contemporary computer-based technologies and practices to cultivate a community of professionals who will serve the public as resources on state-of-the-art computing science and information technology.

### PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO-1	Employability	Work as Competent Computer Engineer either globally or locally by engaging in professional practice in a variety of roles with ability to serve as a team or individual.
PEO-2	Higher studies	Prepared to pursue masters or research programmes in computer science or other disciplines.
PEO-3	Entrepreneurship	Become successful Entrepreneurs who demonstrate strong technical and leadership skills to bring out innovative designs/products that also address social issues.
PEO-4	Lifelong learning and ethics	Adapt to rapidly changing technology in engineering domains through continuous learning and practice code of ethics.

### PROGRAM SPECIFIC OUTCOMES (PSOs)

1	Programming and software Development skills: Ability to acquire programming efficiency to analyze, design and develop optimal solutions, apply standard practices in software project development to deliver quality software product.
2	Computer Science Specific Skills: Ability to formulate, simulate and use knowledge in various domains like data engineering, image processing and information and network security, artificial intelligence etc., and provide solutions to new ideas and innovations

## PROGRAM OUTCOMES (POs)

Graduate Attribute1:	Engineering Knowledge
PO-1	Apply the knowledge of basic engineering sciences, humanities, core engineering and computing concept in modeling and designing computer based systems.
Graduate Attribute2:	Problem Analysis
PO-2	Identify, analyze the problems in different domains and define the requirements appropriate to the solution.
Graduate Attribute3:	Design/Development of Solution
PO-3	Design, implement & test a computer-based system, component or process that meet functional constraints such as public health and safety, cultural, societal and environmental considerations.
Graduate Attribute4:	Conduct Investigations of Complex Problems
PO-4	Apply computing knowledge to conduct experiments and solve complex problems, to analyze and interpret the results obtained within specified timeframe and financial constraints consistently.
Graduate Attribute5:	Modern Tool Usage
PO-5	Apply or create modern techniques and tools to solve engineering problems that demonstrate cognition of limitations involved in design choices.
Graduate Attribute6:	The Engineer and Society
PO-6	Apply contextual reason and assess the local and global impact of professional engineering practices on individuals, organizations and society.
Graduate Attribute7:	Environment and Sustainability
PO-7	Assess the impact of engineering practices on societal and environmental sustainability.
Graduate Attribute8:	Ethics
PO-8	Apply professional ethical practices and transform into good responsible citizens with social concern.
Graduate Attribute9:	Individual and Team Work
PO-9	Acquire capacity to understand and solve problems pertaining to various fields of engineering and be able to function

	effectively as an individual and as a member or leader in a team.
Graduate Attribute10:	Communication
PO-10	Communicate effectively with range of audiences in both oral and written forms through technical papers, seminars, presentations, assignments, project reports etc.
Graduate Attribute11:	Project Management and Finance
PO-11	Apply the knowledge of engineering, management and financial principles to develop and critically assess projects and their outcomes in multidisciplinary areas.
Graduate Attribute12:	Life-long Learning
PO-12	Recognize the need and prepare oneself for lifelong self-learning to be abreast with rapidly changing technology.

### IV Year II Semester Course Structure

CODE	SUBJECT NAME	Category	Scheme of instruction			Sessional marks	Semester end Exam marks	Total Marks	Credits
			L	T	P				
CSE421	OPEN ELECTIVE-IV* (Emerging Technologies)	OE	3	1	0	40	60	100	3
CSE422	PROFESSIONAL ELECTIVE - VI	PE	3	1	0	40	60	100	3
CSE423	Project Lab	PR	0	0	9	100	100	200	8
<b>Total</b>			<b>6</b>	<b>2</b>	<b>9</b>	<b>180</b>	<b>220</b>	<b>400</b>	<b>14</b>

PROFESSIONAL ELECTIVES		OPEN ELECTIVES	
PE VI	CSE422(A) Information Retrieval Systems CSE422(B) Cyber Security CSE422(C) Social Network Analysis CSE422(D) Cloud Computing	OE IV	CSE421(A) RPA using UiPath CSE421(B) DevOps CSE421(C) Data Visualization using Tableau CSE421(D) .Net Frameworks

L - Lecture (clock hours) T - Tutorial (clock hours) P - Practical (clock hours)  
 OE – Open Elective PE - Professional Elective SOC - Skill Oriented Course  
 PC – Professional course HS – Humanity Sciences PR - Project

<b>Robotic Process Automation (RPA) using UiPath (Open Elective -IV)</b>	
<b>Code: CSE421(A)</b>	<b>Credits: 3</b>
Instruction:	Sessional Marks: 40
End Exam: 3 Hours	End Exam Marks: 60

**Pre-requisites:** Basic Knowledge of Programming Skills

**Course Objectives:**

- Create robots from scratch, using one of the market leaders in RPA
- Develop automation apps and deploy them to all the computers in your department
- Understand the key building blocks and components of UiPath
- Build, test and perform enterprise automation tasks with UiPath
- Apply UiPath programming techniques to deploy robot configurations

**Course Outcomes (CO):**

By the end of the course, the student will be able to:	
<b>CO-1</b>	Discuss Robotic Process Automations and types of robots and Panels
<b>CO-2</b>	Explain and apply various control flows,
<b>CO-3</b>	Apply data manipulation and taking control and act on controls
<b>CO-4</b>	Discuss and explain exception handling and debugging techniques
<b>CO-5</b>	Discuss about workflows, deployment and publishing bots

**Mapping of Course Outcomes with Program Outcomes:**

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
<b>1</b>	2	3	2	-	-	-	-	-	-	1	-	-	2	-
<b>2</b>	2	3	3	-	-	-	-	-	-	1	-	-	2	-
<b>3</b>	2	3	2	-	-	-	-	-	-	1	-	-	2	-
<b>4</b>	2	3	2	-	-	-	-	-	-	1	-	-	2	-
<b>5</b>	2	3	2	-	-	-	-	-	-	1	-	-	2	-

## SYLLABUS

### UNIT – I:

10 Periods

#### **RPA Design and Development:**

Introduction: What is RPA, RPA Platforms, UiPath Stack: Types of Bots, Learning UiPath Studio: User Interface Design, Panels and Toolbar.

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Understand the basic functionality of RPA
2. Discuss UiPath Studio and panels

### UNIT-II:

10 Periods

#### **RPA Tool Introduction and Basics:**

Sequence, Flowchart, and Control Flow: Sequencing the workflow, Activities, Control flow, various types of loops, and decision making

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Discuss sequence and flow design
2. Apply various control flow, activities and decision making

### UNIT-III:

10 Periods

#### **Data Manipulation:**

Data Manipulation: Variable and Scope, Collections, Data Table, Clipboard Management, File Operation, CSV/Excel to data table and vice versa

Taking Control of the Controls: Finding and attaching windows, finding the control, Act on controls, working with Ui Explorer.

Handling User Events and Assistant Bots: Monitoring system event triggers, Monitoring system event triggers

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Discuss data manipulation and controls
2. Handle user events and triggering and assistant bots

### UNIT-IV:

10 Periods

#### **Exception Handling:**

Exception Handling, Debugging, and Logging: Common exceptions and ways to handle them, Logging and taking screenshots, Debugging techniques, Collecting crash dumps, Error reporting.

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Explain exception handling and debugging
2. Discuss logging and error reporting

### UNIT-V:

10 Periods

#### **Deploying and Maintaining the Bot:**

Managing and Maintaining the Code: Project organization, Nesting workflows, Reusability of workflows

Deploying and Maintaining the Bot: Publishing using publish utility, Overview of Orchestration Server, Using Orchestration Server to control and deploy bots

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Discuss project organization and workflows
2. Build to deploy and maintain the bots

**Textbooks:**

1. “Alok Mani Tripathi, Learning Robotic Process Automation” Packt Publishing, 2018
2. “Adeel Javed, Anum Sundrani, Nadia Malik, Sidney Madison, Prescott, Robotic Process Automation using UiPath StudioX: A Citizen Developer’s Guide to Hyperautomation” APress Publishing, 2021

**Reference books:**

1. “Nandan Mullakara, Arun Kumar Asokan Robotic Process Automation Projects”, Packt Publishing, 2020
2. “Niyaz Ahmed, Lahiru Fernando, Rajaneesh Balakrishnan, UiPath Associate Certification Guide”, Packt Publishing, 2022



<b>DevOps (Open Elective -IV)</b>	
<b>Code: CSE421(B)</b>	<b>Credits: 3</b>
Instruction:	Sessional Marks: 40
End Exam: 3 Hours	End Exam Marks: 60

**Pre-requisites:** Basic Knowledge of Programming Skills

**Course Objectives:**

- To Understand key concepts and principles of DevOps.
- To list and explain business benefits of DevOps and Continuous Delivery
- Describe how DevOps utilises Lean and Agile methodologies to drive product-focused development
- List the most common and popular DevOps tools

**Course Outcomes (CO):**

By the end of the course, the student will be able to:	
<b>CO-1</b>	Make use of the Influence of DevOps on Software Development Methodologies along with its Misconceptions and Anti-Patterns
<b>CO-2</b>	Illustrate the Methodologies of Four Pillars of DevOps
<b>CO-3</b>	Troubleshoot the common problems that can arise in the effective DevOps
<b>CO-4</b>	Inference the culture of DevOps to the Enterprises for achieving agility and innovation in its business units
<b>CO-5</b>	Discuss about DevOps Practices for deployment

**Mapping of Course Outcomes with Program Outcomes:**

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
<b>1</b>	2	3	2	-	-	-	-	-	-	1	-	-	2	-
<b>2</b>	2	3	3	-	-	-	-	-	-	1	-	-	2	-
<b>3</b>	2	3	2	-	-	-	-	-	-	1	-	-	2	-
<b>4</b>	2	3	2	-	-	-	-	-	-	1	-	-	2	-
<b>5</b>	2	3	2	-	-	-	-	-	-	1	-	-	2	-

## SYLLABUS

### UNIT-I:

10 Periods

#### Introduction to DevOps:

What is DevOps, A History of DevOps, Fundamental Terminology and Concepts – Software Development Methodologies, Operations Methodologies, Systems Methodologies, Development Release and Deployment Concepts, Infrastructure Concepts, Cultural Concepts. DevOps Misconceptions and Anti-Patterns, the Four Pillars of Effective DevOps

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Able to Understand the foundations of DevOps
2. Able to discuss the infrastructure and Cultural concepts.

### UNIT-II:

10 Periods

#### Collaboration:

Defining Collaboration, Individual Differences and Backgrounds, Opportunities for Competitive Advantage, Mentorship, Introducing Mindsets, Mindsets and Learning Organizations, The Role of Feedback, Reviews and Rankings, Communication and Conflict Resolution Styles, Empathy and Trust, Humane Staffing and Resources, Misconceptions and Troubleshooting of Collaboration

**Affinity:** What Makes a Team, Teams and Organizational Structure, Finding Common Ground Between Teams, Benefits of Improved Affinity, Requirements for Affinity, Measuring Affinity, Misconceptions and Troubleshooting of Affinity

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Able to discuss collaborations and its functionalities
2. Able to explain different resources and Affinity

### UNIT-III:

**Tools:** Software Development, Automation, Monitoring, Evolution of the Ecosystem, The Value of Tools to People, What Are Tools?, The Right Tools for Real Problems, Embracing Open Source, Standardization of Tools, Consistent Processes for Tool Analysis, Exceptions to Standardization, Irrelevance of Tools, The Impacts of Tools on Culture, Selection of Tools, Auditing Your Tool Ecosystem, Elimination of Tools, Misconceptions and Troubleshooting of Tools

10 Periods

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Able to discuss Tools of DevOps
2. Able to explain different Tools and addressing how to apply

### UNIT-IV:

10 Periods

#### Scaling:

Understanding Scaling, Considering Enterprise DevOps, Organizational Structure, Team Flexibility, Organizational Life cycle, Complexity and Change, Scaling for Teams, Team Scaling and Growth Strategies, Scaling for Organizations, Misconceptions and Troubleshooting of Scaling

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Able to discuss different scaling of DevOps
2. Able to Explain the life cycle and its organization including troubleshooting

### UNIT-V:

10 Periods

**DevOps Practices:** Implementing CI/CD and continuous deployment, Understanding IaC practices, DevOps Best Practices: Automating everything, Choosing the right tool, Writing all your configuration in code, Designing the system architecture, Building a good CI/CD pipeline, Integrating tests, Applying security with DevSecOps, Monitoring your system, Evolving project management

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Able to apply CI/CD and IaC Practices
2. Able to Demonstrate best practice tools

**Textbooks:**

1. “Jennifer Davis, RynDaniels, Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale, O’Reilly.
2. Mikael Krief, Learning DevOps, Packt Publications

**Reference books:**

1. “Verona, Joakim. Practical DevOps. Packt Publishing Ltd.
2. By Jez Humble and David Farley, Continuous Delivery: Reliable Software Releases through Build, Test and Deployment Automation, Addison-Wesley Professional
3. Mandi Walls, Building a DevOps Culture, O’Reilly publications.

<b>Data Visualization using Tableau (Open Elective -IV)</b>	
<b>Code: CSE421(C)</b>	<b>Credits: 3</b>
Instruction:	Sessional Marks: 40
End Exam: 3 Hours	End Exam Marks: 60

**Pre-requisites:** Basic Knowledge of Visualization and Database and Datasets

**Course Objectives:**

- The course should enable the students to: Prepare to become Junior RPA Developers
- Learn the basic concepts of Robotic Process Automation
- Develop familiarity and deep understanding of UiPath tools
- Develop the ability to independently design and create robots for business processes

**Course Outcomes (CO):**

By the end of the course, the student will be able to:	
<b>CO-1</b>	Discuss about visualization and visual analytics
<b>CO-2</b>	Apply data preparation using discuss joins, grouping and aggregate methods
<b>CO-3</b>	Explain Data Exploration: Distributions and Relationships
<b>CO-4</b>	Discuss about data analysis and creation of tables and customization
<b>CO-5</b>	Discuss about designing dashboards and storytelling

**Mapping of Course Outcomes with Program Outcomes:**

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
<b>1</b>	2	3	2	1	-	-	-	-	-	1	-	-	2	1
<b>2</b>	2	3	3	2	-	-	-	-	-	1	-	-	2	1
<b>3</b>	2	3	2	2	-	-	-	-	-	1	-	-	2	2
<b>4</b>	2	3	2	2	-	-	-	-	-	1	-	-	2	2
<b>5</b>	2	3	2	2	-	-	-	-	-	1	-	-	2	2

## SYLLABUS

### UNIT-I:

10 Periods

#### Introduction:

Foundations for building visualizations: Measures and Dimensions, Importance of Visual Analytics, Discrete and Continuous fields, Applications, Introduction to Tableau Desktop, Connecting to Data source, various data sources and formats, Visualizing Data: Static charts

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Understand foundations of Visualization and its importance
2. Discuss how to connect to different data sources and static visualization charts

### UNIT-II:

10 Periods

#### Data Preparation:

Introduction, connecting to Excel file, various types of Joins, Data Transformation in Data Pane, Data Blending and Data Filters, Flow, Data Preparation using Clean, Group and Split, Aggregation, Pivot, Join, and Union and Exports

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Apply various join operations and data transformation
2. Apply data cleaning and grouping methods
- 3.

### UNIT-III:

10 Periods

#### Data Exploration:

Data exploring across dimensions, across measures, composition of charts.

Data Exploration: Distributions and Relationships, Geographical Data, Creating Maps

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Explain how to explore data across dimensions and measures, composition of charts
2. Discuss exploration using distributions and relationships using geographical data as in Maps

### UNIT-IV:

10 Periods

#### Data Analysis:

Creating different calculations, handling Null values, Table Operations, Custom table calculations, formatting.

**Learning Outcomes:** At the end of this Unit the student will be able to:

3. Apply different calculations and handling null values
4. Create table and perform table operations and formatting

### UNIT-V:

10 Periods

#### Dashboards and Storyboards:

Introduction to Dashboards, Designing, Creating Storyboards, Building Views, Designing of different displays

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Discuss about Dashboards and designing
2. Create storyboards and storytelling through different views

**Textbooks:**

3. “Joshua N. Milligan Learn Tableau 2022”, Packt Publishing, 2019.
4. “Sumit Gupta, Sylvester Pinto, Shweta Sankhe-Savale, JC Gillet, and Kenneth Michael Cherven The Tableau Workshop”, Packt Publishing, 2022.

**Reference books:**

3. “David Baldwin, Mastering Tableau” Packt Publishing, 2017
4. “Prachi Manoj Joshi and Parikshit Narendra Mahalle Data Storytelling and Visualization with Tableau A Hands-on Approach”, CRC Press.

<b>.Net Frameworks (Open Elective -IV)</b>	
<b>Code: CSE421(D)</b>	<b>Credits: 3</b>
Instruction:	Sessional Marks: 40
End Exam: 3 Hours	End Exam Marks: 60

**Pre-requisites:** Basic Knowledge of Programming Skills

**Course Objectives:**

- To learn basic programming in C# and the object-oriented programming concepts
- To update and enhance skills in writing Windows applications, ADO.NET and ASP .NET
- To study the advanced concepts in data connectivity, WPF, WCF and WWF with C# and .NET 4.5
- To implement mobile applications using .Net compact framework
- To understand the working of base class libraries, their operations and manipulation of data using XML

**Course Outcomes (CO):**

By the end of the course, the student will be able to:	
<b>CO-1</b>	Understand the development and deployment cycles of enterprise applications
<b>CO-2</b>	Develop ASP.NET Web Services, secure web services, and .NET remoting applications.
<b>CO-3</b>	Develop web applications using a combination of client-side
<b>CO-4</b>	Understand the protocols behind web services
<b>CO-5</b>	Develop network applications using state-of-the-art RPC technologies including: .NET remoting, and Web Services (SOAP) and cross-platform mobile applications using HTML5 and PhoneGap.

**Mapping of Course Outcomes with Program Outcomes:**

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
<b>1</b>	2	3	2	-	-	-	-	-	-	1	-	-	2	-
<b>2</b>	2	3	3	-	-	-	-	-	-	1	-	-	2	-
<b>3</b>	2	3	2	-	-	-	-	-	-	1	-	-	2	-
<b>4</b>	2	3	2	-	-	-	-	-	-	1	-	-	2	-
<b>5</b>	2	3	2	-	-	-	-	-	-	1	-	-	2	-

## SYLLABUS

### UNIT-I:

10 Periods

#### **Introduction:**

Introductions, .NET Overview, CLR, Assemblies (monolithic vs. component-based applications), Execution Model, Client-Side vs. Server-Side Programming, Web Technologies  
HTML, JavaScript, CSS, jQuery, Open Designs, Introduction to C#: Types and program structure

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Understand and discuss about .Net Technologies
2. Discuss about execution models and web technologies

### UNIT-II:

10 Periods

#### **Environment and Class Library:**

Development Environment Setup, ISS, SQL Server and Visual Studio, Advanced C#: OOP, Delegates, Events, Attributes, unsafe code, .NET Interop  
.NET Framework Class Library (FCL): System, Collections, I/O, Networking, Threading, Transactions, Exceptions

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Discuss about Development environment
2. Explain about .NET Framework Class library and collections.

### UNIT-III:

10 Periods

#### **Database Modeling and Programming Model:**

Databases and Data Access using ADO.NET & LINQ

Introduction to ASP.NET, programming model, server controls, data binding

ASP.NET state management, tracing, caching, error handling, security, deployment, user and custom controls, DotNet Nuke

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Connect Database model and access tools
2. Discuss ASP.Net and Programming model.

### UNIT-IV:

10 Periods

#### **Exposing and Web Services:**

Exposing and consuming ASP.NET Web Services, XML, RESTful, SOAP, DISCO, UDDI

Continue with Web Services, Developing Secure Web Services

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Explain exposing and XML services
2. Discuss different web services.

### UNIT-V:

10 Periods

#### **Remoting and Cross Platform Design:**

.NET remoting

HTML5 and Cross-Platform Mobile Apps using PhoneGap

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Discuss about .NET Remoting
2. Explain about cross-platform deployment



**Textbooks:**

1. Beginning ASP.NET 4.5 in C# and VB, Wrox, 2012, ISBN-10: 1118311809
2. Beginning ASP.NET 4.5 in C#, Apress, 2012, ISBN-10: 1430242515
3. Pro C# with .NET 3.0, Andrew Troelsen, Apress, 2007, ISBN 978-1-59059-823-8

**Reference books:**

1. Microsoft Windows SharePoint Services 3.0 Step by Step, Olga Londer, Todd Bleeker, Penelope Coventry, James Edelen, Microsoft Press, 2005, ISBN-10: 0735623635
2. Microsoft .NET XML Web Services: Step by Step, Adam Freeman, Allen Jones, Microsoft Press, 2003, ISBN 0-7356-1720-1
3. Microsoft .NET Distributed Applications: Integrating XML Web Services and .NET Remoting, Matthew MacDonald, ISBN 0-7356-1933-6,

<b>Information Retrieval Systems (Professional Elective -VI)</b>	
<b>Code: CSE422(A)</b>	<b>Credits: 3</b>
Instruction:	Sessional Marks: 40
End Exam: 3 Hours	End Exam Marks: 60

**Pre-requisites:** Foundations on Data Structures, Relational Database Systems, Bigdata

**Course Objectives:**

To analyze and apply the foundation aspects involved in search, index and retrieval of various kinds of data sources by applying Information Retrieval representation, tools, techniques and strategies

**Course Outcomes (CO):**

By the end of the course, the student will be able to:	
<b>CO-1</b>	Discuss the functional overview and capabilities of the Information Retrieval System
<b>CO-2</b>	Apply indexing and various types of data structures for Information Retrieval.
<b>CO-3</b>	Analyze and apply the Automatic Indexing and Clustering.
<b>CO-4</b>	Explain different user search techniques.
<b>CO-5</b>	Visualize the Information and retrieval of the Multimedia Information.

**Mapping of Course Outcomes with Program Outcomes:**

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
<b>1</b>	1	1	1	1	-	1	1	-	-	-	-	1	1	1
<b>2</b>	2	2	2	2	1	2	1	1	-	-	-	2	1	2
<b>3</b>	1	2	2	2	1	2	1	1	-	-	-	1	1	2
<b>4</b>	1	1	1	1	1	1	1	1	-	-	-	1	1	1
<b>5</b>	1	1	1	1	2	1	1	1	-	-	-	2	1	1

## SYLLABUS

### UNIT-I:

10 Periods

#### **Introduction:**

Introduction to Information Retrieval Systems: Definition of Information Retrieval System, Objectives of Information Retrieval Systems, Functional Overview, Relationship to Database Management System, Digital Libraries and Data Warehouses.

Information Retrieval System Capabilities: Search Capabilities, Browse Capabilities, Miscellaneous Capabilities, Z39.50 and WAIS Standards.

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Able to represent Information Retrieval System.
2. Able to Demonstrate Information Retrieval System Capabilities.

### UNIT-II:

10 Periods

#### **Catalog and Indexing & Data Structures:**

Cataloging and Indexing: History and Objectives of Indexing, Indexing Process, Automatic Indexing, Information Extraction

Data Structure: Introduction to Data Structure, Stemming Algorithms, Inverted File Structure, N-Gram Data Structures, PAT Data Structure, Signature File Structure, Hypertext and XML Data Structures, Hidden Markov Models

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Able to apply indexing.
2. Able to implement different types of data structures.

### UNIT-III:

10 Periods

#### **Automatic Indexing and Clustering:**

Automatic Indexing: Classes of Automatic Indexing, Statistical Indexing, Natural Language, Concept Indexing, Hypertext Linkages.

Document and Term Clustering: Introduction to Clustering, Thesaurus Generation, Item Clustering, Hierarchy of Clusters

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Able to apply Automatic Indexing.
2. Able to analyze Document and Term Clustering

### UNIT-IV:

10 Periods

#### **Searching:**

Search: Introduction, Similarity Measures and Ranking, Hidden Markov Models Techniques, Ranking algorithms, Relevance Feedback, Selective Dissemination of Information Search, Weighted searches of Boolean Systems, Multimedia Searching

User Search Techniques: Search Statements and Binding, Similarity Measures and Ranking, Searching the INTERNET and Hypertext

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Able to apply various searching techniques.
2. Able to analyze ranking

### UNIT-V:

10 Periods

#### **Visualization:**

Information Visualization: Introduction to Information Visualization, Cognition and Perception, Information Visualization Technologies.

Text Search Algorithms: Introduction to Text Search Techniques, Software Text Search Algorithms, Hardware Text Search Systems.

Multimedia Information Retrieval: Spoken Language Audio Retrieval, Non-Speech Audio Retrieval, Graph Retrieval, Imagery Retrieval, Video Retrieval.

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Able to use information visualization techniques.
2. Able to retrieve multimedia information

**Textbooks:**

1. “Kowalski, Gerald, Mark T May bury: INFORMATION RETRIEVAL SYSTEMS: Theory and Implementation, Kluwer Academic Press, 1997.
2. Gerald Kowalski: INFORMATION RETRIEVAL Architecture and Algorithms.
3. Finding Out About: Search Engine Technology from a cognitive Perspective, by Richard, K. Belew, Cambridge University Press, 2000. (for Case Studies )

**Reference books:**

1. Frakes, W.B., Ricardo Baeza-Yates: Information Retrieval data Structures and Algorithms, Prentice Hall, 1992.
2. Modern Information Retrieval by Yates Pearson Education.
3. Information Storage & Retrieval by Robert Korfhage –John Wiley & Sons.
4. Online Resources:
5. <https://nlp.stanford.edu/IR-book/information-retrieval.html>
6. <https://resources.mpi-inf.mpg.de/d5/teaching/ss04/is04/links.htm>
7. <https://www.lisedunetwork.com/information-retrieval-syste/>

<b>Cyber Security (Professional Elective -VI)</b>	
<b>Code: CSE421(B)</b>	<b>Credits: 3</b>
Instruction:	Sessional Marks: 40
End Exam: 3 Hours	End Exam Marks: 60

**Pre-requisites:**

- Basic Knowledge of Data Communications, Computer Networks
- Knowledge of Operating Systems Windows, Linux and Programming Languages

**Course Objectives:**

- Introducing Cyber Security Concepts
- Giving basic exposure about Cyber Crimes
- Explaining tools used in Cyber Crimes
- Explaining Cyber Law present in the system.

**Course Outcomes (CO):**

By the end of the course, the student will be able to:	
<b>CO-1</b>	Explain about vulnerability scanning approaches and describe the functionality of different types of scanning and service tools.
<b>CO-2</b>	Comprehend about networking layers and summarize the defence methodologies and its relevant tools functionality
<b>CO-3</b>	Describe and inspect web vulnerabilities through tools.
<b>CO-4</b>	Comprehend the cybercrime scenario and recognize the appropriate cyber law.
<b>CO-5</b>	Demonstrate the cybercrime scenario and solve the crime through investigation by applying ethical hacking mechanisms.

**Mapping of Course Outcomes with Program Outcomes:**

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
<b>1</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	-	-	-	-	-	<b>2</b>	<b>2</b>	<b>2</b>
<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	-	-	-	-	-	<b>2</b>	<b>2</b>	<b>2</b>
<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	-	-	-	-	-	<b>2</b>	<b>2</b>	<b>1</b>
<b>4</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	-	-	-	-	-	<b>2</b>	<b>2</b>	<b>1</b>
<b>5</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>	-	-	-	<b>2</b>	-	<b>2</b>	<b>2</b>	<b>2</b>

## SYLLABUS

### UNIT-I:

10 Periods

#### **Systems Vulnerability Scanning:**

Overview of vulnerability scanning, Open Port / Service Identification, Banner /Version Check, Traffic Probe, Vulnerability Probe, Vulnerability Examples, OpenVAS, Metasploit. Networks Vulnerability Scanning – Netcat, Socat, understanding Port and Services tools - Data pipe, F pipe, Network Reconnaissance – Nmap,

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Explain ports and probes in detail.
2. Analyze tools usage of Metasploit and netcat

### UNIT-II:

10 Periods

#### **Network Defence tools:**

Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs Firewall, How a Firewall Protects a Network, Packet Characteristic to Filter, Stateless Vs Stateful Firewalls, Network Address Translation (NAT) and Port Forwarding. Snort: Introduction Detection System

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Analyze filters and firewall.
2. Install NAT tool and port forwarding for the VPN

### UNIT-III:

10 Periods

#### **Web Application Tools**

**Scanning for web vulnerabilities tools:** Nikto, W3af, HTTP utilities - Curl, OpenSSL and Stunnel, Application Inspection tools – Zed Attack Proxy, Sqlmap. Webgoat, Password Cracking and Brute-Force Tools – John the Ripper –installation and configuration

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Explain various scanning utilities and Curl and openssl
2. Analyze Brute-force tools.

### UNIT-IV:

10 Periods

#### **Introduction to Cyber Crime Investigation and Ethical Hacking:**

Cyber Crimes, Types of Cybercrime, Hacking, Attack vectors, Cyberspace and Criminal Behaviour, Clarification of Terms, Traditional Problems Associated with Computer Crime, Introduction to Incident Response, Digital Forensics. Recognizing and Defining Computer Crime, Contemporary Crimes, Computers as Targets, Indian IT ACT 2000

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Explain about various cybercrimes.
2. Explain about IT ACT 2000.

### UNIT-V:

10 Periods

#### **Introduction to Cyber Crime and law:**

Password Cracking tools, Key loggers and Spyware, Virus and Worms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow, Attack on wireless Networks

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Usage of password cracking tools.
2. Analyze working principles Trojan and backdoors

**Textbooks:**

1. Anti-Hacker Tool Kit (Indian Edition) by Mike Shema, Publication McGraw Hill.
2. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole and SunitBelpure, Publication Wiley

**Reference books:**

1. "The Complete Reference Network Security By Robert Bragg, Mark Rhodes- Ousley,KeithStrassberg, 1st Edition,McGraw Hill India (2004) Publication.





## SYLLABUS

### UNIT-I:

10 Periods

#### Introduction:

Introduction: Introduction to Web - Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Statistical Properties of Social Networks -Network analysis - Development of Social Network Analysis - Key concepts and measures in network analysis - Discussion networks - Blogs and online communities - Web-based networks.

**Learning Outcomes:** At the end of this unit, Student will be able to

1. Elaborate the functionality, properties and limitations of the social networks.
2. Design personal Blogs and online communities.

### UNIT-II:

10 Periods

#### Modeling and Visualization:

Modeling And Visualization: Visualizing Online Social Networks - A Taxonomy of 26 Visualizations - Graph Representation - Centrality- Clustering - Node-Edge Diagrams - Visualizing Social Networks with Matrix-Based Representations- Node-Link Diagrams - Hybrid Representations - Modelling and aggregating social network data – Random Walks and their Applications –Use of Hadoop and Map Reduce - Ontological representation of social individuals and relationships.

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Analyze the graphical representation of various social networks.
2. Visualize and model Social Networks using different approaches

### UNIT-III:

10 Periods

#### Mining Communities:

Mining Communities: Aggregating and reasoning with social network data- Advanced Representations - Extracting evolution of Web Community from a Series of Web Archive - Detecting Communities in Social Networks - Evaluating Communities – Core Methods for Community Detection & Mining - Applications of Community Mining Algorithms - Node Classification in Social Networks

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Develop mining algorithms for social networks
2. perform mining on large social networks and illustrate the results

### UNIT-IV:

10 Periods

#### Text and Opinion Mining:

Text and Opinion Mining: Text Mining in Social Networks -Opinion extraction – Sentiment classification and clustering - Temporal sentiment analysis - Irony detection in opinion mining - Wish analysis - Product review mining – Review Classification – Tracking sentiments towards topics over time.

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Apply text and Opinion Mining techniques on social Networks.
2. Explain sentiment analysis in the context of opinion mining and rule-based models.

### UNIT-V:

10 Periods

#### Privacy:

**Privacy in online social networks:** Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures. **Tools:**Gephi, Palladio, NodeXL

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Elaborate the security and privacy levels of various social networks using network analysis tools.
2. Explain about trust models, attacks and its countermeasures on social networks

**Textbooks:**

1. “Peter Mika, “Social Networks and the Semantic Web”, 1st Edition, Springer, 2007.
2. Borko Furht, “Handbook of Social Network Technologies and Applications”, 1<sup>st</sup> edition, Springer, 2010

**Reference books:**

1. “Guandong Xu, Yanchun Zhang and Lin Li, “Web Mining and Social Networking – Techniques and applications”, 1<sup>st</sup> Edition, Springer, 2011.
2. Giles, Mark Smith, John Yen, “Advances in Social Network Mining and Analysis”, Springer, 2010.
1. Ajith Abraham, Aboul Ella Hassanien, Václav Snáel, “Computational Social Network Analysis: Trends, Tools and Research Advances”, Springer, 2009.

<b>Cloud Computing (Professional Elective -VI)</b>	
<b>Code: CSE421(D)</b>	<b>Credits: 3</b>
Instruction:	Sessional Marks: 40
End Exam: 3 Hours	End Exam Marks: 60

**Pre-requisites:**

- To undertake this course student must have basic understanding of Data Communications, Operating systems and Networking Technologies

**Course Objectives:**

- To make students understand with the fundamentals and essentials of Cloud Computing.
- To provide students a sound foundation of the Cloud computing so that they are able to start using and adopting Cloud Computing services and tools in their real life scenarios.
- To enable student exploring some important cloud computing driven commercial systems such as Google Apps, Microsoft Azure and Amazon Web Services and other businesses cloud applications.

**Course Outcomes (CO):**

By the end of the course, the student will be able to:	
<b>CO-1</b>	To be familiar with the basics, challenges, need of cloud computing.
<b>CO-2</b>	Able to identify infrastructure of cloud.
<b>CO-3</b>	Describe different cloud services.
<b>CO-4</b>	Analyzing different cloud security fundamentals and risks.
<b>CO-5</b>	Knowledge on software development, networking in cloud and exposure on various Cloud applications.

**Mapping of Course Outcomes with Program Outcomes:**

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
<b>1</b>	2	1	-	-	-	-	-	-	-	-	-	-	1	1
<b>2</b>	2	3	2	2	2	-	-	-	-	-	2	1	2	1
<b>3</b>	3	3	2	2	1	1	-	-	1	-	2	1	2	1
<b>4</b>	2	3	3	2	1	-	-	-	1	-	2	1	2	1
<b>5</b>	2	3	2	2	1	1	1	-	1	-	2	1	2	1

## SYLLABUS

### UNIT-I:

**10 Periods**

**Understanding Abstraction and Virtualization:** Using Virtualization Technologies, Load Balancing and Virtualization, Understanding Hypervisors, Understanding Machine Imaging .

**Capacity Planning:** Capacity Planning, Defining Baseline and Metrics, Network Capacity

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Explore virtualization methods.
2. Explain capacity planning

### UNIT-II:

**10 Periods**

**Defining Cloud Computing:**

Defining Cloud Computing, Cloud Type- The NIST model, The Cloud Cube Model, Deployment models, Service models, Characteristics of Cloud Computing-Paradigm shift, Benefits of cloud computing, Disadvantages of cloud computing, Assessing the Role of Open Standards.

**Cloud Architecture:**

Cloud Computing Stack- Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Connecting to the Cloud-Chromium OS: The Browser as an Operating System.

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Explain the cloud computing model and discuss the advantages and disadvantages of cloud.
2. Connect to the cloud equipped with knowledge on protocols and cloud platforms.

### UNIT-III:

**10 Periods**

**Cloud Computing Software Security Fundamentals:** Cloud Security Services, Relevant Cloud Security Design Principles, NIST 33 Security Principles, Secure Cloud Software Testing, Testing for Security Quality Assurance, Cloud Penetration Testing

**Cloud Computing Risk Issues:** The CIA Triad, Privacy and Compliance Risks, Common Threats and Vulnerabilities, Cloud Access Control Issues, Cloud Service Provider Risks.

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Explain the cloud security services and differentiate testing mechanisms.
2. Explore the cloud risk issues.

### UNIT-IV:

**10 Periods**

**Using Platforms:** Using Google Web Services, Using Amazon Web Services, Using Microsoft Cloud Services. Exploring Platform as a Service.

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Use various cloud platforms
2. Explain platform as service

### UNIT-V:

**10 Periods**

**Understanding Services and Applications:** Understanding Service Oriented Architecture, Energy Moving Applications to the Cloud, Working with Cloud-Based Storage, Using Media and Streaming

**Learning Outcomes:** At the end of this Unit the student will be able to:

1. Implement the cloud storage services for application development.
2. Explain media and streaming usage.

**Textbooks:**

1. “CloudSecurityAComprehensiveGuidetoSecureCloudComputing”,RonaldL.Krutz Russell Dean Vines, Wiley Publishing, Inc (Unit-1: Unit-3: Chapter 3,4)
2. “CloudComputingBible”,BarrieSosinsky,WileyIndiaPvt.Ltd,2013.  
(Unit-2 chapter:1,3)(Unit-4.Chapter:8,9,10) (Unit-5chapter: 13,14, 15,19)

**Reference books:**

1. Buyya R.,Broberg J.,GoscinskiA., “Cloud Computing: Principles and Paradigms”, John Wiley&SonsInc.,
2. AnthonyT.Velte, TobyJ.Velte, RobertElsenpeter.“CloudComputing-A Practical Approach”, 1stEdition, McGrawHill.
3. Cloud computing for dummies-Judith Hurwitz, Robin Bloor, Marcia Kaufman, FernHalper, Wiley Publishing, Inc, 2010.