

# AS PER NEP 2020



**SHRI VILE PARLE KELAVANI MANDAL's**  
**USHA PRAVIN GANDHI COLLEGE OF ARTS, SCIENCE AND COMMERCE**  
Bhakti Vedanta Swami Marg, North-South Road No. 1  
Juhu Scheme, Vile Parle (West), Mumbai 400 056.  
**Accreditation by NAAC "A+" Grade with CGPA 3.27**



Affiliated to the

**UNIVERSITY OF MUMBAI**

**Program: Master of Science**

**M. Sc. (Information Technology)**

**Part I- Sem I & Sem II** (Revised 60-40)

**Part II- Sem III & Sem IV** (Revised 60-40)

**Choice Based Credit System (CBCS) with effect**

**from the Academic year 2025 – 2026**

**Academic Council No:**

**Agenda No:**

Syllabus for Approval  
(As per NEP 2020)

Sr. No.	Heading	Particulars
1	Title of program	<b>M.Sc. (Information Technology)</b>
2	Eligibility	M.Sc. Information Technology admissions are offered on a merit basis. Eligibility for the Programme: B.Sc. (IT) /B.Sc.(CS) /BCA/ BCS/ BE/B.Sc.(Data Science) /Graduate in any discipline with mathematics/statistics as major subject/Graduate with any discipline where subjects are aligned with Computer Science or Information Technology.
3	Duration of program	<b>02 years and 04 semesters</b>
4	Intake Capacity	<b>40 students</b>
5	Scheme of Examination	<b>Semester Pattern (CBCS)</b>
6	Standards of Passing	<b>40 %</b>
7	No. of years/Semesters	<b>02 years and 04 semesters</b>
8	Program Level	<b>Semester</b>
9	Pattern	<b>CBCS</b>
10	Status	<b>NEW</b>
11	To be implemented from Academic Year	<b>June 2025- 26</b>

# Preamble

## 1) Introduction

Master of Science (Information Technology) is a Programme designed to meet the needs of the market for expertise in Information Technology (IT). The Programme is intended to address the increasing demand in the work-place for IT professionals with a broad and sound knowledge of both technical and managerial skills. A master degree is granted to individuals who have undergone study demonstrating a mastery or high-order overview of a specific area.

## 2) Aims and Objectives

1. To equip postgraduate students with an integrated set of skills that will allow them to develop their professional careers in Information Technology.
2. To equip students with the theoretical and practical knowledge that is necessary to enable them to understand the design of complex computer applications/science.
3. The programme also prepares students to embrace future developments in the field and has a demonstrated professional relevance.
4. The programme helps students to acquire the latest skills and build their future capabilities using world-class technology. At the end of this programme, a student will possess a strong foundation of computer systems and information technology.
5. Dexterity in advanced programming languages; power to build sophisticated software for wide area of applications.
6. Skills to work with higher end applications in internet technologies; also, managerial ability to analyze, design, develop and to maintain software development.

### **3) Learning Outcomes**

1. Apply the knowledge of mathematics, science, and computing in the core information technologies.
2. Identify, design, and analyze complex computer systems and implement and interpret the results from those systems.
3. Review literature and indulge in research using research-based knowledge and methods to design new experiments, analyze, and interpret data to draw valid conclusions.
4. Select and apply current techniques, skills, and tools necessary for computing practice and integrate IT-based solutions into the user environment effectively.
5. Apply ethical principles and responsibilities during professional practice.
6. Apply the knowledge of engineering and management principles to manage projects effectively in diverse environments as a member or a leader in the team.

4) Credit Structure of the Program (Sem I, II, III, & IV)

Credit Distribution Structure for  
Two Years / One Year PG M.Sc. (Information Technology)

Year	Level	Sem	Major				RM	OJT/F P	RP	Cum. Cr.	Degree
			Mandatory			Electives					
1	6.0	Sem I	2*4+2*2 + 2			4	4	-	-	22	PG Diploma (after 3 Years Degree)
			Data Science	TH	4	Security Breaches and Countermeasur es (PR) <b>(OR)</b> Data Center Technologies <b>(OR)</b> Image Processing	Research Methodology				
			Data Science Practical	PR	2						
			Soft Computing Techniques	TH	4						
			Soft Computing Techniques Practical	PR	2						
			Cloud Computing	TH	2						
		2*4+2*2 + 2			4			-	4	-	
		Big Data Analytics	TH	4	Malware Analysis(PR) <b>(OR)</b> Cloud Management (PR) <b>(OR)</b> Computer Vision(PR)						
		Big Data Analytics Practical	PR	2							
		Modern Networking	TH	4							
		Modern Networking Practical	PR	2							
		Microservices Architecture	TH	2							
		28				8	4	4	44		
		Cum. Cr. For PG Diploma									
Exit Option: PG Diploma (44 credits) after Three Year UG Degree											

Year	Level	Sem (2yr)	Major				RM	OJT/F P	RP	Cum. Cr.	Degree
2	6.5	Sem III	2*4+2*2 + 2			4	-	-	4	22	PG Degree after 3-yr UG or PG Degree after 4-yr UG
			Advanced AI	TH	4	Natural Language Processing (OR) Security Operations Center (PR) (OR) Server Virtualization on VMWare Platform (PR)					
			Advanced AI Practical	PR	2						
			Machine Learning	TH	4						
			Machine Learning Practical	PR	2						
			Storage as a Service	TH	2						
		2*4+2*2			4		-	-	6	22	
		Sem IV	Blockchain	TH	4	Robotic Process Automation (PR) (OR) Cyber Forensics (PR) (OR) Advanced IoT (PR)					
			Blockchain Practical	PR	2						
			Deep Learning	TH	4						
			Deep Learning Practical	PR	2						
Cum. Cr. For 1 Yr PG Degree			2 6	8			10	44			
Cum. Cr. For 2 Yr PG Degree			5 4	16	4	4	10	88			

Sign of HOD  
 Dr. Smruti Nanavaty  
 Dept. of Information Technology

Sign of Principal  
 Dr. A. Kapoor

**Credit Distribution Structure for  
PART I (M.Sc. (Information Technology))**

<b>SEM I</b>				
<b>Sr. No.</b>	<b>Name of the Module (Subject)</b>	<b>Module Code</b>	<b>Module Category (Core, Core Elective, OE, VSC, SEC, AEC, VSC, IKS, CC, FP, OJT, RM, CEP, RP)</b>	<b>Total no. of credits</b>
1	Data Science	UIDSC501	MAJOR	4
2	Data Science Practical	UIDSC501P	MAJOR	2
3	Soft Computing Techniques	UISCT502	MAJOR	4
4	Soft Computing Techniques Practical	UISCT502P	MAJOR	2
5	Cloud Computing	UICCO503	MAJOR	2
6	Security Breaches and Counter Measures Practical	UISBC504P	ELECTIVE	4
7	Data Center Technologies	UIDCT505	ELECTIVE	4
8	Image Processing	UIIPR506	ELECTIVE	4
9	Research Methodology	UIRME507	RM	4

<b>SEM II</b>				
<b>Sr. No.</b>	<b>Name of the Module (Subject)</b>	<b>Module Code</b>	<b>Module Category (Core, Core Elective, OE, VSC, SEC, AEC, VSC, IKS, CC, FP, OJT, RM, CEP, RP)</b>	<b>Total no. of credits</b>
1	Big Data Analytics	UIBDA551	MAJOR	4
2	Big Data Analytics Practical	UIBDA551P	MAJOR	2
3	Modern Networking	UIMNE552	MAJOR	4
4	Modern Networking Practical	UIMNE552P	MAJOR	2
5	Microservices Architecture	UIMAR553	MAJOR	2
6	Malware Analysis Practical	UIMAN554P	ELECTIVE	4
7	Cloud Management Practical	UICMA555P	ELECTIVE	4
8	Computer Vision Practical	UICVI556P	ELECTIVE	4
9	On Job Training	UIOJT557	OJT	4

**Credit Distribution Structure for**

**PART II (M.Sc. (Information Technology))**

<b>SEM III</b>				
<b>Sr. No.</b>	<b>Name of the Module (Subject)</b>	<b>Module Code</b>	<b>Module Category (Core, Core Elective, OE, VSC, SEC, AEC, VSC, IKS, CC, FP, OJT, RM, CEP, RP)</b>	<b>Total no. of credits</b>
1	Applied Artificial Intelligence	UIAAI601	MAJOR	4
2	Applied Artificial Intelligence Practical	UIAAI601P	MAJOR	2
3	Machine Learning	UIMLE602	MAJOR	4
4	Machine Learning Practical	UIMLE602P	MAJOR	2
5	Storage as a Service	UISAS603	MAJOR	2
6	Natural Language Processing	UINLP604	ELECTIVE	4
7	Security Operations Centre Practical	UISOC605P	ELECTIVE	4
8	Server Virtualization on VMWare Platform Practical	UISVV606P	ELECTIVE	4
9	Research Project	UIRPR607P	RP	4

<b>SEM IV</b>				
<b>Sr. No.</b>	<b>Name of the Module (Subject)</b>	<b>Module Code</b>	<b>Module Category (Core, Core Elective, OE,VSC, SEC, AEC,VSC, IKS, CC, FP, OJT, RM, CEP, RP)</b>	<b>Total no. of credits</b>
1	Blockchain	UIBLO651	MAJOR	4
2	Blockchain Practical	UIBLO651P	MAJOR	2
3	Deep learning	UIDLE652	MAJOR	4
4	Deep Learning Practical	UIDLE652P	MAJOR	2
5	Robotic Process Automation Practical	UIRPA653P	ELECTIVE	4
6	Cyber Forensics Practical	UICFO654P	ELECTIVE	4
7	Advanced IoT Practical	UIAIO655P	ELECTIVE	4
8	Research Project	UIRPR656P	RP	6

# **Syllabus**

**M.Sc. (Information Technology)**

**Part -I**

**(Sem. I & II)**

# **Semester I**

<b>Program: M.Sc. – Information Technology (2025 - 26)</b>		<b>Semester: I</b>	
<b>Course: Data Science</b>		<b>Course Code: UIDSC501</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 40)</b>	<b>Semester End Examinations (SEE) (Marks- 60 in Question Paper)</b>
4	4	40	60
<b>Learning Objectives:</b> To enable the students to: <ul style="list-style-type: none"> <li>• Apply quantitative modeling and data analysis techniques to the solution of real-world business problems, communicate findings, and effectively present results using data visualization techniques.</li> <li>• Demonstrate knowledge of statistical data analysis techniques utilized in business decisionmaking.</li> <li>• Apply principles of Data Science to the analysis of business problems.</li> </ul>			
<b>Prerequisite:</b> Basic understanding of statistics			
<b>Course Outcomes:</b> After completion of the course, learners would be able to: <b>CO1:</b> Develop in depth understanding of the key technologies in data science and business analytics, data mining, machine learning, visualization techniques, predictive modeling, and statistics. <b>CO2:</b> Practice problem analysis and decision-making. <b>CO3:</b> Gain practical, hands-on experience with statistics programming languages and data analysis tools through coursework and applied research experiences.			
<b>Outline of Syllabus: (per session plan)</b>			
<b>Module</b>	<b>Description</b>	<b>No of Hours</b>	
<b>1</b>	<b>Unit 1: Introduction to Data Science, Data Wrangling and Preprocessing</b> <ol style="list-style-type: none"> <li>Overview of data science</li> <li>Role of data scientist</li> <li>Applications of data science in various fields</li> <li>Data cleaning</li> <li>Data transformation</li> <li>Feature engineering</li> <li>Handling missing data</li> <li>Data normalization and standardization</li> </ol>	<b>15</b>	
<b>2</b>	<b>Unit 2: Programming and Software Tools</b> <ol style="list-style-type: none"> <li>Python programming language libraries such as NumPy, Pandas, Matplotlib, and Scikit-learn</li> </ol>	<b>15</b>	

	b. R programming language c. SQL for data manipulation	
<b>3</b>	<b>Unit 3: Machine Learning</b> a. Supervised learning algorithms (e.g., linear regression, logistic regression, decision trees, random forests, support vector machines) b. Unsupervised learning algorithms (e.g., k-means clustering, hierarchical clustering, principal component analysis)	<b>15</b>
<b>4</b>	<b>Unit 4: Data Visualization</b> a. Principles of data visualization b. Plotting libraries (Matplotlib, Seaborn, ggplot in R) c. Dashboarding tools (Tableau, Power BI)	<b>15</b>
	<b>Total</b>	<b>60</b>

### References:

1. Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking, Foster Provost and Tom Fawcett, O'Reilly Media, 1st Edition (2013)
2. Python for Data Analysis, Wes McKinney, O'Reilly Media, 2nd Edition (2017)
3. Feature Engineering for Machine Learning: Principles and Techniques for Data Scientists, Alice Zheng and Amanda Casari, O'Reilly Media, 1st Edition (2020)
4. Missing Data Analysis and Design, Geert Molenberghs and Michael Kenward, Chapman and Hall/CRC, 1st Edition (2007)
5. Python Data Science Handbook, Jake VanderPlas, O'Reilly Media, 1st Edition (2016)
6. R for Data Science, Hadley Wickham and Garrett Golemund, O'Reilly Media, 1st Edition (2017)
7. SQL Cookbook: Query Solutions and Techniques for Database Developers, Anthony Molinaro, O'Reilly Media, 2nd Edition (2009)
8. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, Aurélien Géron, O'Reilly Media, 2nd Edition (2019)
9. Tableau Your Data!: Fast and Easy Visual Analysis with Tableau Software, Daniel G. Murray, Wiley, 1st Edition (2016)

<b>Program: M.Sc. – Information Technology (2025 - 26)</b>		<b>Semester: I</b>	
<b>Course: Data Science Practical</b>		<b>Course Code: UIDSC501P</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 20)</b>	<b>Semester End Practical Examinations (SEPE) (Marks- 30 in Question Paper)</b>
4	2	20	30
<b>Learning Objectives:</b> To enable the students to: <ul style="list-style-type: none"> <li>• Apply quantitative modeling and data analysis techniques to the solution of real-world business problems, communicate findings, and effectively present results using data visualization techniques.</li> <li>• Demonstrate knowledge of statistical data analysis techniques utilized in business decisionmaking.</li> <li>• Apply principles of Data Science to the analysis of business problems.</li> </ul>			
<b>Course Outcomes:</b> After completion of the course, learners would be able to: <b>CO1:</b> Develop in depth understanding of the key technologies in data science and business analytics, data mining, machine learning, visualization techniques, predictive modeling, and statistics. <b>CO2:</b> Practice problem analysis and decision-making. <b>CO3:</b> Gain practical, hands-on experience with statistics programming languages and data analysis tools through coursework and applied research experiences.			
<b>Outline of Syllabus: (per session plan)</b>			
<b>Module</b>	<b>Description</b>	<b>No of Hours</b>	
<b>1</b>	<b>Data Wrangling and Preprocessing</b> <ol style="list-style-type: none"> <li>Removing duplicate records</li> <li>Handling missing data</li> <li>Handling outliers (e.g., winsorization, trimming, imputation)</li> <li>Correcting inconsistencies in data (e.g., fixing typos, standardizing formats)</li> <li>Feature engineering</li> <li>Python programming language libraries such as NumPy, Pandas, Matplotlib, and Scikit-learn</li> <li>SQL for data manipulation</li> </ol>	<b>20</b>	
<b>2</b>	<b>Supervised and Unsupervised Learning</b> <ol style="list-style-type: none"> <li>Supervised learning algorithms (linear regression, logistic regression, decision trees, random forests, support vector machines)</li> <li>Unsupervised learning algorithms (k-means clustering, hierarchical clustering, principal component analysis)</li> </ol>	<b>20</b>	

<b>3</b>	<b>Unsupervised Learning, Plotting, Dashboarding</b> a. Plotting libraries (Matplotlib, Seaborn, ggplot in R) b. Dashboarding tools (Tableau, Power BI)	<b>20</b>
	<b>Total</b>	<b>60</b>

<b>Program: M.Sc. - Information Technology (2025 - 26)</b>		<b>Semester: I</b>	
<b>Course: Soft Computing Techniques</b>		<b>Course Code: UISCT502</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 40)</b>	<b>Semester End Examinations (SEE) (Marks- 60 in Question Paper)</b>
4	4	40	60
<b>Learning Objectives:</b> To enable the students to: <ul style="list-style-type: none"> <li>• Soft computing concepts like fuzzy logic, neural networks, and genetic algorithms, where Artificial Intelligence is the mother branch of all.</li> <li>• All these techniques will be more effective in solving the problem efficiently</li> </ul>			
<b>Course Outcomes:</b> Upon completing this course, the student will be able to: <ul style="list-style-type: none"> <li>CO1: Gain a solid understanding of the fundamental concepts underlying soft computing, including the differences between soft computing and traditional hard computing methods.</li> <li>CO2: Familiarize with a variety of soft computing techniques such as fuzzy logic, neural networks, genetic algorithms, swarm intelligence, and probabilistic reasoning.</li> <li>CO3: Apply soft computing techniques to solve real-world problems from various domains such as engineering, finance, healthcare, and more.</li> <li>CO4: Formulate problems in a way that lends itself to the application of soft computing techniques, taking into account the uncertainties and imprecisions present in real-world data.</li> <li>CO5: Understand how fuzzy logic works and its applications in modeling and decision-making under uncertainty.</li> <li>CO6: Gain knowledge of neural network architectures, training algorithms, and their applications in pattern recognition, regression, and classification tasks.</li> <li>CO7: Understand genetic algorithms, their components, and their use in optimization problems and search spaces.</li> <li>CO8: Familiarize with swarm intelligence algorithms such as ant colony optimization and particle swarm optimization, and their applications in optimization and search problems.</li> </ul>			

<b>Outline of Syllabus: (per session plan)</b>		
<b>Module</b>	<b>Description</b>	<b>No of Hours</b>
<b>1</b>	<p>a) <b>Introduction of soft computing</b> - soft computing vs. hard computing, various types of soft computing techniques, Fuzzy Computing, Neural Computing, Genetic Algorithms, Associative Memory, Adaptive Resonance Theory, Classification, Clustering, Bayesian Networks, Probabilistic reasoning, applications of soft computing.</p> <p>b) <b>Artificial Neural Network</b> - Fundamental concept, Evolution of Neural Networks, Basic Models, McCulloch-Pitts Neuron, Linear Separability, Hebb Network.</p> <p>c) <b>Supervised Learning Network</b> - Perceptron Networks, Adaptive Linear Neuron, Multiple Adaptive Linear Neurons, Backpropagation Network, Radial Basis Function, Time Delay Network, Functional Link Networks, Tree Neural Network</p>	<b>15</b>
<b>2</b>	<p>a) <b>Associative Memory Networks</b> - Training algorithm for pattern Association, Auto-associative memory network, hetero-associative memory network, bi-directional associative memory, Hopfield networks, iterative auto-associative memory networks, temporal associative memory networks. Kohonen self-organizing feature maps, learning vector quantization, counter propagation networks, adaptive resonance theory networks.</p> <p>b) <b>Special Networks</b> - Simulated annealing, Boltzmann machine, Gaussian Machine, Cauchy Machine, Probabilistic neural net, cascade correlation network, cognition network, neo-cognition network, cellular neural network, optical neural network</p> <p>c) <b>Third Generation Neural Networks</b> - Spiking Neural networks, convolutional neural networks, deep learning neural networks, extreme learning machine model.</p> <p>d) <b>UnSupervised Learning Networks</b> - Fixed weight competitive nets</p>	<b>15</b>
<b>3</b>	<p>a) <b>Introduction to Fuzzy Logic, Classical Sets and Fuzzy sets</b> - Classical sets, Fuzzy sets.</p> <p>b) <b>Classical Relations and Fuzzy Relations</b> - Cartesian Product of relation,</p> <p>c) classical relation, fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets.</p> <p>d) <b>Membership Function</b> - features of the membership functions, fuzzification, methods of membership value assignments.</p> <p>e) <b>Defuzzification</b> - Lambda-cuts for fuzzy sets, Lambda-cuts for fuzzy relations, Defuzzification methods.</p> <p>f) <b>Fuzzy Arithmetic and Fuzzy measures</b> - fuzzy arithmetic, fuzzy measures, measures of fuzziness, fuzzy integrals.</p> <p>g) <b>Fuzzy Rule base and Approximate reasoning</b> - Fuzzy proportion, formation of rules, decomposition of rules, aggregation of fuzzy rules, fuzzy reasoning, fuzzy inference systems, Fuzzy logic control systems, control system design,</p>	<b>15</b>

	architecture and operation of FLC system, FLC system models and applications of FLC System.	
<b>4</b>	<p>a) <b>Genetic Algorithm</b> - Biological Background, Traditional optimization and search techniques, genetic algorithm and search space, genetic algorithm vs. traditional algorithms, basic terminologies,</p> <p>b) <b>Simple genetic algorithm</b>, general genetic algorithm, operators in genetic algorithm, stopping condition for genetic algorithm flow, constraints in genetic algorithm, problem-solving using genetic algorithm, the schema theorem, classification of genetic algorithm, Holland classifier systems, genetic programming, advantages and limitations and applications of genetic algorithm.</p> <p>c) <b>Differential Evolution</b> Algorithm, Hybrid soft computing techniques – neuro – fuzzy hybrid, genetic neuro-hybrid systems, genetic fuzzy hybrid and fuzzy genetic hybrid systems.</p>	<b>15</b>
	<b>Total</b>	<b>60</b>

### Reference Book

1. Artificial Intelligence and Soft Computing, Anandita Das Battacharya, SPD, 3rd 2018
2. Principles of Soft computing, S.N.Sivanandam S.N.Deepa Wiley 3rd 2019
3. Neuro-Fuzzy and Soft Computing, J.S.R.Jang, C.T.Sun and E.Mizutani, Prentice Hall of India, 2004
4. Neural Networks, Fuzzy Logic and Genetic Algorithms, Synthesis & Applications, S.Rajasekaran, G. A. Vijayalakshami Prentice Hall of India, 2004
5. Fuzzy Logic with Engineering Applications, Timothy J.Ross, McGraw- Hill, 1997
6. Genetic Algorithms: Search, Optimization and Machine Learning, Davis E.Goldberg, Addison Wesley, 1989
7. Introduction to AI and Expert System, Dan W. Patterson, Prentice Hall of India, 2009

<b>Program: M.Sc. - Information Technology (2025 - 26)</b>		<b>Semester: I</b>	
<b>Course: Soft Computing Techniques Practical</b>		<b>Course Code: UISCT502P</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 20)</b>	<b>Semester End Practical Examinations (SEPE) (Marks- 30 in Question Paper)</b>
4	2	20	30
<b>Learning Objectives:</b> To give the practical aspect of how soft computing techniques are used for solving the problems.			
<b>Course Outcomes:</b> Upon completing this course, the student will be able to: <b>CO1:</b> Develop a simple perceptron model to solve the simple linear separable problems <b>CO2:</b> Develop the program to design an NN model with the learning ability to solve simple NN models. <b>CO3:</b> Develop the problems on the Fuzzy model <b>CO4:</b> design the genetic algorithms to solve the simple optimization problems			
<b>Outline of Syllabus: (per session plan)</b>			
<b>Module</b>	<b>Description</b>	<b>No of Hours</b>	
<b>1</b>	<ol style="list-style-type: none"> <li>1. Implement the following: <ol style="list-style-type: none"> <li>a. Design a simple linear neural network model.</li> <li>b. Calculate the output of the neural net using both binary and bipolar sigmoidal functions.</li> </ol> </li> <li>2. Implement the following: <ol style="list-style-type: none"> <li>a. Generate AND/NOT function using McCulloch-Pitts neural net.</li> <li>b. Generate XOR function using McCulloch-Pitts neural net.</li> </ol> </li> <li>3. Implement the Following <ol style="list-style-type: none"> <li>a. Write a program to implement Hebb's rule.</li> <li>b. Write a program to implement of delta rule.</li> </ol> </li> <li>4. Implement the Following <ol style="list-style-type: none"> <li>a. Write a program for Back Propagation Algorithm</li> <li>b. Write a program for the error Backpropagation algorithm.</li> </ol> </li> <li>5. Implement the Following <ol style="list-style-type: none"> <li>a. Write a program for Hopfield Network.</li> <li>b. Write a program for the Radial Basis function.</li> </ol> </li> </ol>	<b>30</b>	
<b>2</b>	6. Implement the Following	<b>30</b>	

	<ul style="list-style-type: none"> <li>a. Kohonen Self organizing map.</li> <li>b. Adaptive resonance theory.</li> </ul> <p>7. Implement the Following</p> <ul style="list-style-type: none"> <li>a. Write a program for Linear separation.</li> <li>b. Write a program for Hopfield network model for associative memory</li> </ul> <p>8. Implement the Following</p> <ul style="list-style-type: none"> <li>a. Membership and Identity Operators   in, not in,</li> <li>b. Membership and Identity Operators is, is not</li> </ul> <p>9. Implement the Following</p> <ul style="list-style-type: none"> <li>a. Find ratios using fuzzy logic</li> <li>b. Solve Tipping problem using fuzzy logic</li> </ul> <p>10. Implement the Following</p> <ul style="list-style-type: none"> <li>a. Implementation of Simple genetic algorithm</li> <li>b. Create two classes: City and Fitness using Genetic algorithm</li> </ul>	
	<b>Total</b>	<b>60</b>

<b>Program: M.Sc. – Information Technology (2025 - 26)</b>		<b>Semester: I</b>	
<b>Course: Cloud Computing</b>		<b>Course Code: UICCO503</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 20)</b>	<b>Semester End Examinations (SEE) (Marks- 30 in Question Paper)</b>
2	2	20	30
<b>Learning Objectives:</b>			
<ul style="list-style-type: none"> <li>• To understand the fundamental concepts of cloud computing and the evolution of parallel and distributed computing.</li> <li>• To recognize the relationship between virtualization and cloud computing.</li> <li>• To establish a foundational understanding of cloud security basics and identify common cloud security threats.</li> <li>• To examine the prominent cloud service providers including Amazon Web Services, Google App Engine and Microsoft Azure.</li> </ul>			
<b>Course Outcomes:</b>			
After completion of the course, learners would be able to:			
<b>CO1:</b> Gain comprehensive knowledge of cloud computing, distributed systems, and virtualization.			
<b>CO2:</b> Develop a critical understanding of the security considerations associated with cloud computing.			
<b>CO3:</b> Stay updated on the latest trends and advancements in the field.			
<b>Outline of Syllabus: (per session plan)</b>			
<b>Module</b>	<b>Description</b>	<b>No of Hours</b>	
<b>Module 1</b>	<b>Introduction to Cloud Computing, Principles of Parallel and Distributed Computing, Virtualization</b>		
	<p><b>Introduction to Cloud Computing</b> - Introduction, Historical developments, Building Cloud Computing Environments.</p> <p><b>Principles of Parallel and Distributed Computing</b> - Eras of Computing, Parallel v/s distributed computing, Elements of Parallel Computing, Elements of distributed computing, Technologies for distributed computing.</p> <p><b>Virtualization</b> - Introduction, Characteristics of virtualized environments, Taxonomy of virtualization techniques, Virtualization and cloud computing, Pros and cons of virtualization, Technology examples. Logical Network Perimeter, Virtual Server, Cloud Storage Device, Cloud usage monitor, Resource replication, Ready-made environment.</p>	<b>15</b>	

<b>Module 2</b>	<b>Cloud Computing Architecture, Fundamental Cloud Security, Industrial Platforms and New Developments</b>	
	<p><b>Cloud Computing Architecture:</b> Introduction, Fundamental concepts and models, Roles and boundaries, Cloud Characteristics, Cloud Delivery models, CloudDeployment models, Economics of the cloud, Open challenges.</p> <p><b>Fundamental Cloud Security:</b> Basics, Threat agents, Cloud security threats, additional considerations.</p> <p><b>Industrial Platforms and New Developments:</b> Amazon Web Services, Google App Engine, Microsoft Azure.</p>	<b>15</b>
<b>Total</b>		<b>30</b>

**Reference books:**

1. Mastering Cloud Computing Foundations and Applications Programming by Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, Elsevier (2013)
2. Cloud Computing Concepts, Technology & Architecture by Thomas Erl, Zaigham Mahmood, and Ricardo Puttini, Prentice Hall (2013)
3. Distributed and Cloud Computing, From Parallel Processing to the Internet of by Things Kai Hwang, Jack Dongarra, Geoffrey Fox, MK Publishers (2012)

<b>Program: M.Sc. - Information Technology (2025 - 26)</b>		<b>Semester: I</b>	
<b>Course: Security Breaches and Counter Measures Practical</b>		<b>Course Code: UISBC504P</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 40)</b>	<b>Semester End Practical Examinations (SEPE) (Marks- 60 in Question Paper)</b>
8	4	40	60
<p><b>Learning Objectives:</b></p> <ol style="list-style-type: none"> <li>1. Acquire foundational cybersecurity knowledge, emphasizing ethical hacking, legal frameworks, and core principles of cyber defense.</li> <li>2. Master reconnaissance and vulnerability assessment using advanced tools for effective threat identification and evaluation.</li> <li>3. Implement robust defense mechanisms and secure web applications to protect against a wide range of cyber-attacks.</li> <li>4. Develop incident response strategies and utilize cryptographic techniques for comprehensive data protection.</li> <li>5. Integrate security best practices into emerging technologies and operational workflows, preparing for future cybersecurity challenges.</li> </ol>			
<p><b>Course Outcomes:</b></p> <p>Upon completing this course, the student will be able to:</p> <ol style="list-style-type: none"> <li>1. Master core cybersecurity concepts, ethical hacking techniques, and navigate legal considerations to protect information assets effectively.</li> <li>2. Utilize advanced tools for comprehensive reconnaissance and vulnerability assessments, identifying potential security threats and weaknesses.</li> <li>3. Design and implement robust security measures to defend networks and web applications against a variety of cyber threats.</li> <li>4. Develop comprehensive incident response strategies to effectively manage and mitigate the impact of cyber incidents on operations.</li> <li>5. Adapt and integrate cybersecurity practices to address emerging technologies and evolving threat landscapes, ensuring future readiness.</li> </ol>			

<b>Outline of Syllabus: (per session plan)</b>		
<b>Module</b>	<b>Description</b>	<b>No of Hours</b>
<b>Module 1</b>	<p><b>Introduction to Cybersecurity Tools and Reconnaissance:</b></p> <p><b>Footprinting and Reconnaissance Techniques</b></p> <ul style="list-style-type: none"> <li>• Using Kali Linux for Recon-ng.</li> <li>• FOCA Tool for footprinting.</li> <li>• Basic Windows Command Line Utilities for network reconnaissance.</li> <li>• Network scanning tools: Ping, Tracert.</li> <li>• DNS and WHOIS Lookup Tools: NSLookup, DNS Tools, Whois, Ultra Tools Mobile, Smart Whois.</li> </ul> <p><b>Network and System Discovery</b></p> <ul style="list-style-type: none"> <li>• Scanning networks with Hping2/Hping3, Advanced IP Scanner, Angry IP Scanner.</li> <li>• Mass network scanning with Masscan.</li> <li>• Network monitoring and port scanning: NEET, CurrPorts</li> <li>• Packet crafting and analysis: Colasoft Packet Builder, The Dude.</li> </ul>	<b>30</b>
<b>Module 2</b>	<p><b>Enumeration and Vulnerability Analysis Performing</b></p> <p><b>Enumeration</b></p> <ul style="list-style-type: none"> <li>• Network mapping with Nmap</li> <li>• Enumerating services with NetBIOS Enumeration Tool, SuperScan, Hyena.</li> <li>• Comprehensive scanning with SoftPerfect Network Scanner, OpUtils, SolarWinds Engineer's Toolset.</li> <li>• Traffic analysis with Wireshark.</li> </ul> <p><b>Vulnerability Analysis</b></p> <ul style="list-style-type: none"> <li>• Identifying vulnerabilities using Nessus, OpenVAS.</li> <li>• System hacking tools: Winrtgen, PWDump, Ophcrack, Flexispy.</li> <li>• Data hiding and exfiltration: NTFS Stream Manipulation, ADS Spy, Snow, Quickstego.</li> <li>• Log management and evasion: Clearing Audit Policies, Clearing Logs.</li> </ul>	<b>30</b>
<b>Module 3</b>	<p><b>Network Defense and Countermeasures</b></p> <p><b>Network Protection and Attack Mitigation</b></p> <ul style="list-style-type: none"> <li>• MAC address spoofing with SMAC.</li> <li>• Network analysis using Caspa Network Analyser, Omnipeek.</li> <li>• Social engineering defenses using the Social Engineering Toolkit.</li> <li>• DDOS attack mitigation: HOIC, LOIC, HULK, Metasploit.</li> <li>• Traffic interception and modification with Burp Suite.</li> </ul> <p><b>Web Application Security</b></p> <ul style="list-style-type: none"> <li>• Web app scanning with OWASP Zed Attack Proxy</li> <li>• Mobile session hijacking with droidsheep</li> <li>• Firewall deployment and analysis: Zonealarm with Firewall Analyzer, Comodo Firewall</li> <li>• Malicious traffic capture with HoneyBOT</li> <li>• Web server protection tools: ID Server, Microsoft Baseline Security Analyzer, Syhunt Hybrid, dotDefender</li> </ul>	<b>30</b>
<b>Module 4</b>	<p><b>Advanced Security Techniques and Cryptography</b></p> <p><b>Advanced Attacks and Countermeasures</b></p> <ul style="list-style-type: none"> <li>• SQL Injection tools: Tyrant SQL, Havij, BBQSQL.</li> </ul>	<b>30</b>

	<ul style="list-style-type: none"><li>• Wireless network security with Aircrack-ng suite.</li></ul> <b>Cryptography and Secure Communication</b> <ul style="list-style-type: none"><li>• Utilizing cryptographic tools: HashCalc, Advanced Encryption Package, MD5 Calculator, TrueCrypt, CrypTool.</li></ul>	
	<b>Total</b>	<b>120</b>

<b>Program: M.Sc. – Information Technology (2025 - 26)</b>		<b>Semester: I</b>	
<b>Course: Data Center Technologies</b>		<b>Course Code: UIDCT505</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 40)</b>	<b>Semester End Examinations (SEE) (Marks- 60 in Question Paper)</b>
4	4	40	60
<b>Learning Objectives:</b>			
<ul style="list-style-type: none"> <li>• Identify important requirements to design and support a data center.</li> <li>• Determine a data center environment's requirement including systems and network architecture as well as services.</li> <li>• Evaluate options for server farms, network designs, high availability, load balancing, datacenter services, and trends that might affect data center designs.</li> <li>• Assess threats, vulnerabilities and common attacks, and network security devices available to protect data centers.</li> <li>• Design a data center infrastructure integrating features that address security, performance, and availability.</li> <li>• Measure data center traffic patterns and performance metrics.</li> </ul>			
<b>Course Outcomes:</b>			
After completion of the course, a student should be able to:			
<p><b>CO1:</b> Understand basic concepts in Virtualization.  <b>CO2:</b> Use concepts of Load Balancing and Aggregation /virtual switching  <b>CO3:</b> Configure Data center Migration and Fabric Building  <b>CO4:</b> Understand various Changes in Server Architecture  <b>CO5:</b> Use the concepts of Cloud computing and how to move towards a cloud computing technology.</p>			
<b>Outline of Syllabus: (per session plan)</b>			
<b>Module</b>	<b>Description</b>	<b>No of Hours</b>	
<b>1</b>	<p>a) <b>Virtualization</b> - Virtualization History and Definitions  b) <b>Virtualization and Network Technologies – I</b> - Data Center Network Evolution Beginning of Network Virtualization  c) <b>Virtualization and Network Technologies – II</b> - Ace Virtual C contexts Virtual Device Contexts</p>	<b>15</b>	
<b>2</b>	<p>a) <b>Fooling Spanning Tree</b>  b) <b>Virtualized Chassis with Fabric Extenders</b> - History of Data Centers  c) <b>Virtualization in Storage Technologies – I</b> - Storage</p>	<b>15</b>	

	Evolution	
<b>3</b>	<b>a) Virtualization in Storage Technologies – II - Islands inSAN</b> <b>b) Secret Identities One Cable to Unite Us All</b> <b>Server Evolution</b>	<b>15</b>
<b>4</b>	<b>a) Changing Personalities</b> <b>b) Transcending the Rack - Moving Targets</b> <b>End to End Virtualization - Virtual Data Center and Cloud Computing</b>	<b>15</b>
	<b>Total</b>	<b>60</b>

**Reference books:**

1. Data Center Virtualization Fundamentals by Gustavo Alessandro Andrade Santana, Cisco Press, 1<sup>st</sup> Edition (2014)

<b>Program: M.Sc. – Information Technology (2025 - 26)</b>		<b>Semester: I</b>	
<b>Course: Image Processing</b>		<b>Course Code: UIIPR506</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 40)</b>	<b>Semester End Examinations (SEE) (Marks- 60 in Question Paper)</b>
4	4	40	60
<b>Learning Objectives:</b>			
<ul style="list-style-type: none"> <li>• Review the fundamental concepts of a digital image processing system.</li> <li>• Analyze images in the frequency domain using various transforms.</li> <li>• Evaluate the techniques for image enhancement and image restoration.</li> <li>• Categorize various compression techniques.</li> <li>• Interpret Image compression standards.</li> <li>• Interpret image segmentation and representation techniques.</li> </ul>			
<b>Course Outcomes:</b>			
<ul style="list-style-type: none"> <li>• <b>CO1:</b> Understand the relevant aspects of digital image representation and their practical implications.</li> <li>• <b>CO2:</b> Have the ability to design pointwise intensity transformations to meet stated specifications.</li> <li>• <b>CO3:</b> Understand 2-D convolution, the 2-D DFT, and have the ability to design systems using these concepts.</li> <li>• <b>CO4:</b> Have a command of basic image restoration techniques.</li> <li>• <b>CO5:</b> Understand the role of alternative color spaces, and the design requirements leading to choices of color space.</li> <li>• <b>CO6:</b> Appreciate the utility of wavelet decompositions and their role in image processing systems.</li> <li>• <b>CO7:</b> Have an understanding of the underlying mechanisms of image compression, and the ability to design systems using standard algorithms to meet design specifications.</li> </ul>			
<b>Outline of Syllabus: (per session plan)</b>			
<b>Module</b>	<b>Description</b>		<b>No of Hours</b>
<b>1</b>	<p><b>a) Introduction:</b> Digital Image Processing, Origins of Digital Image Processing, Applications and Examples of Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System,</p> <p><b>b) Digital Image Fundamentals:</b> Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Basic Relationships Between Pixels, Basic Mathematical Tools Used in Digital Image Processing,</p> <p><b>c) Intensity Transformations and Spatial Filtering:</b> Basics, Basic Intensity Transformation Functions, Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing (Lowpass) Spatial Filters, Sharpening (Highpass) Spatial Filters, Highpass, Bandreject, and</p>		<b>15</b>

	Bandpass Filters from Lowpass Filters.	
2	<p>a) <b>Filtering in the Frequency Domain:</b> Background, Preliminary Concepts, Sampling and the Fourier Transform of Sampled Functions, The Discrete Fourier Transform of One Variable, Extensions to Functions of Two Variables, Properties of the 2-D DFT and IDFT, Basics of Filtering in the Frequency Domain, Image Smoothing Using Lowpass Frequency Domain Filters, Image Sharpening Using Highpass Filters, Selective Filtering, Fast Fourier Transform</p> <p>b) <b>Image Restoration and Reconstruction:</b> A Model of the Image Degradation/Restoration Process, Noise Models, Restoration in the Presence of Noise Only Spatial Filtering, Periodic Noise Reduction Using Frequency Domain Filtering, Linear, Position- Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering, Geometric Mean Filter, Image Reconstruction from Projections</p>	15
3	<p>a) <b>Color Image Processing:</b> Color Fundamentals, Color Models, Pseudocolor Image Processing, Full-Color Image Processing, Color Transformations, Color Image Smoothing and Sharpening.</p> <p>b) <b>Image Compression and Watermarking:</b> Fundamentals, Huffman Coding, Golomb Coding, Arithmetic Coding, LZW Coding, Run-length Coding, Symbol-based Coding, 8 Bit-plane Coding, Block Transform Coding, Predictive Coding, Wavelet Coding, Digital Image Watermarking,</p> <p>c) <b>Morphological Image Processing:</b> Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transform,.</p>	15
4	<p>a) <b>Image Segmentation I: Edge Detection, Thresholding, and Region Detection:</b> Fundamentals, Thresholding, Segmentation by Region Growing and by Region Splitting and Merging, Region Segmentation Using Clustering and Super pixels, Region Segmentation Using Graph Cuts, Segmentation Using Morphological Watersheds, Use of Motion in Segmentation</p> <p>b) <b>Image Segmentation II: Active Contours: Snakes and Level Sets:</b> Background, Image Segmentation Using Snakes, Segmentation Using Level Sets.</p>	15
	<b>Total</b>	<b>60</b>

#### Reference books:

1. Digital Image Processing by Gonzalez and Woods, Pearson/Prentice Hall, Fourth (2018)
2. Fundamentals of Digital Image Processing by A K. Jain, PHI
3. The Image Processing Handbook by J. C. Russ CRC Fifth 2010

<b>Program: M.Sc. – Information Technology (2025 - 26)</b>		<b>Semester: I</b>	
<b>Course: Research Methodology</b>		<b>Course Code: UIRME507</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 40)</b>	<b>Semester End Examinations (SEE) (Marks- 60 in Question Paper)</b>
4	4	40	60
<b>Learning Objectives:</b> <ul style="list-style-type: none"> <li>• To introspect the fundamentals of research methodology and its association in diverse areas of science.</li> <li>• To be able to conduct research with an understanding of all the latest theories.</li> <li>• To develop the ability to explore research techniques used for solving any real world or innovate problem.</li> </ul>			
<b>Course Outcomes:</b> A learner will be able to: <b>CO1:</b> Understand the psychology of research which includes different perspectives and necessity of research. <b>CO2:</b> Apply the research knowledge to formulate a suitable problem statement by adopting different research methods and models. <b>CO3:</b> Analyze the research outcome by using suitable statistical tool.			
<b>Outline of Syllabus: (per session plan)</b>			
<b>Module</b>	<b>Description</b>	<b>No of Hours</b>	
<b>1</b>	Introduction: Role of Business Research, Information Systems and Knowledge Management, Theory Building, Organization ethics and Issues.	<b>15</b>	
<b>2</b>	Research Process: Problem definition, Qualitative research tools, Secondary data research Research Methods and Data Collection: Survey research, communicating with respondents, Observation methods, Experimental research.	<b>15</b>	
<b>3</b>	Measurement Concepts, Sampling and Field work: Levels of Scale measurement, attitude measurement, questionnaire design, sampling designs and procedures, determination of sample size.	<b>15</b>	
<b>4</b>	Data Analysis and Presentation: Editing and Coding, Basic Data Analysis, Univariate Statistical Analysis and Bivariate Statistical analysis and differences between two variables. Multivariate Statistical Analysis.	<b>15</b>	
	<b>Total</b>	<b>60</b>	

#### TEXT BOOKS:

1. Business Research Methods William G.Zikmund, B.J Babin, J.C. Carr, Atanu Adhikari, M.Griffin,Cengage 8e 2016.
2. Business Analytics Albright Winston Cengage 5e 2015.
3. Research Methodology :Kothari C.R.,Garg,Gaurav
4. Research Methods of Business 8ed: A Skill-Building Approach, An Indian Adaptation Roger Bougie, Uma Sekaran, Mala Srivastava

#### REFERENCE BOOKS:

1. Research Methods for Business Students Fifth Edition Mark Saunders 2011.
2. Multivariate Data Analysis Hair Pearson 7e 2014.

# SEMESTER II

<b>Program: M.Sc. – Information Technology (2025 - 26)</b>		<b>Semester: II</b>	
<b>Course: Big Data Analytics</b>		<b>Course Code: UIBDA551</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 40)</b>	<b>Semester End Examinations (SEE) (Marks- 60 in Question Paper)</b>
4	4	40	60
<b>Learning Objectives:</b>			
<ul style="list-style-type: none"> <li>• To provide an overview of an exciting growing field of big data analytics.</li> <li>• To introduce the tools required to manage and analyze big data like Hadoop, NoSql MapReduce.</li> <li>• To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.</li> <li>• To enable students to have skills that will help them to solve complex real-world problems in for decision support.</li> </ul>			
<b>Course Outcomes:</b>			
Upon completion of this course the students will be able to:			
<b>CO1:</b> Understand Big Data Concepts			
<b>CO2:</b> Do Data Collection and Integration			
<b>CO3:</b> Develop Data Storage and management			
<b>CO4:</b> Perform Data Preprocessing and Cleaning			
<b>CO5:</b> Understand Data Transformation and Feature Engineering			
<b>CO6:</b> Perform Exploratory Data Analysis (EDA)			
<b>CO7:</b> Use Big Data Analytics Tools			
<b>Outline of Syllabus: (per session plan)</b>			
<b>Module</b>	<b>Description</b>	<b>No of Hours</b>	
<b>1</b>	Introduction to Big Data, Characteristics of Data, and Big Data Evolution of Big Data, Definition of Big Data, Challenges with big data, Why Big data? Data Warehouse environment, Traditional Business Intelligence versus Big Data. State of Practice in Analytics, Key roles for New Big Data Ecosystems, Examples of big Data Analytics. Big Data Analytics, Introduction to big data analytics, Classification of Analytics, Challenges of Big Data, Importance of Big Data, Big Data Technologies, Data Science, Responsibilities, Soft state eventual consistency. Data Analytics Life Cycle.	<b>15</b>	

<b>2</b>	Analytical Theory and Methods: Clustering and Associated Algorithms, Association Rules, Apriori Algorithm, Candidate Rules, Applications of Association Rules, Validation and Testing, Diagnostics, Regression, Linear Regression, Logistic Regression, Additional Regression Models. Analytical Theory and Methods: Classification, Decision Trees, Naïve Bayes, Diagnostics of Classifiers, Additional Classification Methods, Time Series Analysis, Box Jenkins methodology, ARIMA Model	<b>15</b>
<b>3</b>	Data Product, Building Data Products at Scale with Hadoop, Data Science Pipeline and Hadoop Ecosystem, Operating System for Big Data, Concepts, Hadoop Architecture, Working	<b>15</b>
<b>4</b>	Distributed Analysis and Patterns, Computing with Keys, Design Patterns, Last-Mile Analytics, Data Mining and Warehousing, Structured Data Queries with Hive, HBase, Data Ingestion, Importing Relational data with Sqoop, Ingesting stream data with flume. Analytics with higher level APIs, Pig, Spark's higher-level APIs.	<b>15</b>
	<b>Total</b>	<b>60</b>

#### References:

1. Big Data and Analytics, Subhashini Chellappan, Seema Acharya, Wiley, First Edition
2. Data Science and Big Data Analytics, Discovering, Analyzing, Visualizing and Presenting Data, EMC Education Services, John Wiley & Sons, Inc., 2015
3. Data Analytics with Hadoop An Introduction for Data Scientists, Benjamin Bengfort and Jenny Kim, O'Reilly, 2016
4. Big Data and Hadoop, V.K Jain, Khanna Publishing, First Edition, 2018

<b>Program: M.Sc. – Information Technology (2025 - 26)</b>		<b>Semester: II</b>	
<b>Course: Big Data Analytics Practical</b>		<b>Course Code: UIBDA551P</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 20)</b>	<b>Semester End Practical Examinations (SEPE) (Marks- 30 in Question Paper)</b>
4	2	20	30
<b>Learning Objectives:</b>			
<ul style="list-style-type: none"> <li>• To provide an overview of an exciting growing field of big data analytics.</li> <li>• To introduce the tools required to manage and analyze big data like Hadoop, NoSql MapReduce.</li> <li>• To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.</li> <li>• To enable students to have skills that will help them to solve complex real-world problems in for decision support.</li> </ul>			
<b>Course Outcomes:</b>			
Upon completion of this course the students will be able to:			
CO1 : Develop various regression models for big datasets			
CO2 : Build supervised learning models using voluminous dataset			
CO3 : Build unsupervised learning models using voluminous dataset			
CO4 : Establish distributed computing environment using Hadoop			
CO5 : Perform big data analysis using Map-reduce based computing framework			
CO6 : Explore NoSQL database technologies			
CO7 : Use various Big Data Analytics Tools such as Hbase, Hive etc			
<b>Outline of Syllabus: (per session plan)</b>			
<b>Module</b>	<b>Description</b>		<b>No of Hours</b>
<b>1</b>	<ul style="list-style-type: none"> <li>• Implement Decision tree classification techniques</li> <li>• Implement SVM classification technique.</li> <li>• Implement Classification model. <ul style="list-style-type: none"> <li>a. Install relevant package for classification.</li> <li>b. Choose classifier for classification problem.</li> <li>c. Evaluate the performance of classifier.</li> </ul> </li> <li>• Implement Clustering model <ul style="list-style-type: none"> <li>a. Apply Clustering algorithms for unsupervised classification.</li> <li>b. Plot the cluster data using visualizations tool.</li> </ul> </li> <li>• Implement Linear Regression model using python.</li> <li>• Implement Logistic Regression model using python.</li> <li>• Implement Multiple Regression model using python.</li> </ul>		<b>30</b>

2	<ul style="list-style-type: none"> <li>• Install, configure, and run Hadoop and HDFS and explore HDFS.</li> <li>• Implement map-reduce based word count program using pyspark</li> <li>• Implement Map Reduce program that processes a weather dataset using pyspark</li> <li>• Implement an application that stores big data in H base / MongoDB and manipulate it using R / Python</li> <li>• Implement data handling using spark SQL</li> <li>• Implement Machine learning using with spark MLlib</li> </ul>	30
	<b>Total</b>	<b>60</b>

<b>Program: M.Sc. – Information Technology (2025 - 26)</b>		<b>Semester: II</b>	
<b>Course: Modern Networking</b>		<b>Course Code: UIMNE552</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 40)</b>	<b>Semester End Examinations (SEE) (Marks- 60 in Question Paper)</b>
4	4	40	60
<b>Learning Objectives:</b> <ul style="list-style-type: none"> <li>• To understand the state-of-the-art in network protocols, architectures, and applications.</li> <li>• Analyze existing network protocols and networks.</li> <li>• Develop new protocols in networking</li> <li>• To understand how networking research is done</li> <li>• To investigate novel ideas in the area of Networking via term-long research projects.</li> </ul>			
<b>Course Outcomes:</b> After completion of the course, a student should be able to: <b>CO1:</b> Acquire a comprehensive understanding of modern networking technologies and concepts. <b>CO2:</b> Develop practical skills in configuring and managing various networking elements. <b>CO3:</b> Be well-prepared for roles requiring expertise in cloud computing, SDN, NFV, and network design with a focus on QoS and QoE.			
<b>Outline of Syllabus: (per session plan)</b>			
<b>Module</b>	<b>Description</b>	<b>Durati on (Lectur e)</b>	
<b>Module 1</b>	<b>Modern Networking, Requirements and Technology</b>	<b>15</b>	
	<b>Modern Networking:</b> Elements of Modern Networking, The Networking Ecosystem, Example Network Architectures, Global Network Architecture, A Typical Network Hierarchy Ethernet Applications of Ethernet Standards Ethernet Data Rates Wi-Fi Applications of Wi-Fi, Standards Wi-Fi Data Rates 4G/5G Cellular First Generation Second Generation, Third Generation Fourth Generation Fifth Generation, Cloud Computing Cloud Computing Concepts The Benefits of Cloud Computing Cloud Networking Cloud Storage, Internet of Things, Evolution Layers of the Internet of Things, Network Convergence Unified Communications,  <b>Requirements and Technology:</b> Types of Networks and Internet		

	Traffic, Elastic Traffic, Inelastic Traffic, Real-Time Traffic Characteristics Demand: Big Data, Cloud Computing, and Mobile Traffic Big Data Cloud Computing, Mobile Traffic, Requirements: QoS and QoE, Quality of Service, Quality of Experience, Routing Characteristics, Packet Forwarding, Congestion Control, Effects of Congestion, Congestion Control Techniques, SDN and NFV Software-Defined Networking, Network Functions Virtualization Modern Networking Elements	
<b>Module 2</b>	<b>Software-Defined Networks, SDN Data Plane, SDN Control Plane, SDN Application Plane</b>	<b>15</b>
	<p><b>Software-Defined Networks:</b> SDN: Background and Motivation, Evolving Network Requirements, Demand Is Increasing, Supply Is Increasing Traffic Patterns Are More Complex Traditional Network Architectures are Inadequate, The SDN Approach Requirements SDN Architecture Characteristics of Software-Defined Networking, SDN- and NFV-Related Standards Standards-Developing Organizations Industry Consortia Open Development Initiatives</p> <p><b>SDN Data Plane:</b> SDN Data Plane and OpenFlow SDN Data Plane, Data Plane Functions Data Plane Protocols OpenFlow Logical Network Device Flow Table Structure Flow Table Pipeline, The Use of Multiple Tables Group Table OpenFlow Protocol,</p> <p><b>SDN Control Plane:</b> SDN Control Plane Architecture Control Plane Functions, Southbound Interface Northbound Interface Routing, ITU-T Model, Open Daylight OpenDaylight Architecture OpenDaylight Helium, REST REST Constraints Example REST API, Cooperation and Coordination Among Controllers, Centralized Versus Distributed Controllers, High-Availability Clusters Federated SDN Networks, Border Gateway Protocol Routing and QoS Between Domains, Using BGP for QoS Management IETF SDNi OpenDaylight SNDi</p> <p><b>SDN Application Plane:</b> SDN Application Plane Architecture Northbound Interface Network Services Abstraction Layer Network Applications, User Interface, Network Services Abstraction Layer Abstractions in SDN, Frenetic Traffic Engineering PolicyCop Measurement and Monitoring Security OpenDaylight DDoS Application Data Center Networking, Big Data over SDN Cloud Networking over SDN Mobility and Wireless Information-Centric Networking CCNx, Use of an Abstraction Layer</p>	
<b>Module 3</b>	<b>Network Functions Virtualization, NFV Functionality, Network Virtualization</b>	<b>15</b>
	<b>Network Functions Virtualization:</b> Concepts and Architecture, Background and Motivation for NFV, Virtual Machines The Virtual Machine Monitor, Architectural Approaches Container Virtualization, NFV Concepts SimpleExample of the Use of NFV,	

	<p>NFV Principles High-Level NFV Framework, NFV Benefits and Requirements NFV Benefits, NFV Requirements, NFV Reference Architecture NFV Management and Orchestration, Reference Points Implementation, NFV Functionality</p> <p><b>NFV Functionality:</b> NFV Infrastructure, Container Interface, Deployment of NFVI Containers, Logical Structure of NFVI Domains, Compute Domain, Hypervisor Domain, Infrastructure Network Domain, Virtualized Network Functions, VNF Interfaces, VNFC to VNFC Communication, VNF Scaling, NFV Management and Orchestration, Virtualized Infrastructure Manager, Virtual Network Function Manager, NFV Orchestrator, Repositories, Element Management, OSS/BSS, NFV Use Cases Architectural Use Cases, Service-Oriented Use Cases, SDN and NFV</p> <p><b>Network Virtualization:</b> Virtual LANs, The Use of Virtual LANs, Defining VLANs, Communicating VLAN Membership, IEEE 802.1Q VLAN Standard, Nested VLANs, OpenFlow VLAN Support, Virtual Private Networks, IPsec VPNs, MPLS VPNs, Network Virtualization, Simplified Example, Network Virtualization Architecture, Benefits of Network Virtualization, OpenDaylight’s Virtual Tenant Network, Software-Defined Infrastructure, Software-Defined Storage, SDI Architecture</p>	
<b>Module 4</b>	<b>Defining and Supporting User Needs, Defining and Supporting User Needs, Network Design Implications of QoS and QoE</b>	<b>15</b>
	<p><b>Defining and Supporting User Needs:</b> Quality of Service, Background, QoS Architectural Framework, Data Plane, Control Plane, Management Plane, Integrated Services Architecture, ISA Approach ISA Components, ISA Services, Queuing Discipline, Differentiated Services, Services, DiffServ Field, DiffServ Configuration and Operation, Per-Hop Behavior, Default Forwarding PHB, Service Level Agreements, IP Performance Metrics, OpenFlow QoS Support, Queue Structures, Meters</p> <p><b>QoE: User Quality of Experience:</b> Why QoE?, Online Video Content Delivery, Service Failures Due to Inadequate QoE Considerations QoE-Related Standardization Projects, Definition of Quality of Experience, Definition of Quality, Definition of Experience Quality Formation Process, Definition of Quality of Experience, QoE Strategies in Practice, The QoE/QoS Layered Model Summarizing and merging the, QoE/QoS Layers, Factors Influencing QoE, Measurements of QoE, Subjective Assessment, Objective Assessment, End-User Device Analytics, Summarizing the QoE Measurement Methods, Applications of QoE</p> <p><b>Network Design Implications of QoS and QoE:</b> Classification of QoE/ QoS Mapping Models, Black-Box Media-Based QoS/QoE Mapping Models, Glass-Box Parameter-Based QoS/QoE Mapping</p>	

	Models, Gray-Box QoS/QoE Mapping Models, Tips for QoS/QoE Mapping Model Selection, IP-Oriented Parameter-Based QoS/QoE Mapping Models, Network Layer QoE/QoS Mapping Models for Video Services, Application Layer QoE/QoS Mapping Models for Video Services Actionable QoE over IP-Based Networks, The System-Oriented Actionable QoE Solution, The Service-Oriented Actionable QoE Solution, QoE Versus QoS Service Monitoring, QoS Monitoring Solutions, QoE Monitoring Solutions, QoE-Based Network and Service Management, QoE-Based Management of VoIP Calls, QoE-Based Host-Centric Vertical Handover, QoE-Based Network-Centric Vertical Handover	
	<b>Total Lectures</b>	<b>60</b>

**References:**

1. Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud by William Stallings, Addison- Wesley Professional (2015)
2. SDN and NFV Simplified A Visual Guide to Understanding Software Defined Networks and Network Function Virtualization by Jim Doherty, Pearson Education, Inc
3. Network Functions Virtualization (NFV) with a Touch of SDN by Rajendra Chayapathi Syed Farrukh Hassan, Addison- Wesley
4. CCIE and CCDE Evolving Technologies Study Guide by Brad dgeworth, Jason Gooley, Ramiro Garza Rios, Pearson Education, Inc (2019)

<b>Program: M.Sc. – Information Technology (2025 - 26)</b>		<b>Semester: II</b>	
<b>Course: Modern Networking Practical</b>		<b>Course Code: UIMNE552P</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 20)</b>	<b>Semester End Practical Examinations (SEPE) (Marks- 30 in Question Paper)</b>
4	2	20	30
<b>Learning Objectives:</b> <ul style="list-style-type: none"> <li>To gain practical knowledge in Modern networking</li> <li>To understand the practical skills in configuring and managing complex network scenarios</li> </ul>			
<b>Course Outcomes:</b> After completion of the course, a student should be able to: <b>CO1:</b> Develop a deep understanding of routing protocols, path control, and security measures. <b>CO2:</b> Gain hands-on experience with SDN concepts and simulations. <b>CO3:</b> Be well-prepared for roles requiring expertise in network design, routing, and SDN technologies.			
<b>Outline of Syllabus: (per session plan)</b>			
<b>Module</b>	<b>Description</b>		<b>Duration (Lecture)</b>
<b>1.</b>	Configure IP SLA Tracking and PathControl Topology		<b>30</b>
	Using the AS_PATH Attribute		
	Configuring IBGP and EBGP Sessions, Local Preference, and MED		
	Secure the Management Plane		
	Configure and Verify Path ControlUsing PBR		
<b>2.</b>	IP Service Level Agreements andRemote SPAN in a Campus Environment		<b>30</b>
	Inter-VLAN Routing		
	Simulating MPLS environment andSimulating VRF		
	Simulating SDN with <ul style="list-style-type: none"> <li>OpenDaylight SDN Controller with the Mininet Network Emulator</li> <li>OFNet SDN network emulator</li> </ul>		
	Simulating OpenFlow UsingMININET		
<b>Total Lectures</b>			<b>60</b>

<b>Program: M.Sc. - Information Technology (2025 - 26)</b>		<b>Semester: II</b>	
<b>Course: Microservices Architecture</b>		<b>Course Code: UIMAR553</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 20)</b>	<b>Semester End Examinations (SEE) (Marks- 30 in Question Paper)</b>
2	2	20	30
<b>Learning Objective</b> <ul style="list-style-type: none"> <li>Gain a thorough understanding of the philosophy and architecture of Web applications using ASP.NET Core MVC;</li> <li>Gain a practical understanding of .NET Core;</li> <li>Acquire a working knowledge of Web application development using ASP.NET Core MVC 6 and Visual Studio</li> <li>Persist data with XML Serialization and ADO.NET with SQL Server</li> <li>Create HTTP services using ASP.NET Core Web API;</li> <li>Deploy ASP.NET Core MVC applications to the Windows Azure cloud.</li> </ul>			
<b>Course Outcomes:</b> After completion of the course, learners would be able to: <b>CO1:</b> Understand the concept of microservices and its architecture <b>CO2:</b> Understand the business values, goals, and principles to follow for designing microservices <b>CO3:</b> Understand the distribution, transactions, message passing and dependencies of microservices. <b>CO4:</b> Learn the design of solution architecture of microservices			
<b>Outline of Syllabus: (per session plan)</b>			
<b>Module</b>	<b>Description</b>	<b>No of Hours</b>	
<b>1</b>	<b>Microservices:</b> Understanding Microservices, Adopting Microservices, The Microservices Way. <b>Microservices Value Proposition:</b> Deriving Business Value, defining a Goal-Oriented, Layered Approach, Applying the Goal-Oriented, Layered Approach. <b>Designing Microservice Systems:</b> The Systems Approach to Microservices, A Microservices Design Process, Establishing a Foundation: Goals and Principles, Platforms, Culture.	<b>15</b>	
<b>2</b>	<b>Unit 2</b> <b>Service Design:</b> Microservice Boundaries, API design for Microservices, Data and Microservices, Distributed Transactions and Sagas, Asynchronous Message-Passing and Microservices, dealing with Dependencies, <b>System Design and Operations:</b> Independent Deployability, More Servers, Docker and Microservices, Role of Service Discovery, Need for an API Gateway, Monitoring and Alerting. <b>Adopting Microservices in Practice:</b> Solution Architecture Guidance,	<b>15</b>	

	Organizational Guidance, Culture Guidance, Tools and Process Guidance, Services Guidance.	
	<b>Total</b>	<b>30</b>

### Reference Books

1. Microservice Architecture: Aligning Principles, Practices, and Culture Irakli Nadareishvili, Ronnie Mitra, Matt McLarty, and Mike Amundsen, O'Reilly, First **Edition**, 2016
2. Building Microservices with ASP.NET Core Kevin Hoffman, O'Reilly, First **Edition**, 2017
3. Building Microservices: Designing Fine-Grained Systems, Sam Newman, O'Reilly, First **Edition**
4. Production-ready Microservices, Susan J. Fowler, O'Reilly, 2016

<b>Program: M.Sc. - Information Technology (2025 - 26)</b>		<b>Semester: II</b>	
<b>Course: Malware Analysis Practical</b>		<b>Course Code: UIMAN554P</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 40)</b>	<b>Semester End Practical Examinations (SEPE) (Marks- 60 in Question Paper)</b>
8	4	40	60
<b>Learning Objectives:</b>			
<ul style="list-style-type: none"> <li>• Possess the skills necessary to carry out independent analysis of modern malware samples using both static and dynamic analysis techniques.</li> <li>• Have an intimate understanding of executable formats, Windows internals and API, and analysis techniques.</li> <li>• Extract investigative leads from host and network-based indicators associated with a malicious program.</li> <li>• Apply techniques and concepts to unpack, extract, decrypt, or bypass new anti-analysis techniques in future malware samples.</li> <li>• Achieve proficiency with industry standard tools including IDA Pro, OllyDbg, WinDBG, PE Explorer, ProcMon etc.</li> </ul>			
<b>Course Outcomes:</b>			
After completion of the course, a student should be able to:			
<b>CO1:</b> Understand various introductory techniques of malware analysis and creating the testing environment			
<b>CO2 :</b> Perform advanced dynamic analysis and recognize constructs in assembly code.			
<b>CO3 :</b> Perform Reverse Engineering using OLLYDBG and WINDBG and study the behaviours and functions of malware			
<b>CO4 :</b> Understand data encoding, various techniques for anti-disassembly and anti-debugging			
<b>CO5 :</b> Understand various anti virtual machine techniques and perform shellcode analysis of various languages along with x64 architecture.			

<b>Outline of Syllabus: (per session plan)</b>		
<b>Module</b>	<b>Description</b>	<b>No of Hours</b>
<b>1</b>	<b>1. a. Files: <i>Lab01-01.exe</i> and <i>Lab01-01.dll</i>.</b>	<b>30</b>
	i. Upload the files to <a href="http://www.VirusTotal.com/">http://www.VirusTotal.com/</a> and view the reports. Does either file match any existing antivirus signatures?	
	ii. When were these files compiled?	
	iii. Are there any indications that either of these files is packed or obfuscated? If so, what are these indicators?	
	iv. Do any imports hint at what this malware does? If so, which imports are they?	
	v. Are there any other files or host-based indicators that you could look for on infected systems?	
	vi. What network-based indicators could be used to find this malware on infected machines?	
	vii. What would you guess is the purpose of these files?	
	<b>b. Analyze the file <i>Lab01-02.exe</i>.</b>	
	i. Upload the <i>Lab01-02.exe</i> file to <a href="http://www.VirusTotal.com/">http://www.VirusTotal.com/</a> . Does it match any existing antivirus definitions?	
	ii. Are there any indications that this file is packed or obfuscated? If so, what are these indicators? If the file is packed, unpack it if possible.	
	iii. Do any imports hint at this program's functionality? If so, which imports are they and what do they tell you?	
	iv. What host- or network-based indicators could be used to identify this malware on infected machines?	
	<b>c. Analyze the file <i>Lab01-03.exe</i>.</b>	
	i. Upload the <i>Lab01-03.exe</i> file to <a href="http://www.VirusTotal.com/">http://www.VirusTotal.com/</a> . Does it match any existing antivirus definitions?	
	ii. Are there any indications that this file is packed or obfuscated? If so, what are these indicators? If the file is packed, unpack it if possible.	
	iii. Do any imports hint at this program's functionality? If so, which imports are they and what do they tell you?	
	iv. What host- or network-based indicators could be used to identify this malware on infected machines?	
	<b>d. Analyze the file <i>Lab01-04.exe</i>.</b>	
	i. Upload the <i>Lab01-04.exe</i> file to <a href="http://www.VirusTotal.com/">http://www.VirusTotal.com/</a> . Does it match any existing antivirus definitions?	
	ii. Are there any indications that this file is packed or obfuscated? If so, what are these indicators? If the file is packed, unpack it if possible.	
iii. When was this program compiled?		
iv. Do any imports hint at this program's functionality? If so, which imports are they and what do they tell you?		
v. What host- or network-based indicators could be used to identify this malware on infected machines?		

	<p>vi. This file has one resource in the resource section. Use Resource Hacker to examine that resource, and then use it to extract the resource. What can you learn from the resource?</p> <p><b>e. Analyze the malware found in the file Lab03-01.exe using basic dynamic analysis tools.</b></p> <p>i. What are this malware's imports and strings?</p> <p>ii. What are the malware's host-based indicators?</p> <p>iii. Are there any useful network-based signatures for this malware? If so, what are they?</p>	
	<p><b>f. Analyze the malware found in the file Lab03-02.dll using basic dynamic analysis tools.</b></p> <p>i. How can you get this malware to install itself?</p> <p>ii. How would you get this malware to run after installation?</p> <p>iii. How can you find the process under which this malware is running?</p> <p>iv. Which filters could you set in order to use procmon to glean information?</p> <p>v. What are the malware's host-based indicators?</p> <p>vi. Are there any useful network-based signatures for this malware?</p> <p><b>g. Execute the malware found in the file Lab03-03.exe while monitoring it using basic dynamic analysis tools in a safe environment</b></p> <p>i. What do you notice when monitoring this malware with Process Explorer?</p> <p>ii. Can you identify any live memory modifications?</p> <p>iii. What are the malware's host-based indicators?</p> <p>iv. What is the purpose of this program?</p> <p><b>h. Analyze the malware found in the file Lab03-04.exe using basic dynamic analysis tools.</b></p> <p>i. What happens when you run this file?</p> <p>ii. What is causing the roadblock in dynamic analysis?</p> <p>iii. Are there other ways to run this program?</p>	
2.	<p><b>a. Analyze the malware found in the file Lab05-01.dll using only IDA Pro. The goal of this lab is to give you hands-on experience with IDA Pro. If you've already worked with IDA Pro, you may choose to ignore these questions and focus on reverse engineering the malware.</b></p> <p>i. What is the address of DllMain?</p> <p>ii. Use the Imports window to browse to gethostbyname. Where is the import located?</p> <p>iii. How many functions call gethostbyname?</p> <p>iv. Focusing on the call to gethostbyname located at 0x10001757, can you figure out which DNS request will be made?</p> <p>v. How many local variables has IDA Pro recognized for the subroutine at 0x10001656?</p> <p>vi. How many parameters has IDA Pro recognized for the subroutine at 0x10001656?</p> <p>vii. Use the Strings window to locate the string \cmd.exe /c in the disassembly. Where is it located?</p> <p>viii. What is happening in the area of code that references \cmd.exe/c?</p>	

	<p>ix. In the same area, at 0x100101C8, it looks like word_1008E5C4 is a global variable that helps decide which path to take. How does the malware set dword_1008E5C4? (Hint: Use dword_1008E5C4's cross-references.)</p> <p>x. A few hundred lines into the subroutine at 0x1000FF58, a series of comparisons use memcmpt to compare strings. What happens if the string comparison to robotwork is successful (when memcmpt returns 0)?</p> <p>xi. What does the export PSLIST do?</p> <p>xii. Use the graph mode to graph the cross-references from sub_10004E79. Which API functions could be called by entering this function? Based on the API functions alone, what could you rename this function?</p> <p>xiii. How many Windows API functions does DllMain call directly? How many at a depth of 2?</p> <p>xiv. At 0x10001358, there is a call to Sleep (an API function that takes one parameter containing the number of milliseconds to sleep). Looking backward through the code, how long will the program sleep if this code executes?</p> <p>xv. At 0x10001701 is a call to socket. What are the three parameters?</p>	
	<p>xvi. Using the MSDN page for socket and the named symbolic constants functionality in IDA Pro, can you make the parameters more meaningful? What are the parameters after you apply changes?</p> <p>xvii. Search for usage of the in instruction (opcode 0xED). This instruction is used with a magic string VMXh to perform VMware detection. Is that in use in this malware? Using the cross-references to the function that executes the in instruction, is there further evidence of VMware detection?</p> <p>xviii. Jump your cursor to 0x1001D988. What do you find?</p> <p>xix. If you have the IDA Python plug-in installed (included with the commercial version of IDA Pro), run <i>Lab05-01.py</i>, an IDA Pro Python script provided with the malware for this book. (Make sure the cursor is at 0x1001D988.) What happens after you run the script?</p> <p>xx. With the cursor in the same location, how do you turn this data into a single ASCII string?</p> <p>xxi. Open the script with a text editor. How does it work?</p> <p><b>b. analyze the malware found in the file Lab06-01.exe.</b></p> <p>i. What is the major code construct found in the only subroutine called by main?</p> <p>ii. What is the subroutine located at 0x40105F?</p> <p>iii. What is the purpose of this program?</p> <p><b>c. Analyze the malware found in the file Lab06-02.exe.</b></p> <p>i. What operation does the first subroutine called by main perform?</p> <p>ii. What is the subroutine located at 0x40117F?</p> <p>iii. What does the second subroutine called by main do?</p> <p>iv. What type of code construct is used in this subroutine?</p> <p>v. Are there any network-based indicators for this program?</p> <p>vi. What is the purpose of this malware?</p>	

	<p><b>d. analyze the malware found in the file Lab06-03.exe.</b></p> <p>i. Compare the calls in main to Lab 6-2's main method. What is the new function called from main?</p> <p>ii. What parameters does this new function take?</p> <p>iii. What major code construct does this function contain?</p> <p>iv. What can this function do?</p> <p>v. Are there any host-based indicators for this malware?</p> <p>vi. What is the purpose of this malware?</p> <p><b>e. analyze the malware found in the file Lab06-04.exe.</b></p> <p>i. What is the difference between the calls made from the main method in Labs 6-3 and 6-4?</p> <p>ii. What new code construct has been added to main?</p> <p>iii. What is the difference between this lab's parse HTML function and those of the previous labs?</p> <p>iv. How long will this program run? (Assume that it is connected to the Internet.)</p> <p>v. Are there any new network-based indicators for this malware?</p> <p>vi. What is the purpose of this malware?</p>	
3.	<p><b>a. Analyze the malware found in the file Lab07-01.exe.</b></p> <p>i. How does this program ensure that it continues running (achieves persistence) when the computer is restarted?</p> <p>ii. Why does this program use a mutex?</p> <p>iii. What is a good host-based signature to use for detecting this program?</p> <p>iv. What is a good network-based signature for detecting this malware?</p> <p>v. What is the purpose of this program?</p> <p>vi. When will this program finish executing?</p> <p><b>b. Analyze the malware found in the file Lab07-02.exe.</b></p> <p>i. How does this program achieve persistence?</p> <p>ii. What is the purpose of this program?</p> <p>iii. When will this program finish executing?</p> <p><b>c. For this lab, we obtained the malicious executable, Lab0703.exe, and DLL, Lab07-03.dll, prior to executing. This is important to note because the malware might change once it runs. Both files were found in the same directory on the victim machine. If you run the program, you should ensure that both files are in the same directory on the analysis machine. A visible IP string beginning with 127 (a loopback address) connects to the local machine. (In the real version of this malware, this address connects to a remote machine, but we've set it to connect to localhost to protect you.)</b></p> <p>i. How does this program achieve persistence to ensure that it continues running when the computer is restarted?</p> <p>ii. What are two good host-based signatures for this malware?</p> <p>iii. What is the purpose of this program?</p> <p>iv. How could you remove this malware once it is installed?</p> <p><b>d. Analyze the malware found in the file Lab09-01.exe using OllyDbg and IDA Pro to answer the following questions. This malware was initially analyzed in the Chapter 3 labs using basic</b></p>	30

	<p><b>static and dynamic analysis techniques.</b></p> <p>i. How can you get this malware to install itself?</p> <p>ii. What are the command-line options for this program? What is the pass word requirement?</p> <p>iii. How can you use OllyDbg to permanently patch this malware, so that it doesn't require the special command-line password?</p> <p>iv. What are the host-based indicators of thismalware?</p> <p>v. What are the different actions this malware can be instructed to take via the network?</p> <p>vi. Are there any useful network-based signatures for this malware?</p> <p><b>e. Analyze the malware found in the file Lab09-02.exe using OllyDbg to answer the following questions.</b></p> <p>i. What strings do you see statically in the binary?</p> <p>ii. What happens when you run this binary?</p> <p>iii. How can you get this sample to run its malicious payload?</p> <p>iv. What is happening at 0x00401133?</p> <p>v. What arguments are being passed to subroutine 0x00401089?</p> <p>vi. What domain name does this malware use?</p> <p>vii. What encoding routine is being used to obfuscate the domain name?</p> <p>viii. What is the significance of the CreateProcessAcall at 0x0040106E?</p>	
	<p><b>f. Analyze the malware found in the file Lab09-03.exe using OllyDbg and IDA Pro. This malware loads three included DLLs (DLL1.dll, DLL2.dll, and DLL3.dll ) that are all built to request the same memory load location. Therefore, when viewing these DLLs in OllyDbg versus IDA Pro, code may appear at different memory locations. The purpose of this lab is to make you comfortable with finding the correct location of code within IDA Pro when you are looking at code in OllyDbg</b></p> <p>i. What DLLs are imported by <i>Lab09-03.exe</i>?</p> <p>ii. What is the base address requested by <i>DLL1.dll</i>, <i>DLL2.dll</i>, and <i>DLL3.dll</i>?</p> <p>iii. When you use OllyDbg to debug <i>Lab09-03.exe</i>, what is the assigned based address for: <i>DLL1.dll</i>, <i>DLL2.dll</i>, and <i>DLL3.dll</i>?</p> <p>iv. When <i>Lab09-03.exe</i> calls an import function from <i>DLL1.dll</i>, what does this import function do?</p> <p>v. When <i>Lab09-03.exe</i> calls WriteFile, what is the filename it writes to?</p> <p>vi. When <i>Lab09-03.exe</i> creates a job using NetScheduleJobAdd, where does it get the data for the second parameter?</p> <p>vii. While running or debugging the program, you will see that it prints out three pieces of mystery data. What are the following: DLL 1 mystery data 1, DLL 2 mystery data 2, and DLL 3 mystery data 3?</p>	

	viii. How can you load <i>DLL2.dll</i> into IDA Pro so that it matches the load address used by OllyDbg?		
4	<b>a. This lab includes both a driver and an executable. You can run the executable from anywhere, but in order for the program to work properly, the driver must be placed in the C:\Windows\System32 directory where it was originally found on the victim computer. The executable is Lab10-01.exe, and the driver is Lab10-01.sys.</b>		
	i. Does this program make any direct changes to the registry? (Use procmon to check.)		
	ii. The user-space program calls the ControlService function. Can you set a breakpoint with WinDbg to see what is executed in the kernel as a result of the call to ControlService?		
	iii. What does this program do?		
	<b>b. The file for this lab is Lab10-02.exe.</b>		
	i. Does this program create any files? If so, what are they?		
	ii. Does this program have a kernel component?		
	iii. What does this program do?		
	<b>c. This lab includes a driver and an executable. You can run the executable from anywhere, but in order for the program to work properly, the driver must be placed in the C:\Windows\System32 directory where it was originally found on the victim computer. The executable is Lab10-03.exe, and the driver is Lab10-03.sys.</b>		
	i. What does this program do?		
	ii. Once this program is running, how do you stop it?		
	iii. What does the kernel component do?		
	5	<b>a. Analyze the malware found in Lab11-01.exe</b>	30
		i. What does the malware drop to disk?	
ii. How does the malware achieve persistence?			
iii. How does the malware steal user credentials?			
iv. What does the malware do with stolen credentials?			
v. How can you use this malware to get user credentials from your test environment?			
<b>b. Analyze the malware found in Lab11-02.dll. Assume that a suspicious file named Lab11-02.ini was also found with this malware.</b>			
i. What are the exports for this DLL malware?			
ii. What happens after you attempt to install this malware using			
iii. <i>rundll32.exe</i> ?			
iv. Where must <i>Lab11-02.ini</i> reside in order for the malware to install properly?			
v. How is this malware installed for persistence?			
vi. What user-space rootkit technique does this malware employ?			
vii. What does the hooking code do?			

	viii. Which process(es) does this malware attack and why?	
	ix. What is the significance of the <i>.ini</i> file?	
	<b>c. Analyze the malware found in <i>Lab11-03.exe</i> and <i>Lab11-03.dll</i>. Make sure that both files are in the same directory during analysis</b>	
	i. What interesting analysis leads can you discover using basic static analysis?	
	ii. What happens when you run this malware?	
	iii. How does <i>Lab11-03.exe</i> persistently install <i>Lab11-03.dll</i> ?	
	iv. Which Windows system file does the malware infect?	
	v. What does <i>Lab11-03.dll</i> do?	
	vi. Where does the malware store the data it collects?	
<b>6</b>	<b>a. Analyze the malware found in the file <i>Lab12-01.exe</i> and <i>Lab12-01.dll</i>. Make sure that these files are in the same directory when performing the analysis</b>	
	i. What happens when you run the malware executable?	
	ii. What process is being injected?	
	iii. How can you make the malware stop the pop-ups?	
	iv. How does this malware operate?	
	<b>b. Analyze the malware found in the file <i>Lab12-02.exe</i>.</b>	
	i. What is the purpose of this program?	
	ii. How does the launcher program hide execution?	
	iii. Where is the malicious payload stored?	
	iv. How is the malicious payload protected?	
	v. How are strings protected?	
	<b>c. Analyze the malware extracted during the analysis of Lab 122, or use the file <i>Lab12-03.exe</i>.</b>	
	i. What is the purpose of this malicious payload?	
	ii. How does the malicious payload inject itself?	
	iii. What filesystem residue does this program create?	
	<b>d. Analyze the malware found in the file <i>Lab12-04.exe</i>.</b>	
	i. What does the code at 0x401000 accomplish?	
	ii. Which process has code injected?	
	iii. What DLL is loaded using LoadLibraryA?	
	iv. What is the fourth argument passed to the CreateRemoteThread call?	
	v. What malware is dropped by the main executable?	
<b>7</b>	<b>a. Analyze the malware found in the file <i>Lab13-01.exe</i>.</b>	<b>30</b>
	i. Compare the strings in the malware (from the output of the strings command) with the information available via dynamic analysis. Based on this comparison, which elements might be encoded?	
	ii. Use IDA Pro to look for potential encoding by searching for the string xor. What type of encoding do you find?	
	iii. What is the key used for encoding and what content does it encode?	

	<p>iv. Use the static tools FindCrypt2, Krypto ANALyzer (KANAL), and the IDA Entropy Plugin to identify any other encoding mechanisms. What do you find?</p> <p>v. What type of encoding is used for a portion of the network traffic sent by the malware?</p> <p>vi. Where is the Base64 function in the disassembly?</p> <p>vii. What is the maximum length of the Base64-encoded data that is sent? What is encoded?</p> <p>viii. In this malware, would you ever see the padding characters (= or ==) in the Base64-encoded data?</p> <p>ix. What does this malware do?</p> <p><b>b. Analyze the malware found in the file <i>Lab13-02.exe</i>.</b></p> <p>i. Using dynamic analysis, determine what this malware creates.</p> <p>ii. Use static techniques such as an xor search, FindCrypt2, KANAL, and the IDA Entropy Plugin to look for potential encoding. What do you find?</p> <p>iii. Based on your answer to question 1, which imported function would be a good prospect for finding the encoding functions?</p> <p>iv. Where is the encoding function in the disassembly?</p> <p>v. Trace from the encoding function to the source of the encoded content. What is the content?</p> <p>vi. Can you find the algorithm used for encoding? If not, how can you decode the content?</p> <p>vii. Using instrumentation, can you recover the original source of one of the encoded files?</p> <p><b>c. Analyze the malware found in the file <i>Lab13-03.exe</i>.</b></p> <p>i. Compare the output of strings with the information available via dynamic analysis. Based on this comparison, which elements might be encoded?</p> <p>ii. Use static analysis to look for potential encoding by searching for the string xor. What type of encoding do you find?</p> <p>iii. Use static tools like FindCrypt2, KANAL, and the IDA Entropy Plugin to identify any other encoding mechanisms. How do these findings compare with the XOR findings?</p> <p>iv. Which two encoding techniques are used in this malware?</p> <p>v. For each encoding technique, what is the key?</p> <p>vi. For the cryptographic encryption algorithm, is the key sufficient? What else must be known?</p> <p>vii. What does this malware do?</p> <p>viii. Create code to decrypt some of the content produced during dynamic analysis. What is this content?</p>	
8	<p><b>a. Analyze the malware found in file <i>Lab14-01.exe</i>. This program is not harmful to your system.</b></p> <p>i. Which networking libraries does the malware use, and what are their advantages?</p> <p>ii. What source elements are used to construct the networking</p>	

beacon, and what conditions would cause the beacon to change?	
iii. Why might the information embedded in the networking beacon be of interest to the attacker?	
iv. Does the malware use standard Base64 encoding? If not, how is the encoding unusual?	
v. What is the overall purpose of this malware?	
vi. What elements of the malware's communication may be effectively detected using a network signature?	
vii. What mistakes might analysts make in trying to develop a signature for this malware?	
viii. What set of signatures would detect this malware (and future variants)?	
<b>b. Analyze the malware found in file <i>Lab14-02.exe</i>. This malware has been configured to beacon to a hard-coded loopback address in order to prevent it from harming your system, but imagine that it is a hard-coded external address.</b>	
i. What are the advantages or disadvantages of coding malware to use direct IP addresses?	
ii. Which networking libraries does this malware use? What are the advantages or disadvantages of using these libraries?	
iii. What is the source of the URL that the malware uses for beaoning? What advantages does this source offer?	
iv. Which aspect of the HTTP protocol does the malware leverage to achieve its objectives?	
v. What kind of information is communicated in the malware's initial beacon?	
vi. What are some disadvantages in the design of this malware's communication channels?	
vii. Is the malware's encoding scheme standard?	
viii. How is communication terminated?	
ix. What is the purpose of this malware, and what role might it play in the attacker's arsenal?	
<b>c. This lab builds on Practical 8 a. Imagine that this malware is an attempt by the attacker to improve his techniques. Analyze the malware found in file <i>Lab14-03.exe</i>.</b>	
i. What hard-coded elements are used in the initial beacon? What elements, if any, would make a good signature?	
ii. What elements of the initial beacon may not be conducive to a long lasting signature?	
iii. How does the malware obtain commands? What example from the chapter used a similar methodology? What are the advantages of this technique?	
iv. When the malware receives input, what checks are performed on the input to determine whether it is a valid command? How does the attacker hide the list of commands the malware is searching for?	
v. What type of encoding is used for command arguments? How is it different from Base64, and what advantages or disadvantages	

does it offer?	
vi. What commands are available to this malware?	
vii. What is the purpose of this malware?	
viii. This chapter introduced the idea of targeting different areas of code with independent signatures (where possible) in order to add resiliency to network indicators. What are some distinct areas of code or configuration data that can be targeted by network signatures?	
ix. What set of signatures should be used for this malware?	
<b>d. Analyze the sample found in the file Lab15-01.exe. This is a command-line program that takes an argument and prints “Good Job!” if the argument matches a secret code.</b>	
i. What anti-disassembly technique is used in this binary?	
ii. What rogue opcode is the disassembly tricked into disassembling?	
iii. How many times is this technique used?	
iv. What command-line argument will cause the program to print “Good Job!”?	
<b>e. Analyze the malware found in the file Lab15-02.exe. Correct all anti-disassembly countermeasures before analyzing the binary in order to answer the questions.</b>	
i. What URL is initially requested by the program?	
ii. How is the User-Agent generated?	
iii. What does the program look for in the page it initially requests?	
iv. What does the program do with the information it extracts from the page?	
<b>f. Analyze the malware found in the file Lab15-03.exe. At first glance, this binary appears to be a legitimate tool, but it actually contains more functionality than advertised.</b>	
i. How is the malicious code initially called?	
ii. What does the malicious code do?	
iii. What URL does the malware use?	
iv. What filename does the malware use?	
<b>Total</b>	<b>120</b>

### Reference Books

1. Practical Malware Analysis – The Hands-On Guide to Dissecting Malicious Software  
By Michael Sikorski, Andrew Honig - 2013
2. Mastering Malware Analysis - 2019
3. Windows Malware Analysis Essentials 2015

<b>Program: M.Sc. - Information Technology (2025 - 26)</b>		<b>Semester: II</b>	
<b>Course: Cloud Management Practical</b>		<b>Course Code: UICMA555P</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 40)</b>	<b>Semester End Practical Examinations (SEPE) (Marks- 60 in Question Paper)</b>
8	4	40	60
<b>Learning Objectives:</b>			
<ul style="list-style-type: none"> <li>Understand System Center 2019 and its different components. Each unit of 30 hours duration</li> </ul>			
<b>Course Outcomes:</b>			
After completion of the course, a student should be able to:			
<b>CO1:</b> Understand the concepts of VMM, SDN, NAS , HyperV etc. <b>CO2:</b> Understand and use of Service manager with various deployments that can be performed using it. <b>CO3:</b> Understand and use SCCM and Demonstrate the use of Configuration Manager <b>CO4:</b> Use automation with runbooks and demonstrate the use of Windows Orchestrator <b>CO5:</b> Use Data Protection Manager			
<b>Outline of Syllabus: (per session plan)</b>			
<b>Module</b>	<b>Description</b>	<b>No of Hours</b>	
<b>1</b>	a. Create and Manage Cloud using SCVMM 2019 b. Deploy a guarded host fabric using Microsoft SCVMM 2019 a. Deploy and manage SDN Infra structure using SCVMM 2019 b. Deploy and Manage Storage Space Direct (S2D) using SCVMM 2019 a. Deploy Service Manager 2019 and install on 4 Computer Scenario b. Setup SQL Server reporting Service using Service Manager 2019 a. User Connectors to import data: i. Import data from Active Directory Domain Services ii. Import data and alerts from Operations Manager iii. Import data from Configuration Manager iv. Import runbooks from Orchestrator v. Import data from VMM vi. Use a CSV file to import data	<b>30</b>	
<b>2</b>	b. Automate IT processes with workflows vii. Add or remove workflow activities viii. Configure the way activities manage and pass information <b>ix.</b> Deploy a workflow to Service Manager using the Authoring	<b>30</b>	

Tool Configure the Activities Toolbox in the Authoring Tool		
3	a. Managing devices with Configuration Manager	30
	b. Design a hierarchy of sites using Microsoft End Point Configuration	
	a. Data transfers between sites	
	i. Types of data transfer	
	ii. File-based replication	
	iii. Database replication	
	b. Configure sites and hierarchies	
	i. Add site system roles	
	ii. Install site system roles	
	iii. Install cloud-based distribution points	
	iv. Configuration options for site system roles	
v. Database replicas for management points		
4	a. Install Orchestrator	30
	b. Create and test a monitor runbook	
	a. Manage Orchestrator Servers – 1	
	i. Runbook permissions	
	b. Manage Orchestrator Servers – 2	
	i. Recover web components	
	ii. Add an integration pack	
	iii. View Orchestrator data with PowerPivot	
	iv. Change Orchestrator user groups	
	v. Common activity properties	
	vi. Computer groups	
	Install and Deploy DPM	
	i. Install DPM	
	ii. Deploy the DPM protection agent	
	iii. Deploy protection groups	
	iv. Configure firewall settings	
	Protect Workloads	
i. Back up Hyper-V virtual machines		
ii. Back up SQL Server with DPM		
iii. Back up file data with DPM		
iv. Backup system state and bare metal		
v. Backup and restore VMware servers		
vi. Backup and restore VMM servers		
<b>Total</b>	<b>120</b>	

<b>Program: M.Sc. - Information Technology (2025 - 26)</b>		<b>Semester: II</b>	
<b>Course: Computer Vision Practical</b>		<b>Course Code: UICVI556P</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 40)</b>	<b>Semester End Examinations (SEE) (Marks- 60 in Question Paper)</b>
8	4	40	60
<b>Learning Objectives:</b> <ul style="list-style-type: none"> <li>• Understand foundational concepts of computer vision, image manipulation, and processing using tools like OpenCV.</li> <li>• Master feature detection, description, and matching; implement pedestrian detection using advanced algorithms.</li> <li>• Apply deep learning models for face and object detection, recognition, and tracking in videos.</li> <li>• Explore advanced applications including text recognition, image segmentation, and constructing 3D models from images.</li> <li>• Develop practical skills through hands-on projects, focusing on real-world applications of computer vision techniques.</li> </ul>			
<b>Course Outcomes:</b>  After completion of the course, a student should be able to: <b>CO1:</b> Demonstrate proficiency in using computer vision libraries and tools for image processing and manipulation. <b>CO2:</b> Identify and apply appropriate feature detection and extraction techniques for various computer vision tasks. <b>CO3:</b> Implement and analyze deep learning models for effective face and object detection, as well as recognition in images and videos. <b>CO4:</b> Execute advanced computer vision applications, including text detection, image segmentation, and 3D model construction from images. <b>CO5:</b> Apply theoretical concepts and practical techniques to solve real-world problems, showcasing a comprehensive understanding of computer vision.			
<b>Outline of Syllabus: (per session plan)</b>			
<b>Module</b>	<b>Description</b>	<b>No of Hours</b>	
<b>1</b>	<b>Fundamentals of Computer Vision and Image Processing</b> <b>Introduction to Computer Vision:</b> Overview of computer vision, its applications, and tools <b>Working with Images:</b> Basics of image manipulation using libraries like OpenCV; understanding pixels and image formats <b>Basic Image Processing Techniques:</b> Filtering, edge detection, and binary operations; introduction to image matting and compositing.	<b>30</b>	

	<b>Practical Lab Sessions:</b> Hands-on exercises focusing on image manipulation, applying filters, and basic processing techniques including colorization.	
2	<p><b>Feature Detection, Description, and Matching</b></p> <p><b>Feature Detection and Description:</b> Exploring corner detection, edge detection, blob detection, and feature descriptors such as SIFT, SURF, and ORB.</p> <p><b>Object and Pedestrian Detection:</b> Introduction to object detection algorithms, including Haar cascades, with a focus on pedestrian detection.</p> <p><b>Feature Extraction using RANSAC:</b> Understanding and implementing feature extraction with RANSAC for robust matching.</p> <p><b>Practical Lab Sessions:</b> Implementing feature detection, description, and pedestrian detection; exercises on feature extraction with RANSAC.</p>	30
3	<p><b>Deep Learning in Computer Vision</b></p> <p><b>Convolutional Neural Networks (CNNs):</b> Fundamentals of CNNs, their architecture, and applications in image classification.</p> <p><b>Deep Learning for Object Detection and Recognition:</b> Utilizing advanced models like R-CNN, YOLO, and SSD for object detection; face detection and recognition techniques.</p> <p><b>Implementing Object Detection and Tracking from Video:</b> Overview of techniques for video analysis, including motion analysis and tracking algorithms.</p> <p><b>Practical Lab Sessions:</b> Hands-on exercises with TensorFlow or PyTorch, focusing on face detection, object detection, and tracking in video content</p>	30
4	<p><b>Advanced Computer Vision Applications</b></p> <p><b>Image Segmentation and Advanced Recognition Techniques:</b> Techniques for image segmentation; detailed exploration of face recognition algorithms.</p> <p><b>Text Detection and Recognition:</b> Methods for detecting and recognizing text in images.</p> <p><b>Constructing 3D Models from Images:</b> Introduction to techniques for 3D reconstruction from image sets.</p> <p><b>Practical Lab Sessions:</b> Projects involving image segmentation, text detection and recognition, and constructing 3D models from multiple images.</p>	30
	<b>Total</b>	<b>120</b>

## Reference Books

1. Computer Vision: Algorithms and Applications by Richard Szeliski, Springer, 1<sup>st</sup> Edition, 2010

<b>Program: M.Sc. - Information Technology (2025 - 26)</b>	<b>Semester: II</b>
<b>Course: On Job Training</b>	<b>Course Code: UIOJT557</b>

## On-Job Training (OJT) Component for M.Sc.-IT

### A. Introduction

The M.Sc. IT program at SVKM's Usha Pravin Gandhi College of Arts, Science and Commerce incorporates a comprehensive On-Job Training (OJT) module, designed to bridge the gap between academic learning and real-world industry practices. This mandatory component is structured to enrich our students' educational experience, providing them with hands-on exposure to practical work scenarios and enhancing their employability and skill set.

- **Importance of OJT:**

This direct engagement with the industry and research projects not only enhances students' learning experiences but also significantly boosts their confidence, problem-solving abilities, and readiness for employment.

- **Scope of OJT:**

OJT is an integral part of the curriculum, scheduled during the semester, offering students the opportunity to work on actual projects within industries, research institutions, and other professional environments. This experiential learning phase allows students to apply theoretical knowledge to practical challenges, fostering a deeper understanding of their field.

### B. Conduct of OJT:

- **Mode of Participation:** Students have the flexibility to undertake their OJT in a physical mode within the industry or online, depending on the nature of the project and the hosting organization's policies.
- **On-Premise for Research Projects:** For those inclined towards research, OJT can be conducted on-premise, assisting in ongoing research projects at research institutions, offering a unique insight into the research methodologies and challenges.

### C. On-the-Job Training for Industry Readiness

- **Hands-On Experience:** M.Sc. IT students will engage in a 4-6 week OJT program, accumulating 120 hours of practical experience. This immersive learning opportunity allows students to apply theoretical knowledge in real-world settings.
- **Diverse Job Opportunities:** During OJT, students can explore various roles such as software developer, system analyst, database administrator, cybersecurity analyst, IT consultant, and more. These roles align with their academic background and provide valuable industry exposure.
- **Industry-Relevant Skills:** OJT enables students to develop technical skills in programming languages, software development methodologies, database management, network security, and other IT domains. Additionally, they gain soft skills like communication, teamwork, problem-solving, and time management.

- **External Placement:** Students are responsible for securing their OJT placements however institution will also provide guidance and support from for internships in reputable organizations/startups etc., ensuring exposure to diverse work environments and cutting-edge technologies.
- **Career Readiness:** By bridging the gap between academia and industry, OJT prepares M.Sc. IT students for successful careers in fields such as artificial intelligence, data science, cloud computing, cybersecurity, and software engineering. This practical experience enhances their employability and professional competency.

#### **D. OJT Opportunities Across Various Organizations**

Internship Placements: Students are encouraged to seek OJT experiences in a wide range of organizations, including:

- **Software Development Firms:** Students can immerse themselves in software development and programming tasks, gaining practical skills and insights into industry best practices.
- **Hardware/Manufacturing Companies:** Opportunities abound for students to delve into hardware design, manufacturing processes, and quality assurance protocols, providing valuable hands-on experience in technological innovation.
- **Small-Scale Industries/Service Providers:** Students have the chance to explore diverse sectors such as banking, healthcare clinics, NGOs, and professional institutions like CA firms or law firms. This exposure allows for a comprehensive understanding of industry operations and service delivery.
- **Civic Departments:** Engagement with local civic departments such as ward offices, post offices, police stations, or panchayats offers students a unique opportunity to observe governance structures and contribute to community activities, fostering civic responsibility and practical knowledge.
- **Research Centers/University Departments/Colleges:** Students can actively participate as research assistants or in similar capacities within research projects or initiatives. This collaboration between academia and industry fosters innovation and enriches academic learning with real-world applications.

#### **E. Evaluation:**

As part of our internship program, students need to submit two important documents:

##### **Daily Diary:**

- Students must write daily entries in an online diary, including what they did each day during the internship.
- Each entry should be short, just 3-4 sentences, summarizing the day's activities.
- Faculty members will regularly check these entries to monitor progress.

##### **OJT Report:**

It includes:

- **A Certificate:** This is a paper from the organization where the student did the internship, saying they completed it.
- **Title:** This explains what the student did during the internship.

- Information about the organization: A short description of where the student worked.
- Job Description: A summary of the tasks and activities the student was given.
- Self-assessment: The student's own thoughts on what they learned during the internship.

The OJT is evaluated on a dual-component basis to ensure a comprehensive assessment of the student's performance and learning outcomes.

- Supervisor's Feedback: Each student will have a supervisor in the organization where they intern. The supervisor will give feedback on how well the student did their tasks, solved problems, and behaved professionally.
- Institutional Review: After finishing the internship, students will give a presentation at the college. They'll talk about what they did during the internship and how it helped them learn. Teachers will watch and evaluate the presentation.

## **F. OJT workload for the faculty**

Each student is paired with a faculty mentor who guides them through their OJT experience. The faculty mentor oversees a group of students, serving as their main point of contact throughout the process. They monitor the progress of each student's OJT by reviewing their diary entries, coordinating with industry mentors, and offering support with report writing. To ensure effective mentorship, faculty members are entitled to one hour of workload allocation per week for their mentoring responsibilities.

## Evaluation Scheme

**Theory courses of 4 credits:** Total marks 100. Out of the total, 40% is for internal and 60% is for external evaluation.

**A. Internal Evaluation (20m + 10m + 10m = 40 Marks)**

The internal assessment marks shall be awarded as follows:

- i) 10 marks + 10marks (three tests\* for 10 marks each to be conducted at different instants of time amongst which best two out of three will be considered)
- ii) 10 marks assignments / projects / presentations etc.
- iii) 10 marks research paper

10 marks from every course (Two 4 credits mandatory courses, one 4 credits mandatory course, one 4 credits Research Methodology/Research Project) coming to a total of 40 marks, shall be awarded on publishing of research paper in Journal/Conference with plagiarism less than 15%. The marks can be awarded as per the impact factor of the journal, quality of the paper, importance of the contents published, social value.

**Suggested format of Question paper of 10 marks for the written test.**

Q1.	Attempt <i>any two out of three</i> :	10 marks
a.		
b.		
c.		

**B. External Examination: (60 marks) Duration: 2 hours**

All questions are compulsory		
Q1	(Based on Module 1) Attempt <i>any three</i> of the following out of four	15 marks
Q2	(Based on Module 2) Attempt <i>any three</i> of the following out of four	15 marks
Q3	(Based on Module 3) Attempt <i>any three</i> of the following out of four	15 marks
Q4	(Based on Module 4) Attempt <i>any three</i> of the following out of four	15 marks

**Theory courses of 2 credits:** Total marks 50. Out of the total, 40 % is for internal and 60% is for external evaluation.

**A. Internal Evaluation (20 Marks)**

- a. 10 marks (two tests\* of 10 marks each to be conducted at different instants of time and average of two will be considered)
- b. 10 marks assignments / projects / presentations etc.

**Suggested format of Question paper of 10 marks for the written test.**

Q1.	Attempt <i>any two out of three</i> :	10 marks
a.		
b.		
c.		

**B. External Examination: (30 marks) Duration: 1 hour**

All questions are compulsory		
Q1	(Based on Module 1) Attempt <i>any two out of three</i> of the following:	10 marks
Q2	(Based on Module 2) Attempt <i>any two out of three</i> of the following:	10 marks
Q.3	(Based on Module 1 & 2) Attempt <i>any two out of three</i> of the following.	10 marks

**Computer Based Test courses for 4 credits:** Total marks 100. Out of the total, 40% is for internal and 60% is for external evaluation.

**A. Practical Evaluation Internal (40 marks)**

1.	Performance during the regular practical sessions	30
2.	Viva Voce	10

**B. Computer Based Test - Practical Evaluation External (60 marks)**

A Certified copy of hard-bound journal is essential to appear for the practical examination.

1.	Practical Question ( <b>Computer Based Test</b> )	40
2.	Journal	10
3.	Viva Voce	10

**Computer Based Test courses for 2 credits:** Total marks 50. Out of the total, 40% is for internal and 60% is for external evaluation.

**A. Practical Evaluation Internal (20 marks)**

1.	Performance during the regular practical sessions	15
2.	Viva Voce	5

**B. Computer Based Test - Practical Evaluation External (30 marks)**

A Certified copy of hard-bound journal is essential to appear for the practical examination.

1.	Practical Question ( <b>Computer Based Test</b> )	20
2.	Journal	5
3.	Viva Voce	5

<b>Rubrics for Practical</b>					
	<b>Performance Indicator</b>	<b>Poor</b>	<b>Average</b>	<b>Good</b>	<b>Excellent</b>
<b>1</b>	<b>Knowledge (Factual /Conceptual/Procedural/cognitive)</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>2</b>	<b>Describe and Demonstration (Factual /Conceptual/procedural/cognitive)</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>3</b>	<b>Strategy (Analyze &amp;/or Evaluate) (Factual /Conceptual/procedural/cognitive)</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>4</b>	<b>Interpret/Develop/ Attitude towards Learning (Factual /Conceptual/procedural/cognitive/ receiving, attending, responding, valuing, organizing, Characterization by value)</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>

<b>5</b>	<b>Nonverbal communication skills/Behavior skills (motor skills, hand-eye coordination, speech behavior)</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
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### **Evaluation of On Job Training Course (4 Credit Course)**

<b>Internal Evaluation</b>	
Online diary	20
Mid-term interaction	20
<b>Total</b>	<b>40</b>
<b>External Evaluation</b>	
OJT Report and Documentation	20
Quality & Relevance	20
OJT Viva	20
<b>Total</b>	<b>60</b>

**Appendix-I**

Maintain the weekly online diary for each week in the following format.

	Day	Date	Name of the Topic/Module Completed	Remarks
1 <sup>st</sup> WEEK	MONDAY			
	TUESDAY			
	WEDNESDAY			
	THURSDAY			
	FRIDAY			
	SATURDAY			

Signature of the Faculty mentor: \_\_\_\_\_

Seal of the College

## Appendix-II

*(Proforma for the certificate for internship in official letter head)*

This is to certify that Mr. /Ms. ....  
worked as an intern as part of his/her M.Sc. course in Information Technology of SVKM's  
Usha Pravin Gandhi College of Arts, Science and Commerce. The particulars of internship are  
given below:

Internship starting date: \_\_\_\_\_

Internship ending date: \_\_\_\_\_

Actual number of days worked: \_\_\_\_\_

Tentative number of hours worked: \_\_\_\_\_ Hours

Broad area of work: \_\_\_\_\_

A small description of work done by the intern during the period:

\_\_\_\_\_  
\_\_\_\_\_

Supervisor Signature: \_\_\_\_\_

Name: \_\_\_\_\_

Designation: \_\_\_\_\_

Contact: \_\_\_\_\_

Email: \_\_\_\_\_

(Seal of the organization)

## Appendix-III

(Proforma for the Evaluation of the intern by the industry mentor /to whom the intern was reporting in the organization)

### Professional Evaluation of intern

Name of intern: \_\_\_\_\_

College/institution:            [Note: Give a score in the 1 to 5 scale by putting √ in the respective cells]

No	Particular	Excellent	Very Good	Good	Moderate	Satisfactory
1	Attendance & Punctuality					
2	Ability to work in a team					
3	Written and oral communication skills					
4	Problem solving skills					
5	Ability to grasp new concepts					
6	Technical skill in terms of technology, programming etc					
7	Ability to complete the task					
8	Quality of overall work done					

Comments: \_\_\_\_\_

Signature: \_\_\_\_\_

Name: \_\_\_\_\_

Designation: \_\_\_\_\_

Contact: \_\_\_\_\_

Email: \_\_\_\_\_

# **Syllabus**

**M.Sc. (Information Technology)**

**Part -II**

**(Sem. III & IV)**

# SEMESTER III

<b>Program: M.Sc. – Information Technology (2025 - 26)</b>		<b>Semester: III</b>	
<b>Course: Applied Artificial Intelligence</b>		<b>Course Code: UIAAI601</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 40)</b>	<b>Semester End Examinations (SEE) (Marks- 60 in Question Paper)</b>
4	4	40	60
<b>Learning Objectives:</b> <ul style="list-style-type: none"> <li>To explore the applied branches of artificial intelligence</li> <li>To enable the learner to understand fundamentals and applications of fuzzy set theory, probability theory, artificial neural network and intelligent agent</li> <li>To enable the student to solve the problem aligned with derived branches of artificial intelligence such as genetic algorithm, knowledge representation and language decoding</li> <li>To enable student to apply the concepts of Artificial Intelligence to its allied branches of information technology</li> </ul>			
<b>Course Outcomes:</b> After completion of the course, learners would be able to: <b>CO1:</b> Understand the fundamentals concepts of expert system, its applications and probability theory <b>CO2:</b> Use the concept of fuzzy sets and artificial neural network for solving AI based problems. <b>CO3:</b> Understand the concept of Evolutionary Computation and Intelligent Agents <b>CO4:</b> Apply the Knowledge Representation Techniques and language decoding methods			
<b>Outline of Syllabus: (per session plan)</b>			
<b>Modules</b>	<b>Topics</b>	<b>Duration (Lecture)</b>	
<b>Module 1</b>	<b>Expert System and its Applications, Probability Theory</b>	<b>15</b>	
	<b>Expert System and Applications:</b> Phases in Building Expert System, Expert System Architecture, Expert System versus Traditional Systems, Rule based Expert Systems, Blackboard Systems, Truth Maintenance System, Application of Expert Systems, Shells and Tools <b>Probability Theory:</b> joint probability, conditional probability, Bayles’s theorem, probabilities in rules and facts of rule-based system, cumulative probabilities, rule-based system and Bayesian method		

<b>Module 2</b>	<b>Fuzzy Sets, Fuzzy Logic, Artificial Neural Networks</b>	<b>15</b>
	<p><b>Fuzzy Sets and Fuzzy Logic:</b> Fuzzy Sets, Fuzzy set operations, Types of Member ship Functions, Multivalued Logic, Fuzzy Logic, Linguistic variables and Hedges, Fuzzy propositions, inference rules for fuzzy propositions, fuzzy systems, possibility theory and other enhancement to Logic</p> <p><b>Artificial Neural Networks:</b> Artificial Neural Networks, Single-Layer feedforward networks, multi-layer feed- forward networks, radial basis function networks, design issues of artificial neural networks and recurrent networks</p>	
<b>Module 3</b>	<b>Evolutionary Computation &amp; Intelligent Agents</b>	<b>15</b>
	<p><b>Evolutionary Computation:</b> Genetic algorithms, genetic programming concepts, evolutionary programming, swarm intelligence, ant colony paradigm, particle swarm optimization and applications of evolutionary algorithms.</p> <p><b>Intelligent Agents:</b> Agents vs software programs, classification of agents, working of an agent, single agent and multiagent systems, performance evaluation, architecture, agent communication language, applications</p>	
<b>Module 4</b>	<b>Knowledge Representation and Language Decoding</b>	<b>15</b>
	<p><b>Advanced Knowledge Representation Techniques:</b> Conceptual dependency theory, script structures, CYC theory, script structure, CYC theory, case grammars, semantic web.</p> <p><b>Decoding Language:</b> Sentence Analysis phases, grammars and parsers, types of parsers, semantic analysis, universal networking language, dictionary</p>	
<b>Total Lectures</b>		<b>60</b>

<b>Reference Books:</b>					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Artificial Intelligence	Saroj Kaushik	Cengage	1 <sup>st</sup>	2019
2.	Artificial Intelligence: A Modern Approach	A. Russel, Peter Norvig		1 <sup>st</sup>	
3.	Artificial Intelligence	Elaine Rich, Kevin Knight, Shivashankar B. Nair	Tata Mc-Grawhill	3rd	

<b>Program: M.Sc. – Information Technology (2025 - 26)</b>		<b>Semester: III</b>	
<b>Course: Applied Artificial Intelligence Practical</b>		<b>Course Code: UIAAI601P</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 20)</b>	<b>Semester End Practical Examinations (SEPE) (Marks- 30 in Question Paper)</b>
4	2	20	30
<b>Learning Objectives:</b>			
<ul style="list-style-type: none"> <li>• To enable the learner to develop Expert System for various domain applications</li> <li>• To enable the student to solve the problem associated with probability theory and fuzzy set theory</li> <li>• To enable the learner to understand applications of artificial neural networks</li> <li>• To enable the student to solve the problem using the concept of an intelligent agent</li> <li>• To enable the learners to apply various knowledge representation techniques and language decoding methods</li> </ul>			
<b>Course Outcomes:</b>			
After completion of the course, learners would be able to:			
<b>CO1:</b> Understand the fundamentals concepts of expert system, its applications and probability theory			
<b>CO2:</b> Use the concept of fuzzy sets and artificial neural network for solving AI based problems.			
<b>CO3:</b> Understand the concept of Evolutionary Computation and Intelligent Agents			
<b>CO4:</b> Apply the Knowledge Representation Techniques and language decoding methods			
<b>Outline of Syllabus: (per session plan)</b>			
<b>Modules</b>	<b>Topics</b>	<b>Duration (Lecture)</b>	
<b>Module 1</b>	<b>Expert System its Applications, Probability theory</b>	<b>15</b>	
	<ul style="list-style-type: none"> <li>• Design an Expert system using AIML.</li> <li>• Implement Bayes Theorem using Python.</li> <li>• Implement Conditional Probability and joint probability using Python.</li> </ul>		
<b>Module 2</b>	<b>Fuzzy Sets, Fuzzy Logic, Artificial Neural Networks</b>	<b>15</b>	
	<ul style="list-style-type: none"> <li>• Write a program to implement Rule based system.</li> <li>• Design a Fuzzy based application using Python / R.</li> <li>• Simulate artificial neural network model with both feedforward and backpropagation approach.</li> </ul>		
<b>Module 3</b>	<b>Evolutionary Computation &amp; Intelligent Agents</b>	<b>15</b>	
	<ul style="list-style-type: none"> <li>• Simulate genetic algorithm with suitable example using Python / R or any other platform.</li> </ul>		

	<ul style="list-style-type: none"> <li>Design intelligent agent using any AI algorithm. (e.g. design tic-tac-toe game, design expert tutoring system)</li> </ul>	
<b>Module 4</b>	<b>Knowledge Representation and Language Decoding</b>	<b>15</b>
	<ul style="list-style-type: none"> <li>Design an application to simulate language parser.</li> <li>Develop the semantic net using python.</li> </ul>	
<b>Total Lectures</b>		<b>60</b>

**Reference Books:**

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Artificial Intelligence	Saroj Kaushik	Cengage	1 <sup>st</sup>	2019
2.	Artificial Intelligence: A Modern Approach	A. Russel, Peter Norvig		1 <sup>st</sup>	
3.	Artificial Intelligence	Elaine Rich, Kevin Knight, Shivashankar B. Nair	Tata Mc-Grawhill	3rd	

<b>Program: M.Sc. – Information Technology (2025 - 26)</b>		<b>Semester: III</b>	
<b>Course: Machine Learning</b>		<b>Course Code: UIMLE602</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 40)</b>	<b>Semester End Examinations (SEE) (Marks- 60 in Question Paper)</b>
4	4	40	60
<b>Learning Objectives:</b>			
<ul style="list-style-type: none"> <li>• Understanding Human learning aspects.</li> <li>• Understanding primitives in learning process by computer.</li> <li>• Understanding nature of problems solved with Machine Learning</li> </ul>			
<b>Course Outcomes:</b>			
After completion of the course, learners would be able to:			
<b>CO1:</b> Understand core machine learning concepts problem structures, and learning paradigms.			
<b>CO2:</b> Develop practical skills in feature construction, transformation, and selection for effective data preprocessing.			
<b>CO3:</b> Acquire practical skills in assessing classification and regression performance			
<b>CO4:</b> Understand theoretical aspects like generalization, VC dimensions, and regularization.			
<b>Outline of Syllabus: (per session plan)</b>			
<b>Modules</b>	<b>Topics</b>	<b>Duration (Lecture)</b>	
<b>Module 1</b>	<b>Introduction</b>	<b>15</b>	
	Machine learning, Examples of Machine Learning Problems, Structure of Learning, learning versus Designing, Training versus Testing, Characteristics of Machine learning tasks, Predictive and descriptive tasks, Machine learning Models: Geometric Models, Logical Models, Probabilistic Models. Features: Feature types, Feature Construction and Transformation, Feature Selection.		
<b>Module 2</b>	<b>Classification and Regression</b>	<b>15</b>	
	<p><b>Classification:</b> Binary Classification- Assessing Classification performance, Class probability Estimation Assessing class probability Estimates, Multiclass Classification.</p> <p><b>Regression:</b> Assessing performance of Regression- Error measures, Overfitting- Catalysts for Overfitting, Case study of Polynomial Regression.</p> <p><b>Theory of Generalization:</b> Effective number of hypothesis, Bounding the Growth function, VC Dimensions, Regularization theory</p>		

<b>Module 3</b>	<b>Linear Models &amp; Logic Based and Algebraic Model</b>	<b>15</b>
	Least Squares method, Multivariate Linear Regression, Regularized Regression, Using Least Square regression for Classification. Perceptron, Support Vector Machines, Soft Margin SVM, Obtaining probabilities from Linear classifiers, Kernel methods for non-Linearity. Nearest Neighbours Classification, Distance based clustering-K means Algorithm, Hierarchical clustering, <b>Rule Based Models:</b> Rule learning for subgroup discovery, Association rule mining. <b>Tree Based Models:</b> Decision Trees, Ranking and Probability estimation Trees, Regression trees, Clustering Trees.	
<b>Module4</b>	<b>Trends In Machine Learning</b>	<b>15</b>
	Model and Symbols- Bagging and Boosting, Multitask learning, Online learning and Sequence Prediction, Data Streams and Active Learning, Deep Learning, Reinforcement Learning	
<b>Total Lectures</b>		<b>60</b>

<b>Books and References:</b>					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Machine Learning: The Art and Science of Algorithms that Make Sense of Data	Peter Flach	Cambridge University Press		2012
2.	Introduction to Statistical Machine Learning with Applications in R	Hastie, Tibshirani, Friedman	Springer	2nd	2012
3.	Introduction to Machine Learning	Ethem Alpaydin	PHI	2nd	2013

<b>Program: M.Sc. – Information Technology (2025 - 26)</b>		<b>Semester: III</b>	
<b>Course: Machine Learning Practical</b>		<b>Course Code: UIMLE602P</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 20</b>	<b>Semester End Practical Examinations (SEPE) (Marks- 30 in Question Paper)</b>
4	2	20	30
<b>Learning Objectives:</b>			
<ul style="list-style-type: none"> <li>• To understand the principles of machine learning and its capabilities</li> <li>• To acquire practical skills to design, implement, and train practical machine learning systems.</li> </ul>			
<b>Course Outcomes:</b>			
After completion of the course, learners would be able to:			
<b>CO1:</b> Understand the key issues in Machine Learning and its associated applications in intelligent business and scientific computing.			
<b>CO2:</b> Acquire the knowledge about classification and regression techniques where a learner will be able to explore his skill to generate data base knowledge using the prescribed techniques.			
<b>CO3:</b> Understand and implement the techniques for extracting the knowledge using machine learning methods.			
<b>CO4:</b> Achieve adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc.			
<b>CO5:</b> Understand the statistical approach related to machine learning. He will also Apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.			
<b>Outline of Syllabus: (per session plan)</b>			
<b>Modules</b>	<b>Topics</b>	<b>Duration (Lecture)</b>	
<b>Module 1</b>	a. Design a simple machine learning model to train the training instances and test the same. b. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file	<b>15</b>	
	a. Perform Data Loading, Feature selection (Principal Component analysis) and Feature Scoring and Ranking b. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.		

<b>Module 2</b>	<p>a. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.</p> <p>b. Write a program to implement Decision Tree and Random forest with Prediction, Test Score and Confusion Matrix.</p>	<b>15</b>
	<p>a. For a given set of training data examples stored in a .CSV file implement Least Square Regression algorithm.</p> <p>b. For a given set of training data examples stored in a .CSV file implement Logistic Regression algorithm.</p>	
<b>Module 3</b>	<p>a. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.</p> <p>b. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set.</p>	<b>15</b>
	<p>a. Implement the different Distance methods (Euclidean) with Prediction, Test Score and Confusion Matrix.</p> <p>b. Implement the classification model using clustering for the following techniques with K means clustering with Prediction, Test Score and Confusion Matrix</p>	
<b>Module 4</b>	<p>a. Implement the classification model using clustering for the following techniques with hierarchical clustering with Prediction, Test Score and Confusion Matrix</p> <p>b. Implement the Rule based method and test the same.</p>	<b>15</b>
	<p>a. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set.</p> <p>b. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.</p>	
<b>Total Lectures</b>		<b>60</b>

<b>Books and References:</b>					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Machine Learning: The Art and Science of Algorithms that Make Sense of Data	Peter Flach	Cambridge University Press		2012
2.	Introduction to Statistical Machine Learning with Applications in R	Hastie, Tibshirani, Friedman	Springer	2nd	2012
3.	Introduction to Machine Learning	Ethem Alpaydin	PHI	2nd	2013

<b>Program: M.Sc. – Information Technology (2025 - 26)</b>		<b>Semester: III</b>	
<b>Course: Storage as a Service</b>		<b>Course Code: UISAS603</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 20)</b>	<b>Semester End Examinations (SEE) (Marks- 30 in Question Paper)</b>
2	2	20	30
<b>Learning Objectives:</b>			
<ul style="list-style-type: none"> <li>• Study storage technologies: SAN, NAS, IP storage etc., which will bridge the gap between the emerging trends in industry and academics.</li> <li>• To get an insight of Storage area network architecture, protocols and its infrastructure.</li> <li>• To study and discuss the applications of SAN to fulfill the needs of the storage management in the heterogeneous environment.</li> <li>• Study and understand the management of Storage Networks.</li> </ul>			
<b>Course Outcomes:</b>			
After completion of the course, a student should be able to:			
<b>CO1:</b> Understand different techniques of storage and RAID Technologies			
<b>CO2:</b> Understand different intelligent storage technologies. Also, understand the benefits of Fibre Channel Storage Networks along with iSCSI.			
<b>CO3:</b> Understand the architecture of NAS			
<b>Outline of Syllabus: (per session plan)</b>			
<b>Modules</b>	<b>Topics</b>		<b>Duration (Lecture)</b>
<b>Module 1</b>	<b>Introduction to Information Storage, Data Center Environment, Data Protection: RAID</b>		<b>15</b>
	<p><b>Introduction to Information Storage:</b> Information Storage, Evolution of Storage Architecture, Data Center Infrastructure, Virtualization and Cloud Computing</p> <p><b>Data Center Environment:</b> Application, Database Management System (DBMS), Host (Compute), Connectivity, Storage, Disk Drive Components, Disk Drive Performance, Host Access to Data, Direct-Attached Storage, Storage Design Based on Application, Disk Native Command Queuing, Introduction to Flash Drives, Concept in Practice: VMware ESXi</p> <p><b>Data Protection: RAID:</b> RAID Implementation Methods, RAID Array Components, RAID Techniques, RAID Levels, RAID Impact on Disk Performance, RAID Comparison, Hot Spares</p>		

<b>Module 2</b>	<b>Intelligent Storage Systems, Fibre Channel Storage Area Networks, IP SAN and FCoE, Network-Attached Storage</b>	<b>15</b>
	<p><b>Intelligent Storage Systems:</b> Components of an Intelligent Storage System, Storage Provisioning, Types of Intelligent Storage Systems, Concepts in Practice: EMC Symmetrix and VNX</p> <p><b>Fibre Channel Storage Area Networks:</b> Fibre Channel: Overview, The SAN and Its Evolution, Components of FC SAN, FC Connectivity, Switched Fabric Ports, Fibre Channel Architecture, Fabric Services, Switched Fabric Login Types, Zoning, FC SAN Topologies, Virtualization in SAN</p> <p><b>IP SAN and FCoE:</b> iSCSI, FCIP, FCoE</p> <p><b>Network-Attached Storage:</b> General-Purpose Servers versus NAS Devices, Benefits of NAS, File Systems and Network File Sharing, Components of NAS, NAS I/O Operation, NAS Implementations, NAS File-Sharing Protocols, Factors Affecting NAS Performance, File-Level Virtualization</p>	
<b>Total Lectures</b>		<b>30</b>

**Essential readings:**

Information Storage and Management: Storing, Managing, and Protecting Digital Information in Classic, Virtualized, and Cloud Environments, EMC, John Wiley & Sons, 2<sup>nd</sup> Edition, 2012

<b>Program: M.Sc. – Information Technology (2025 - 26)</b>		<b>Semester: III</b>	
<b>Course: Natural Language Processing</b>		<b>Course Code: UINLP604</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 40)</b>	<b>Semester End Examinations (SEE) (Marks- 60 in Question Paper)</b>
4	4	40	60
<b>Learning Objectives:</b>			
<ul style="list-style-type: none"> <li>• The prime objective of this course is to introduce the students to the field of Language Computing and its applications ranging from the classical era to modern context.</li> <li>• To provide an understanding of various NLP tasks and NLP abstractions such as Morphological analysis, POS tagging, the concept of syntactic parsing, semantic analysis etc.</li> <li>• To provide knowledge of different approaches/algorithms for carrying out NLP tasks.</li> <li>• To highlight the concepts of Language grammar and grammar representation in Computational Linguistics.</li> </ul>			
<b>Course Outcomes:</b>			
After completion of the course, learners would be able to:			
<b>CO1:</b> Understand the fundamental NLP tasks such as Segmentation, Chunking, Tagging, Named Entity Recognition (NER), Parsing, Word Sense disambiguation, and NL Generation.			
<b>CO2:</b> Identify and analyze the key challenges and open problems in NLP research and development.			
<b>CO3:</b> Understand the importance of segmentation in various NLP tasks and applications.			
<b>CO4:</b> Use the Morphology, and segmentation concepts in developing NLP applications.			
<b>CO5:</b> Apply these concepts and techniques to analyze and process text data effectively in various NLP applications			
<b>CO6:</b> Understand the concept of Semantic Role Labelling (SRL) and its applications in natural language understanding.			
<b>Outline of Syllabus: (per session plan)</b>			
<b>Modules</b>	<b>Topics</b>	<b>Duration (Lecture)</b>	
<b>Module 1</b>	<b>Introduction</b>	<b>15</b>	
	Introduction to NLP, a brief history of NLP NLP applications: Speech to Text (STT), Text to Speech (TTS), Story Understanding, NL Generation, QA system, Machine Translation, Text Summarization, Text classification, Sentiment Analysis, Grammar/Spell Checkers etc., Challenges/Open Problems, NLP abstraction levels, NL tasks: Segmentation, Chunking, tagging, NER, Parsing, Word Sense Disambiguation, NL Generation, Web 2.0 Applications: Sentiment Analysis; Text Entailment; Cross-lingual information Retrieval (CLIR).		

<b>Module 2</b>	<b>Text Processing Challenges</b>	<b>15</b>
	<p><b>Text Processing Challenges:</b> Overview of Language Scripts and their representation on Machines using Character Sets, Language, Corpus and Application Dependence issues,</p> <p><b>Segmentation:</b> word level (Tokenization), Sentence level. Regular Expression and Automata,</p> <p><b>Morphology:</b> Inflectional and Derivation Morphology, Morphological analysis and generation using Finite State Automata and Finite State transducer, Indian Languages Morphology, and Machine Learning approaches.</p> <p><b>Stemming and Lemmatization:</b> Understanding the difference between stemming and lemmatization, Stemming algorithms: Porter stemmer, Snowball Stemmer, Challenges in Lemmatization</p>	
<b>Module 3</b>	<b>Part-of-Speech tagging (POS) and Parsing</b>	<b>15</b>
	<p>Word Classes and Part-of-Speech tagging (POS), survey of POS tagsets, Rule-based approaches (ENGTOWL), Stochastic approaches (Probabilistic, N-gram and HMM), TBL morphology, unknown word handling;</p> <p><b>Evaluation metrics:</b> Precision/Recall/F-measure, error analysis.</p> <p><b>Parsing:</b> NL parsing basics, approaches: TopDown, BottomUp, Overview of Grammar, NL parsing basics, approaches Formalisms: constituency and dependency school, Grammar notations CFG, LFG, PCFG, LTAG, Feature- Unification, an overview of English CFG, Indian Language Parsing in Paninian Karaka Theory, CFG parsing using Earley's and CYK algorithms, Probabilistic parsing, Dependency Parsing: Covington algorithm, MALT parser, MST parser.</p>	
<b>Module4</b>	<b>Semantic Analysis</b>	<b>15</b>
	<p>Word similarity, Lexical Semantics, word senses and relationships, WordNet (English and IndoWordnet),</p> <p>Word Sense Disambiguation: Lesk's Algorithm, Walker's algorithm, Coreferences Resolution: Anaphora, Cataphora.</p> <p>WordNet, Thematic Roles, Semantic Role Labelling with CRFs</p> <p>Statistical Alignment and Machine Translation, Text alignment, Word Alignment</p>	
<b>Total Lectures</b>		<b>60</b>

**Reference books:**

<b>Books and References:</b>					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Handbook of Natural Language Processing	Indurkha, N., & Damerau, F. J.	CRC Press Taylor and Francis Group	2 <sup>nd</sup>	2010
2.	Speech and Language Processing	Martin, J. H., & Jurafsky, D.	Pearson Education India	2 <sup>nd</sup>	2013
3.	Foundations of Statistical Natural Language Processing	Manning, Christopher and Heinrich, Schutze	MIT Press	1 <sup>st</sup>	1997
4.	Natural Language Processing With Python	Steven Bird, Edward Loper	O'Reilly Media	2 <sup>nd</sup>	2016
5.	Video Links 1. <a href="http://www.nptelvideos.in/2012/11/natural-language-processing.html">http://www.nptelvideos.in/2012/11/natural-language-processing.html</a>				

<b>Program: M.Sc. – Information Technology (2025 - 26)</b>		<b>Semester: III</b>	
<b>Course: Security Operations Centre Practical</b>		<b>Course Code: UISOC605P</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 40)</b>	<b>Semester End Practical Examinations (SEPE) (Marks- 60 in Question Paper)</b>
8	4	40	60
<b>Learning Objectives:</b> -			
<b>Course Outcomes:</b> After completion of the course, learners would be able to:  <b>CO1:</b> Understanding basics of SOC, Cryptography and managing and deploying VPNs. <b>CO2:</b> Analyse Windows and Linux based logs along with logs generated by endpoints. <b>CO3:</b> Understand and analyze various forms of intrusions, threats and perform forensic analysis on them. <b>CO4:</b> Understand the incident response process and handle incidents by adhering to compliance policies and standards set by the organization. <b>CO5:</b> Understand the various types of attacks and vulnerabilities, categorize events and perform incident analysis.			
<b>Outline of Syllabus: (per session plan)</b>			
<b>Modules</b>	<b>Topics</b>	<b>Duration (Lecture)</b>	
<b>Module 1</b>	<b>Introduction to Security Operations Center (SOC)</b> Overview of Security Operations Center (SOC), Role and Responsibilities of SOC Analysts, SOC Architecture and Components, Incident Response Frameworks (e.g., NIST, SANS), Introduction to Security Information and Event Management (SIEM) Systems Practical Activities: <ul style="list-style-type: none"> <li>• Setting up a basic SOC environment</li> <li>• Introduction to SIEM tool (e.g., Splunk, ELK Stack)</li> <li>• Configuring data sources and log collection</li> <li>• Encrypting and Decrypting Data Using OpenSSL</li> </ul>	<b>30</b>	

<b>Module 2</b>	<b>Threat Detection and Analysis</b> Understanding Cyber Threats and Attack Vectors, Threat Intelligence and Indicators of Compromise (IoCs), Log Analysis and Correlation Techniques, Network Traffic Analysis, Malware Analysis Basics Practical Activities: <ul style="list-style-type: none"> <li>• Analyzing log files for potential security incidents</li> <li>• Conducting network traffic analysis using Wireshark or Zeek</li> <li>• Identifying and analyzing malware samples</li> <li>• Demonstrate Analysis of DNS Traffic</li> <li>• Demonstrate Extract an Executable from a PCAP</li> <li>• Demonstrate the use of Snort and Firewall Rules</li> </ul>	<b>30</b>
<b>Module 3</b>	<b>Incident Response and Handling</b> Incident Response Lifecycle, Incident Triage and Prioritization, Incident Investigation and Analysis Techniques, Containment and Eradication Strategies, Post-Incident Reporting and Documentation Practical Activities: <ul style="list-style-type: none"> <li>• Simulated incident response scenarios</li> <li>• Incident triage and response exercises</li> <li>• Creating incident response playbooks and runbooks</li> <li>• Demonstrate Conversion of Data into a Universal Format</li> </ul>	<b>30</b>
<b>Module 4</b>	<b>SOC Automation and Advanced Techniques</b> Automation and Orchestration in SOC Operations, Security Orchestration, Automation, and Response (SOAR) Platforms, Threat Hunting Techniques, Security Analytics and Machine Learning, SOC Metrics and Key Performance Indicators (KPIs) Practical Activities: <ul style="list-style-type: none"> <li>• Implementing automation workflows in a SOC environment</li> <li>• Threat hunting exercises using various tools and techniques</li> <li>• Developing custom alerts and rules in a SIEM</li> <li>• Create your own syslog Server</li> <li>• Configure your Linux system to send syslog messages to a syslog server and Read them</li> <li>• Install and Run Splunk on Linux</li> <li>• Install and Configure ELK on Linux</li> <li>• Install and Configure GrayLog on Linux</li> </ul>	<b>30</b>
<b>Total Lectures</b>		<b>120</b>

## Reference books:

1. "Security Operations Center: Building, Operating, and Maintaining your SOC" by Joseph Muniz, Gary McIntyre, Nadhem AlFardan, Cisco Press, 2015
2. "The Practice of Network Security Monitoring: Understanding Incident Detection and Response" by Richard Bejtlich, No Starch Press, 2013
3. "Applied Network Security Monitoring: Collection, Detection, and Analysis" by Chris Sanders, Jason Smith, Syngress, 2014
4. "Practical Malware Analysis: The Hands-On Guide to Dissecting Malicious Software" by Michael Sikorski, Andrew Honig, 2012
5. "Incident Response & Computer Forensics" by Jason T. Luttgens, Matthew Pepe, Kevin Mandia, McGraw-Hill Education, 2014
6. "Computer Incident Response and Forensics Team Management: Conducting a Successful Incident Response" by Leighton Johnson, Syngress, 2014
7. "Security Automation Essentials: Streamlined Enterprise Security Management & Monitoring with SCAP" by Marjorie G. Jones, Syngress, 2018
8. "Cyber Security Operations Handbook" by J.W. Ritti, Steve Rittinghouse, CRC Press, 2018

<b>Program: M.Sc. – Information Technology (2025 - 26)</b>		<b>Semester: III</b>	
<b>Course: Server Virtualization on VMWare Platform Practical</b>		<b>Course Code: UISVV606P</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 40)</b>	<b>Semester End Practical Examinations (SEPE) (Marks- 60 in Question Paper)</b>
8	4	40	60
<b>Learning Objectives:</b>			
<ul style="list-style-type: none"> <li>Identify the need for Server Virtualization</li> <li>Describe the components and features of vSphere 6.7 and ESXi</li> <li>Describe how VMware's products help solve business and technical challenges with regard to Server Virtualization</li> </ul>			
<b>Course Outcomes:</b>			
After completion of the course, learners would be able to:			
<b>CO1:</b> Understand VMWare VSphere 6.7, Install ESXi and Configure VSphere Centre			
<b>CO2:</b> Demonstrate the use of VSphere Update Manager and Create a VSphere Network			
<b>CO3:</b> Understand VSphere Security, Create and configure storage devices and Perform configurations to ensure business continuity			
<b>CO4:</b> Demonstrate Resource allocation, Creating and managing virtual machine and the use of templates			
<b>CO5:</b> Understand automation of vSphere and manage resource allocation			
<b>Outline of Syllabus: (per session plan)</b>			
<b>Modules</b>	<b>Topics</b>	<b>Duration (Lecture)</b>	
<b>Module 1</b>	<p><b>Introducing VMware vSphere 6.7:</b> Exploring VMware vSphere 6.7, Examining the Products in the vSphere Suite, Examining the Features in VMware vSphere</p> <p><b>Planning and Installing VMware ESXi</b> VMware ESXi Architecture, Understanding the ESXi Hypervisor, Examining the ESXi Components, Planning a VMware vSphere Deployment, Choosing a Server Platform, Determining a Storage Architecture, Integrating with the Network Infrastructure, Deploying VMware ESXi, Installing VMware ESXi Interactively, Performing an Unattended Installation of VMware ESXi, Deploying VMware ESXi with vSphere Auto Deploy, Performing Post-installation Configuration, Reconfiguring the Management Network, Using the vSphere Host Client, Configuring Time Synchronization, Configuring Name Resolution</p> <p><b>Installing and Configuring vCenter Server</b> Introducing vCenter Server, Centralizing User Authentication Using vCenter Single Sign-On, Understanding the Platform Services Controller, Using the vSphere Web Client for Administration, Providing an Extensible Framework, Choosing the Version of vCenter Server, Planning and Designing a vCenter Server Deployment, Sizing Hardware for vCenter Server, Planning for vCenter Server</p>	<b>30</b>	

	Availability, Running vCenter Server and Its Components as VMs, Installing vCenter Server and Its Components, Installing vCenter Server in an Enhanced Linked Mode Group, Exploring vCenter Serve	
<b>Module 2</b>	<p><b>vSphere Update Manager and the vCenter Support Tool</b></p> <p><b>Creating and Configuring a vSphere Network</b>  Putting Together a vSphere Network, Working with vSphere Standard Switches, Comparing Virtual Switches and Physical Switches, Understanding Ports and Port Groups, Understanding Uplinks, Configuring the Management Network, Configuring VMkernel Networking, Enabling Enhanced Multicast Functions, Configuring TCP/IP Stacks, Configuring Virtual Machine Networking, Configuring VLANs, Configuring NIC Teaming, Using and Configuring Traffic Shaping, Bringing It All Together, Working with vSphere Distributed Switches, Creating a vSphere Distributed Switch, Removing an ESXi Host from a Distributed Switch, Removing a Distributed Switch, Managing Distributed Switches, Working with Distributed Port Groups, Managing VMkernel Adapters, Using NetFlow on vSphere Distributed Switches, Enabling Switch Discovery Protocols, Enabling Enhanced Multicast Functions, Setting Up Private VLANs, Configuring LACP, Configuring Virtual Switch Security, Understanding and Using Promiscuous Mode, Allowing MAC Address Changes and Forged Transmits</p>	<b>30</b>
<b>Module 3</b>	<p><b>Creating and Configuring Storage Devices</b>  Reviewing the Importance of Storage Design, Examining Shared Storage Fundamentals, Comparing Local Storage with Shared Storage, Defining Common Storage Array Architectures, Explaining RAID, Understanding vSAN, Understanding Midrange and External Enterprise Storage Array Design, Choosing a Storage Protocol, Making Basic Storage Choices, Implementing vSphere Storage Fundamentals, Reviewing Core vSphere Storage Concepts, Understanding Virtual Volumes, SCs vs LUNs, Storage Policies, Virtual Volumes, Working with VMFS Datastores, Working with Raw Device Mappings, Working with NFS Datastores, Working with vSAN, Working with Virtual Machine–Level Storage, Configuration, Leveraging SAN and NAS Best Practice</p> <p><b>Ensuring High Availability and Business Continuity:</b>  Understanding the Layers of High Availability, Clustering VMs, Introducing Network Load Balancing Clustering, Introducing Windows Server Failover Clustering, Implementing vSphere High Availability, Understanding vSphere High Availability Clusters. Understanding vSphere High Availability’s Core Components, Enabling vSphere HA, Configuring vSphere High Availability, Configuring vSphere HA Groups, Rules, Overrides, and Orchestrated VM Restart, Managing vSphere High Availability, Introducing vSphere SMP Fault Tolerance, Using vSphere SMP Fault Tolerance with vSphere High Availability, Examining vSphere Fault Tolerance, Use Cases, Planning for Business Continuity, Providing Data Protection, Recovering from Disasters, Using vSphere Replication.</p>	<b>30</b>

	<b>Securing VMware vSphere</b>	
<b>Module 4</b>	<p><b>Creating and Managing virtual machines</b>  Understanding Virtual Machines, Examining Virtual Machines from the Inside, Examining Virtual Machines from the Outside, Creating a Virtual Machine, Choosing Values for Your New Virtual Machine, Sizing Virtual Machines, Naming Virtual Machines, Sizing Virtual Machine Hard Disks, Virtual Machine Graphics, Installing a Guest Operating System, Working with Installation Media Using the Installation Media, Working in the Virtual Machine Console, Installing VMware Tools, Installing VMware Tools in Windows, Installing VMware Tools in Linux, Managing Virtual Machines, Adding or Registering Existing VMs, Changing VM Power States, Removing VMs, Deleting VMs, Modifying Virtual Machines, Changing Virtual Machine Hardware, Using Virtual Machine Snapshots</p> <p><b>Managing Resource Allocation</b>  Reviewing Virtual Machine, Resource Allocation, Working with Virtual Machine Memory, Understanding ESXi Advanced Memory Technologies, Controlling Memory Allocation, Managing Virtual Machine CPU Utilization, Default CPU Allocation, Setting CPU Affinity, Using CPU Reservations, Using CPU Limits, Using CPU Shares, Summarizing How Reservations, Limits, and Shares, Work with CPUs</p> <p><b>Monitoring VMware vSphere Performance</b>  Overview of Performance Monitoring, Using Alarms Understanding Alarm Scopes, Creating Alarms, Managing Alarms, Working with Performance Charts, Overview Layout, Advanced Layout, Working with esxtop, Monitoring CPU Usage, Monitoring Memory Usage, Monitoring Network Usage, Monitoring Disk Usage.</p>	<b>30</b>
<b>Total Lectures</b>		<b>120</b>

**Reference books:**

<b>Books and References:</b>					
Sr No	Title	Author/s	Publisher	Edition	Year
1.	Mastering VMware vSphere 67	Nick Marshall, Mike Brown, G Blair Fritz, Ryan Johnson	Sybex, Wiley	--	2019
2.	Mastering VMware vSphere 67	Martin Gavanda, Andrea Mauro, Paolo Valsecchi, Karel Novak	Packt	--	2019

<b>Program: M.Sc. – Information Technology (2025 - 26)</b>	<b>Semester: III</b>
<b>Course: Research Project</b>	<b>Course Code: UIRPR607P</b>

**Research Project courses of 4 credits:** Total marks 100. Out of the total, 60 % each for internal and external evaluation.

**A. Research Project Evaluation Internal (40 marks)**

1.	Internal Continuous Evaluation of chapter 1 to 4	30
2.	Presentation and Viva Voce	10

**B. Research Project Evaluation External (60 marks)**

A Certified copy of report is essential to appear for the examination.

1.	Project Documentation Report	30
	Contents of Report: Chapter 1: Introduction Chapter 2: Literature Survey Chapter 3: Requirement Analysis / Methodology Chapter 4: System Design	
2.	Innovation in the topic	10
3.	Documentation / Topic Presentation and Viva Voce	20

# SEMESTER IV

<b>Program: M.Sc. – Information Technology (2025 - 26)</b>		<b>Semester: IV</b>	
<b>Course: Blockchain</b>		<b>Course Code: UIBLO651</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 40)</b>	<b>Semester End Examinations (SEE) (Marks- 60 in Question Paper)</b>
4	4	40	60
<b>Learning Objectives:</b> <ul style="list-style-type: none"> <li>• To provide conceptual understanding of the function of Blockchain as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.</li> <li>• To cover the technological underpinnings of blockchain operations as distributed data structures and decision-making systems, their functionality and different architecture types.</li> <li>• To provide a critical evaluation of existing “smart contract” capabilities and platforms, and examine their future directions, opportunities, risks and challenges.</li> </ul>			
<b>Course Outcomes:</b> After completion of the course, learners would be able to: <b>CO1:</b> Understand blockchain technology, historical context, centralized versus decentralized systems, layers, use cases <b>CO2:</b> Understand working of Bitcoin and Ethereum <b>CO3:</b> Implement working of smart token and how to mine ether <b>CO4:</b> Deploy Blockchain and hyperledger concept			
<b>Outline of Syllabus: (per session plan)</b>			
<b>Modules</b>	<b>Topics</b>		<b>Duration (Lecture)</b>
<b>Module 1</b>	<b>Introduction and Working of Blockchain</b>		<b>15</b>
	<b>Blockchain:</b> Introduction, History, Centralised versus Decentralised systems, Layers of blockchain, Importance of blockchain, Blockchain uses and use cases.  <b>Working of Blockchain:</b> Blockchain foundation, Cryptography, Game Theory, Computer Science Engineering, Properties of blockchain solutions, blockchain transactions, distributed consensus mechanisms, Blockchain mechanisms, Scaling blockchain		

<b>Module 2</b>	<b>Working of Bitcoin &amp; Ethereum</b>	<b>15</b>
	<p><b>Working of Bitcoin:</b> Money, Bitcoin, Bitcoin blockchain, bitcoin network, bitcoin scripts, Full Nodes, and SVPs, Bitcoin wallets</p> <p><b>Ethereum:</b> three parts of blockchain, Ether as currency and commodity, Building trustless systems, Smart contracts, Ethereum Virtual Machine, The Mist browser, Wallets as a Computing Metaphor, The Bank Teller Metaphor, Breaking with Banking History, How Encryption Leads to Trust, System Requirements, Using Parity with Geth, Anonymity in Cryptocurrency, Central Bank Network, Virtual Machines, EVM Applications, State Machines, Guts of the EVM, Blocks, Mining's Place in the State Transition Function, Renting Time on the EVM, Gas, Working with Gas, Accounts, Transactions, and Messages, Transactions and Messages, Estimating Gas Fees for Operations, Opcodes in the EVM.</p>	
<b>Module 3</b>	<b>Smart Contracts and Tokens &amp; Mining Ether</b>	
	<p><b>Smart Contracts and Tokens:</b> EVM as Back End, Assets Backed by Anything, Cryptocurrency Is a Measure of Time, Function of Collectibles in Human Systems, Platforms for High-Value Digital Collectibles, Tokens as Category of Smart Contract, Creating a Token, Deploying the Contract, Playing with Contracts</p> <p><b>Mining Ether</b> Why? Ether's Source, Defining Mining, Difficulty, Self-Regulation, and the Race for Profit, How Proof of Work Helps Regulate Block Time, DAG and Nonce, Faster Blocks, Stale Blocks, Difficulties, Ancestry of Blocks and Transactions, Ethereum and Bitcoin, Forking, Mining, Geth on Windows, Executing Commands in the EVM via the Geth Console, Launching Geth with Flags, Mining on the Testnet, GPU Mining Rigs, Mining on a Pool with Multiple GPUs.</p>	<b>15</b>
<b>Module 4</b>	<b>Hyperledger &amp; Blockchain Application Development</b>	
	<p>Hyperledger: Overview, Fabric, composer, installing hyperledger fabric and composer, deploying, running the network, error troubleshooting</p> <p>Blockchain Application Development: Decentralized Applications, Blockchain Application Development, Interacting with the Bitcoin Blockchain, Interacting Programmatically with Ethereum— Sending Transactions, Creating a Smart Contract, Executing Smart Contract Functions, Public vs. Private Blockchains, Decentralized Application Architecture</p>	<b>15</b>
<b>Total Lectures</b>		<b>60</b>

**Reference Books:**

<b>Books and References:</b>					
<b>Sr. No.</b>	<b>Title</b>	<b>Author/s</b>	<b>Publisher</b>	<b>Edition</b>	<b>Year</b>
1.	Beginning Blockchain A Beginner's Guide to Building Blockchain Solutions	Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda	Apress		2018
2.	Introducing Ethereum and Solidity	Chris Dannen	Apress		2017
3.	The Blockchain Developer	Elad Elrom	Apress		2019
4.	Mastering Ethereum	Andreas M. Antonopoulos Dr. Gavin Wood	O'Reilly	First	2018
5.	Blockchain Enabled Applications	Vikram Dhillon David Metcalf Max Hooper	Apress		2017

<b>Program: M.Sc. – Information Technology (2025 - 26)</b>		<b>Semester: IV</b>	
<b>Course: Blockchain Practical</b>		<b>Course Code: UIBLO651P</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 20)</b>	<b>Semester End Practical Examinations (SEPE) (Marks- 30 in Question Paper)</b>
4	2	20	30
<b>Learning Objectives:</b> To provide practical concepts of Blockchain			
<b>Course Outcomes:</b> After completion of the course, learners would be able to: <b>CO1:</b> The students would understand the structure of a blockchain and why/when it is better than a simple distributed database. <b>CO2:</b> Analyze the incentive structure in a blockchain based system and critically assess its functions, benefits and vulnerabilities. <b>CO3:</b> Evaluate the setting where a blockchain based structure may be applied, its potential and its limitations. <b>CO4:</b> Understand what constitutes a “smart” contract, what are its legal implications and what it can and cannot do, now and in the near future <b>CO5:</b> Develop blockchain DApps			
<b>Outline of Syllabus: (per session plan)</b>			
<b>Modules</b>	<b>Topics</b>		<b>Duration (Lecture)</b>
<b>Module1</b>	<ul style="list-style-type: none"> <li>• Write a simple client class that generates the private and public keys by using the built-in Python RSA algorithm and test it.</li> <li>• Setting up Ethereum network by using Geth command line interface.(INSTALLATION)</li> <li>• Transfer ethers from one contract to another on an Ethereum testnet.</li> <li>• Transfer ethers from one account to another on an Ethereum testnet.</li> <li>• Implement and demonstrate the use of the following in Solidity:</li> <li>• Variable, Operators, Loops, Decision Making, Strings, Arrays, Enums, Structs, Mappings, Conversions, Ether Units, Special Variables</li> <li>• Functions, Function Modifiers, View functions, Pure Functions, Fallback Function, Function Overloading, Mathematical functions, Cryptographic functions.</li> <li>• Implement and demonstrate the use of the following in Solidity.</li> <li>• Withdrawal Pattern, Restricted Access.</li> <li>• Contracts, inheritance, Constructors, Abstract Contracts, Interfaces</li> </ul>		<b>30</b>

	<ul style="list-style-type: none"> <li>Libraries, Assembly, Events, Error handling.</li> </ul>	
<b>Module2</b>	<ul style="list-style-type: none"> <li>Deploying a contracts on an external blockchain by using Ganache and/or MyEtherwallet, Metamask</li> <li>Deploy a local private blockchain over a network with Ethereum or Rust (VM )</li> <li>Implement the mining module of Bitcoin client. The mining module, or miner, should produce blocks that solve proof-of-work puzzle</li> <li>Compile and test smart contracts on a testing framework using the Ethereum Virtual Machine (EVM).</li> <li>Demonstrate the running of the blockchain node</li> <li>Demonstrate the use of Bitcoin Core API.</li> <li>Create your own blockchain and demonstrate its use.(1f)</li> </ul>	<b>30</b>
<b>Total Lectures</b>		<b>60</b>

### Reference books:

<b>Books and References:</b>					
<b>Sr. No.</b>	<b>Title</b>	<b>Author/s</b>	<b>Publisher</b>	<b>Edition</b>	<b>Year</b>
1.	Beginning Blockchain A Beginner's Guide to Building Blockchain Solutions	Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda	Apress		2018
2.	Introducing Ethereum and Solidity	Chris Dannen	Apress		2017
3.	The Blockchain Developer	Elad Elrom	Apress		2019
4.	Mastering Ethereum	Andreas M. Antonopoulos Dr. Gavin Wood	O'Reilly	First	2018
5.	Blockchain Enabled Applications	Vikram Dhillon David Metcalf Max Hooper	Apress		2017

<b>Program: M.Sc. – Information Technology (2025 - 26)</b>		<b>Semester: IV</b>	
<b>Course: Deep Learning</b>		<b>Course Code: UIDLE652</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 40)</b>	<b>Semester End Examinations (SEE) (Marks- 60 in Question Paper)</b>
4	4	40	60
<b>Learning Objectives:</b>			
<ul style="list-style-type: none"> <li>To present the mathematical, statistical and computational challenges of building neural networks</li> <li>To study the concepts of deep learning</li> <li>To enable the students to know deep learning techniques to support real-time applications</li> </ul>			
<b>Course Outcomes:</b>			
After completion of the course, learners would be able to:			
<b>CO1:</b> Describes basics of mathematical foundation that will help the learner to understand the concepts of Deep Learning			
<b>CO2:</b> Understand and describe model of deep learning			
<b>CO3:</b> Design and implement various deep supervised learning architectures for text & image data.			
<b>CO4:</b> Design and implement various deep learning models and architectures.			
<b>CO5:</b> Apply various deep learning techniques to design efficient algorithms for real-world applications.			
<b>Outline of Syllabus: (per session plan)</b>			
<b>Modules</b>	<b>Topics</b>	<b>Duration (Lecture)</b>	
<b>Module 1</b>	<b>Applied Math and Machine Learning Basics &amp; Numerical Computation</b>	<b>15</b>	
	<b>Applied Math and Machine Learning Basics:</b> Linear Algebra: Scalars, Vectors, Matrices and Tensors , Multiplying Matrices and Vectors , Identity and Inverse Matrices, Linear Dependence and Span, norms, special matrices and vectors, eigen decompositions. <b>Numerical Computation:</b> Overflow and under flow, poor conditioning, Gradient Based Optimization, Constraint optimization.		
<b>Module 2</b>	<b>Deep Networks</b>	<b>15</b>	
	<b>Deep Networks:</b> Deep Feedforward Networks, Multilayer perceptrons (MLPs), Regularization techniques for deep learning (e.g., dropout, weight decay), Optimization algorithms for training deep models (e.g., stochastic gradient descent, Adam) <b>Convolutional Neural Networks (CNNs):</b> Convolutional layers and pooling layers, CNN architectures and applications		
<b>Module 3</b>	<b>Advanced Deep Learning Techniques</b>	<b>15</b>	
	Recurrent Neural Networks (RNNs), Introduction to sequential data		

	<p>processing, Long Short-Term Memory (LSTM) and Gated Recurrent Unit (GRU), Sequence Modeling</p> <p>Language modeling and text generation, Sequence-to-sequence models for machine translation and chatbots, Attention Mechanisms, Self-attention and transformer architectures</p> <p>Applications in natural language processing (NLP) tasks, Reinforcement Learning Basics, Markov decision processes, Q-learning and policy gradients, Autoencoders, representation learning</p>	
<b>Module4</b>	<b>Introduction to Generative Models</b>	<b>15</b>
	<p>Overview of generative modeling, Probabilistic interpretation and latent variables, Variational Autoencoders (VAEs), Encoder-decoder architecture, Variational inference and latent space interpolation</p> <p>Generative Adversarial Networks (GANs): Adversarial training framework, GAN architectures (e.g., DCGAN, WGAN), Applications of GANs</p> <p>Image generation, style transfer, and super-resolution, GANs for data augmentation and synthesis</p>	
<b>Total Lectures</b>		<b>60</b>

**Reference books:**

1. Deep Learning by Ian Goodfellow, Yoshua Bengio, Aaron Courville, An MIT Press book, 1<sup>st</sup> Edition (2016)
2. Fundamentals of Deep Learning by Nikhil Buduma, O'Reilly, 1<sup>st</sup> edition (2017)  
 Deep Learning CookBook by Douwe Osinga, O'Reilly, 1<sup>st</sup> edition (2017)

<b>Program: M.Sc. – Information Technology (2025 - 26)</b>		<b>Semester: IV</b>	
<b>Course: Deep Learning Practical</b>		<b>Course Code: UIDLE652P</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 20)</b>	<b>Semester End Examinations (SEE) (Marks - 30 in Question Paper)</b>
4	2	20	30
<b>Learning Objectives:</b>			
<ul style="list-style-type: none"> <li>To understand the principles of deep learning and its capabilities and</li> <li>To acquire practical skills to design, implement, and train practical deep learning systems.</li> </ul>			
<b>Course Outcomes:</b>			
After completion of the course, a student should be able to:			
<b>CO1:</b> Describes basics of mathematical foundation that will help the learner to understand the concepts of Deep Learning.			
<b>CO2:</b> Understand and describe model of deep learning.			
<b>CO3:</b> Design and implement various deep supervised learning architectures for text & image data.			
<b>CO4:</b> Design and implement various deep learning models and architectures.			
<b>CO5:</b> Apply various deep learning techniques to design efficient algorithms for real-world applications.			
<b>Outline of Syllabus: (per session plan)</b>			
<b>Modules</b>	<b>Topics</b>	<b>Duration (Lecture)</b>	
<b>Module 1</b>	Implement basic operations with Scalars, Vectors, Matrices, and Tensors using NumPy. <ul style="list-style-type: none"> <li>Perform matrix multiplication and vector operations.</li> <li>Compute norms of vectors and matrices.</li> </ul>	<b>15</b>	
	Explore issues like overflow, underflow, and poor conditioning in numerical computation. <ul style="list-style-type: none"> <li>Implement Gradient-Based Optimization algorithms (e.g., Gradient Descent) for simple optimization problems.</li> <li>Solve Constraint Optimization problems using optimization techniques.</li> </ul>		
	Implementing deep neural network for performing binary classification task. Solving XOR problem using deep feed forward network.		
<b>Module 2</b>	Build and train a Multilayer Perceptron (MLP) for a classification task using TensorFlow or PyTorch. <ul style="list-style-type: none"> <li>Apply regularization techniques such as dropout and weight decay to prevent overfitting.</li> <li>Experiment with different optimization algorithms (e.g., SGD, Adam) for training the model.</li> </ul>	<b>15</b>	

	<p>Implement convolutional layers and pooling layers from scratch using NumPy.</p> <ul style="list-style-type: none"> <li>• Construct a simple CNN architecture and train it on a dataset for image classification.</li> <li>• Explore various CNN architectures and their applications through hands-on exercises.</li> </ul>	
<b>Module 3</b>	<p>Implement basic RNN cells and sequence modeling using TensorFlow or PyTorch.</p> <ul style="list-style-type: none"> <li>• Train an RNN model for language modeling and text generation tasks.</li> <li>• Understand the challenges of training RNNs and explore solutions like LSTM and GRU.</li> </ul>	<b>15</b>
	<p>Implement a sequence-to-sequence model for machine translation using RNNs or Transformer architecture.</p> <ul style="list-style-type: none"> <li>• Train the model on a dataset and evaluate its performance using appropriate metrics.</li> <li>• Explore attention mechanisms and their role in improving sequence-to-sequence models.</li> </ul>	
	<p>Implement basic reinforcement learning algorithms such as Q-learning and policy gradients.</p> <ul style="list-style-type: none"> <li>• Apply these algorithms to solve simple Markov decision processes (MDPs).</li> <li>• Experiment with different reward structures and explore their impact on learning.</li> </ul>	
<b>Module4</b>	<p>Implement a Variational Autoencoder (VAE) architecture for learning latent representations.</p> <ul style="list-style-type: none"> <li>• Train the VAE model on a dataset and visualize the learned latent space.</li> <li>• Explore techniques for generating new data samples using the trained VAE model.</li> </ul>	<b>15</b>
	<p>Implement a basic GAN architecture (e.g., DCGAN) using TensorFlow or PyTorch.</p> <ul style="list-style-type: none"> <li>• Train the GAN model on a dataset for image generation or style transfer tasks.</li> <li>• Experiment with different loss functions and architectures to improve GAN performance.</li> </ul>	
	<ul style="list-style-type: none"> <li>• Use pre-trained GAN models for image generation and synthesis tasks.</li> <li>• use of GANs for text generation tasks such as dialogue generation or story generation.</li> </ul>	
<b>Total Lectures</b>		<b>60</b>

### Essential readings:

1. Deep Learning by Ian Goodfellow, Yoshua Bengio, Aaron Courville, An MIT Press book, 1<sup>st</sup> Edition (2016)
2. Fundamentals of Deep Learning by Nikhil Buduma, O'Reilly, 1<sup>st</sup> edition (2017)  
Deep Learning CookBook by Douwe Osinga, O'Reilly, 1<sup>st</sup> edition (2017)

<b>Program: M.Sc. – Information Technology (2025 - 26)</b>		<b>Semester: IV</b>	
<b>Course: Robotic Process Automation Practical</b>		<b>Course Code: UIRPA653P</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 40)</b>	<b>Semester End Examinations (SEE) (Marks- 60 in Question Paper)</b>
8	4	40	60
<b>Learning Objectives:</b>			
<ul style="list-style-type: none"> <li>To make the students aware about the automation today in the industry.</li> <li>To make the students aware about the tools used for automation.</li> <li>To help the students automate a complete process</li> </ul>			
<b>Course Outcomes:</b>			
After completion of the course, learners would be able to:			
<b>CO1:</b> Understand the mechanism of business process and can provide the solution in an optimize way.			
<b>CO2:</b> Understand the features use for interacting with database plugins.			
<b>CO3:</b> Use the plug-ins and other controls used for process automation.			
<b>CO4:</b> Use and handle the different events, debugging and managing the errors.			
<b>CO5:</b> Test and deploy the automated process.			
<b>Outline of Syllabus: (per session plan)</b>			
<b>Modules</b>	<b>Topics</b>	<b>Duration (Lecture)</b>	
<b>Module 1</b>	<p>UiPath stack, Downloading and installing UiPath Studio, Learning UiPath Studio, Task recorder, Step-by-step examples using the recorder.</p> <p>Sequence, Flowchart, and Control Flow: Sequencing the workflow, Activities, Control flow, various types of loops, and decision making, Step-by-step example using Sequence and Flowchart, Step-by-step example using Sequence and Control flow, Step-by-step examples using the recorder.</p> <ol style="list-style-type: none"> <li>Create a simple sequence based project.</li> <li>Create a flowchart-based project.</li> <li>Create an automation UiPath Project using decision statements.</li> <li>Consider an array of names. We have to find out how many of them start with the letter "a". Create an automation where the number of names starting with "a" is counted and the result is displayed.</li> <li>Create an UiPath Robot which can empty a folder in Gmail solely on basis of recording</li> <li>Automate any process using basic recording.</li> <li>Automate any process using desktop recording.</li> </ol>	<b>30</b>	

	h) Automate any process using web recording	
<b>Module 2</b>	<p>Data Manipulation: Variables and scope, Collections, Arguments – Purpose and use, Data table usage with examples, Clipboard management, File operation with step-by-step example, CSV/Excel to data table and vice versa (with a step-by-step example)</p> <ol style="list-style-type: none"> <li>a) Automate UiPath Number Calculation (Subtraction, Multiplication, Division of numbers).</li> <li>b) Create an automation UiPath project using different types of variables (number, datetime, Boolean, generic, array, data table)</li> <li>c) Create an application automating the read, write and append operation on excel file.</li> <li>d) Automate the process to extract data from an excel file into a data table and vice versa</li> </ol>	<b>30</b>
<b>Module 3</b>	<p>Taking Control of the Controls: Finding and attaching windows, Finding the control, Techniques for waiting for a control, Act on controls – mouse and keyboard activities, Working with UiExplorer, Handling events, Revisit recorder, Screen Scraping, When to use OCR, Types of OCR available, How to use OCR.</p> <p>Handling User Events and Assistant Bots: What are assistant bots? Monitoring system event triggers, Hotkey trigger, Mouse trigger, System trigger ,Monitoring image and element triggers, An example of monitoring email, Example of monitoring a copying event and blocking it, Launching an assistant bot on a keyboard event</p> <ol style="list-style-type: none"> <li>a) Implement the attach window activity.</li> <li>b) Find different controls using UiPath.</li> <li>c) Demonstrate the following activities in UiPath: i. Mouse (click, double click and hover) ii. Type into iii. Type Secure text</li> <li>d) Demonstrate the following events in UiPath: i. Element triggering event ii. Image triggering event iii. System Triggering Event</li> <li>e) Automate the following screen scraping methods using UiPath i. Full Test ii. Native iii. OCR</li> <li>f) Automate the process of launching an assistant bot on a keyboard event</li> </ol>	<b>30</b>
<b>Module 4</b>	<p>Exception Handling, Debugging, and Logging: Exception handling, Common exceptions and ways to handle them, Logging and taking screenshots, Debugging techniques, Collecting crash dumps, Error reporting</p> <ol style="list-style-type: none"> <li>a) Automate the process of send mail event (on any email).</li> <li>b) Demonstrate the Exception handing in UiPath.</li> <li>c) Demonstrate the use of config files in UiPath.</li> <li>d) Install and automate any process using UiPath with the following plug-ins: <ol style="list-style-type: none"> <li>i. Java Plugin</li> <li>ii. Mail Plugin</li> <li>iii. PDF Plugin</li> <li>iv. Web Integration</li> </ol> </li> </ol>	<b>30</b>

	v. Excel Plugin vi. Word, Plugin vii. Credential Management	
<b>Total Lectures</b>		<b>120</b>

**Reference books:**

1. "Learning Robotic Process Automation" by Alok Mani Tripathi
2. "Mastering UiPath" by Brandon T. Olszewski

<b>Program: M.Sc. – Information Technology (2025 - 26)</b>		<b>Semester: IV</b>	
<b>Course: Cyber Forensics Practical</b>		<b>Course Code: UICFO654P</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks -40)</b>	<b>Semester End Practical Examinations (SEPE) (Marks- 60 in Question Paper)</b>
8	4	40	60
<b>Learning Objectives:</b>			
<b>Course Outcomes:</b> After completion of the course, learners would be able to:  <b>CO1:</b> Investigate the cyber forensics with standard operating procedures. <b>CO2:</b> Recover the data from the hard disk with legal procedure. <b>CO3:</b> To recover and analyse the data using forensics tool <b>CO4:</b> Acquire the knowledge of network analysis and use it for analysing the internet attacks. <b>CO5:</b> Able to investigate internet frauds done through various gadgets like mobile, laptops, tablets and become a forensic investigator.			
<b>Outline of Syllabus: (per session plan)</b>			
<b>Modules</b>	<b>Topics</b>	<b>Duration (Lecture)</b>	
<b>Module 1</b>	<b>Introduction to Cyber Forensics and File System Analysis</b> Introduction to Cyber Forensics, Legal and Ethical Issues in Cyber Forensics, Basic Concepts of Digital Evidence, File System Analysis Basics, Introduction to Forensic Tools and Environments Practical Activities: <ul style="list-style-type: none"> <li>• Basic file system analysis using The SleuthKit (Autopsy, fsstat, istat, fls, img_stat)</li> </ul>	<b>30</b>	
<b>Module 2</b>	<b>Digital Forensics Investigation Techniques</b> Windows Forensics Investigation Techniques, Mobile Device Forensics Investigation Techniques, Data Acquisition and Imaging Techniques, Introduction to File Recovery Tools and Techniques Practical Activities: <ul style="list-style-type: none"> <li>• Windows forensic investigation using OSForensics</li> <li>• Mobile device forensics using Molekit Forensics</li> <li>• Data acquisition using ProDiscover Pro</li> <li>• File recovery using FTK Imager and other recovery tools</li> </ul>	<b>30</b>	

<b>Module 3</b>	<b>Network Forensics</b> Introduction to Network Forensics Principles and Practices, Network Traffic Analysis Techniques and Tools, Web Attack Detection and Analysis Methods, Log & Traffic Capturing & Analysis Tools and Techniques Practical Activities: <ul style="list-style-type: none"> <li>• Network traffic analysis using Wireshark</li> <li>• Web attack detection using Wireshark</li> <li>• Log &amp; traffic capturing using Wireshark</li> <li>• Network forensic analysis using NetworkMiner</li> </ul>	<b>30</b>
<b>Module4</b>	<b>Advanced Cyber Forensics Techniques</b> Memory Forensics Techniques and Tools, Steganography Techniques and Detection Methods, Password Cracking Techniques and Tools, Sniffing Techniques and Tools Registry Analysis Techniques and Tools Practical Activities: <ul style="list-style-type: none"> <li>• Memory dump analysis using PMdump</li> <li>• Steganography using S-Tools and SNOW</li> <li>• Password cracking and sniffing using Cain &amp; Abel</li> <li>• Registry analysis using RegScanner and Alien Registry Viewer</li> </ul>	<b>30</b>
<b>Total Lectures</b>		<b>120</b>

**Reference books:**

1. "Computer Forensics: Investigating Network Intrusions and Cyber Crime" by EC-Council, Cengage Learning, 3rd Edition (2019)
2. "Guide to Computer Forensics and Investigations" by Bill Nelson, Amelia Phillips, Christopher Steuart, Cengage Learning, 6th Edition (2019)
3. "Mobile Forensic Investigations: A Guide to Evidence Collection, Analysis, and Presentation" by Lee Reiber, McGraw-Hill Education, (2018)
4. "Windows Forensic Analysis Toolkit: Advanced Analysis Techniques for Windows 10" by Harlan Carvey, Syngress, 5th Edition (2018)
5. "Network Forensics: Tracking Hackers through Cyberspace" by Sherri Davidoff, Jonathan Ham, Pearson IT Certification, (2012)
6. "Practical Packet Analysis: Using Wireshark to Solve Real-World Network Problems" by Chris Sanders, No Starch Press, 3rd Edition (2017)
7. "Network Forensics: An Investigation Guide for Beginners" by Jonathan Ham, Sherri Davidoff, Wiley, (2012)
8. "The Art of Memory Forensics: Detecting Malware and Threats in Windows, Linux, and Mac Memory" by Michael Hale Ligh, Andrew Case, Jamie Levy, Aaron Walters, Wiley, (2014),
9. Steganography: The Art of Hiding Information" by Neil F. Johnson, Sushil Jajodia, Springer, (1998)
10. "The Hash Crack: Password Cracking Manual" by Joshua Picolet, No Starch Press, (2015)

<b>Program: M.Sc. – Information Technology (2025 - 26)</b>		<b>Semester: IV</b>	
<b>Course: Advanced IoT Practical</b>		<b>Course Code: UIAIO655P</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 40)</b>	<b>Semester End Practical Examinations (SEPE) (Marks- 60 in Question Paper)</b>
8	4	40	60
<b>Learning Objectives:</b>			
<b>Course Outcomes:</b> After completion of the course, learners would be able to: <b>CO1 :</b> Build smart IoT applications on Azure. <b>CO2 :</b> Use Microsoft cognitive APIs to build IoT applications. <b>CO3 :</b> Implement Blockchain in IoT. <b>CO4 :</b> Install and use microservices in IoT. <b>CO5 :</b> Build own IoT platform and use it in a customized way			
<b>Outline of Syllabus: (per session plan)</b>			
<b>Modules</b>	<b>Topics</b>	<b>Duration (Lecture)</b>	
<b>Module 1</b>	The Artificial Intelligence 2.0, IoT and Azure IoT Suite, Creating Smart IoT Application, <ul style="list-style-type: none"> <li>Loading Raspbian and Windows IoT Core on Raspberry Pi and executing applications on it using Python and node.js.</li> </ul>	<b>30</b>	
	Create a home automation system and control the devices remotely.		
<b>Module 2</b>	Cognitive APIs, Consuming Microsoft Cognitive APIs, Building Smarter Application using Cognitive APIs. <ul style="list-style-type: none"> <li>Create the programs using the Microsoft Cognitive APIs for IoT.</li> </ul>	<b>30</b>	
	Implementing Blockchain as a service, Capturing, Analyzing and Visualizing real-time data, Making prediction with machine learning. <ul style="list-style-type: none"> <li>Create blockchain on Raspberry Pi and implement and test it. Authenticate IoT with blockchain.</li> </ul>		
<b>Module 3</b>	IoT and Microservices, Service Fabric, Build your own IoT platform: Introduction, Building blocks for IoT solution, Essentials for building your own platform, Platform requirements, building the platform by initializing cloud instance <ul style="list-style-type: none"> <li>Implement Microservices on IoT device.</li> <li>Build your own IoT platform.</li> </ul>	<b>30</b>	

	<ul style="list-style-type: none"> <li>• Use IoT device with AWS or Azure.</li> </ul>	
<b>Module4</b>	Send telemetry from a device to an IoT hub and read it with a service application.	<b>30</b>
	Use the Azure CLI and Azure portal to configure IoT Hub message routing.	
	Face Detection using IoT device. (Pi Camera or anything else).	
<b>Total Lectures</b>		<b>120</b>

**Reference books:**

1. IoT, AI, and Blockchain for .NET Building a Next-Generation Application from the Ground Up , Nishith Pathak Anurag Bhandari, Apress,2018
2. Microservices, IoT and Azure ,Bob Familiar, Apress ,2015
3. Build your own IoT Platform ,Anand Tamboli , Apress ,2019

<b>Program: M.Sc. – Information Technology (2025 - 26)</b>	<b>Semester: IV</b>
<b>Course: Research Project</b>	<b>Course Code: UIRPR656P</b>

**Research Project courses of 6 credits (Sem IV):**

Total marks 150. Out of the total, 40% each for internal and external evaluation.

**A. Research Project Evaluation Internal (60 marks)**

1.	Documentation Report (Chapter 5 to Last)	20
2.	Implementation	20
3.	Viva Voce	20

**B. Research Project Evaluation External (90 marks)**

A Certified copy of hard-bound journal is essential to appear for the Research Project Examination.

1.	Documentation Report (Chapter 5 to Last)	20
2.	Implementation	30
3.	Relevance of the Topic	20
1.	Viva Voce	20

## Evaluation Scheme

**Theory courses of 4 credits:** Total marks 100. Out of the total, 40% is for internal and 60% is for external evaluation.

**C. Internal Evaluation (20m + 10m + 10m = 40 Marks)**

The internal assessment marks shall be awarded as follows:

- iv) 10 marks + 10marks (three tests\* for 10 marks each to be conducted at different instants of time amongst which best two out of three will be considered)
- v) 10 marks assignments / projects / presentations etc.
- vi) 10 marks research paper

10 marks from every course (Two 4 credits mandatory courses, one 4 credits mandatory course, one 4 credits Research Methodology/Research Project) coming to a total of 40 marks, shall be awarded on publishing of research paper in Journal/Conference with plagiarism less than 15%. The marks can be awarded as per the impact factor of the journal, quality of the paper, importance of the contents published, social value.

**Suggested format of Question paper of 10 marks for the written test.**

Q1.	Attempt <i>any two out of three</i> :	10 marks
a.		
b.		
c.		

**D. External Examination: (60 marks) Duration: 2 hours**

All questions are compulsory		
Q1	(Based on Module 1) Attempt <i>any three</i> of the following out of four	15 marks
Q2	(Based on Module 2) Attempt <i>any three</i> of the following out of four	15 marks
Q3	(Based on Module 3) Attempt <i>any three</i> of the following out of four	15 marks
Q4	(Based on Module 4) Attempt <i>any three</i> of the following out of four	15 marks

**Theory courses of 2 credits:** Total marks 50. Out of the total, 40 % is for internal and 60% is for external evaluation.

**C. Internal Evaluation (20 Marks)**

- c. 10 marks (two tests\* of 10 marks each to be conducted at different instants of time and average of two will be considered)
- d. 10 marks assignments / projects / presentations etc.

**Suggested format of Question paper of 10 marks for the written test.**

Q1.	Attempt <i>any two out of three</i> :	10 marks
a.		
b.		
c.		

**D. External Examination: (30 marks) Duration: 1 hour**

All questions are compulsory		
Q1	(Based on Module 1) Attempt <i>any two out of three</i> of the following:	10 marks
Q2	(Based on Module 2) Attempt <i>any two out of three</i> of the following:	10 marks
Q.3	(Based on Module 1 & 2) Attempt <i>any two out of three</i> of the following.	10 marks

**Computer Based Test courses for 4 credits:** Total marks 100. Out of the total, 40% is for internal and 60% is for external evaluation.

**C. Practical Evaluation Internal (40 marks)**

1.	Performance during the regular practical sessions	30
2.	Viva Voce	10

**D. Computer Based Test - Practical Evaluation External (60 marks)**

A Certified copy of hard-bound journal is essential to appear for the practical examination.

1.	Practical Question ( <b>Computer Based Test</b> )	40
2.	Journal	10
3.	Viva Voce	10

**Computer Based Test courses for 2 credits:** Total marks 50. Out of the total, 40% is for internal and 60% is for external evaluation.

**C. Practical Evaluation Internal (20 marks)**

1.	Performance during the regular practical sessions	15
2.	Viva Voce	5

**D. Computer Based Test - Practical Evaluation External (30 marks)**

A Certified copy of hard-bound journal is essential to appear for the practical examination.

1.	Practical Question ( <b>Computer Based Test</b> )	20
2.	Journal	5
3.	Viva Voce	5

<b>Rubrics for Practical</b>					
	<b>Performance Indicator</b>	<b>Poor</b>	<b>Average</b>	<b>Good</b>	<b>Excellent</b>
<b>1</b>	<b>Knowledge (Factual /Conceptual/Procedural/cognitive)</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>2</b>	<b>Describe and Demonstration (Factual /Conceptual/procedural/cognitive)</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>3</b>	<b>Strategy (Analyze &amp;/or Evaluate) (Factual /Conceptual/procedural/cognitive)</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>4</b>	<b>Interpret/Develop/ Attitude towards Learning (Factual /Conceptual/procedural/cognitive/ receiving, attending, responding, valuing, organizing, Characterization by value)</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>5</b>	<b>Nonverbal communication skills/Behavior skills (motor skills, hand-eye coordination, speech behavior)</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>