

## SECOND SEMESTER

Sl. No	Course Code	Course Title	HC/ SC/ FC	Credit Pattern			Credits	Working Hrs
				L	T	P		
1	M23DE0201	Machine Learning	HC	3	1	0	4	4
2	M23DE0202	Object Oriented Programming using JAVA	HC	3	1	0	4	4
3	M23DE0203	Computer Networks	HC	3	1	0	4	4
4	M23DE0204	Web Application Development Framework	HC	3	0	1	4	5
5	M23DE0205	Research Methodology		2	0	0	2	2
6	M23DES211	Advanced Database Management Systems	SC	2	0	1	3	4
	M23DES212	Human Computer Interaction						
	M23DES213	Digital Image Processing						
	M23DES214	Agile Project Management and Testing						
7	M23DES221	Artificial Intelligence	SC	3	1	0	4	4
	M23DES222	Computer Graphics						
	M23DES223	Optimization Techniques						
	M23DES224	Enterprise Resource Planning						
<b>Practical Courses</b>								
8	M23DE0206	Machine Learning Lab in Python	HC	0	0	2	2	4
9	M23DE0207	Java Lab	HC	0	0	2	2	4
<b>Mandatory - (NonCreditable Courses)</b>								
10	M23DEM201	Skills for Career Development						
11	M23DEM202	Technical Certification						
<b>Total Credits</b>						<b>19</b>	<b>4</b>	<b>6</b>
						<b>29</b>		<b>35</b>

## Semester 2

COURSE DESCRIPTION		
<b>Course Code</b>	M23DE0201	<b>Course Credit: 4</b>
<b>Course Name</b>	<b>Machine Learning</b>	
<b>L-T-P</b>	<b>3-1-0</b>	
<b>Pre-requisite</b>	<b>Basic Statistics and Basic Programming Skills</b>	
<b>Year of Introduction</b>	<b>2023</b>	

COURSE OBJECTIVES	
<b>1</b>	Develop a deeper understanding of basic components and categories of Machine Learning
<b>2</b>	Explore on various data pre-processing techniques and various supervised based Machine learning algorithms.
<b>3</b>	Understand the characteristics and its limitation of various unsupervised based Machine learning algorithms
<b>4</b>	Examine the limitations of various machine learning algorithms upon Reinforcement Learning.

COURSE OUTCOMES (COs)	
<b>At the end of the course students will be able to:</b>	
<b>CO1</b>	Understand the fundamental issues and challenges of machine learning: data, model selection, model complexity etc.
<b>CO2</b>	Analyze the characteristics, strengths and weaknesses of Supervised, Unsupervised and Reinforcement Learning techniques and perform evaluation and model selection
<b>CO3</b>	Appreciate the underlying mathematical relationships within and across machine learning algorithms.
<b>CO4</b>	Build various machine learning models in a range of real-world applications based on suitable model parameters.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	M	M	M	M	M	M	M	L	M	L

<b>CO2</b>	H	H	H	H	H	M	M	H	M	M	M	M	L
<b>CO3</b>	H	H	H	H	H	M	M	H	M	M	M	M	L
<b>CO4</b>	M	M	M	H	H	M	H	H	M	M	M	M	M

### SYLLABUS (Brief)

Introduction to Machine learning - Supervised Learning - Unsupervised Learning – Reinforcement Learning

### COURSE CONTENT

Unit -I		COs	Hrs.	SEE Marks
Unit Title	Introduction to Machine learning			
Overview of ML, broad categories of Machine learning- Supervised, Unsupervised, Semi-supervised, and Reinforcement Learning, Applications areas of Machine Learning.	Data Pre-processing, Training and Choosing Predictive Models, Model Evaluation and Validation of unseen data instances.	1	10	25%
Unit -II		COs	Hrs.	SEE Marks
Unit Title	Supervised Learning			
Introduction, Classification and Linear Regression, k-Nearest Neighbor, Linear models, Decision Trees, Naive Bayes Classifiers, Support Vector Machine - Soft Margin and Non-Linear SVM classification. Neural Networks - The Perceptron, Activation Functions, MLP and Backpropagation, Train a DNN, Construction and Execution phase, How to use the Neural Network, Fine-tuning the Hyperparameters, The Number of Hidden Layers.	Visual Cortex Architecture, Convolutional Layers, Filters, Common CNN architectures, LexNet , AlexNet, GoogleNet and ResNet	2	14	25%
Unit -III		COs	Hrs.	SEE Marks
Unit Title	Unsupervised Learning			
Introduction, types and challenges, preprocessing and scaling of datasets, Dimensionality reduction, feature extraction. Principal Component Analysis (PCA), k-means, agglomerative and DBSCAN clustering algorithms.		3	14	

			25%
<b>Unit Title</b>	<b>Unit -IV</b>	<b>COS</b>	<b>Hrs.</b>
	<b>Reinforcement Learning</b>		<b>SEE Marks</b>

Introduction, Learning How to Optimize Rewards, Policy Search, Neural Network Policies, Action Evaluation: Credit Assignment problem, Using Policy Gradients, Markov Decision Processes, Q learning –function,Using Deep QLearning to learn how to play Pacman.

4	14	25%
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#### TEXT BOOKS

1	Andreas C Muller & Sarah Guido , <i>Introduction of Machine Learning with Python</i> , O'Reilly & Shroff publishers. Chapters 1, 2 and 3.
2	Sam Bill Lubanovic, <i>Introducing Python</i> , Oriely Publications, 1st Edition , Chapters 1-6ple)Font
3	Tom M Mitchell , Machine Learning, McGraw Hill Education publication – 2013. Chapter 13.
4	EthemAlpaydi, Introduction to Machine Learning, Second Edition, The MIT Press, 2015
5	ShaiShalev- Shwartz and Shai Ben David, Understanding Machine Learning: From Theory to Algorithms, First Edition, Cambridge University Press, 2014
6.	EthemAlpaydin , Machine Learning , PHI learning private limited. Chapter 1, 7, 16, 18, 19.

#### REFERENCE BOOKS / MOOCs

1	Sudharsan Ravichandran , <i>Reinforcement Learning with Python: Master reinforcement and deep reinforcement learning using OpenAI Gym and TensorFlow</i> , Packt Publishers, 2018.
2	Bharath Ramsundar and Reza BosaghZadeh <i>TensorFlow for Deep Learning</i> , O'Reilly Publications, 2018.
3	Peter Flach, <i>Machine Learning: The Art and Science of algorithms</i> , Cambridge University Press. Chapter 12
4	David barber, <i>Bayesian Reasoning and Machine Learning</i> , Cambridge University Press. Chapter 13, 15
5	Christopher Bishop, <i>Pattern Recognition and Machine Learning</i> , Springer, 2006

#### COURSE DESCRIPTION

Course Code	M23DE0202	Course Credit: 4
Course Name	<b>Object Oriented Programming using Java</b>	
L-T-P	3-1-0	

<b>Pre-requisite</b>	Basics of Programming
<b>Year of Introduction</b>	2023

<b>COURSE OBJECTIVES</b>	
<b>1</b>	To Understand the fundamentals of object-oriented programming in Java -classes, objects, instance variables, methods
<b>2</b>	To comprehend the concepts of Polymorphism, Inheritance and String Handling
<b>3</b>	To enable an insight into the concept of Packages, Interfaces and Exception handling in Java
<b>4</b>	To explore GUI and JDBC concepts

<b>COURSE OUTCOMES (COs)</b>	
<b>At the end of the course students will be able to:</b>	
<b>CO1</b>	Apply the concepts of Classes, Objects using Java Programming Language.
<b>CO2</b>	Develop the applications using core OOPs concepts
<b>CO3</b>	Design the User Defined Packages, Interfaces and User Defined Exceptions
<b>CO4</b>	Build Java Applications incorporating GUI and JDBC Concepts

<b>SYLLABUS (Brief)</b>	
Introduction to the Fundamentals of Java Programming - Introduction to Inheritance, String Handling and Collections – Packages, Interfaces, Multithreading and Exception Handling – Introduction to GUI and JDBC Programming.	

## **COURSE CONTENT**

<b>Unit -I</b>		<b>COs</b>	<b>Hrs.</b>	<b>SEE Marks</b>
<b>Unit Title</b>	<b>Introduction to the Fundamentals of Java Programming</b>			
An overview of Java, Internal Details of JVM				25%
Difference between JDK, JRE and JVM, Features of Java				

Data types, Tokens, Type Conversion, Casting, Arrays, Operators and Precedence, Branching and Looping statements. Classes, objects, methods, Constructors, this, super and final keyword			13	
<b>Unit -II</b>				
<b>Unit Title</b>	<b>Introduction to Polymorphism, Inheritance, String Handling, Collections</b>	<b>Cos</b>	<b>Hrs.</b>	<b>SEE Marks</b>
Method Overloading, Inheritance, Method Overriding, String Handling, Wrapper Class, Input/Output Java Streams Collections: Collections Overview, The Collection Interfaces, The Collection Classes. Lambda Expressions, Java Memory Management			13	25%
<b>Unit -III</b>			13	25%
<b>Unit Title</b>	<b>Packages, Interfaces, Multithreading and Exception Handling</b>			
Creation of User defined Packages, Importing Packages, Accessing Inbuilt Packages Introduction to Interfaces, Features of Interfaces, Creation of Interfaces, Introduction to Multithreading, Life Cycle of a Thread, Creation of a Thread, Exception Handling, Creation of User Defined Exceptions, Understanding the keywords in Java – try, catch, throw, throws and finally, Examples on Exception Handling.				
<b>Unit -IV</b>		<b>Cos</b>	<b>Hrs.</b>	<b>SEE Marks</b>
<b>Unit Title</b>	<b>Introduction to GUI and JDBC Programming</b>			
Swing Introduction, Introduction to basic Widgets in Java Java Swing Apps, Layout Managers Introduction to JDBC, JDBC Drivers DB Connectivity Steps, Connectivity with various Databases.			13	25%

### TEXT BOOKS

<b>1</b>	Java: The Complete Reference, 12th Edition by Herbert Schildt, Publication Date-2022, Published by McGraw Hill
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### **REFERENCE BOOKS / MOOCs**

<b>1</b>	Aaron Walsh and John Fronckowick, "Java Bible, Programming Version 2", IDG Books Worldwide, Inc. 2000.
<b>2</b>	Balagurusamy E, "Programming with JAVA", TMG, 2007
<b>3</b>	Deitel H.M, Deitel P.J,"Java How to program", Sixth Edition, Prentice Hall India, 2005.

### **COURSE DESCRIPTION**

<b>Course Code</b>	M23DE0203	<b>Course Credit: 4</b>
<b>Course Name</b>	<b>COMPUTER NETWORKS</b>	
<b>L-T-P</b>	3-1-0	
<b>Pre-requisite</b>	<b>Fundamentals of Computers</b>	
<b>Year of Introduction</b>	<b>2023</b>	

### **COURSE OBJECTIVES**

<b>1</b>	To analyse the functions and design strategies of various layers.
<b>2</b>	To understand network architectures and components required for data communication.
<b>3</b>	To understand networking concepts and basic communication model.
<b>4</b>	To gain knowledge of various application protocols standard developed for internet Layer

### **COURSE OUTCOMES (COs)**

**At the end of the course students will be able to:**

<b>CO1</b>	Identify the components required to build different types of networks.
<b>CO2</b>	Demonstrate relevant transmission media and switching techniques as per need.
<b>CO3</b>	Obtain the skills of routing mechanisms and configure various networking devices.
<b>CO4</b>	gain knowledge of various application protocols and peer to peer communication.

### **SYLLABUS (Brief)**

Introduction and the physical layer-Data link layer and medium access layer-The network layer- The transport and Application layer

## COURSE CONTENT

Unit -I		COs	Hrs.	SEE Marks
Unit Title	INTRODUCTION AND THE PHYSICAL LAYER			
	<b>INTRODUCTION:</b> Network applications, network hardware, network software, reference models: OSI, TCP/IP, Internet.			
	<b>THE PHYSICAL LAYER:</b> signals, Transmission impairment, transmission: serial transmission, guided transmission media, wireless transmission, the public switched telephone networks, mobile telephone system.	1	13	25%
Unit -II		COs	Hrs.	SEE Marks
Unit Title	THE DATA LINK LAYER			
	<b>THE DATA LINK LAYER:</b> Design issues, error detection and correction, elementary data link protocols, sliding window protocols, example data link protocols - HDLC, the data link layer in the internet.			25%
	<b>THE MEDIUM ACCESS SUBLAYER:</b> Channel allocations problem, multiple access protocols, Ethernet, Data Link Layer switching, Wireless LAN, Broadband Wireless, Bluetooth	2	13	
Unit -III		COs	Hrs.	SEE Marks
Unit Title	THE NETWORK LAYER			
	Network Layer Design issues, store and forward packet switching connection-less and connection-oriented networks, Routing algorithms- optimality principle, shortest path, flooding, Distance Vector Routing, Count to Infinity Problem, Link State Routing, Path Vector Routing, Hierarchical Routing; Congestion control algorithms the network layer in the internet (IPv4 and IPv6), Quality of Service.	3	13	25%
Unit -IV		COs	Hrs.	SEE Marks
Unit Title	TRANSPORT LAYER AND THE APPLICATION LAYER			

Transport service, elements of transport protocol, Simple Transport Protocol, Internet transport layer protocols: UDP and TCP.  Domain name system, electronic mail, World Wide Web: architectural overview, dynamic web document and http.  <b>APPLICATION LAYER PROTOCOLS:</b> Simple Network Management Protocol, File Transfer Protocol, Simple Mail Transfer Protocol.	3	13	25%
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### TEXT BOOKS

1	Andrew S Tanenbaum, Computer Networks, fifth edition, Pearson
2	Data Communications and Networking - Behrouz A. Forouzan, Fifth Edition TMH, 2013.
3	Stallings, "Data and Computer Communications", Pearson Education 2012, 7th Edition.

### REFERENCE BOOKS / MOOCs

1	Larry L Peterson and Brusce S Davie, Computer Networks, fifth edition, ELSEVIER
2	James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, Pearson,2017 .
3	An Engineering Approach to Computer Networks - S. Keshav, 2nd Edition, Pearson Education.
4	Understanding communications and Networks, 3rd Edition, W. A. Shay, Cengage Learning.
5	Computer Networking: A Top-Down Approach Featuring the Internet, James F. Kurose, K. W. Ross, 3rd Edition, Pearson Education.

### COURSE DESCRIPTION

Course Code	M23DE0204	Course Credit: 4
Course Name	Web Application Development Framework	
L-T-P	3-0-1	
Pre-requisite	Basic Logic and design skills	
Year of Introduction	2023	

### COURSE OBJECTIVES

<b>1</b>	Understand the Semantic Structure of HTML and CSS.
<b>2</b>	Compose forms and tables using HTML and CSS and also Design Client-Side programs using JavaScript.
<b>3</b>	Understand working of Web servers and Design Methodologies with MVC Architecture.
<b>4</b>	Develop web applications using XML.

### COURSE OUTCOMES (COs)

**At the end of the course students will be able to:**

<b>CO1</b>	Design Client-Side webpage by using HTML and CSS											
<b>CO2</b>	Design Client-Side programs using JavaScript.											
<b>CO3</b>	Create XML documents and use XQuery to retrieve data and develop application using JSON environment.											
<b>CO4</b>	Illustrate various application development frameworks and develop application using AngularJS Framework.											

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	H	M	M	M	M	H	M	H	L	M	H
CO2	M	M	H	H	L	L	M	M	H	H	M	M
CO3	H	L	L	M	H	L	H	L	M	M	H	L
CO4	L	L	M	L	M	M	L	L	H	M	L	L

### SYLLABUS (Brief)

**HTML & CSS – JavaScript - XML & JSON- Web Application Frameworks**

### COURSE CONTENT

<b>Unit -I</b>		<b>COs</b>	<b>Hrs.</b>	<b>SEE Marks</b>
<b>Unit Title</b>	<b>HTML &amp; CSS</b>			

Introduction to HTML: What is HTML,HTML Syntax	1	2	
Semantic Markup, Structure of HTML Documents, Quick Tour of HTML Elements	1	5	
HTML5 Semantic Structure Elements, HTML Tables and Forms.	1	5	25%
Introduction to CSS: What is CSS, CSS Syntax, Location of Styles, Selectors.			
The Cascade: How Styles Interact, The Box Model, CSS Text Styling.	1	1	
<b>Unit -II</b>		COs	Hrs.
Unit Title	JavaScript		
Introduction to JavaScript: what is the JavaScript and benefits of the language,	2	2	
JavaScript language syntax, Variable declaration, Operators, Control Statements,	2	5	
Error Handling, Understanding arrays, Function Declaration. Built in Functions,	2	5	25%
Standard Date and Time Functions in java script.	2	1	
<b>Unit -III</b>		COs	Hrs.
Unit Title	XML & JSON		
FLOWR	3	3	
Syntax of XML, document structure, and document type definition,			
namespaces, XML schemas, document object model, presenting XML	3	3	
using CSS, XSLT, XPath, XQuery, FLOWR	3	3	25%
Features, JSON vs. XML, JSON Data Types, JSON Objects, JSON	3	3	
Arrays, JSON HTML.	3	1	
<b>Unit -IV</b>		COs	Hrs.

<b>Unit Title</b>	<b>Web Application Frameworks</b>			<b>SEE Marks</b>
Introduction to application development frameworks – AngularJS, ReactJS		4	6	25%
Angular JS: Introduction, Angular JS Expressions, Modules, Data Binding, Controllers,		4	6	
DOM, Events, Forms, Validations.		4	1	

### **TEXT BOOKS**

<b>1</b>	Programming the World Wide Web, 7th Edition, Robet W Sebesta, Pearson, 2013.
<b>2</b>	 FULL STACK REACT – The complete guide to ReactJS and Friends ,1st Edition,Anthony Accomazzo,Leanpub,2020

### **REFERENCE BOOKS / MOOCs**

<b>1</b>	Ditel and Nieto, Internet and World Wide Web - How to program, PHI/Pearson Education, 2006.
<b>2</b>	Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book, 1st Edition, Dream Tech, 2009

## **Softcore Courses**

### **Softcore 1**

### **COURSE DESCRIPTION**

<b>Course Code</b>	M23DES211	<b>Course Credit: 3</b>
<b>Course Name</b>	<b>Advanced Database Management Systems (IL)</b>	
<b>L-T-P</b>	2-0-1	
<b>Pre-requisite</b>	<b>RDBMS, Data Structure, Distributed &amp; Parallel System.</b>	

<b>Year of Introduction</b>	<b>2023</b>
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<b>COURSE OBJECTIVES</b>	
<b>1</b>	To understand hard disk structure, storage concept and File Organisation methods.
<b>2</b>	To understand SQL Query translation mechanism, Algorithms selection process ,Cost Estimation of Algorithms and Optimization process.
<b>3</b>	To understand Transaction processing concept, states, properties, and conflict control mechanism.
<b>4</b>	To understand information retrieval mechanism and Web search engine as application.

<b>COURSE OUTCOMES (COs)</b>	
<b>At the end of the course students will be able to:</b>	
<b>CO1</b>	Recall, arrange and define on storage types and sand file Organisation methods
<b>CO2</b>	Identify and describe on Query Processing System Algorithm selection and working process
<b>CO3</b>	Identity and describe Transaction Processing System phase and working
<b>CO4</b>	Asses on IR and Web Search engine.

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
<b>CO1</b>	H	M	L	-	-	-	-	M	M	-	-	-
<b>CO2</b>	H	M	L	-	-	-	-	M	M	-	-	-
<b>CO3</b>	H	M	L	-	-	-	-	M	M	-	-	-
<b>CO4</b>	H	M	M	-	-	-	-	M	M	-	-	-

<b>SYLLABUS (Brief)</b>	
File Storage and File Organization-Algorithms for Query Processing and Optimization- Transaction Processing System & Schedules - System Architecture -Information Retrieval - Web Search	

## **COURSE CONTENT**

<b>Unit -I</b>	<b>COs</b>	<b>Hrs.</b>

<b>Unit Title</b>	<b>File Storage and File Organization</b>			<b>SEE Marks</b>
<b>Storage and File Structure</b>	Overview of Physical Storage Media , Magnetic Disk(T2), Buffering of Blocks, Placing of File records on disk (T1), RAID (T2) .	1	4	
<b>File Organization , Indexes and Hashing</b>	Comparison of Three File Organizations -Heap Files, Sorted Files, Hashed Files , Choosing a File Organization; Overview of Indexes - Alternatives for Data Entries in an Index, Properties of Indexes , ISAM – ex: static index structure, B+ Tree – ex: dynamic index structure; Hashing – Introduction to Static Hashing and Dynamic Hashing (T3).	1	6	25%
<b>Unit -II</b>		<b>COS</b>	<b>Hrs.</b>	<b>SEE Marks</b>
<b>Unit Title</b>	<b>Algorithms for Query Processing and Optimization</b>			
	Introduction to Translating SQL Queries into Relational Algebra , Algorithms for External Sorting ; Algorithms for SELECT and JOIN Operations , Combining Operations Using Pipelining, Using Heuristics in Query Optimization ; Using Selectivity and Cost Estimates in Query Optimization (T1).	2	10	25%
<b>Unit -III</b>		<b>COS</b>	<b>Hrs.</b>	<b>SEE Marks</b>
<b>Unit Title</b>	<b>Transaction Processing System &amp; Schedules</b>			
	Introduction to Transaction Concept , Transaction Processing and System: Transaction Concept, A Simple Transaction Model, Storage Structure (T2); Introduction to Transaction Processing : Single-User versus Multiuser Systems, Why Concurrency Control Is Needed, Why Recovery Is Needed ; Transaction and System Concepts : Transaction States and Additional Operations; Desirable Properties of Transactions.  Concurrency Control through Schedules: Taxonomy of Schedules – Characterizing Schedules Based on Recoverability, Characterizing Schedules Based on Serializability (T1); Transaction Isolation Levels (T2).	3	10	25%
<b>Unit -IV</b>		<b>COS</b>	<b>Hrs.</b>	<b>SEE Marks</b>
<b>Unit Title</b>	<b>System Architecture ,Information Retrieval and Web Search</b>			
	System Architecture: Distributed databases & Parallel databases  Database System Architecture (T2); Parallel versus Distributed database Architecture; Types of Distributed databases Systems - Homogenous, Heterogenous; Distributed database Storage-Data Fragmentation, Replication and Allocation techniques for Distributed	4	5	25%

database design ; Query Processing and Optimization in Distributed databases(T1)			
Introduction to Information Retrieval and Web Search :	4	5	
Information Retrieval (IR) Concepts : Introduction to Information Retrieval, Databases and IR Systems Comparison, Modes of IR System – Retrieval mode & Browsing mode, Generic IR Pipeline Framework ; Taxonomy of Retrieval Models -types ; Web Search and Analysis(T1).			

### TEXT BOOKS

1	Ramez Elmasri, Sham Navathe .Fundamentals of Database Systems, Publisher: Pearson/Addison , 7 <sup>Th</sup> Edition , ISBN-10: 0-13-397077-9 ISBN-13: 978-0-13-397077-7
2	Abraham Silberschatz, Henry F. Korth, S. Sudarshan ,Database System Concepts, Publisher: McGraw-Hill, 2011.
3	Raghuramakrishnan, Johannes Gehrke ,Database Management Systems - Publisher: McGraw-Hill ,2000.

### REFERENCE BOOKS / MOOCs

1	Foster, Elvis C., Godbole, Shripad. Database Systems: A Pragmatic Approach. United States: Apress, 2014.
2	Rauber, Thomas., Rünger, Gudula. Parallel Programming: For Multicore and Cluster Systems. Germany: Springer Berlin Heidelberg, 2013.
3	Bochmann, G. von. Concepts for Distributed Systems Design. Germany: Springer Berlin Heidelberg, 2012.
	Websites : <ul style="list-style-type: none"> <li>• <a href="https://amirsmvt.github.io/Database/Static_files/Fundamental_of_Database_Systems.pdf">https://amirsmvt.github.io/Database/Static_files/Fundamental_of_Database_Systems.pdf</a></li> <li>• <a href="https://github.com/noahabe/database_system_concepts_answers">https://github.com/noahabe/database_system_concepts_answers</a></li> </ul>

### COURSE DESCRIPTION

<b>Course Code</b>	M23DES212	<b>Course Credit: 3</b>
<b>Course Name</b>	<b>Human Computer Interaction</b>	
<b>L-T-P</b>	<b>2-0-1</b>	
<b>Pre-requisite</b>	<b>Knowledge of Computer Fundamental, Software tools</b>	
<b>Year of Introduction</b>	<b>2023</b>	

### COURSE OBJECTIVES

<b>1</b>	To learn the basic physiological, perceptual, and cognitive components of human learning and memory.
<b>2</b>	To gain theoretical knowledge of and practical experience in the fundamental aspects of designing and implementing user interfaces
<b>3</b>	To understand the techniques and technologies available for the requirement gathering of interactive machines
<b>4</b>	To design mock-ups and carry out a user and expert evaluation of interfaces

### COURSE OUTCOMES (COs)

**At the end of the course students will be able to:**

<b>CO1</b>	Interpret the contributions of human factors and technical constraints on Human-Computer interaction.
<b>CO2</b>	Apply Human-computer Interaction techniques and methods to the design of software
<b>CO3</b>	Practice in developing Human-Computer Interfaces with respect to usability.
<b>CO4</b>	Design effective HCI for individuals and persons with disabilities. Assess the importance of user feedback.

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
<b>CO1</b>	L	M	M	L	L	L	L	L	L	L	M	L
<b>CO2</b>	M	L	M	M	L	L	M	L	L	L	M	L
<b>CO3</b>	H	H	L	M	L	L	H	L	L	L	H	L
<b>CO4</b>	M	M	M	L	L	L	M	L	L	L	M	L

### SYLLABUS (Brief)

In this course, students are introduced to the fundamental theories and concepts of Human Computer Interaction (HCI). HCI is an interdisciplinary field that integrates theories and methodologies across many domains including cognitive psychology, neurocognitive engineering, computer science, human factors, and engineering design. This subject emphasizes on design and evaluation of human computer interfaces using different frameworks and elements. It also provides the techniques to measure the usability and flexibility of software or applications. The subject covers the basics of human computer interaction,

guidelines to design the websites and selection of colours, widgets, functional keys and interaction device.

## COURSE CONTENT

Unit -I		COs	Hrs.	SEE Marks
Unit Title	Foundations of HCI			
<i>The Human:</i> I/O channels, Memory, Reasoning and problem solving	1	2	25%	
<i>The computer:</i> Devices, Memory, processing and networks	1	2		
<i>Interaction:</i> Models, frameworks, Ergonomics, styles, elements, interactivity	1	3		
<i>Paradigms:</i> Introduction, usability paradigms, Paradigms for time-sharing computers, Case Studies	1	3		
Unit -II		COs	Hrs.	SEE Marks
Unit Title	HCI Design and Process			
<i>Design process:</i> Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds, understanding business junctions,	2	3	25%	
<i>Screen Designing:</i> Design goals, Screen planning and purpose, organizing screen elements	2	3		
<i>Ordering of screen data and content:</i> screen navigation and flow, visually pleasing composition, amount of information, focus and emphasis	2	4		
Unit -III		COs	Hrs.	SEE Marks
Unit Title	Requirements Specification			
User Experience Requirements	3	2	25%	
Analysis within the Usability Engineering Lifecycle,	3	1		
Task Analysis	3	1		
Contextual Design	3	1		
Grounded Theory Method in Human Computer Interaction and Computer-Supported Cooperative Work	3	3		
An Ethnographic Approach to Design	3	2		

Unit -IV			COs	Hrs.	SEE Marks
Unit Title	Design and Development				
Employing User Personas			4	1	25%
Prototyping Tools and Techniques			4	2	
Scenario-Based Design,			4	2	
Participatory Design			4	2	
Application-/Domain-Specific Design: Health Care, Aerospace, kids			4	3	

#### TEXT BOOKS

1	Dix, A. (2003). <i>Human-computer interaction</i> . Pearson Education. (Unit- 1 & II)
2	Jacko, J. A. (Ed.). (2012). <i>Human computer interaction handbook: Fundamentals, evolving technologies, and emerging applications</i> , Third Edition, CRC Press, Taylor and Francis Group (Unit- III & IV)

#### REFERENCE BOOKS / MOOCs

1	Sharp, Rogers, Preece, <i>Interaction Design-Beyond Human Computer Interaction</i> , Fourth Edition, Wiley, 2015
2	Scott, B., & Neil, T. (2009). <i>Designing web interfaces: Principles and patterns for rich interactions</i> . " O'Reilly Media, Inc.".
3	Booth, D. (2004). The Human-Computer Interaction Handbook: Fundamentals Evolving Technologies and Emerging Applications. <i>Journal of Occupational Psychology, Employment and Disability</i> , 6(2), 85-87.
4	Shneiderman, Ben, Catherine Plaisant, Maxine Cohen, Steven Jacobs, Niklas Elmquist, and Nicholas Diakopoulos. <i>Designing the user interface: strategies for effective human-computer interaction</i> . Pearson, 2016.

#### COURSE DESCRIPTION

Course Code	M23DES213	Course Credit: 3
Course Name	Digital Image Processing (IL)	
L-T-P	2-0-1	

<b>Pre-requisite</b>	Basic concepts of digital electronics, calculus and probability Basic concepts of Digital images, Basic programming skills
<b>Year of Introduction</b>	<b>2023</b>

<b>COURSE OBJECTIVES</b>	
<b>The objectives of this course are to:</b>	
<b>Machine 1</b>	To understand the digital processing systems and corresponding terminology.
<b>2</b>	To study the image fundamentals and mathematical transforms necessary for image processing.
<b>3</b>	To understand the base image transformation domains and image enhancement methods.
<b>4</b>	To have an understanding of colour models, type of image representations and related statistics.

<b>COURSE OUTCOMES (COs)</b>	
<b>At the end of the course students will be able to:</b>	
<b>CO1</b>	Describe the fundamentals of digital image processing.
<b>CO2</b>	Conduct independent study and analysis of image enhancement and apply image enhancement techniques in both the spatial and frequency (Fourier) domains.
<b>CO3</b>	Interpret and implementing image segmentation techniques.
<b>CO4</b>	Categorize various compression techniques, representation and recognition of images

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
<b>CO1</b>	H	M	M	L	-	-	-	-	-	-	-	-
<b>CO2</b>	L	H	H	L	-	-	-	-	-	-	-	-
<b>CO3</b>	L	M	H	M	-	-	-	-	-	-	-	-
<b>CO4</b>	H	L	M	H	-	-	-	-	-	-	-	-

<b>SYLLABUS (Brief)</b>	
Fundamentals of Image processing- Image Enhancement- Image Segmentation- Image Compression and Recognition	

## COURSE CONTENT

Unit -I		COs	Hrs.	SEE Marks
Unit Title	Fundamentals of Image processing			
Introduction, Applications of Image Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, simple image formation, Image sampling and Quantization, Representing digital pixels, Some Basic Relationships Between Pixels- Neighbours and Connectivity of pixels in image, Colour model.		1	10	25%
Unit -II		COs	Hrs.	SEE Marks
Unit Title	Image Enhancement			
Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering–Smoothing and Sharpening Spatial Filtering		2	10	25%
Frequency Domain: Fourier Transform, Discrete Fourier Transform (DFT), Discrete Cosine Transform (DCT) – Smoothing and Sharpening frequency domain filters.				
Unit -III		COs	Hrs.	SEE Marks
Unit Title	Image Segmentation			
Introduction, Classification of Image segmentation techniques-region - boundary-edge, Classification of edges, Edge detection, Edge linking,		3	10	25%
Morphological processing- erosion and dilation, Standard Binary Morphological operations, Dilation and Erosion based operation, Properties of Morphological operation				
Unit -IV		COs	Hrs.	SEE Marks
Unit Title	Image Compression and Recognition			
Introduction, Redundancy in images, Classification of redundancy, Image Compression scheme-classification, Huffman Coding, Arithmetic Coding, Run length coding, Need for object recognition system, Pattern and pattern class, Approaches to object recognition, Application of Object recognition.		4	10	25%

## TEXT BOOKS

1	Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, Fourth Edition, Pearson Edition, 2017, ISBN-10: 9780133356724
2	Jayaraman S, Esakkirajan S, Veerakumar T, “Digital Image Processing”, Tata McGraw Hill Education, 2009.

### REFERENCE BOOKS / MOOCs

<b>1</b>	Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, „Digital Image Processing using MATLAB‘, Pearson Education, Inc., 2011.
<b>2</b>	Malay K. Pakhira, “Digital Image Processing and Pattern Recognition”, First Edition, PHI Learning Pvt. Ltd., 2011.
<b>3</b>	Willliam K Pratt, “Digital Image Processing”, John Willey, 2002.

### COURSE DESCRIPTION

<b>Course Code</b>	M23DES214	<b>Course Credit:03</b>
<b>Course Name</b>	<b>Agile Project Management and Testing</b>	
<b>L-T-P</b>	2-0-1	
<b>Pre-requisite</b>	Basic understanding of Software Design Process and Software Engineering.	
<b>Year of Introduction</b>	2023	

### COURSE OBJECTIVES

<b>1</b>	Students will be able to understand the modern concepts of Agile transformation and testing principles.
<b>2</b>	Students will be familiar with the various Agile tools and techniques used for software development.
<b>3</b>	Comprehend and apply the concepts to drive agile transformation in the organization.
<b>4</b>	Analyse and illustrate the concepts and process of software testing activates that occur within the process using the various testing techniques and test cases.

### COURSE OUTCOMES (COs)

<b>At the end of the course students will be able to:</b>	
<b>CO1</b>	Understand the Agile concepts, principles, SCRUM terminology, and roles and responsibilities of stake holders. (Level 1).
<b>CO2</b>	Classify various types of software projects to identify the type of development methodologies for the software development using SCRUM (Level 2).
<b>CO3</b>	Implement the project management using Scrum methods to develop quality projects. (Level 3).

<b>CO4</b>	Evaluate software testing types and apply well defined software testing strategies to produce quality software (Level 4).											
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	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
<b>CO1</b>	L	M	M	M	M	L	M	M	L	L	L	L
<b>CO2</b>	M	H	M	M	L	M	H	L	M	L	H	H
<b>CO3</b>	H	H	H	M	H	M	M	L	H	M	M	M
<b>CO4</b>	M	M	H	M	M	L	H	M	M	L	M	M

### **SYLLABUS (Brief)**

This course describes the key aspects of Agile Project Management (APM). It begins with the overview of APM and elaborates the various key terminologies of APM. This course also includes those topics relevant to successful software development by writing Effective user stories, Sprint Execution and Tracking. Elaborates the importance of software testing using tools.

### **COURSE CONTENT**

<b>Unit -I</b>			<b>COs</b>	<b>Hrs.</b>	<b>SEE Marks</b>
<b>Unit Title:</b>	<b>Introduction to Agile concepts &amp; SCRUM Process &amp; High-level view:</b>				
<b>Introduction</b> -Business Agility-Business gains achieved due to agility-Agility in software industry-Agile manifesto and Philosophy-Agile principles- Agile Transformation.	<b>All about SCRUM:</b> Introduction-SCRUM terminology- SCRUM roles-Development team- Project Manager-Growing Leadership.	<b>SCRUM Process: High-level view:</b> High-Level view of the SCRUM process-SCRUM Phases- Construction Iterations from 1 to N activities.	1	10	25%
<b>Product Backlog Management &amp; Sprint Planning:</b>					
<b>Product Backlog Management:</b> Lightweight documentation of Requirements in SCRUM- Contents of the Product Backlog-Properties-Why product backlog sizing is needed at early stage-Attributes of the product backlog item-Product backlog preparation-Example-Operational guidelines for handling product backlog.					
<b>Sprint Planning:</b> Introduction-Sprint Planning practice in detail- Operational guidelines on sprint planning.	2	10	25%		

Unit -III		COs	Hrs.	SEE Marks
Unit Title	Writing Effective user stories-Sprint Execution and Tracking-Sprint Review & Retrospectives:			
<b>Writing Effective user stories</b> -Format of the user story- advantages-limitations-Who should write and review user stories-When user stories should be written? - Handling non-functional requirements as user stories.	<b>Sprint Execution:</b> Introduction-weekly tracking Vs Daily tracking-Advantages of Daily Tracking-Daily Stand-up or Daily Scrum ceremony-Role of Scrum Master- Role of PO in daily Scrum-Challenges of Sprint Execution.  <b>Sprint Review &amp; Retrospectives:</b> Planning of Sprint review-Operational guidelines for effective Sprint Review Ceremony-Preparing for Retrospective ceremony-Conducting Retrospectives Ceremony- Operational guide lines for effective retrospective meeting.	3	10	25%
Unit -IV		COs	Hrs.	SEE Marks
Unit Title	Software Testing & Types of automation tools:			
<b>Software Testing:</b> Humans and Errors, Bugs, Faults and Failures, Purpose of Software Testing, Testing Techniques, Types of Testing, Basic Concepts and definitions. Testing life Cycle, Software Testing Verification and Validation Techniques, Static Testing, Testing Tool: Introduction, Automation Testing Framework, Types of automation tools, Case Study.		4	10	25%

#### TEXT BOOKS

1	Rama Bedarkar, “Agile Scrum- Improving Practices for Business Gains”, Wiley Emerging Technology series, Pearson Education; First Edition, 2020, ISBN: 978-81-265-6086-8, ISBN: 978-81-265-8984, <a href="http://www.weleyindia.com">www.weleyindia.com</a> (Unit 1 – 3: Chapters: 1,2,3,4,5,6,7,8,9)
2	Sandeep Desai, Abhishek Srivastava, “Software Testing : A Practical Approach”, 2nd Edition, PHI Learning Pvt Ltd, 2016 (Unit IV –Software Testing) (Chapters: 1, 2, 3, 4, 6, 7)

#### REFERENCE BOOKS / MOOCs

1	Mark C. Layton, Steven J. Ostermiller , “Agile Project Management for Dummies”, John Wiley & Sons, Inc, 3 <sup>rd</sup> Edition, 2022, ISBN: 13: 9781119676997.
2	Project Management Institute, “ Agile Practice Guide”, Project Management Institute, 1 <sup>st</sup> Edition, 2017, ISBN: 10: 1628251999 or 13: 97816228251999.
3	Srinivasan Desikan and Gopalaswamy Ramesh, “SOFTWARE TESTING - PRINCIPLES AND PRACTICES”, Pearson India Education, 2016.
4	Mauro Pezze, Michael Young, “SOFTWARE TESTING AND ANALYSIS- PROCESS, PRINCIPLES AND TECHNIQUES”, Wiley India, 2018.

COURSE DESCRIPTION		
Course Code	M23DES221	Course Credit: 4
Course Name	Artificial Intelligence	
L-T-P	3-1-0	
Pre-requisite	Basic Mathematics, Computer science fundamentals, logic and control systems.	
Year of Introduction	2023	

COURSE OBJECTIVES	
1	Develop a deeper foundational concepts and historical development of Artificial Intelligence.
2	Understanding problem-solving strategies, including heuristic search and adversarial techniques, to address AI challenges.
3	Represent knowledge effectively using propositional and first-order logic in intelligent agent decision-making.
4	Analyze and understand planning techniques, learning mechanisms, and applications across diverse AI domains.

COURSE OUTCOMES (COs)	
<b>At the end of the course students will be able to:</b>	
CO1	Demonstrate a solid understanding of AI's history and foundational concepts.
CO2	Apply problem-solving skills through heuristic and adversarial search methods in AI scenarios.
CO3	Utilize effective knowledge representation techniques in decision-making for intelligent agents.
CO4	Analyze and synthesize knowledge in planning, learning, and various AI applications.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	M	M	M	M	M	M	M	L	M	L
CO2	H	H	H	H	H	M	M	H	M	M	M	L

<b>CO3</b>	H	H	H	H	H	M	M	H	M	M	M	L
<b>CO4</b>	M	M	M	H	H	M	H	H	M	M	M	M

### SYLLABUS (Brief)

Introduction to Artificial Intelligence, Solving Problems by Searching, Adversial search, Knowledge Represent, Symbolic Reasoning under Uncertainty, Planning, Learning, Robotics, Fuzzy Logic Systems, Expert Systems, Natural Language Processing

### COURSE CONTENT

<b>Unit -I</b>			<b>COs</b>	<b>Hrs.</b>	<b>SEE Marks</b>
<b>Unit Title</b>	<b>Introduction to Artificial Intelligence, Solving Problems by Searching and Adversial search</b>				
Introduction to Artificial Intelligence: Definition, foundation of AI, history of AI, Task Domains of AI, Levels of Artificial Intelligence, Applications of AI. Intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents. Solving Problems by Searching: Problem-solving Agents, formulating problems, Example problems, and searching for Solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Hill climbing, Best-First Search, A*.	1	13	25%		
<b>Unit -II</b>			<b>COs</b>	<b>Hrs.</b>	<b>SEE Marks</b>
<b>Unit Title</b>	<b>Adversial search, Knowledge Represent and Symbolic Reasoning under Uncertainty</b>				
<b>Adversial search:</b> Games, mini-max algorithm, optimal decisions in multiplayer games, Problem in Game playing, Alpha-Beta pruning  Knowledge Represent, Knowledge Based Agent, Knowledge Representation, Knowledge Representation Techniques, Propositional Logic, First-order logic, Knowledge Engineering in FOL, Inference in First-Order Logic, Forward Chaining, and backward chaining.	2	13	25%		
<b>Symbolic Reasoning under Uncertainty:</b> Introduction to Nonmonotonic Reasoning; Logics for Nonmonotonic Reasoning, Default Reasoning and Minimalist Reasoning					
<b>Unit -III</b>			<b>COs</b>	<b>Hrs.</b>	<b>SEE Marks</b>
<b>Unit Title</b>	<b>Planning, Learning and Robotics</b>				

<b>Planning:</b> The Blocks World, Components of a Planning System, Goal Stack Planning, Nonlinear Planning Using Constraint Posting, Hierarchical Planning, Other Planning Techniques.			
<b>Learning:</b> Rote Learning, learning by Taking Advice, Learning in Problem-solving, Learning from Examples: Induction, Explanation-based Learning, Discovery, Analogy, Formal Learning Theory. Learning in Neural and Belief Networks' How the Brain Works, Neural Networks, perceptions. <b>Robotics:</b> Introduction, Robot Hardware, Robotic Perception, Robotic Software Architectures, Application Domains.	3	13	25%
<b>Unit -IV</b>		<b>COs</b>	<b>Hrs.</b>
<b>Unit Title</b>	<b>Fuzzy Logic Systems, Expert Systems, Natural Language Processing</b>		<b>SEE Marks</b>
<b>Fuzzy Logic Systems:</b> Introduction; Crisp Sets; Fuzzy Sets; Fuzzy Terminology; Fuzzy Logic Control-Fuzzy Room Cooler.			
<b>Expert Systems:</b> Representing and Using Domain Knowledge, Expert System Shells, Explanation, Knowledge Acquisition.	4	13	25%
<b>Natural Language Processing:</b> Definition, History of NLP, Advantages and Disadvantages of NLP, Components of NLP, real time Applications, NLP pipeline, Phases of NLP, Difficulties in NLP, NLP APIs			

#### TEXT BOOKS

1	S. Russel and P. Nerving, <i>Artificial intelligence – A Modern Approach</i> , Pearson Education; 3 <sup>rd</sup> Edition, 2015, ISBN: 9789332543515, ISBN: 9789332518698.
2	E. Rich, K. Knight, and S. B. Nair, "Artificial Intelligence," 3rd ed. Tata McGraw Hill, 2013.

#### REFERENCE BOOKS / MOOCs

1	L. Ermine, "Expert Systems: Theory and Practice," Prentice Hall of India, 1995.
2	A. Basu and S. Sarkar, "Artificial Intelligence, IIT Kharagpur," <a href="https://archive.nptel.ac.in/courses/106/105/106105077/">https://archive.nptel.ac.in/courses/106/105/106105077/</a>
3	Lavika Goel, "Artificial Intelligence: Concepts and Applications", Wiley, 1 January 2021, ISBN: 978-8126519934.

#### COURSE DESCRIPTION

<b>Course Code</b>	M23DES222	<b>Course Credit: 4</b>
<b>Course Name</b>	<b>Computer Graphics</b>	

<b>L-T-P</b>	<b>3-1-0</b>
<b>Pre-requisite</b>	Fundamentals of Computer Organization and must have completed the course Mathematics for Computer Applications.
<b>Year of Introduction</b>	<b>2023</b>

<b>COURSE OBJECTIVES</b>	
<b>The Objectives of this course are to:</b>	
<b>1</b>	Introduce the basic concepts of graphic systems
<b>2</b>	Illustrate the concepts of 2D and 3D graphics.
<b>3</b>	Awareness of various projections and Curve representations.
<b>4</b>	Basics of Illumination, lighting and shading models.

<b>COURSE OUTCOMES (COs)</b>	
<b>At the end of the course, students will be able to:</b>	
<b>CO1</b>	Understand the concepts of graphic systems
<b>CO2</b>	Master the concepts of 2D graphics.
<b>CO3</b>	Illustrate the concepts in 3D graphics, Various projections and Curve representations.
<b>CO4</b>	Introduce the Illumination, lighting and shading models.

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
<b>CO1</b>	H	M	M	L	L	-	-	-	-	-	-	-
<b>CO2</b>	M	M	H	M	L	-	L	-	-	-	-	-
<b>CO3</b>	M	H	M	L	H	-	L	-	-	-	-	-
<b>CO4</b>	H	M	M	M	M	-	L	-	-	-	L	-

<b>SYLLABUS</b>	
Introduction to computer graphics and graphic systems- 2D transformations and Viewing- 3D Transformations, Projections and Curves - Hidden surface Detection, Lighting and shading models.	

## COURSE CONTENT

Unit -I		COs	Hrs.	SEE Marks
Unit Title	Introduction to computer graphics and graphic systems			
	Overview of computer graphics, storage tube graphics display, Raster scan display, Random scan display, Flat panel devices, Frame buffer.	1	6	25%
	Graphic primitives: Points and lines, Line drawing algorithms: DDA algorithm, Bresenham's line algorithm, Circle generation algorithm, Scan line, polygon fill algorithm, flood fill algorithm.	1	7	
Unit -II		COs	Hrs.	SEE Marks
Unit Title	2D transformations and Viewing			
	Basic transformations: Translation, Rotation, Scaling, Matrix representations & homogeneous coordinates, transformations between coordinate systems, reflection shear.	2	6	25%
	Viewing: Viewing pipeline, Window to viewport coordinate transformation, clipping: clipping operations, point clipping, line clipping, clipping circles and polygons, text clipping	2	7	
Unit -III		COs	Hrs.	SEE Marks
Unit Title	3D Transformations, Projections and Curves			
	Translation, Rotation, Scaling transformations, Rotation about an arbitrary axis in space, reflection through an arbitrary plane.	3	6	25%
	Projection: Parallel projection, Perspective projection, 3D viewing.			
	Curve representation: Polygon surfaces, designs, Bezier curves, B-spline curves, end conditions for periodic B-spline curves, NURBS.	3	7	
Unit -IV		COs	Hrs.	SEE Marks
Unit Title	Hidden surface Detection, Lighting and shading models			

<b>Hidden surface Detection:</b> Depth comparison, Z-buffer algorithm, Backface detection, scan-line algorithm, Hidden line elimination, wireframe methods.	4	6	25%
<b>Lighting and shading models:</b> Light and colour model, Lambert lighting model, Phong lighting model, shading model : Interpolative shading model, Flat shading, Phong shading, Gouraud shading, <b>Texture.</b>	4	7	

### TEXTBOOKS

<b>1</b>	Donald Hearne and M. Pauline Baker, "Computer Graphics, C Versions." Prentice Hall, ISBN-9788177587654.
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### REFERENCE BOOKS / MOOCs

<b>1</b>	J.D. Foley, S.K. Feiner and J.F. Hughes, "Computer Graphics – Principles and Practises" (Second Edition in C)
<b>2</b>	R.K. Maurya, "Computer Graphics with Virtual Reality", Wiley India
<b>3</b>	F.S. Hill, Stephen M.Kelley, "Computer Graphics using Open GL" Prentice Hall

### COURSE DESCRIPTION

<b>Course Code</b>	M23DE0223	<b>Course Credit: 4</b>
<b>Course Name</b>	<b>Optimization Techniques</b>	
<b>L-T-P</b>	3 – 1 – 0	
<b>Pre-requisite</b>	Basic knowledge of calculus of several variables, linear or matrix algebra.	
<b>Year of Introduction</b>	2023	

### COURSE OBJECTIVES

<b>1</b>	To provide the concept and an understanding of basic concepts in Operations Research Techniques for Analysis and Modelling in Computer Applications
<b>2</b>	To understand develop and solve mathematical model of linear programming problems.
<b>3</b>	To understand develop and solve mathematical model of Transport and assignment problems.
<b>4</b>	To understand network modelling for planning and scheduling the project activities

### COURSE OUTCOMES (COs)

**At the end of the course students will be able to:**

<b>CO1</b>	Formulate and model of a linear programming problem from a word problem and solve them graphically in 2 dimensions, while employing some convex analysis.
<b>CO2</b>	Illustrate and apply the concepts of place a primal linear programming problem into standard form and use the simplex method or dual simplex method to solve it. Effectively communicate complex mathematical ideas and carefully reasoned arguments both orally and in writing.
<b>CO3</b>	Recognize and compute / solve a number of classical linear programming problems and such as the minimum / maximum of the assignment problem, the transportation problem, the shortest- path problem, while taking advantage of the special structures of certain problems.
<b>CO4</b>	Demonstrate the ability to apply analytical and theoretical skills to create quantitative models to solve real world problems in appropriate contexts

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
<b>CO1</b>	M	L	H	M	M	H	L	L	M	L	L	L
<b>CO2</b>	L	M	L	L	H	L	M	H	M	L	L	M
<b>CO3</b>	L	L	L	L	M	M	L	M	L	M	M	L
<b>CO4</b>	M	L	H	H	L	L	H	L	M	L	L	M

### SYLLABUS (Brief)

This course introduces the fundamentals of Operations Research Models including linear programming and applications. Topics includes Introduction to Linear Programming and Overview of the OR Modelling, Solving LPP - The Simplex Method, Transportation and Assignment Problems and Game Theory and Network Analysis. Course will help to the students how to construct appropriate models to particular applications/Problems, develop optimal solutions, understand the theory behind solutions and translate solutions into directives for action. The main goal is to find the lowest cost or the

maximum profit to take decisions related to the Business and to resolve the issues related to the game theory, Transport and Assignment problems.

## COURSE CONTENT

<b>Unit -I</b>		<b>COs</b>	<b>Hrs.</b>	<b>SEE Marks</b>
<b>Unit Title</b>	<b>Introduction to Linear Programming and Overview of the OR Modelling :</b>			
	The origin of OR, the nature of OR, the impact of OR, defining the problem and gathering data, Formulating a mathematical model, deriving solutions from the model, testing the model, preparing to apply the model, implementation.	1	13	25%
	Formulation of linear programming problem (LPP), examples, Graphical solution, the LP Model, Special cases of Graphical method, assumptions of Linear Programming (LP), additional examples.			
<b>Unit -II</b>		<b>COs</b>	<b>Hrs.</b>	<b>SEE Marks</b>
<b>Unit Title</b>	<b>Solving LPP - The Simplex Method :</b>			
	The essence of the simplex method, setting up the simplex method, algebra of the simplex method, the simplex method in tabular form, special cases in the simplex method, tie breaking in the simplex method, adopting to other model forms (Two Phase method, Big-M method), post optimality analysis. The essence of duality theory, economic interpretation of duality, primal dual relationship, adapting to other primal forms.	2	13	25%
<b>Unit -III</b>		<b>COs</b>	<b>Hrs.</b>	<b>SEE Marks</b>
<b>Unit Title</b>	<b>Transportation and Assignment Problems :</b>			
	The transportation problem, a stream line simplex method for the transportation problem, Least Corner Method, Matrix Minima Method, Vogel's Approximation Method for finding basic feasible solution and its optimal (U V Method) solution problem, the assignment problem, a special algorithm for the assignment problem.	3	13	25%
<b>Unit -IV</b>		<b>COs</b>	<b>Hrs.</b>	<b>SEE Marks</b>
<b>Unit Title</b>	<b>Game Theory and Network Analysis :</b>			
	The formulation of two persons, zero sum games, solving simple games- a prototype example, games with mixed strategies, graphical solution procedure, Shortest Path: Dijkstra Algorithm; PERT-CPM problems (Cost Analysis, Crashing, Resource Allocation excluded).	4	13	25%

### TEXT BOOKS

<b>1</b>	Frederick S.Hillier& Gerald J.Lieberman: Introduction to Operations Research, 8thEdition, Tata McGraw Hill, 2022.
<b>2</b>	Hamdy A Taha: Operations Research - An Introduction, 7th Edition, Pearson Education 2022
<b>3</b>	Operations Research Problems & Solutions, V K Kapoor, Sultan Chand & Sons Educational Publishers, 2021

### REFERENCE BOOKS / MOOCs

<b>1</b>	KantiSwarup, P K Guptha and Man Mohan, "Operations Research", Sultan Chand & Sons, New Delhi, 2013.
<b>2</b>	P K Srimani and M Vinayaka Murthy, "Computer Oriented Numerical Methods & Linear Programming", Subhas Stores, Bengaluru, 2021.
<b>3</b>	S. Kalavathy, "Operations Research", Vikas Publishing House Pvt Ltd, Noida India-2013
<b>4</b>	Theory and Problems of Operations Research, Richard Bronson and Govindasami Naadimuthu, Schaum's Outline, Tata McGraw Hill, 2nd Edition, 1997.
<b>5</b>	A Wayne L. Winston: Operations Research Applications and Algorithms, 4th Edition, Thomson Course Technology, 2019.

### COURSE DESCRIPTION

<b>Course Code</b>	M23DES224	<b>Course Credit: 4</b>
<b>Course Name</b>	<b>Enterprise Resource Planning</b>	
<b>L-T-P</b>	<b>3-1-0</b>	
<b>Pre-requisite</b>	Fundamentals of information systems in an organization.	
<b>Year of Introduction</b>	<b>2023</b>	

### COURSE OBJECTIVES

**The Objectives of this course are to:**

<b>1</b>	Build an understanding of the fundamental concepts of ERP systems
<b>2</b>	Analyze the working of different ERP functional modules.

<b>3</b>	Learn and Implement ERP Systems at the technological, operational, and Business levels.
<b>4</b>	Explore the future of ERP and Apply them in real-life scenarios.

### COURSE OUTCOMES (COs)

**At the end of the course, students will be able to:**

<b>CO1</b>	Demonstrate a good understanding of the basic issues in ERP systems											
<b>CO2</b>	Analyze the strategic options for ERP identification and adoption											
<b>CO3</b>	Design the ERP implementation strategies											
<b>CO4</b>	Understand the need for Business Systems and Processes through strategic analysis of ERP systems											

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
<b>CO1</b>	H	H	H	M	H	M	L	M	M	H	M	M
<b>CO2</b>	H	H	L	M	H	L	M	M	M	H	M	M
<b>CO3</b>	H	H	H	M	H	M	M	H	L	H	L	M
<b>CO4</b>	H	H	H	L	H	L	M	M	L	L	M	M

### SYLLABUS

Enterprise Resource Planning (ERP) Overview - ERP Functional Modules - ERP Implementation - ERP Future and Case Studies.

### COURSE CONTENT

<b>Unit -I</b>		<b>COs</b>	<b>Hrs.</b>	<b>SEE Marks</b>
<b>Unit Title</b>	<b>Enterprise Resource Planning (ERP) Overview</b>			
Introduction: Role of Enterprise in implementing ERP system, Business Modelling, Advantages of ERP, ERP Packages, Risk Factors of ERP Implementation.	Business Process Reengineering, Data Warehousing, Data Mining, Online Analytical Processing, Product Life Cycle Management, Supply Chain Management, Customer Relationship Management, Technological Advancements and ERP Security	1	6	25%

Unit -II		COs	Hrs.	SEE Marks
Unit Title	ERP Functional Modules			
Market Overview, Market Place Dynamics, Changing Market, Indian Scenario		2	6	25%
ERP Functional Modules: Functional Modules of ERP software, Integration of ERP, Supply Chain and Customer Relationship applications		2	7	
Unit -III		COs	Hrs.	SEE Marks
Unit Title	ERP Implementation			
The need for ERP, Technological, Operational, and Business reasons for implementing ERP, Implementation challenges,		3	6	25%
ERP Implementation Life Cycle: Objectives, Phases of ERP Implementation, Reasons for Failure.		3	7	
Unit -IV		COs	Hrs.	SEE Marks
Unit Title	ERP Future and Case Studies			
ERP Future: New Markets, New Channels, Faster implementation methodologies, Application Platforms, and New Business Segments.		4	6	25%
Case Studies: SAP R/3, Peoplesoft, Bann, Oracle.		4	7	

## TEXTBOOKS

1	Alexis Leon, Enterprise Resource Planning, Second Edition, 2008, ISBN(13) : 978-0-07-065680-2, ISBN(10) : 0-07-065680-0
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## REFERENCE BOOKS / MOOCs

1	Manufacturing Resource Planning (MRP II) with Introduction to ERP; SCM; an CRM by Khalid Sheikh, Publisher: McGraw-Hill
2	ERP and Supply Chain Management by Christian N. Madu, Publisher: CHI
3	Implementing SAP ERP Sales & Distribution by Glynn C. Williams, Publisher McGraw-Hill

## COURSE DESCRIPTION

Course Code	M23DE0205	Course Credit: 2
Course Name	Research Methodology	

<b>L-T-P</b>	<b>2-0-0</b>
<b>Pre-requisite</b>	Basic Analytical Skills
<b>Year of Introduction</b>	<b>2023</b>

### COURSE OBJECTIVES

**The Objectives of this course are to:**

- 1** To orient students towards research work.
- 2** To equip students to carry out individual or team research work according to scientific/technology requirements.

### COURSE OUTCOMES (COs)

**At the end of the course, students will be able to:**

<b>CO1</b>	Identify and describe researchable ideas, projects, and themes.
<b>CO2</b>	Design and specify methods for carrying out scientific research and demonstrate possession of skills and attitudes to conduct such research.
<b>CO3</b>	Be able to analyze data using scientific methodologies
<b>CO4</b>	Present research results in a systematic and objective way.

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
<b>CO1</b>						H	M			H	L	
<b>CO2</b>						H	M			H	M	
<b>CO3</b>						M	M			H	L	
<b>CO4</b>						M	H			L	M	

### COURSE CONTENT

<b>Unit -I</b>		<b>COs</b>	<b>Hrs.</b>	<b>SEE Marks</b>
<b>Unit Title</b>	<b>Research and Types of research</b>			

Research and Types of research: Meaning of Research- Objectives of Research- Motivation in Research. Research methods vs Methodology. Types of research – Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical.	1	7	25%
Research Process. Criteria of good Research.			
<b>Unit -II</b>			
<b>Unit Title</b>	<b>Research Formulation</b>	<b>COs</b>	<b>Hrs.</b>
Research Formulation – Defining and formulating the research problem - Selecting the problem - Necessity of defining the problem - Importance of literature review in defining a problem – Literature review – Primary and secondary sources – reviews, treatise, monographs- patents – web as a source – searching the web - Critical literature review – Identifying gap areas from literature review - Development of working hypothesis.	2	6	25%
<b>Unit -III</b>			
<b>Unit Title</b>	<b>Data Collection and Analysis</b>	<b>COs</b>	<b>Hrs.</b>
Data Collection and analysis - I: Execution of the research - Observation and Collection of data - Methods of data collection – Modeling, Mathematical Models for research, Sampling Methods- Data Processing and Analysis strategies. Data Analysis with Statistical Packages – Hypothesis-testing, Generalization-and-Interpretation.	3	6	25%
<b>Unit -IV</b>			
<b>Unit Title</b>	<b>Application of results and Ethics</b>	<b>COs</b>	<b>Hrs.</b>
Application of results and ethics - Environmental impacts - Ethical issues - ethical committees - Commercialization – Copy right – royalty - Reproduction of published material – Plagiarism - Citation and acknowledgement - Reproducibility and accountability.	4	7	25%

#### **REFERENCE BOOKS**

1	Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
2	Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International.
3	Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications.

<b>4</b>	Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing
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<b>COURSE DESCRIPTION</b>		
<b>Course Code</b>	M23DE0207	<b>Course Credit: 2</b>
<b>Course Name</b>	<b>Java Lab</b>	
<b>L-T-P</b>	0-0-2	
<b>Pre-requisite</b>	Object oriented programming in Java	
<b>Year of Introduction</b>	<b>2023</b>	

<b>COURSE OBJECTIVES</b>	
<b>1</b>	To Understand the fundamentals of object-oriented programming in Java -classes, objects, instance variables, methods
<b>2</b>	To comprehend the concepts of Polymorphism, Inheritance and String Handling
<b>3</b>	To enable an insight into the concept of Packages, Interfaces and Exception handling in Java
<b>4</b>	To explore GUI and JDBC concepts

<b>COURSE OUTCOMES (COs)</b>	
<b>At the end of the course students will be able to:</b>	
<b>CO1</b>	Apply the concepts of Classes, Objects using Java Programming Language.
<b>CO2</b>	Develop the applications using core OOPs concepts
<b>CO3</b>	Design the User Defined Packages, Interfaces and User Defined Exceptions
<b>CO4</b>	Build Java Applications incorporating GUI and JDBC Concepts

#### **List of Laboratory Programs**

<b>Sl. No.</b>	<b>Part A</b> (Minimum 80% of programs are mandatory)	<b>Hrs</b>	<b>Cos</b>
1	Demonstration of Programs on Command Line Arguments		

2	Demonstration of Creation of Class, Objects		
3	Programs on Method Overloading and Constructor Overloading		
4	Programs on Inheritance and Method Overriding		
5	Program on demonstrations of Input Output Stream.		
6	Program on Creation of Packages, importing the user defined Package.		
7	Demonstration of Multithreading using Thread Class and Runnable Interface		
8	Demonstration of GUI using Swings		
Sl. No	<b>Part B</b> (Minimum 80% of programs are mandatory)	Hrs	Cos
1	<p>Design a simple JDBC Application with a relevant User Interface created using Swings with the following mandate constraints listed below</p> <ul style="list-style-type: none"> <li>• Should be a team project with max of four students</li> <li>• All the validations are must.</li> <li>• Packages, interfaces, inheritance and Exception handling concepts must be used</li> </ul>		

#### REFERENCE BOOKS / MOOCs

1	Aaron Walsh and John Fronckowick, “Java Bible, Programming Version 2”, IDG Books Worldwide, Inc. 2000.
2	Balagurusamy E, “Programming with JAVA”, TMG, 2007
3	Deitel H.M, Deitel P.J, “Java How to program”, Sixth Edition, Prentice Hall India, 2005.

#### COURSE DESCRIPTION

Course Code	M23DE0206	Course Credit: 2
Course Name	Machine Learning Lab using Python	
L-T-P	0-0-2	

<b>Pre-requisite</b>	<b>Programming Languages</b>
<b>Year of Introduction</b>	<b>2023</b>

<b>COURSE OBJECTIVES</b>	
<b>1</b>	Develop a deeper understanding of basic components and categories of Machine Learning
<b>2</b>	Explore on various data pre-processing techniques and various supervised based Machine learning algorithms.
<b>3</b>	Understand the characteristics and its limitation of various unsupervised based Machine learning algorithms
<b>4</b>	Examine the limitations of various machine learning algorithms upon Reinforcement Learning.

<b>COURSE OUTCOMES (COs)</b>	
<b>At the end of the course students will be able to:</b>	
<b>CO1</b>	Understand the fundamental issues and challenges of machine learning: data, model selection, model complexity etc.
<b>CO2</b>	Analyze the characteristics, strengths and weaknesses of Supervised, Unsupervised and Reinforcement Learning techniques and perform evaluation and model selection
<b>CO3</b>	Appreciate the underlying mathematical relationships within and across machine learning algorithms.
<b>CO4</b>	Build various machine learning models in a range of real-world applications based on suitable model parameters.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	M	M	M	M	M	M	M	L	M	L
CO2	H	H	H	H	H	M	M	H	M	M	M	L
CO3	H	H	H	H	H	M	M	H	M	M	M	L
CO4	M	M	M	H	H	M	H	H	M	M	M	M

## List of Laboratory Programs

<b>Sl. No.</b>	<b>Part A</b> (Minimum 80% of programs are mandatory)
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<b>1</b>	Write a program to implement how to read and display a dataset in Python.
<b>2</b>	Write a program to learn how to select features for machine learning
<b>3</b>	Write the program to implement Data Pre-processing for Machine learning
<b>4</b>	Write a program to implement Classification Algorithm. Calculate the accuracy, precision, recall.
<b>5.</b>	Write a program to demonstrate SVM with different kernel methods.
<b>6</b>	Comparison of Machine Learning techniques.
<b>7</b>	Write a program to create the clustering model.
<b>8</b>	Write a program to create two clustering models on the same dataset. Compare the results of these two algorithms and comment on the quality of clustering.
<b>Sl. No</b>	<p style="text-align: center;"><b>Part B</b></p> <p style="text-align: center;">(Minimum 80% of programs are mandatory)</p>
<b>1</b>	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.
<b>2</b>	Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
<b>3</b>	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.
<b>4</b>	Write a program to demonstrate Reinforcement learning.
<b>5</b>	Write a program to Implement CNN models for classification of images.