Curriculum & Syllabus

M. Tech in Multimedia Technology

Submitted by

School of Education Technology

Jadavpur University

Kolkata

Curriculum for the 4-Semester M. Tech in Multimedia Technology programme

First Year	First Semester	

Sl. No		Code	Subject Name	Contact Periods / Week			Credit	Marks	
				L	T	P		Theory	Sessional
1.	Program Core – I	PG/CWE/PC/T/111	Object Oriented Programming using Python	3			3	100	
2.	Program Core – II	PG/MMT/PC/T/112	Pattern Recognition and Image Processing	3			3	100	
3.	Program Elective - I	PG/MMT/PE/T/113/A	Multimedia Technology	3			3	100	
		PG/MMT/PE/T/113/B	Video Analytics						
4.	Program Elective – II	PG/MMT/PE/T/114/A	Human Computer Interaction	3			3	100	
		PG/CWE/PE/T/114/B	Augmented & Virtual Reality						
		PG/MMT/PE/T/114/C	Computer Vision						
5	Program Elective – III	PG/CWE/PE/T/115/A	Web Technology	3			3	100	
		PG/MMT/PE/T/115/B	Multimedia Communication Networks						
6		PG/FET/RM/T/116	Research Methodology, Ethics & IPR	2			2	100	
7	Audit Course	PG/MMT/AC/T/117	Technical Report Writing and Presentation	2			0		
8	Laboratory1	PG/MMT/P/111	AI enabled Multimedia Laboratory			4	2		100
9.	Sessional	PG/MMT/P/112	Seminar			4	2		100
			Total	**18**		**8**	**21**	**600**	**200**

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First Year	Second Semester								
Sl. No		**Code**	**Subject Name**	**Contact Periods / Week**			**Credit**	**Marks**	
				L	**T**	**P**		**Theory**	**Sessional**
1.	Program Core – III	PG/MMT/PC/T/121	Advanced Graphics and Animation	3			3	100	
2.	Program Core – IV	PG/MMT/PC/T/122	Multimedia Design Principles and Authoring	3			3	100	
3.	Program Elective – IV	PG/MMT/PE/T/123/A	Database Management Systems for Multimedia	3			3	100	
		PG/MMT/PE/T/123/B	Machine Learning						
		PG/MMT/PE/T/123/C	Applied Probability & Statistics						
4.	Program Elective – V	PG/MMT/PE/T/124/A	Multimodal Data Analysis	3			3	100	
		PG/MMT/PE/T/124/B	Media Security						
5	Open Elective	PG/MMT/OE/T/125	Java Programming	3			3	100	
6	Laboratory2	PG/MMT/P/121	Advanced Graphics and Animation Lab			4	2		100
7	Mini Project & Seminar	PG/MMT/P/122	Term Paper			6	4		200
			Total	**15**		**10**	**21**	**500**	**300**

Second Year	Third Semester			
Sl. No	**Code**	**Subject Name**	**Credit**	**Marks**
1.	PG/MMT/P/211	Dissertation/Internship-I	16	200
		Total	**16**	**200**

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Second Year		Fourth Semester		
Sl. No	**Code**	**Subject Name**	**Credit**	**Marks**
1.	PG/MMT/P/221	Dissertation/Internship-II	18	400
		Total	**18**	**400**

Program Outcomes (POs)

PO1: An ability to independently carry out research /investigation and development work to solve practical problems.

PO2: An ability to write and present a substantial technical report/document.

PO3: Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.

Program Specific Objectives (PSOs)

PSO1: Utilize contemporary tools and technologies including Artificial Intelligence (AI), Machine Learning (ML) to design, develop, and implement advanced multimedia systems.

PSO2: Conceptualize and create interactive multimedia solutions that are user-centric and aligned with the latest industry trends in web, mobile, and gaming platforms.

PSO3: Develop expertise in digital signal processing, image and video processing, and pattern recognition techniques for building effective multimedia applications.

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Syllabus for PG Course – M. Tech in Multimedia Technology

Course code	PG/CWE/PC/T/111
Category	Program Core – I
Course title	OBJECT ORIENTED PROGRAMMING USING PYTHON
Scheme and Credits	L-T-P: 3-0-0; Credits: 3;
Pre-requisites (if any)	

Syllabus:

Unit 1: Data types and control structures -- Operators (unary, arithmetic, etc.) -- Data types, variables, expressions, and statements -- Assignment statements -- Strings and string operations -- Control Structures: loops and decision

Unit 2: Modularization and Classes -- Standard modules -- Packages -- Defining Classes -- Defining functions – Functions and arguments (signature)

Unit 3: Exceptions and data structures -- Data Structures (array, List, Dictionary) -- Error processing -- Exception Raising and Handling

Unit 4: Object-oriented design -- Programming types -- Object Oriented Programming -- Object Oriented Design -- Inheritance and Polymorphism

Unit 5: Introduction to NumPy: Basics of NumPy Arrays, Computation on NumPy Arrays: Universal Functions, Aggregations. Working with NumPy: Broadcasting, Comparisons, Masks, and Boolean Logic, Fancy Indexing, Sorting Arrays, Structured Data.

Unit 6: Data Manipulation with Pandas: Introducing Pandas Objects, Data Indexing and Selection, Operating on Data in Pandas, Handling Missing Data. Working with Datasets using Pandas: Hierarchical Indexing, Combining Datasets: Concat and Append, Merge and Join, Aggregation and Grouping, Pivot Tables, Vectorized String Operations, Working with Time Series, High-Performance Pandas -eval() and query().

Unit 7: Visualization with Matplotlib: General MatplotLib, Simple Line Plots, Simple Scatter Plots, Density and Contour Plots, Histograms, Binnings, and Density, Customizing Plot Legends, Customizing Colorbars, Text and Annotation, Three-Dimensional Plotting in Matplotlib, Geographic Data with Basemap, Visualization with Seaborn.

Reference Books:

1. Python Data Science Handbook: Essential Tools for Working with Data, by Jake VanderPlas, O'reilly Media, 2017.
2. Data Science From Scratch: First Principles with Python by Joel Grus, Second Edition, 2019, O'reilly Media.
3. Python for Data Science by Mohd. Abdul Hameed, May 2021, Wiley.
4. Python for Data Science: A Crash Course for Data Science and Analysis, Python

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Machine Learning and Big Data by Computer Science Academy.

5. Python for Data Science: The Ultimate Step-by-Step Guide to Python Programming by Daniel, March 2021, O'Reilly.

Content Delivery Method

- Classroom lecture (chalk and board) (D1)
- Visual presentation (D2)
- Tutorial (D3)
- Discussion (D7)

Course Outcomes:

After completing the course, the students will be able to

CO1	Understand the programming basics (operations, control structures, data types, etc.) Readily use the Python programming language.
CO2	Apply various data types and control structures.
CO3	Understand class inheritance and polymorphism.
CO4	Understand the object-oriented program design and development.

CO-PO Mapping (3 – Strong, 2 – Moderate and 1 – Weak)

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1:	**2**		**3**	**3**		
CO2:	**2**		**3**	**3**		
CO3:	**2**		**3**	**3**		
CO4:	**2**		**3**	**3**		

Course code	PG/MMT/PC/T/112
Category	Program Core – II
Course title	MULTIMEDIA TECHNOLOGY
Scheme and Credits	L-T-P: 3-0-0; Credits: 3;
Pre-requisites (if any)	

Syllabus:

Unit 1 Introduction: Definition, Evolution, Multimedia presentation and production, Characteristics of a multimedia presentation, Components and Structure, Hardware and

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Software Specifications, Digitization concepts, Application domains

Unit 2 Text: Introduction, Types of text, ASCII codes, Unicode standards, Font, Insertion of text, OCR, File formats

Unit 3 Image and Graphics: Introduction, Image types, Color and color models, Scanner, Digital camera, Interface standards, Specification of digital images, Color management systems, Device independent color models, Gamma and gamma correction, Image processing steps and software, File formats, Image output on monitor and printer

Unit 4 Audio: Introduction, Nature of sound waves, Musical sound and noise, Tone and note, Psychoacoustics and decibels, Microphone, Amplifier, Speakers, Digital audio specifications, Synthesizers, Musical Instrument Digital Interface (MIDI), Sound card, Audio processing steps and software, File formats

Unit 5 Video: Introduction, Video frames and frame rate, Analog video camera, Video signal formats, Television broadcasting standards, Digital video, Digital video standards, PC Video, Video processing steps and software, File formats

Unit 6 Compression: Introduction, CODEC, Types of compression, Types of redundancies, Lossless compression techniques, Lossy compression techniques, Run length encoding, Huffman coding, Arithmetic coding, Lempel-Ziv-Welsh coding, Differential pulse code modulation, GIF standard, JPEG standard, H.261/H.263/ H.264, MPEG-1, MPEG-2, MPEG-4, MPEG-7, AMR, AAC

Unit 7 Multimedia Databases: Introduction, Limitations of textual descriptions of media, Content based storage and retrieval (CBSR), Image color, Image texture, Image shape, Audio speech and music discrimination, Video cut detection and shot identification, "low-level" vs. "high-level" features, Design and implementation of a prototype system

Reference Books:

1. Ranjan Parekh, "Principle of Multimedia", Tata McGraw Hill, New Delhi, 2006. ISBN: 0-07-058833-3
2. Fred Halsall, "Multimedia Communications: Applications, Networks, Protocols and Standards", Pearson Education Ltd., 2001
3. Francois Fluckiger, "Understanding Networked Multimedia: Applications and Technology", Prentice Hall, 1995
4. Prabhat K Andleigh, KiranThakrar, "Multimedia System Design", Prentice Hall, 1996
5. Ralf Steinmetz, KlaraNahrstedt, "Multimedia Computing, Communications and Applications", Prentice Hall, 1995
6. Nalin Sharda, "Multimedia Information Networking", Prentice Hall, 1999, ISBN : 0132587734

Content Delivery Method

- Classroom lecture (chalk and board) (D1)
- Visual presentation (D2)
- Tutorial (D3)
- Discussion (D7)

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Course Outcomes:	
After completing the course, the students will be able to	
CO1	To analyze the key components of multimedia technologies including text, graphics, voice, video and animation and the broad principles associated with multimedia concepts used in computer graphics.
CO2	To apply techniques for digital image processing, including editing, compression, and enhancement, to produce high-quality visual content.
CO3	To understand the principles of audio and video processing, including recording, editing, and compression, and implement these in multimedia applications.
CO4	To analyze and apply various data compression techniques to optimize the storage and transmission of multimedia content.
CO5	To understand and apply multimedia standards, such as MPEG, JPEG, and HTML5, in the development of multimedia applications.

CO-PO Mapping (3 – Strong, 2 – Moderate and 1 – Weak)

	PO1	**PO2**	**PO3**	**PSO1**	**PSO2**	**PSO3**
CO1:	**2**		**3**		**3**	**1**
CO2:	**2**		**3**		**3**	**1**
CO3:	**2**		**3**		**3**	**1**
CO4:	**2**		**3**		**3**	**1**
CO5:	**2**		**3**		**3**	**1**

Course code	PG/MMT/PE/T/113/A
Category	Program Elective – I
Course title	PATTERN RECOGNITION AND IMAGE PROCESSING
Scheme and Credits	L-T-P: 3-0-0; Credits: 3;
Pre-requisites (if any)	

Syllabus:

Unit 1: Fundamentals of Image Processing: Introduction – Elements of visual perception, Steps in Image Processing Systems – Digital Imaging System - Image Acquisition – Sampling and Quantization – Pixel Relationships – File Formats – colour images and models - Image Operations – Arithmetic, logical, statistical and spatial operations.

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Unit 2: Image enhancement and restoration: Image Transforms -Discrete and Fast Fourier Transform and Discrete Cosine Transform, Spatial Domain - Gray level Transformations Histogram Processing Spatial Filtering – Smoothing and Sharpening. Frequency Domain: Filtering in Frequency Domain – Smoothing and Sharpening filters – Homomorphic Filtering., Noise models, Constrained and Unconstrained restoration models.

Unit 3: Image Segmentation and Morphology: Detection of Discontinuities – Edge Operators – Edge Linking and Boundary Detection – Thresholding – Region Based Segmentation – Motion Segmentation, Image Morphology: Binary and Gray level morphology operations - Erosion, Dilation, Opening and Closing Operations- Distance Transforms Basic morphological Algorithms. Features – Textures - Boundary representations and Descriptions Component Labeling – Regional descriptors and Feature Selection Techniques.

Unit 4: Introduction to Pattern Recognition: Component Labeling - Image Features - Textures - Boundary representations and descriptions - Regional descriptors - Feature selection and Feature dimensionality reduction. Image Classification and Recognition- Statistical Classifiers _ Clustering Algorithms - Hierarchical and Partitional clustering

Unit 5: Image Pattern Recognition Case Studies: Image Understanding – Case Studies in Biometrics, Video Processing, Image Fusion - Image Security - Steganography and Watermarking - Stereo vision - Visual Effects - Image compositing

Reference Books:

1. Alasdair McAndrew, "Introduction to Digital Image Processing with MATLAB", Cengage Learning 2011, India.
2. Anil J Jain, "Fundamentals of Digital Image Processing", PHI, 2011.
3. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", Third Edition, Pearson Education, 2008, New Delhi.
4. Sridhar, "Digital Image Processing", Oxford University Press, 2011, New Delhi.
5. Wilhelm Burger, Mark J Berge, "Digital Image Processing: An algorithmic Introduction using Java", Springer International Edition, 2008.

Content Delivery Method

- Classroom lecture (chalk and board) (D1)
- Visual presentation (D2)
- Tutorial (D3)
- Discussion (D7)

Course Outcomes:

After completing the course, the students will be able to

CO1	Implement basic image processing algorithms using MATLAB tools
CO2	Design an application that incorporates different concepts of Image processing
CO3	Apply and explore new techniques in the areas of image enhancement, restoration, segmentation, compression, wavelet processing and image morphology

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CO4	Critically analyze different approaches to implements mini projects
CO5	Explore the possibility of Appling image processing concepts in various domains

CO-PO Mapping (3 – Strong, 2 – Moderate and 1 – Weak)

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1:	**2**		**3**		**2**	**3**
CO2:	**2**		**3**		**2**	**3**
CO3:	**2**		**3**		**2**	**3**
CO4:	**2**		**3**		**2**	**3**
CO5:	**2**		**3**		**2**	**3**

Course code	PG/MMT/PE/T/113/B
Category	Program Elective – I
Course title	VIDEO ANALYTICS
Scheme and Credits	L-T-P: 3-0-0; Credits: 3;
Pre-requisites (if any)	

Syllabus:

Unit 1 Video Analytic Components: Need for Video Analytics, Overview of video Analytics, Foreground extraction, Feature extraction, classifier, Pre-processing, edge detection, smoothening, Feature space-PCA-FLD-SIFT features.

Unit 2 Foreground Extraction: Background estimation, Averaging, Gaussian Mixture Model, Optical Flow based, Image Segmentation, Region growing, Region splitting, Morphological operations, erosion, Dilation, Tracking in a multiple camera environment.

Unit 3 Classifiers: Neural networks (back propagation), Deep learning networks, Fuzzy Classifier, Bayesian classifier, HMM based classifier.

Unit 4 Video Analytics for Security: Abandoned object detection, human behavioural analysis, human action recognition, perimeter security, crowd analysis and prediction of crowd congestion.

Unit 5 Video Analytics for Business Intelligence & Traffic Monitoring and Assistance: Customer behaviour analysis, people counting, Traffic rule violation detection, traffic congestion identification for route planning, driver assistance, lane change warning.

Unit 6 Video Analysis Action Recognition: Video Analysis Action Recognition, Video

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based rendering, Context and scene understanding. Case Study: Surveillance - Advanced Driver Assistance System.

Reference Books:

1. LALIT V. PATIL, ANUP INGLE, A TEXT BOOK OF VIDEO ANALYTICS

Content Delivery Method

- Classroom lecture (chalk and board) (D1)
- Visual presentation (D2)
- Tutorial (D3)
- Discussion (D7)

Course Outcomes:

After completing the course, the students will be able to

CO1	Develop a thorough understanding of the fundamental components of video analytics,
CO2	Apply various methods for foreground extraction, such as background estimation, Gaussian Mixture Models (GMM), and morphological operations, to process and analyze video data effectively.
CO3	Utilize advanced classification techniques, including neural networks, deep learning models, Bayesian classifiers, and HMM-based approaches, to recognize patterns and classify video data accurately.
CO4	Design and implement video analytics systems for security applications, such as abandoned object detection, human behavior analysis, perimeter security, and crowd congestion prediction, to enhance situational awareness.
CO5	Apply video analytics in business intelligence and traffic monitoring scenarios, including customer behavior analysis, people counting, traffic rule violation detection, and route optimization, to improve decision-making and operational efficiency.

CO-PO Mapping (3 – Strong, 2 – Moderate and 1 – Weak)

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1:	**2**		**3**		**2**	**3**
CO2:	**2**		**3**		**2**	**3**

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CO3:	**2**		**3**		**2**	**3**
CO4:	**2**		**3**		**2**	**3**
CO5:	**2**		**3**		**2**	**3**

Course code	PG/MMT/PE/T/114/A
Category	Program Elective – II
Course title	HUMAN COMPUTER INTERACTION
Scheme and Credits	L-T-P: 3-0-0; Credits: 3;
Pre-requisites (if any)	

Syllabus:

Unit 1: Introduction
Introduction (History) to HCI, screen design, world wide web and Interaction Design, Good and Poor Design, The Double Diamond of Design, Neilson's Heuristics, Contextual Inquiry, Users and User Experience, Accessible and Inclusive Designs, Issues with Interaction Design, Interface Metaphors & Interaction Types, Case Studies

Unit 2 Principles: Modern 2D and 3D interfaces (AR/VR), Human Considerations in Interface and Screen Design, Direct Manipulation and Invisible Interfaces, Human Abilities, Design Principles and Heuristics, Mental Models and Representations, Task Analysis, Distributed Cognition, Figma Tutorial, Case Studies

Unit 3 Methods: Ethics and Human Research, Data Gathering - Techniques and Analysis, Need finding and Requirements Gathering, Design Alternatives, Rapid Prototyping, Evaluation, HCI and Agile Development, Case studies

Unit 4 Applications: Technologies, Ideas, Domains, Project Evaluation

Unit 5 Testing: Usability Testing Methods (Fitt's Law, Heuristics etc.), User Study Designs**,** Quantitative and Qualitative Research Methods, Project Evaluation

Reference Books:

1. Human Computer Interaction: An Empirical Research Perspective by I. Schott Mackenzie, (Morgan Kaufmann)
2. Research Methods in Human-Computer Interaction, by Jonathan Lazar, Jinjuan Heidi Feng, Harry Hochheiser, (Wiley)
3. The essential guide to user interface design, Wilbert O Galitz, Wiley, Dream Tech
4. Human – Computer Interaction. Alan Dix, Janet Fincay, Gre Goryd, Abowd, Russell Bealg, Pearson Education
5. Interaction Design: Beyond Human-Computer Interaction (4th Edition) by Jenny Preece, Helen Sharp, Yvonne Rogers (Wiley)
6. 3D User Interfaces: Theory and Practice (2nd Edition) (Usability) by Joseph J. LaViola Jr., Ernst Kruijff, Ryan P. McMahan, Doug Bowman, Ivan P. Poupyrev

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Web Resources

1. https://archive.nptel.ac.in/courses/106/106/106106177/
2. https://www.behance.net/gallery/48435387/Contextual-Inquiry-Surveys-Web-UI-Research-Phase?tracking_source=search_projects%7Ccontextual+inquiry+affinity+diagram

Content Delivery Method

- Classroom lecture (chalk and board) (D1)
- Visual presentation (D2)
- Tutorial (D3)
- Discussion (D7)

Course Outcomes:

After completing the course, the students will be able to

CO1	Comprehensive Understanding of HCI Principles and Interaction Design
CO2	Application of Modern HCI Techniques and Tools
CO3	Proficiency in Data Gathering, Prototyping, and Evaluation
CO4	Ethical Research and Project-Based Implementation

CO-PO Mapping (3 – Strong, 2 – Moderate and 1 – Weak)

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1:	**2**		**3**		**3**	**2**
CO2:	**2**		**3**		**3**	**2**
CO3:	**2**		**3**		**3**	**2**
CO4:	**2**		**3**		**3**	**2**

Course code	PG/CWE/PE/T/114/B
Category	Program Elective – II
Course title	AUGMENTED & VIRTUAL REALITY

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Scheme and Credits	L-T-P: 3-0-0; Credits: 3;
Pre-requisites (if any)	

Syllabus:

Unit 1 Introduction: Introduction to Virtual Reality – Definition – Three I‟s of Virtual Reality – Virtual Reality Vs 3D Computer Graphics – Benefits of Virtual Reality - Components of VR System - Input Devices – 3D Position Trackers -Performance Parameters – Types of Trackers - Navigation and Manipulation Interfaces – Gesture Interfaces – Types of Gesture Input Devices. Output Devices – Graphics Display – Human Visual System – Personal Graphics Displays – Large Volume Displays – Sound Displays – Human Auditory System.

Unit 2 VR Architecture: Computing Architectures of VR – Rendering Principle – Graphics and Haptics Rendering –PC Graphics Architecture – Graphics Accelerators – Graphics Benchmarks – Workstation Based Architectures – Sun Blade 1000 Architecture – SGI Infinite Reality Architecture – Distributed VR Architectures – Multipipeline Synchronization – Collocated Rendering Pipelines – Distributed Virtual Environments.

Unit 3 VR Modeling: Modeling – Geometric Modeling – Virtual Object Shape – Object Visual Appearance – Kinematics Modeling – Transformation Matrices – Object Position – Transformation Invariants –Object Hierarchies – Viewing the 3D World – Physical Modeling – Collision Detection – Surface Deformation – Force Computation – Force Smoothing and Mapping – Behavior Modeling – Model Management.

Unit 4 VR Programming: VR Programming – Toolkits and Scene Graphs – World ToolKit – Java 3D – Comparison of World ToolKit and Java 3D - GHOST – People Shop – Human Factors in VR – Methodology and Terminology – VR Health and Safety Issues – VR and Society.

Unit 5 VR Application: Medical Applications of VR – Education, Arts and Entertainment – Military VR Applications – Emerging Applications of VR – VR Applications in Manufacturing – Applications of VR in Robotics – Information Visualization.

Reference Books:

1. Reinhard Klette , Concise computer vision: an introduction into theory and algorithms.
2. E.R. Davies, Computer vision: principles, algorithms, applications, learning.
3. Simon J.D. Prince, Computer vision: models, learning and inference.
4. Yeshwanth Reddy and Kishore Ayyaderava , Modern computer vision with Pytorch.
5. David A. Forsyth , Computer vision: a modern approach.
6. Scott Krig , Computer vision metrics: survey, taxonomy, and analysis.

Content Delivery Method

- Classroom lecture (chalk and board) (D1)
- Visual presentation (D2)
- Tutorial (D3)
- Discussion (D7)

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Course Outcomes:	
After completing the course, the students will be able to	
CO1	Discuss the basic concepts of Virtual reality.
CO2	Develop Virtual Reality applications in different areas.
CO3	Design of various modelling concepts.
CO4	Expose the concept of Virtual Reality Programming with toolkits.

CO-PO Mapping (3 – Strong, 2 – Moderate and 1 – Weak)

	PO1	**PO2**	**PO3**	**PSO1**	**PSO2**	**PSO3**
CO1:	**2**		**3**		**3**	**3**
CO2:	**2**		**3**		**3**	**3**
CO3:	**2**		**3**		**3**	**3**
CO4:	**2**		**3**		**3**	**3**

Course code	PG/MMT/PE/T/114/C
Category	Program Elective – II
Course title	COMPUTER VISION
Scheme and Credits	L-T-P: 3-0-0; Credits: 3;
Pre-requisites (if any)	

Syllabus:

Unit 1 Image Processing Foundations: Review of image processing techniques – classical filtering operations – thresholding techniques – edge detection techniques – corner and interest point detection – mathematical morphology – texture

Unit 2 Shapes and Regions: Binary shape analysis – connectedness – object labeling and counting – size filtering – distance functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and shape recognition – centroidal profiles – handling occlusion – boundary length measures – boundary descriptors – chain codes – Fourier descriptors – region descriptors – moments

Unit 3 Hough Transform: Line detection – Hough Transform (HT) for line detection – foot-of-normal method – line localization – line fitting – RANSAC for straight line detection – HT

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based circular object detection – accurate center location – speed problem – ellipse detection – Case study: Human Iris location – hole detection – generalized Hough Transform (GHT) – spatial matched filtering – GHT for ellipse detection – object location – GHT for feature collation

Unit 4 3D Vision and Motion: Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D reconstruction – introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion – splinebased motion – optical flow – layered motion

Unit 5 Applications: Application: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance foreground-background separation – particle filters – Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians

Reference Books:

1. D. L. Baggio et al., "Mastering OpenCV with Practical Computer Vision Projects", Packt Publishing, 2012.
2. E. R. Davies, "Computer & Machine Vision", Fourth Edition, Academic Press, 2012.
3. Jan Erik Solem, "Programming Computer Vision with Python: Tools and algorithms for analyzing images", O'Reilly Media, 2012.
4. Mark Nixon and Alberto S. Aquado, "Feature Extraction & Image Processing for Computer Vision", Third Edition, Academic Press, 2012.
5. R. Szeliski, "Computer Vision: Algorithms and Applications", Springer 2011.
6. Simon J. D. Prince, "Computer Vision: Models, Learning, and Inference", Cambridge University Press, 2012

Content Delivery Method

- Classroom lecture (chalk and board) (D1)
- Visual presentation (D2)
- Tutorial (D3)
- Discussion (D7)

Course Outcomes:

After completing the course, the students will be able to

CO1	Implement fundamental image processing techniques required for computer vision
CO2	Perform shape analysis
CO3	Implement boundary tracking techniques
CO4	Apply chain codes and other region descriptors

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CO5	Apply Hough Transform for line, circle, and ellipse detections
CO6	Implement motion related techniques for various AI applications

CO-PO Mapping (3 – Strong, 2 – Moderate and 1 – Weak)

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1:	**2**		**3**		**2**	**3**
CO2:	**2**		**3**		**2**	**3**
CO3:	**2**		**3**		**2**	**3**
CO4:	**2**		**3**		**2**	**3**
CO5:	**2**		**3**		**2**	**3**
CO6:	**2**		**3**		**2**	**3**

Course code	PG/CWE/PE/T/115/A
Category	Program Elective – III
Course title	WEB TECHNOLOGY
Scheme and Credits	L-T-P: 3-0-0; Credits: 3;
Pre-requisites (if any)	

Syllabus:

Unit 1: Introduction to Internet and World-Wide-Web

Overview- What is Internet and WWW, Evolution of Internet & WWW, How Internet Works (TCP/IP Overview, IP Addressing, Packet Switching, ISPs), Web Basics: Static and Dynamic Web Pages; Client-Server Model of the Internet (Web Clients and Web Servers), Basic Working of the Web – CS Interaction, HTTP, URL, HTML, Other concepts - Proxy Servers, Search Engines, Home Pages, HTTP: Overview, Requests and Responses, HTTP Headers, Methods, Session Management - Persistent Connections, Cookies, Caching; Redirection; Conditional GET, Important Services offered on internet and related application protocols, Email: SMTP, MIME, IMAP/POP3; Domain Services-DNS; FTP

Unit 2: Web Page Design using Mark-up Language HTML5 and Cascaded Stylesheets

Introduction to HTML, HTML Document Structure , Basic Tags, HTML Elements and Attributes - Headings, Paragraph, Text Formatting (styles, colours, text), Images, Links, Lists,

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Tables, Frames, Divisions & Spans, Forms and Form Elements, Meta tags, HTML5 tags: Embedding Audio and Video, Semantic Tags, **CSS,** Stylesheet Types – Inline, Internal, External, Selectors – Element, ID, Class, Grouping of Selectors, CSS Properties: Colors, Background, Borders, Padding and Margins – CSS Box Model, Alignment, Positioning – Relative vs Absolute, z-index, Overflow, Pseudo Classes & Pseudo Elements, Combinators, Specificity, Responsive Web Designs, Flex/Grid, Media Queries, Introduction to Bootstrap Grid Systems, Buttons, Glyphicons, Tables, Forms, Dropdowns & Responsive Tabs, Alerts, Pagination, Progress Bar etc.

Unit 3: Client-side scripting language JavaScript

Java vs JavaScript, Structure of JavaScript Program, Adding JS to HTML, Syntax - Variables and Data Types; Statements: Expression, Keyword, Block; Operators; Flow Controls, Looping, Popup/Dialog Boxes, Functions; Arrays; Objects, properties and methods; Built-in Objects (String, Date, Math, Windows, Document), Document Object Model – Dynamically creating elements/changing attributes and styles; Events and Tag attributes, Event Handling, Form Validation, Error Handling, Introduction to jQuery and JSON, Brief idea about popular JS frameworks/libraries – Angular JS, React JS, Node JS

Unit 4: XML

Introduction to XML and its Application, Syntax Rules for creating XML document, XML Elements and XML Attributes; XML Tree; XML Namespace; XML schema languages: Document Type Definition(DTD), XML Schema Definition (XSD); XSD Simple Types, XSD Attributes; XSD Complex Types; Basics of XML Style Sheets (XSLT) and XQuery

Unit 5: Server-side Technology

Web servers and web hosting, types of web hosting, Server-side scripting vs Client-side Scripting, Basics of Server-Side Scripting with PHP (Primitives, Operations, Control Statements, Arrays and Functions, Form handling, Connecting to Database), Web Application Development using Python (using Flask Framework)

Reference Books:

1. James Kurose, Keith Ross, "Computer Networking: A Top-Down Approach, 6th Edition, Pearson, 2017
2. Behrouz A. Forouzan, Firouz Mosharaf, "Computer Networks: A Top-Down Approach", Special Indian Edition, McGraw Hill Publication, 2017
3. Andrew Tannenbaum, "Computer Networks", 5th Edition, Pearson, 2013
4. P.J. Dietel, H.M. Dietel, "Internet & World Wide Web How to Program", 5th Edition, Deitel.com, 2011
5. D. Flanagan, "Java Script-The Definitive Guide", 7th Edition, O'Reilly, 2020
6. M Lutz, "Learning Python", 5th Edition, O'Reilly, 2013

Content Delivery Method

- Classroom lecture (chalk and board) (D1)
- Visual presentation (D2)

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- Tutorial (D3)
- Discussion (D7)

Course Outcomes:

After completing the course, the students will be able to

CO1	Understand the basic technologies of the Internet and World-Wide-Web.
CO2	Illustrate client-side and server-side technologies and associated components involved at both client and server ends.
CO3	Apply in-demand technical skills such as HTML5/CSS for Web-design, client-side scripting language JavaScript, XML for handling Web-data and server-side scripting language PHP.
CO4	Understand the importance of frameworks in server-side scripting.

CO-PO Mapping (3 – Strong, 2 – Moderate and 1 – Weak)

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1:	**2**		**3**	**3**		
CO2:	**2**		**3**	**3**		
CO3:	**2**		**3**	**3**		
CO4:	**2**		**3**	**3**		

Course code	PG/MMT/PE/T/115/B
Category	Program Elective – III
Course title	MULTIMEDIA COMMUNICATION NETWORKS
Scheme and Credits	L-T-P: 3-0-0; Credits: 3;
Pre-requisites (if any)	

Syllabus:

Unit 1 Multimedia Communication Models

Common Multimedia applications - VoIP- Video Conferencing- Military Surveillance- Interactive TVVideo on Demand- Smart Phone - Requirements and Design challenges of multimedia communications-Architecture of Internet Multimedia Communication- Protocol Stack-H.323.

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Unit 2 Best Effort and Guaranteed Service Models

Best effort service model and its limitations-Resource allocation-Metrics-Max and Min fair sharing Queuing-FIFO-Priority queue-Fair queue- Waited fair queue-Traffic policing-Token bucket-leaky bucket-Admission control-Packet classification and scheduling.

Unit 3 Multimedia on IP Networks

QoS aware routing-RSVP-Integrated and Differentiated services-MPLS-Multicasting-IGMP-PIMDVMRP

Unit 4 Transport Layer Suppor6t for Multimedia

Multimedia over TCP-Significance of UDP- Multimedia Streaming- Audio and Video Streaming Interactive and non Interactive Multimedia-RTP/RTCP-SIP-RTSP.

Unit 5 Multimedia QoS on Wireless Networks

IEEE 802.11e, IEEE 802.16, 3G networks-UMTS, 3GPP, 4G networks-LTE-IMS

Reference Books:

1. James F. Kurose and Keith W. Ross, "Computer Networking-A Top-Down Approach Featuring the Internet", Pearson, 2012.
2. Larry L. Peterson and Bruce S. Davie, "Computer Networks- A Systems Approach", Morgan Kaufmann Publishers, 2007.
3. Mario Marques da Silva, "Multimedia Communications and Networking", CRC Press, 2012.
4. 4. Mark Wuthnow, Jerry Shih, Matthew Stafford, "IMS: A New Model for Blending Applications", Auerbach Publications, 2009.

Content Delivery Method

- Classroom lecture (chalk and board) (D1)
- Visual presentation (D2)
- Tutorial (D3)
- Discussion (D7)

Course Outcomes:

After completing the course, the students will be able to

CO1	Deploy the right Multimedia Communication models
CO2	Apply QoS to multimedia network applications with efficient routing techniques
CO3	Develop the real-time multimedia network applications

CO-PO Mapping (3 – Strong, 2 – Moderate and 1 – Weak)

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	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1:	**2**		**3**	**2**	**3**	
CO2:	**2**		**3**	**2**	**3**	
CO3:	**2**		**3**	**2**	**3**	

Course code	PG/MMT/AC/T/117
Category	Audit Course
Course title	TECHNICAL REPORT WRITING AND PRESENTATION
Scheme and Credits	L-T-P: 0-0-0; Credits: 0;
Pre-requisites (if any)	

Syllabus:

MS-Word, MS-Excel, MS-Powerpoint

Unit I: Introduction to LaTeX: Overview of LaTeX, Installing LaTeX: MiKTeX, TeX Live, and Overleaf, Basic structure of a LaTeX document: Preamble, document class, sections, Creating and compiling a simple LaTeX document, Setting up the LaTeX environment and writing a

Unit II: Document Structure and Formatting: Organizing content with sections, subsections, and paragraphs, Customizing fonts, text styles, and page layout, Using lists: Itemized, enumerated, and description lists, Adding comments and special characters in LaTeX, Creating a structured document with various formatting options

Unit III: Typesetting Mathematical Content: Introduction to mathematical typesetting in LaTeX, Writing equations, fractions, roots, sums, integrals, and matrices, Aligning and numbering equations

Unit IV: Including Figures and Tables: Inserting and positioning figures, Including images and diagrams; creating and formatting tables: Simple tables, multi-row, and multi-column tables; using the `graphicx` and `tabular` packages, Adding captions, labels, and references to figures and tables, Lab session: Working with figures and tables in a LaTeX document

Unit V: References and Citations: Adding bibliographic references using the `bibliography` and `biblatex` packages, Managing citations: In-text citations, bibliography styles, and reference lists, Using BibTeX for automated bibliography management

Unit VI: Advanced Document Features: Customizing headers and footers, Working with large documents: Table of contents, index, and glossaries

Unit VII: Presentations with LaTeX (Beamer): Introduction to the Beamer class for creating presentations, Structuring a Beamer presentation: Frames, slides, and overlays, Adding content: Text, bullet points, and multimedia elements, Customizing themes, colours, and slide transitions

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Unit VIII: Overview of essential LaTeX packages: `amsmath`, `geometry`, `hyperref`, `xcolor` Customising LaTeX templates for articles, reports, and theses, Troubleshooting common LaTeX errors and issues, Applying packages and customisations in various document types

Reference Books:

1. LaTeX: A Document Preparation System", Leslie Lamport, Addison-Wesley, 1986.
2. The LaTeX Companion", Frank Mittelbach, Michel Goossens, Johannes Braams, David Carlisle, and Chris Rowley, Addison-Wesley Professional, 2004.
3. LaTeX Beginner's Guide", Stefan Kottwitz, Packt Publishing Ltd, 2024
4. LaTeX Cookbook", Stefan Kottwitz, Packt Publishing Ltd, 2015
5. LaTeX in 24 Hours: A Practical Guide for Scientific Writing", Dilip Datta, Springer Cham, 2017

Content Delivery Method

- Classroom lecture (chalk and board) (D1)
- Visual presentation (D2)
- Tutorial (D3)
- Discussion (D7)

Course Outcomes:

After completing the course, the students will be able to

CO1	Understand the fundamental concepts and syntax of LaTeX.
CO2	Develop skills to create well-structured documents, including articles, reports, and presentations.
CO3	Learn to include and format mathematical equations, tables, figures, and references.
CO4	Gain proficiency in using LaTeX packages to enhance document functionality.

CO-PO Mapping (3 – Strong, 2 – Moderate and 1 – Weak)

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1:		**3**				
CO2:		**3**				
CO3:		**3**				
CO4:		**3**				

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Course code	PG/MMT/P/111
Category	Laboratory 1
Course title	AI-ENABLED MULTIMEDIA LABORATORY
Scheme and Credits	L-T-P: 0-0-4; Credits: 2;
Pre-requisites (if any)	

Syllabus:

Unit I: Image Editing [Introducing open-source image editing software (GIMP) for image manipulation and image editing, layer masks and alpha channel, cropping, resizing, transforming an image, adjustment of colour balance, applying filters, understanding various colour modes, creating an Ink Smudge Portrait, creating a Low Poly Portrait in Black and White, preparing photo collage, saving and exporting images

Unit II: Audio Editing [Introducing open-source audio editing software (Audacity) for working with multiple tracks, recording voice by setting recording levels and playback levels, recording desktop audio, editing audio using options like trimming, crossfading, mixing, panning, noise reduction, spectral analysis and saving and exporting projects

Unit III: Video Editing [Assignment-based projects involving various video editing options, multi-layer track handling, text embedding, audio and motion image synchronisation]

Reference Books:

1. Nigel Chapman and Jenny Chapman, Digital Multimedia, Wiley, 3rd Edition, 2009
2. Jennifer Smith and Christopher Smith, Adobe Creative Cloud All-in-One For Dummies, 2nd Edition, 2018
3. Olivier Lecarme and Karine Delvare, The Book of GIMP: A Complete Guide to Nearly Everything, No Starch Press, 2013
4. Enrico Valenza, The Blender 3D Cookbook, Packt Publishing, 2015
5. Oscar Baechler and Xury Greer, Blender 3D by Example Packt Publishing, 2020

Content Delivery Method

- Classroom lecture (chalk and board) (D1)
- Visual presentation (D2)
- Tutorial (D3)
- Discussion (D7)

Course Outcomes:

After completing the course, the students will be able to

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CO1	Design of raster images using various themes and layouts, understanding the significance of colour models and their application, composing old photos, and analysing the filters and their application.
CO2	Create music and speech audio files using several editing options for final export.
CO3	Perform project-based video editing for final rendition and production.
CO4	Integrate multimedia components to produce cohesive digital presentations and applications.

CO-PO Mapping (3 – Strong, 2 – Moderate and 1 – Weak)

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1:	**3**		**3**		**3**	
CO2:	**3**		**3**		**3**	
CO3:	**3**		**3**		**3**	
CO4:	**3**		**3**		**3**	

Course code	PG/MMT/P/112
Category	Seminar
Course title	SEMINAR
Scheme and Credits	L-T-P: 0-0-4; Credits: 2;
Pre-requisites (if any)	

Syllabus:

Unit I: Identification of relevant state-of-the-art topics related to Courseware Engineering through group discussion and literature search.

Unit II: Dissemination of recent technology and its application for developing executable applications identified in Unit 1 through seminar presentation and report.

Reference Books:

Resources:

https://ieeexplore.ieee.org/Xplore/home.jsp
https://link.springer.com/
https://www.sciencedirect.com/

Content Delivery Method

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- Visual presentation (D2)
- Tutorial (D3)
- Discussion (D7)

Course Outcomes:

After completing the course, the students will be able to

CO1	Conduct group discussions to identify recent research topics relevant to Multimedia Technology.
CO2	Prepare and deliver the presentation as a PowerPoint based on recent research topics, which will form the baseline for the dissertation in the third and fourth semesters.
CO3	Conduct group discussions to identify recent research topics relevant to Multimedia Technology.
CO4	

CO-PO Mapping (3 – Strong, 2 – Moderate and 1 – Weak)

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1:	**1**	**3**		**X**	**X**	**X**
CO2:	**1**	**3**		**X**	**X**	**X**
CO3:	**1**	**3**		**X**	**X**	**X**
CO4:						

Course code	PG/MMT/PC/T/121
Category	Program Core – III
Course title	ADVANCED GRAPHICS AND ANIMATION
Scheme and Credits	L-T-P: 3-0-0; Credits: 3;
Pre-requisites (if any)	

Syllabus:

Unit 1: 3D Display methods, 3D graphics packages, Polygon surfaces, Curves lines and Surfaces, Spline representations, Bezier Curves and Surfaces, B-Spline Curves, Beta-Splines, Relational Splines, Convection between Spline representations. Displaying Spline, Curves,

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Methods 3D Planar Geometric projection. Transformation, Rotation Scaling, other Transformations, Composite Transformations, 3D Transformation functions, Modelling and Co-ordinate transformations, 3D viewing concepts, Representing solid, Sweep representation, Boundary representation, Spatial partitionary representation, Constructive solid geometry, Octrees, BSP Trees, Fractal-Geometry

Unit 2: Introduction to Animation [Animation as a special effect, Types of Animation, overview of computer-based animation

Unit 3: 2D Animation: Types of 2-D Animations; Sprite Rendering, 2DImage Manipulation Techniques , Tools for 2D Animation

Unit 4: 3D Animation [Basics of 3D modelling, Using transform modifiers, Creation of Static and Animated Materials, Creation and Rotation of Wireframe Objects, Keyframing and Animation Editing, Forward and Inverse Kinematics, Surface Modelling – Flat and curved surfaces, Bending, Warping, Lighting and Materials – Effects of Lights, Attributes of Materials, Textures, Highlight and Shadows, Spotlights, Techniques, Scanline rendering, Raytracing rendering, Organic Modelling: Character animation, Bipedal Animation, Meshes, Skeletons, Morphing, Lens flare, Glow, Splash, Blur etc., Tools for 3D Animation, Animation file formats]

Reference Books:

1. J. D. Foley, A. Van Dam, S. K. Feiner and J. F. Hughes, Computer Graphics - Principles andPractice, Pearson 3 rd Edition, 2014
2. Steve Marschner, Peter Shirley, Fundamentals of Computer Graphics, CRC press, 4thEdition, 2016
3. Hearn, Baker, Computer Graphics with OpenGL, Pearson, 4 th Edition,2011
4. William M. Newman and Robert F. Sproull, Principles of Interactive Computer Graphics,TMH, 2nd Edition, 2006
5. David F. Rogers, Procedural elements of Computer Graphics, McGraw-Hill, 1985

Content Delivery Method

- Classroom lecture (chalk and board) (D1)
- Visual presentation (D2)
- Tutorial (D3)
- Discussion (D7)

Course Outcomes:

After completing the course, the students will be able to

CO1	Mastery of 3D Graphics and Transformation Techniques
CO2	Proficiency in 2D and 3D Animation Principles
CO3	Expertise in Rendering Techniques and Lighting Effects
CO4	Application of Advanced Modelling and Animation Tools

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CO-PO Mapping (3 – Strong, 2 – Moderate and 1 – Weak)						
	PO1	**PO2**	**PO3**	**PSO1**	**PSO2**	**PSO3**
CO1:	**2**		**3**		**2**	**3**
CO2:	**2**		**3**		**2**	**3**
CO3:	**2**		**3**		**2**	**3**
CO4:	**2**		**3**		**2**	**3**

Course code	PG/MMT/PC/T/122
Category	Program Core – IV
Course title	MULTIMEDIA DESIGN PRINCIPLES AND AUTHORING
Scheme and Credits	L-T-P: 3-0-0; Credits: 3;
Pre-requisites (if any)	

Syllabus:

Unit 1: Multimedia Documents & Interchange Formats [Open Document Architecture (ODA), Multimedia and Hypermedia Information Coding Expert Group (MHEG), Open Media Framework (OMF), Markup, Standard Generalized Markup Language (SGML), Hypermedia]

Unit 2: Document for Multimedia Content Design[Introduction to Multimedia Presentation, Flowcharts, Simple interactive flowchart, Complex interactive flowchart, Storyboards, Advantages of Storyboarding, Interactive storyboarding, Script, Case studies]

Unit 3: Multimedia Authoring Metaphors [Functions and Tasks of Authoring Metaphors, Types of Authoring Metaphors: The Slide Show Metaphor, Book Metaphor/Page metaphor, Windowing Metaphor, The Network Metaphor, Icon Metaphor, Animation and Keyframes basics, Introduction to Action Script 3.0 using Adobe Animate]

Unit 4: Learning Management System (LMS) [Introduction to LMS, Types of LMS: Proprietary, Open Source and Cloud based LMSs, Comparison among various types of LMSs, Usability and Usability Heuristics for User Interface Design, Learners and Instructors, Heuristics for Design of Learning Interfaces, LMS Administrator, SCORM and xAPI Standards, Course building process, Implementation Strategies, LMS Evaluation: Duration of evaluation, Response rate, Data analysis, Adaptive Intelligent Tutoring System (AITS)]

Unit 5: MOODLE [Basics of MOODLE, Managing course content, Creating lessons, quizzes, assignments and glossaries, MOODLE Administration]

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Reference Books:

1. Braunstein Roger ActionScript 3.0 Bible, 2nd Edition, Wiley Publishing Inc., 2010
2. Cole Jason, Foster Helen, Using Moodle, 2nd Edition, O'Reilly Community Press, 2008

Content Delivery Method

- Classroom lecture (chalk and board) (D1)
- Visual presentation (D2)
- Tutorial (D3)
- Discussion (D7)

Course Outcomes:

After completing the course, the students will be able to

CO1	Visualize Pre-production processes for designing a presentation (CBT) through flowchart, storyboard and script
CO2	Compare various authoring metaphors and selecting the appropriate metaphor
CO3	Implement Action Script 3.0 in CBT construction
CO4	Explain LMS and Course Content Management and formulating it using MOODLE

CO-PO Mapping (3 – Strong, 2 – Moderate and 1 – Weak)

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1:	**2**		**3**		**3**	**2**
CO2:	**2**		**3**		**3**	**2**
CO3:	**2**		**3**		**3**	**2**
CO4:	**2**		**3**		**3**	**2**

Course code	PG/MMT/PC/T/123/A
Category	Program Elective – IV
Course title	DATABASE MANAGEMENT SYSTEMS FOR MULTIMEDIA
Scheme and Credits	L-T-P: 3-0-0; Credits: 3;

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Pre-requisites (if any)	

Syllabus:

Unit 1 Introduction: An introduction to Multimedia Database, Need for MMDB, Metadata and Content-based Retrieval. Object Oriented and Object Relational Databases, Daa Models

Unit 2 Multidimensional Data Structures: k-d tree, Point Quadtree, MX-Quad tree, R-tree, Comparison of Different Data Structures

Unit 3 Architectures for MMDB: Architecture requirements, multimedia server design, distributed multimedia servers, client-server architecture, peer-to-peer systems, Metadata for MMDB, Features of Metadata, Metadata for Text, Images, Audio, Video, Annotation, generation and extraction standards, Multimedia Query Processing, Data Manipulation, Transaction Management, Query Processing, SQL for Multimedia Queries. Storage Management, Access Methods and Indexing, Storage Methods of Quadtree and R-Tree

Unit 4 Image Database: Raw Images, Compressed Image Representations, Similarity-Based Retrieval, Representing Image DBs with Relations, Representing Image DBs with R-Trees, Retrieving Images by Spatial Layout - Implementations.

Unit 5 Text/Document Database: Precision and Recall, Stop Lists, Word Stems, and Frequency Tables, Latent Semantic Indexing, TV-Trees, Other Retrieval Techniques

Unit 6 Audio and Video Databases: A General Model of Audio Data - Capturing Audio Content through Discrete Transformation - Indexing Audio Data, Organizing Content of a Single Video, Query Languages for Videos, Indexing Video Content, Video Segmentation, Mining Combinations of Multimedia Data, Performance Issues, Visualization of Multimedia Data.

Unit 7 Creating Distributed Multimedia Presentations: Objects in Multimedia Presentations, Specifying Multimedia Documents with Temporal Constraints, Efficient Solution of Temporal Presentation Constraints, Spatial Constraints.

Unit 8 Spatial Concepts and Data Models: Models of spatial information, Design the ER model with spatial concepts, Extending the ER model pictograms, Object-oriented data model with UML.

Reference Books:

1. Subrahmanian V S, "Principles of Multimedia Database Systems", Morgan Kaufmann Publisher, 2001.
2. Lynne Dunckley, "Multimedia Databases: An Object – Relational Approach", Pearson Education, 2003.
3. Bhavani Thurasingham, "Managing and Mining Multimedia Databases", CRC Press, 2001.
4. Khoshafian, "Multimedia and Imaging Databases", Lavoisier Publications, 1997
5. Stolze K.: SQL/MM Spatial: The Standard to Manage Spatial Data in Relational Database Systems. BTW 2003.

Content Delivery Method

- Classroom lecture (chalk and board) (D1)

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- Visual presentation (D2)
- Tutorial (D3)
- Discussion (D7)

Course Outcomes:

After completing the course, the students will be able to

CO1	Explain the concepts and theories of multimedia databases.
CO2	Develop and utilise appropriate data models (relational, object-oriented, hierarchical) for effective multimedia database design.
CO3	Comprehend the unique attributes of multimedia data, including text, images, audio, and video, and their storage and retrieval requirements.
CO4	Analyse and create database schemas for multimedia applications, considering data representation, compression, and storage techniques.
CO5	Use query languages like SQL/MM, XPath, and XQuery for efficient content-based retrieval of multimedia data.
CO6	Develop systems for retrieving multimedia data based on features like colour, texture, shape, or motion.
CO7	Examine the architecture and functionalities of MDBMS, including metadata management and data integration.

CO-PO Mapping (3 – Strong, 2 – Moderate and 1 – Weak)

	PO1	**PO2**	**PO3**	**PSO1**	**PSO2**	**PSO3**
CO1:	**2**		**3**	**3**	**2**	
CO2:	**2**		**3**		**2**	**2**
CO3:	**2**		**3**		**2**	**2**
CO4:	**2**		**3**		**2**	**2**
CO5:	**2**		**3**		**2**	**2**
CO6:	**2**		**3**		**2**	**2**
CO7:	**2**		**3**		**2**	**2**

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Course code	PG/MMT/PE/T/123/B
Category	Program Elective – IV
Course title	MACHINE LEARNING
Scheme and Credits	L-T-P: 3-0-0; Credits: 3;
Pre-requisites (if any)	

Syllabus:

Unit 1 Introduction: Components of Learning, Learning Models, Geometric Models, Probabilistic Models, Logic Models, Grouping and Grading, Designing a Learning System, Types of Learning, Supervised, Unsupervised, Reinforcement, Perspectives and Issues, Version Spaces, PAC Learning, VC Dimension; datasets, Dataset division: test, train and validation sets, cross validation, Real life examples of Machine Learning.

Unit 2 Basics of Feature engineering: Data visualization, Data cleaning and preprocessing techniques, Feature selection and Feature extraction and reduction

Unit 3 Supervised learning: Classification and Regression: K-Nearest Neighbor, Linear Regression, Logistic Regression, Random Forest, Decision tree, Multilayer Perceptron, Support Vector Machine (SVM), Evaluation Measures: SSE, MME, R2, confusion matrix and evaluation metrics, ROC-Curve, AUC curve.

Unit 4 Unsupervised learning: Introduction to clustering, Types of Clustering: Hierarchical, Agglomerative Clustering and Divisive clustering; Partitional Clustering - K-means clustering, Naïve Bayes classifier

Unit 5 Reinforcement Learning and Evaluating Hypotheses: Learning Task, Q Learning, Non deterministic Rewards and actions, temporal-difference learning, Relationship to Dynamic Programming, Active reinforcement learning, Generalization in reinforcement learning. Motivation, Basics of Sampling Theory: Error Estimation and Estimating Binomial Proportions, the Binomial Distribution, Estimators, Bias, and Variance

Unit 6 Ensemble and Probabilistic Learning: Model Combination Schemes, Voting, Error-Correcting Output Codes, Bagging: Random Forest Trees, Boosting: Adaboost, Stacking. Gaussian mixture models - The Expectation-Maximization (EM) Algorithm, Information Criteria, Nearest neighbour methods – Nearest Neighbour Smoothing, Efficient Distance Computations: the KD-Tree, Distance Measures.

Unit 7 ML tools: Weka, TensorFlow, PyTorch, Keras

Reference Books:

1. Ethem Alpaydin, Introduction to Machine Learning.
2. Tom Mitchell., Machine Learning. McGraw- Hill, 1997.
3. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, Foundations of Machine Learning, MIT Press, 2012.
4. Stephen Marsland, Machine Learning - An Algorithmic Perspective, 2015.
5. Kevin P. Murphy, Machine Learning: A Probabilistic Perspective. The MIT Press,

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2012.
6. C. M. Bishop, Pattern Recognition and Machine Learning (Information Science and Statistics). Springer, 2006.

Content Delivery Method

- Classroom lecture (chalk and board) (D1)
- Visual presentation (D2)
- Tutorial (D3)
- Discussion (D7)

Course Outcomes:

After completing the course, the students will be able to

CO1	Explain and illustrate basic application and characteristics of Machine Learning techniques.
CO2	Apply various supervised learning methods to evaluate an appropriate ML model.
CO3	Create probabilistic and unsupervised learning models for handling unknown pattern
CO4	Interpret and Analyze results with reasoning on different datasets using various ML techniques.
CO5	Demonstrate ensemble techniques to combine predictions from different models.

CO-PO Mapping (3 – Strong, 2 – Moderate and 1 – Weak)

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1:	**2**		**3**	**3**	**1**	
CO2:	**2**		**3**	**3**	**1**	
CO3:	**2**		**3**	**3**	**1**	
CO4:	**2**		**3**	**3**	**1**	
CO5:	**2**		**3**	**3**	**1**	

Course code	PG/MMT/PE/T/123/C
Category	Program Elective – IV
Course title	APPLIED PROBABILITY AND STATISTICS

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Scheme and Credits	L-T-P: 3-0-0; Credits: 3;
Pre-requisites (if any)	

Syllabus:

UNIT I PROBABILITY AND RANDOM VARIABLES

Probability – Axioms of probability – Conditional probability – Baye‟s theorem - Random variables - Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a random variable.

UNIT II TWO DIMENSIONAL RANDOM VARIABLES

Joint distributions – Marginal and conditional distributions – Functions of two dimensional random variables – Regression curve – Correlation.

UNIT III ESTIMATION THEORY

Unbiased estimators – Method of moments – Maximum likelihood estimation - Curve fitting by principle of least squares – Regression lines.

UNIT IV TESTING OF HYPOTHESIS

Sampling distributions – Type I and Type II errors – Small and large samples – Tests based on Normal, t, Chi square and F distributions for testing of mean, variance and proportions – Tests for independence of attributes and goodness of fit.

UNIT V MULTIVARIATE ANALYSIS

Random vectors and matrices – Mean vectors and covariance matrices – Multivariate normal density and its properties – Principal components - Population principal components – Principal components from standardized variables

Reference Books:

1. Devore, J. L., “Probability and Statistics for Engineering and the Sciences”, 8th Edition, Cengage Learning, 2014.
2. Dallas E. Johnson, “Applied Multivariate Methods for Data Analysis”, Thomson and Duxbury press, 1998.
3. Gupta S.C. and Kapoor V.K.,” Fundamentals of Mathematical Statistics”, Sultan and Sons, New Delhi, 2001.
4. Johnson, R.A., Miller, I and Freund J., “Miller and Freund‟s Probability and Statistics for Engineers “, Pearson Education, Asia, 8th Edition, 2015.
5. Richard A. Johnson and Dean W. Wichern, “Applied Multivariate Statistical Analysis”, 5th Edition, Pearson Education, Asia, 2002.

Content Delivery Method

- Classroom lecture (chalk and board) (D1)
- Visual presentation (D2)
- Tutorial (D3)
- Discussion (D7)

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Course Outcomes:	
After completing the course, the students will be able to	
CO1	Apply probability theory, discrete and continuous random variables to solve various problems
CO2	Understand consistency, efficiency and unbiasedness of estimators, method of maximum likelihood estimation and Central Limit Theorem.
CO3	Use statistical tests in testing hypotheses on data.
CO4	Perform exploratory analysis of multivariate data, such as multivariate normal density, calculating descriptive statistics, testing for multivariate normality.

CO-PO Mapping (3 – Strong, 2 – Moderate and 1 – Weak)

	PO1	**PO2**	**PO3**	**PSO1**	**PSO2**	**PSO3**
CO1:	**2**		**3**	**3**		
CO2:	**2**		**3**	**3**		
CO3:	**2**		**3**	**3**		
CO4:	**2**		**3**	**3**		

Course code	PG/MMT/PE/T/124/A
Category	Program Elective – V
Course title	MULTIMODAL DATA ANALYSIS
Scheme and Credits	L-T-P: 3-0-0; Credits: 3;
Pre-requisites (if any)	

Syllabus:

Unit : Introduction to Multimodal Data

Data vs Information, Definition of multimodality in data, Types of data – Qualitative vs. Quantitative, Structured vs. Unstructured, Static vs. Dynamic, Data Analysis and its importance, Process of Data Analysis , Terminology: Data Science, Data Analysis, Data Analytics, Data Mining, Big Data, AI and Machine Learning, Data Analysis vs. Data Mining, Data Mining vs Data Warehousing, Data Analysis vs. Data Analytics

Unit 2: Data Collection & Pre-processing

Data Collection - Planning to collect data , Sample vs Population, Determine sample size, confidence Level, Confidence Interval, z-score, Data Collection Methods & Techniques Data

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pre-processing - Filtering / filling out missing values. Detecting and filtering outliers Drop duplicate data, Data fusion, Data Normalization

Unit 3: Data Visualization & Exploratory Data Analysis

Visualization - Importance of Data Visualization; Common forms of graphs / charts and– examples illustrated using Python's Matplotlib Selecting the right plot for data analysis, Metrics, KPIs and Dashboards, EDA through Visualization (using Seaborn package): Categorical Variables – Box plot, Bar plot, Violin Plot, Swarm Plot, Strip Plot, Factor Plot, Facet Grid etc. Numeric Variables – Histogram, KDE, ECDF ; Regression Plot; Scatter Plot; Heat Map; Multiple Plots – Joint Plots – Joint Hexbin, KDE, Pair Plots Statistical Inference - Correlation vs Causation, Correlation Statistics – Pearson Coefficient, p-Value, Testing association of categorical variables – Chi Square Test, ANOVA test of variance EDA Case Study

Unit 4: Types and techniques of data analysis

Data Analysis and it's importance Types of Analysis – Statistical, Diagnostic, Predictive, Prescriptive; Methods of Data Analysis Quantitative Cluster Analysis (KMeans Algorithm), Regression Analysis, Support Vector Machine, Decision Tree, Classification(K-NN), Time Series Analysis, Association Rule Mining etc. Qualitative – Text Analysis, Sentiment Analysis etc.

Unit 5: Develop, evaluate and refine a model (using Case Study)

Model Development- Regression Analysis – Simple Linear, Multiple Linear, Polynomial Model Evaluation - Visualization, Quantitative measures for accuracy (mean-square error, R-squared), K- Fold Cross Validation for testing model Model Refinement - Over-fitting, Underfitting & Regularization, Grid Search Model Selection

Unit 6: Text Mining and Analysis (using NLTK)

Areas and Techniques of Text Mining, Basics of NLP, Text Preprocessing using NLTK Tokenization, Noise Removal, Lexicon Normalization through Stemming & Lemmatization, POS tagging); Word Association Mining - finding Context Similarity; Feature Selection & Extraction(Bag of Words Model, Vector Space Model, Count Vectorizer, TF-IDF Vectorizer), Computing Document Similarities & Relevance Ranking for Search Engines; Clustering vs Classification in Text Analytics through examples Classification - Naïve Bayes Classifiers for spam classification; Clustering - Topic Mining

Unit 7: Image Analysis & Computer Vision (using OpenCV)

Image processing and applications - Noise filtering, blurring/de-blurring, compression, sharpening, edge- detection etc., Image Segmentation/Thresholding; Image Retrieval Techniques; Computer Vision & its applications; Demonstration of image processing tasks like blurring, sharpening, edge and corner detection, thresholding etc. and also Face detection in Images/Videos using Open CV

Unit 8: Audio Signal Processing and Analysis (using Librosa)

Applications of Audio Processing/ Audio Mining; Understanding audio signals and their features (time and frequency domain) ; Feature Extraction Pipeline (Quantization, Framing, Feature Computation, Aggregation, Windowing, DFT, STFT) Illustration/Comparison of features of audio signals using Librosa Time domain – Amplitude Envelope, RMS Energy, Zero Crossing Rate Frequency Domain – Power Spectrum, Spectrogram, Mel Spectrogram, MFCC, Band Energy Ratio, Spectral Centroid

Reference Books:

1. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction to Data Mining", 2nd Edition,Pearson Education, 2021

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2. Jiawei Han, Michelin Kamber and Jian Pei, "Data Mining: Concepts and Techniques", 3rd Edition, Morgan Kauffman, 2011
3. Wes McKinney, "Python for Data Analysis", 3rd Edition, O'Reilly, 2022
4. Edward Tuffe, "The Visual Display of Quantitative Information", 2nd Edition, 2001

Web References

https://www.nltk.org
https://docs.opencv.org/Librosa
https://librosa.org/doc/latest/index.html

Content Delivery Method

- Classroom lecture (chalk and board) (D1)
- Visual presentation (D2)
- Tutorial (D3)
- Discussion (D7)

Course Outcomes:

After completing the course, the students will be able to

CO1	Understand multimodal data analysis
CO2	Be familiar with tools and techniques of multimodal data analysis (text, images, video and audio)
CO3	Analyze available data and gain meaningful insights using data visualization techniques.
CO4	Explore new avenues for research

CO-PO Mapping (3 – Strong, 2 – Moderate and 1 – Weak)

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1:	**2**		**3**		**3**	**1**
CO2:	**2**		**3**		**3**	**1**
CO3:	**2**		**3**		**3**	**1**
CO4:	**2**		**3**		**3**	**1**

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Course code	PG/MMT/PE/T/124/B
Category	Program Elective – V
Course title	MEDIA SECURITY
Scheme and Credits	L-T-P: 3-0-0; Credits: 3;
Pre-requisites (if any)	

Syllabus:

Unit 1 Digital rights management (DRM) framework: Requirements of a DRM system, Architectures, Dimensions to content protection: Tracing (fingerprinting), authentication, Encryption, Key management and access control.

Unit 2 Multimedia fingerprinting: Fingerprinting basics, Marking assumption, Collusion attack, Frame proof and anti-collusion codes; Combining fingerprint modulation with coding: Introduction to coded fingerprint modulation, Semi-fragile fingerprinting; Multicast fingerprinting problem: Bandwidth security tradeoff; Efficient security architectures: WHIM, Watercasting, Chameleon cipher; Joint fingerprinting and decryption (JFD)framework; Fingercasting.

Unit 3 Multimedia encryption: Traditional symmetric key ciphers, Shannon's principles and diffusion; Overview of Advanced Encryption Standard (AES); Block and stream ciphers; Information theoretic secrecy; Concept of layering, Multimedia compression technologies and standards; Principles for selective encryption; Image and Video encryption schemes: Chaotic maps, Transform domain encryption, Huffman tree mutation; Streaming media encryption: Scalable video protection; Key management and distribution schemes: Key management for IP Multimedia: Public key methods, Key distribution by data embedding; Key exchange in multicast groups: Key refresh problem, Logical Key Hierarchy (LKH); Key distribution for fine grained access control.

Unit 4 Content authentication techniques: Data authentication, One way hash functions, Message authentication codes (MACs); Multimedia authentication: Perceptual hashes; Parameterization; Watermarking based authentication: Notion of semi-fragility, Construction and design of semi-fragile watermarks; Example: Principles of video authentication: Scalability issues, packet loss, post-processing.

Unit 5 Privacy preserving protocols: Zero knowledge protocols, Anonymous fingerprinting, Public key watermarking, Non-perfect secret sharing constructions for anonymous finger printing with shared access control.

Reference Books:

1. W. Zeng, H. Yu and C. Lin, Multimedia Security Technologies for Digital Rights Management, Elsevier, UK, 2006.
2. K. Karthik and D. Hatzinakos, Multimedia Encoding for Access Control With Traitor Tracing: Balancing Secrecy, Privacy and Traceability, VDM Verlag, ISBN: 978-3-8364-3638-0, Germany, 2008.
3. B. Furht and D. Kirovski (Eds.), Multimedia Security Handbook, CRC press, U.S., 2005.
4. B. Schneier, Applied Cryptography: Protocols, Algorithms and Source Code in C, 2nd Edition, Wiley India, 2007 (Reprint).

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Content Delivery Method

- Classroom lecture (chalk and board) (D1)
- Visual presentation (D2)
- Tutorial (D3)
- Discussion (D7)

Course Outcomes:

After completing the course, the students will be able to

CO1	Understand the framework and requirements of Digital Rights Management (DRM) systems.
CO2	Analyze multimedia fingerprinting techniques and security architectures.
CO3	Apply multimedia encryption and key management techniques for secure content distribution.
CO4	Implement content authentication and privacy-preserving protocols

CO-PO Mapping (3 – Strong, 2 – Moderate and 1 – Weak)

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1:	**2**		**3**		**3**	**1**
CO2:	**2**		**3**		**3**	**1**
CO3:	**2**		**3**		**3**	**1**
CO4:	**2**		**3**		**3**	**1**

Course code	PG/MMT/OE/T/125
Category	Open Elective
Course title	JAVA PROGRAMMING
Scheme and Credits	L-T-P: 3-0-0; Credits: 3;
Pre-requisites (if any)	

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Syllabus:

Unit 1: Java evolution and overview, Java features, Java differs from C and C++, Data types, Operators, Control statements
Unit 2: Classes and objects, Arrays, Constructor & Initializer, Static Members, Access specifier/modifier, static data members, String, StringBuffer and StringTokenizer classes
Unit 3: Inheritance, protected access specifier, super keyword, final modifier, Object class and its methods, Abstract class, interface, cloning,
Unit 4: Exception, try/catch/throw/throws/finally, package, instanceof operator, Wrapper class, Command-line arguments, Nested classes
Unit 5: Input/Output operations, byte stream, character stream and File input/output streams, Data input/outsput streams, Serialization
Unit 6: Java Multimedia (interMedia Java Classes for Image, Audio, Video), JDBC

Reference Books:

1. Introduction to Java Programming – Y. Daniel Liang
2. Java The Complete Reference – Herbert Schildt
3. Java Programming Language – James Gosling

Content Delivery Method

- Classroom lecture (chalk and board) (D1)
- Visual presentation (D2)
- Tutorial (D3)
- Discussion (D7)

Course Outcomes:

After completing the course, the students will be able to

CO1	Explain, illustrate and recognise the basic features of classes and objects.
CO2	Illustrate the extended features of OOP (Inheritance, Polymorphism) and apply them in practical problem solving.
CO3	Demonstrate I/O, exception handling and generic programming. (K3, A2)
CO4	Design and develop Multimedia applications using Java

CO-PO Mapping (3 – Strong, 2 – Moderate and 1 – Weak)

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1:	**1**		**3**	**3**		
CO2:	**1**		**3**	**3**		

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CO3:	**1**		**3**	**3**		
CO4:	**1**		**3**	**3**		

Course code	PG/MMT/P/121
Category	Laboratory 2
Course title	ADVANCED GRAPHICS AND ANIMATION LAB
Scheme and Credits	L-T-P: 0-0-4; Credits: 2;
Pre-requisites (if any)	

Syllabus:

Unit 1: 2D Animation [Introduction to Adobe Animate interface and various tools, handling layers, shapes, symbols (graphics, buttons, movie clips) and libraries, alignment, 2D Transformation of objects motion tween, shape tween and classic tween, masking, output files, interactivity using Action Script 3.0, working with dynamic and input text formats, variables, creating interactive buttons, custom mouse pointer]

Unit 2: 3D Animation [Blender is a free and open-source 3D computer graphics software toolset used for creating animated films, visual effects, art, 3D-printed models, motion graphics, interactive 3D applications, virtual reality, and, formerly, video games.
Introduction of user interface, working with editors, explore scenes & object, object modeling techniques, rendering]

Reference Books:

1. Russel Chan, Adobe Animate CC Classroom in a Book, Pearson Education, 1st Edition, 2018.
2. Tom Green, Joseph Labrecque, Beginning Adobe Animate CC: Learn to Efficiently Create and Deploy Animated and Interactive Content, Apress, 2017
3. Jim Chronister, Blender Basics: Classroom Tutorial Book, Blender Nation, 5th Edition, 2017
4. John M. Blain, The Complete Guide to Blender Graphics: Computer Modeling and Animation, A K Peters/CRC Press, 1st Edition, 2012.
5. Oliver Villar, Learning Blender, Addison-Wesley Professional, 3rd Edition, 2021

Content Delivery Method

- Visual presentation (D2)
- Tutorial (D3)
- Discussion (D7)

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Course Outcomes:	
After completing the course, the students will be able to	
CO1	Study theory, techniques and practise in both 2D and 3D graphics for synthetic dynamic image production.
CO2	Explore different approaches in computer animation from its conceptual stage to the final product creation.
CO3	Learn the various approaches of modeling, animation, realism creation and rendering.
CO4	

CO-PO Mapping (3 – Strong, 2 – Moderate and 1 – Weak)

	PO1	**PO2**	**PO3**	**PSO1**	**PSO2**	**PSO3**
CO1:	**3**		**3**		**3**	**2**
CO2:	**3**		**3**		**3**	**2**
CO3:	**3**		**3**		**3**	**2**
CO4:						

Course code	PG/MMT/P/122
Category	Mini project with report and seminar
Course title	Term Paper
Scheme and Credits	L-T-P: 0-0-6; Credits: 4;
Pre-requisites (if any)	

Syllabus:

Unit I: Entail the design and development of state-of-the-art topics identified during the 1st semester.

Unit II: A report based on the design and implementation from Unit I, followed by a formal presentation of the findings.

Reference Books:

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Resources:

https://ieeexplore.ieee.org/Xplore/home.jsp
https://link.springer.com/
https://www.sciencedirect.com/

Content Delivery Method

- Visual presentation (D2)
- Tutorial (D3)
- Discussion (D7)

Course Outcomes:

After completing the course, the students will be able to

CO1	Design and develop algorithms based on the research topic identified in the 1st Semester.
CO2	Prepare a report and deliver the presentation on the research topic as a PowerPoint presentation, which will form the baseline for the dissertation in the third and fourth semesters.
CO3	
CO4	

CO-PO Mapping (3 – Strong, 2 – Moderate and 1 – Weak)

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1:	**3**	**3**	**3**	**X**	**X**	**X**
CO2:	**3**	**3**	**3**	**X**	**X**	**X**
CO3:						
CO4:						

'X' denotes that the mapping will be done for each Term Paper.

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