

ANNA UNIVERSITY, CHENNAI
AFFILIATED INSTITUTIONS
M.E. E-LEARNING TECHNOLOGIES
REGULATIONS – 2017
CHOICE BASED CREDIT SYSTEM

1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

- I. To succeed in E-Learning Technologies Profession by adapting to the rapid advances in new emerging technologies
- II. To foster the art and science of instructional design and develop practical skills to analyze performance, create new solutions, that meet instructional design models.
- III. To inculcate leadership qualities, ethical attitude, team work and effective communication skills for successful professional growth.

2. PROGRAMME OUTCOMES (POs):

After going through the two years of study, our students will exhibit the following:

PO #	PROGRAMME OUTCOME
1	Create, select, learn and apply appropriate techniques, resources, modern engineering , IT and e-learning tools, for e-learning activities with an understanding of the limitations.
2	Think laterally and originally, conceptualize and solve engineering education problems, evaluate a wide range of potential solutions for those problems and arrive at feasible, optimal solutions after considering, cultural, societal and environmental factors in the core areas of expertise.
3	An ability to independently carry out research /investigation and development work to solve practical problems in the e-Learning design and delivery system and to write and present a substantial technical report/document on the e-learning projects
4	Acquire professional and intellectual integrity, professional code of conduct, ethics of research and scholarship, consideration of the impact of research outcomes on professional practices and an understanding of responsibilities.
5	Demonstrate knowledge and understanding of engineering education and management principles and apply the same to e-learning framework design, as a member and leader in a team, manage projects efficiently in e-learning models design.
6	Recognize the need for, and have the preparation and ability to engage in life-long learning independently, with a high level of enthusiasm and commitment to improve knowledge and competence continuously.

3. MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME

OUTCOMES:

Programme Educational Objectives	PROGRAM OUTCOMES					
	PO 1	PO 2	PO 3	PO 4	PO 5	PO6
PEO 1	✓	✓	✓			✓
PEO 2	✓		✓	✓	✓	✓
PEO 3		✓	✓	✓	✓	✓

YE A R	SEMESTE R	COURSE NAME	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
YE A R 1	SEM -1	Probability and Statistical Methods	✓	✓	✓	✓		
		Principles of Multimedia	✓		✓	✓	✓	
		Animation Techniques	✓	✓	✓	✓	✓	✓
		Instructional Systems Design	✓	✓	✓	✓	✓	
		E-Learning Design and Development		✓	✓	✓		
		Research Methodology and IPR	✓	✓	✓	✓	✓	✓
		Educational Technology Lab	✓	✓	✓	✓	✓	✓
	SEM - 2	Learning Analytics	✓	✓	✓		✓	
		Mixed Reality	✓		✓	✓		✓
		Game Programming	✓	✓		✓		✓
		Short Film Development	✓		✓		✓	✓
		Program Elective I						
		Program Elective II						
Game Programming and Mixed Reality LAB	✓	✓	✓		✓	✓		
YE A R	SEMESTE R	COURSE NAME	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6

YE AR 2	SEM - 3	Program Elective III						
		Program Elective IV						
		Program Elective V						
		Seminar	✓	✓	✓	✓	✓	
		Project Work – Phase I	✓	✓	✓	✓	✓	✓
	SEM - 4	Project Work – Phase II	✓	✓	✓	✓	✓	✓

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REGULATIONS – 2017

CHOICE BASED CREDIT SYSTEM

I - IV SEMESTER CURRICULA AND SYLLABUS

SEMESTER I

SI. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
	MA5164	Probability and Statistical Methods	FC	4	4	0	0	4
	MM5101	Principles of Multimedia	PC	5	3	0	2	4
	MM5004	Animation Techniques	PC	5	3	0	2	4
		Instructional Systems Design	PC	3	3	0	0	3
		E- Learning Design and Development	PC	3	3	0	0	3
	RM5151	Research Methodology and IPR	RMC	2	2	0	0	2
PRACTICALS								
		Educational technology Lab	PC	2	0	0	2	1
TOTAL				24	18	0	6	21

SEMESTER- II

SI. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.		Learning Analytics	PC	3	3	0	2	4
2.	MM5072	Mixed Reality	PC	3	3	0	0	3
3.	MM5005	Game Programming	PC	3	3	0	0	3
4.	MM5003	Short Film Development	PC	5	3	0	2	4
5.		Professional Elective I	PE	3	3	0	0	3
6.		Professional Elective II	PE	3	3	0	0	3
PRACTICALS								
8		Game Programming and Mixed Reality LAB		4	0	0	4	2

TOTAL	23	18	0	6	22
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SEMESTER- III

SI. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.		Professional Elective III	PE	5	3	0	2	4
2.		Professional Elective IV	PE	3	3	0	0	3
3.		Professional Elective V	PE	3	3	0	0	3
PRACTICALS								
4		Seminar	EEC	2	0	0	2	1
5		Project Work – Phase I	EEC	12	0	0	12	6
TOTAL				25	9	0	14	17

SEMESTER- IV

SI. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
PRACTICALS								
		Project Work – Phase II	EEC	24	0	0	24	12
TOTAL				24	0	0	24	12
TOTAL CREDITS (I –IV)								72

FOUNDATION COURSES (FC)

SI. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
	MA5164	Probability and Statistical Methods	FC	4	4	0	0	4

RESEARCH METHODOLOGY AND IPR COURSE (RMC)

SI. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	RM5151	Research Methodology and IPR	RMC	2	2	0	0	2

PROFESSIONAL CORE (PC)

SI. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	MM5101	Principles of Multimedia	PC	5	3	0	2	4
		Animation Techniques	PC	5	3	0	2	4
2		Instructional Systems Design	PC	3	3	0	0	3
3		E- Learning Design and Development	PC	3	3	0	0	3
5		Educational Technology Tools Lab	PC	2	0	0	2	2 ₁
6		Learning Analytics	PC	5	3	0	2	4
7	MM5072	Mixed Reality	PC	3	3	0	0	3
8	MM5005	Game Programming	PC	3	3	0	0	3
9	MM5003	Short Film Development	PC	5	3	0	2	4
10		Game Programming and Mixed Reality Lab	PC	4	0	0	4	2

PROFESSIONAL ELECTIVES

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
Professional Elective - I								
		Python Programming	PE	3	3	0	0	3
		Student Psychology	PE	3	3	0	0	3
		Digital Marketing	PE	3	3	0	0	3
		Training and Development	PE	3	3	0	0	3
Professional Elective - II								
1		Learning Science	PE	3	3	0	0	3
2		Multimedia Databases	PE	3	3	0	0	3
3		Software Project Management and Quality	PE	3	3	0	0	3
4		Knowledge Management	PE	3	3	0	0	3
Professional Elective - III								
1		Web Design	PE	5	3	0	2	4

2		Multimedia Information Storage & Retrieval	PE	5	3	0	2	4
3		Mobile Application Development	PE	5	3	0	2	4
4		Design and development of MOOC	PE	5	3	0	2	4
Professional Elective - IV								
1		Artificial Intelligence	PE	3	3	0	0	3
2		Media Security	PE	3	3	0	0	3
3		Social Media Web Analytics	PE	3	3	0	0	3
4		Educational Management Information System	PE	3	3	0	0	3
Professional Elective - V								
1		Human Computer Interaction Techniques	PE	3	3	0	0	3
2		Visualization Techniques	PE	3	3	0	0	3
3		Sound Engineering	PE	3	3	0	0	3
4		Video Processing and Analytics	PE	3	3	0	0	3

MA5164	PROBABILITY AND STATISTICAL METHODS	L	T	P	C
		4	0	0	4
OBJECTIVES					
<p>This course is designed to provide the solid foundation on topics in probability and various statistical methods which form the basis for many other areas in the mathematical sciences including statistics, modern optimization methods and risk modeling. It is framed to address the issues and the principles of estimation theory, testing of hypothesis, design of experiments and time series analysis.</p>					
UNIT I PROBABILITY AND RANDOM VARIABLES					12
<p>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.</p>					
UNIT II ESTIMATION THEORY					12

Principle of least squares – Regression – Multiple and partial correlations – Estimation of parameters – Maximum likelihood estimates – Method of moments.	
UNIT III TESTING OF HYPOTHESIS	12
Sampling distributions – Small and large samples and problems – Tests based on Normal, t-distribution, Chi-square, Goodness of fit and F-distributions.	
UNIT IV DESIGN OF EXPERIMENTS	12
Analysis of variance – Completely randomized design – Randomized block design – Latin square design – 2 ² Factorial designs.	
UNIT V TIME SERIES	12
Characteristics and representation – Moving averages – Exponential smoothing – Auto regressive processes.	
<p>OUTCOMES</p> <p>After completing this course, students should demonstrate competency in the following topics:</p> <ul style="list-style-type: none"> ● Basic probability axioms and rules and the moments of discrete and continuous random variables. ● Least squares, correlation, regression, consistency, efficiency and unbiasedness of estimators, method of maximum likelihood estimation and Central Limit Theorem. ● Use statistical tests in testing hypotheses on data. ● List the guidelines for designing experiments and recognize the key historical figures in Design of Experiments. ● Differentiate between various time series models and application of these models appropriately to engineering problems. ● The students should have the ability to use the appropriate and relevant, fundamental and applied mathematical and statistical knowledge, methodologies and modern computational tools. 	
REFERENCES	

1. Anderson, O.D, "Time Series Analysis: Theory and Practice", North - Holland, Amsterdam, 1982.
2. Devore, J. L., "Probability and Statistics for Engineering and Sciences", 8th Edition, Cengage Learning, 2014.
3. Gupta, S.C and Kapoor, V.K., "Fundamentals of Mathematical Statistics", Sultan and Chand Company, New Delhi, 1999.
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. Montgomery D.C and Johnson, L.A, "Forecasting and Time Series", 6th Edition, McGraw Hill, 1990.

MM5101	PRINCIPLES OF MULTIMEDIA	L	T	P	C
		3	0	2	4
OBJECTIVES					
<ul style="list-style-type: none"> ● To understand different forms of media in systems. ● To acquire knowledge in multimedia components. ● To acquire knowledge about multimedia tools and authoring. ● To acquire knowledge in the development of multimedia applications. ● To explore the latest trends and technologies in multimedia 					
UNIT I INTRODUCTION					7
Introduction to Multimedia – Characteristics of Multimedia Presentation – Multimedia Components – Promotion of Multimedia Based Components – Digital Representation – Media and Data Streams – Multimedia Architecture – Multimedia Documents – Visual Display System.					
Suggested Activities:					
<ul style="list-style-type: none"> ● Flipped classroom on media Components. ● External learning – Interactive presentation. 					
Suggested Evaluation Methods:					
<ul style="list-style-type: none"> ● Tutorial – Handling media components ● Quizzes on different types of data presentation. 					
UNIT II ELEMENTS OF MULTIMEDIA					11

Text: Types, Font, Unicode Standard, Text Compression, File Formats – Image: Types, Image Processing, Standards, Specification, Device Independent Color Models, Gamma Correction, File Formats – Video: Video Signal Transmission, Signal Formats, Broadcasting Standards, Digital Video Standards, PC Video, Video File Formats – Audio: Acoustics, Characteristics of Sound – Elements of Audio System: Microphone, Amplifier, Loudspeaker, Audio Mixer, Digital Audio, MIDI – Graphics: Components of Graphics System, Co-ordinate System, Plotter – Introduction to 2D and 3D Graphics – Surface Characteristics and Texture, Illumination Models – Animation: Key Frames and Tweening Techniques – 2D and 3D Animation.

Suggested Activities:

- Flipped classroom on different file formats of various media elements.
- External learning – Adobe after effects, Adobe Media Encoder, Adobe Audition.

Suggested Evaluation Methods:

- Demonstration on after affects animations.
- Quizzes on file formats and color models.

UNIT III MULTIMEDIA SYSTEMS	9
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Compression Types and Techniques: CODEC, GIF Coding Standards, JPEG, MPEG – Multimedia Database System – User Interfaces – OS Multimedia Support – Hardware Support – Real Time Protocols – Play Back Architectures – Synchronization – Document Architecture – Hypermedia Concepts: Hypermedia Design – Digital Copyrights.

Suggested Activities:

- Flipped classroom on concepts of multimedia hardware architectures.
- External learning – Digital repositories and hypermedia design.

Suggested Evaluation Methods:

- Quizzes on multimedia hardware and compression techniques.
- Tutorial – Hypermedia design.

UNIT IV MULTIMEDIA TOOLS	9
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Authoring Tools – Features and Types – Card and Page Based Tools – Icon and Object Based Tools – Time Based Tools – Cross Platform Authoring Tools – Editing Tools – Painting and Drawing Tools – 3D Modeling and Animation Tools – Image Editing Tools – Sound Editing Tools – Digital Movie Tools.

Suggested Activities:

- Flipped classroom on multimedia tools.
- External learning – Comparison of various authoring tool.

Suggested Evaluation Methods:

- Tutorial – Audio editing tool.
- Quizzes on animation tool.

UNIT V MULTIMEDIA APPLICATION DEVELOPMENT	9
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Software Life Cycle – ADDIE Model – Conceptualization – Content Collection – Story Board–Script – Authoring Metaphors – Testing – Report Writing – Documentation.

Suggested Activities:

- External learning – Game consoles.
- External learning – VRML scripting languages.

Suggested Evaluation Methods:

- Demonstration of simple interactive game.
- Tutorial – Simple VRML program.

PRACTICAL EXERCISES:

30

1. Install tools like GIMP, Photoshop, Blender.
2. Design a simple web page with animated web advertisement.
3. Creating visual effects by editing and mixing various media elements using tools like Adobe Premier Pro.
4. Use Adobe after effects for creating lighting effects and shades.
5. Use Adobe audition for sound mixing.
6. Use Adobe media encoder for coding an audio.
7. Use Photoshop to create a button, banner and texture.
8. Use Photoshop to create morphing and animation.
9. Develop a full-fledge multimedia application.
10. Develop a digital story boarding and 3D animation as mini project.

OUTCOMES

- Handle the multimedia elements effectively.
- Articulate the concepts and techniques used in multimedia applications.
- Develop effective strategies to deliver Quality of Experience in multimedia applications.
- Design and implement algorithms and techniques applied to multimedia objects.
- Design and develop multimedia applications following software engineering models.

REFERENCES

1. Ranjan Parekh, “Principles of Multimedia”, Second Edition, McGraw-Hill Education, 2017.
2. Tay Vaughan, “Multimedia: Making It Work”, Ninth Edition, McGraw-Hill,2014.
3. Paul Dietel, Harvey Dietel, Abbey Dietel, “Internet & World Wide Web How to Program”, Fourth Edition, Prentice Hall,2008.

	ANIMATION TECHNIQUES	L	T	P	C
		3	0	2	4
OBJECTIVES					

- To understand the fundamentals of animation.
- To know the working principles of animation tools.
- To acquire knowledge about the issues in 2D and 3D animation.
- To train the student as a member or leader in diverse teams of animation.
- To gain skill in designing real time animation movie.

UNIT I	INTRODUCTION TO ANIMATION	9
<p>Basics of 2D and 3D Graphics – Introduction to Animation – Kinematics – Inverse Kinematics – Different Types of Animation – Designing Elements – Styles and Formats – Properties of Multimedia System.</p> <p>Suggested Activities:</p> <p>· Flipped classroom on properties of multimedia systems design elements · External learning – Graphics display devices and input devices</p> <p>Suggested Evaluation Methods:</p> <p>· Quizzes based on designing elements. · Assignment on latest input and output devices</p>		
UNIT II	PERSPECTIVE IN ANIMATION	9
<p>Perspective Blocks and Boxes – Vanishing Point in Horizon – Outside Horizon and Indoors – Scale Diagrams in Perspective – Different View Points – Importance of Eye Level – Curves and Cylinders in Perspective – Perspective in 1 point, 2 point, 3 point, Multiple Points – Shapes in Perspective with Light and Shade – Foreshortening.</p> <p>Suggested Activities:</p> <p>· Flipped classroom on discussion on projection. · External learning – Camera mechanism.</p> <p>Suggested Evaluation Methods:</p> <p>· Tutorials – Viewing port and camera positing. · Assignment on camera working and principles.</p>		
UNIT III	ANIMATION PRINCIPLE	9
<p>Drawing for Animation – Sequential Movement Drawing – Caricaturing the Action – Thumbnails – Motion Studies – Drawing for Motion – Basic Principles in Animation – Squash and Stretch – Anticipation – Staging – Straight Ahead – Pose to Pose – Follow Through – Overlapping Action – Slow In and Slow Out – Arcs – Secondary Action – Timing – Exaggeration – Solid Drawing – Appeal – Mass and Weight – Character Acting – Volume – Line of Action – Path of Action – Walk Cycles – Animal and Human.</p> <p>Suggested Activities:</p> <p>· Flipped classroom on drawing gestures, facial expressions and pose to pose sketching. · External learning – Sketching from acting, sketching from live models.</p> <p>Suggested Evaluation Methods:</p> <p>· Tutorial – Drawing body movements and facial expression. · Assignments on sketching various animal movements.</p>		
UNIT IV	ANIMATION PRESENTATION	9

Timing for Inanimate Objects – Rotating Objects – Timing a Slow Action – Timing a Fast Action—
 Single Frames or Double Frames – Special Effects: Flames, Smoke, Water, Rain, Snow, Explosions
 – Repeat Movements of Inanimate Objects – Accentuating a Movement – Strobing – Basic
 Expressions – Lip Movement – Key Animation – Clean Up – Character Design – Different Characters
 – Change of Expression.

Suggested Activities:

· Flipped classroom on different special effects · Discussion on slow and fast actions and movements of the objects

Suggested Evaluation Methods:

· Tutorial – Environmental and surrounding Effects · Assignments on physical nature of the objects

UNIT V	ADVANCES IN ANIMATION	9
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Dynamic Web Pages – Publishing in Internet – User interactions Using Multimedia Systems,
 Advanced Animations Tools and Applications – Dialogues in Animation – As a Part of Acting –
 Phrasing – Picture and Sound Sync – Accents – Attitude – Secret – Animation with Sound Track –
 Dialogue and Voice Over.

Suggested Activities:

· Flipped classroom on designing web pages. · External learning – Sound editing tools.

Suggested Evaluation Methods

· Tutorial – Creating web pages. · Assignment on different sound effects and background music.

PRACTICAL EXERCISES:	30
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1. Simple 2D text animation
2. Implementing morphing, and Tweening
3. Implementation Animation with control buttons
4. Creating interactive slide shows
5. Adding back ground music and voice over to animation sequence
6. Editing the animation sequence and adding transitions
7. Story-board writing
8. Adding visual effects
9. Designing models, objects and background environment
10. Exporting a simple animation output

TOTAL	75
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OUTCOMES

- Demonstrate the concepts and techniques used in Animation.
- Apply the physics and basic movements of character.
- Conduct various experiment for effective modern interactive Animation.
- Design and implement algorithms and techniques applied to Animation.
- Apply various tools and software efficiently to up-hold the professional and social obligation.

REFERENCES

1. Donald Hearn, M. Paulline Baker, "Computer Graphics", Prentice-Hall, 2001.
2. Peter Shirley, "Fundamentals of Computer Graphics", AK Peters, 2002.
3. Steven Heller, Karen Pomeroy "Design Literacy: Understanding Graphic Design", Allworth Press, 1997.
4. Mark Gaimbruno, "3D Graphics and Animation", Second Edition, New Riders, 2002.
5. Micheal O'Rourke, "Principles of 3D Computer Animation: Modelling, Rendering and Animation with 3D Computer Graphics", W. W. Norton, 1998.
6. Rogers David, "Animation: Master – A Complete Guide (Graphics Series)", Charles River Media, 2006.
7. Tom Bancroft, "Creating Characters with Personality: For Film, TV, Animation, Video Games and Graphics Novels", Watson-Guption Publications, 2006.

		L	T	P	C
		3	0	0	3
INSTRUCTIONAL SYSTEMS DESIGN					
OBJECTIVES					
<ul style="list-style-type: none"> ● Analyse and discuss various learning theories and how they relate to e-Learning design ● Acquire a working knowledge of instructional systems design ● Explain Bloom's taxonomy and its implications on learning strategies and objectives ● Apply the instructional systems design model to a learning environment ● Produce analysis and design outputs at each stage of the ISD process ● Develop an evaluation plan for the E-Learning 					
UNIT I LEARNING THEORIES AND PRINCIPLES					9
Learning and Instruction - Learning theories – Behaviorism, Cognitivism, Constructivism and Connectivism – Principles of Learning – Multimedia Learning Principles - Cognitive Load Theory - Cognitive Flexibility Theory – E-Learning					
UNIT II INSTRUCTIONAL DESIGN MODELS AND THEORIES					9
Overview of Instructional Design (ID) – Instructional System Design Models - ADDIE Models – Dick and Carey Model — Rapid eLearning Design - 4C-ID Model ASSURE Model – Collaborative Learning - Scenario-Based Learning - Problem-Based Learning - Top Down and Bottom up models in curriculum Development					
UNIT III INSTRUCTIONAL DESIGN PROCESSES					9
Learning Domains – Taxonomy for Cognitive, Psychomotor, Affective - Blooms Revised Taxonomy – Constructing Learning objectives - Gagne's Nine principles of ID - Learners and Learning Styles -Vygotsky: Language of thought - Banner-Memory and learning -Structuring the online course - Role of Instructional Designer					

UNIT IV INSTRUCTIONAL DEVELOPMENT – STRATEGIES AND MATERIALS	9
<p>Computer Mediated Tools - Concept Mapping - Technology Analysis for e-Learning - Synchronous Online Learning - Tools for Synchronous Learning - Asynchronous Online Learning - Tools for Asynchronous Learning – Online –Blended – Flipped -Online Tutoring- Skills and Competencies of Online Tutors - Developing Instructional Materials</p>	
UNIT V ASSESSMENT AND EVALUATION	9
<p>Activities for Online Learning -e-Moderating, The Five Stage Model for Online moderation - R2D2 (Read, Reflect, Display, Do) Model –Assessment – Diagnosis, Formative and Summative - The Many Faces of Evaluation -• Kirkpatrick’s Model – Developing Evaluation Instruments – Evaluating e-Learning Development – Evaluating E-Learning Course</p>	
<p>OUTCOMES</p> <ol style="list-style-type: none"> 1. Demonstrate a working knowledge of instructional systems development (ISD) process and instructional design models through class discussion and collaborative activities 2. Create a design document for a training program in a selected work setting 3. Demonstrate ability to use computer-based technologies effectively to facilitate instructional design process. 4. Formulate instructional objectives and design learning activities and assessments for a specified online course 5. Determine the quality, effectiveness, and continuous improvement of the e-Learning 	
<p>REFERENCES</p> <ol style="list-style-type: none"> 1. Dick, W., Carey, L. & Carey, J. (2008). <i>Systematic Design of Instruction, (7th ed.)</i> 2. Upper Saddle River, NJ: Pearson Available at the U.T. Co-op and other bookstores (in this syllabus: DC). 3. Rothwell,W.J.& Kazanas, H. C.(2008). <i>Mastering the Instructional Design Process : A Systematic Approach, 2nd Ed</i> 4. Julie Dirkse, <i>Design for How People Learn (2nd Edition)</i>, Pearson Education (US),2015 5. Ruth Colvin Clark and Richard E. Mayer: “e-Learning and the Science of Instruction: Proven Guidelines for Consumers and Designers of Multimedia Learning, 4th Edition Pfeffier Wiley,2012 6. Marina Arshavskiy, <i>Instructional Design for ELearning: Essential guide to creating successful eLearning courses</i> , CreateSpace Independent Publishing Platform; 1st edition, 2013 7. <i>Empowering Online Learning (2008)</i> by Curtis J. Bonk and Ke Zhang. Published by Jossey Bass: San Francisco. 	

E-LEARNING DESIGN AND DEVELOPMENT		L	T	P	C
		3	0	0	3
OBJECTIVES					
<ul style="list-style-type: none"> ● To learn the various E-learning approaches and Components. ● To understand the key elements of Design Thinking. ● To explore the models for E-learning courseware development. ● To design E-learning courses using Authoring tools. ● To analyze various E-learning solutions for design and development 					
UNIT I	INTRODUCTION				9
<p>Introduction to E- Learning - Need for E-Learning – Types of E-Learning – Components of E-Learning – Synchronous and Asynchronous Modes of Learning – Quality of E-Learning – Blended Learning: Activities, Team and Technology – Work Flow to Produce and Deliver E-Learning Content. Design Thinking: Introduction – Actionable Strategy – Act to Learn – Leading Teams to Win.</p> <p>Suggested Activities:</p> <ul style="list-style-type: none"> ● External learning - E-learning approaches and components. ● Discussion on design thinking. <p>Suggested Evaluation Methods:</p> <ul style="list-style-type: none"> ● Assignment on E-learning approaches and components. ● Quiz on design thinking. 					
UNIT II	DESIGNING E-LEARNING CONTENT / COURSE				9
<p>Design Models of E-Learning – Identifying and Organizing E-Learning Course Content: Needs Analysis –Analyzing the Target Audience – Identifying Course Content - Defining Learning Objectives – Defining the Course Sequence – Defining Instructional Methods – Defining Evaluation and Delivery Strategies – Case Study.</p> <p>Suggested Activities:</p> <ul style="list-style-type: none"> ● Preparation of Concept Map ● Discussion forum – design models. ● External learning - E-learning instructional methods. <p>Suggested Evaluation Methods:</p> <ul style="list-style-type: none"> ● Assignment on design models of multimedia E-learning. ● Quiz on E-Learning instructional methods. 					
UNIT III	CREATING INTERACTIVE E- CONTENT				9

Preparing content: Tips for Content Development and Language Style – Creating storyboards: Structure of an interactive Multimedia E-lesson – Techniques for presenting Multimedia content – Integrating multimedia elements -Developing Practice and Assessment Tests – Courseware Development – Authoring tools – Types of Authoring Tools – Selecting an Authoring Tool.

Suggested Activities:

- Discussion forum on creation of multimedia storyboards.
- External learning on types of authoring tools.

Suggested Evaluation Methods:

- Assignment on multimedia story boards creation.
- Quiz on authoring tools.

UNIT IV LEARNING PLATFORMS

9

Types of Learning Platforms – Proprietary vs. Open – Introduction Learning Management System (LMS) – Content management System – CMS vs LMS – LMS solutions – Functional Areas of LMS.

Suggested Activities:

- Design of CMS using FOSS framework
- Course and User Administration
- Resource and Activities scheduling in LMS
- Plugin Management
- Report Generation

Suggested Evaluation Methods:

- Assignment on proprietary and open source LMS.
- Quiz on LMS solutions.

UNIT V COURSE DELIVERY AND EVALUATION

9

Components of an Instructor Led or Facilitated Course – Planning and Documenting Activities – Facilitating Learners Activities – E-learning Methods and Delivery Formats – Using Communication Tools for E-learning – Course Evaluation.

Suggested Activities:

- Discussion on planning and documentation.
- External learning - Evaluation and delivery methods.

Suggested Evaluation Methods:

- Assignment on planning an documentation.
- Quiz on evaluation and delivery methods.

OUTCOMES

- Distinguish the phases of activities in models of E-learning
- Identify appropriate E-Learning instructional methods and delivery strategies
- Choose appropriate E-learning Authoring tools
- Create interactive E-Learning courseware
- Evaluate the E-learning courseware

REFERENCES

1. Clark, R. C., & Mayer, R. E. (2016). E-Learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning. John Wiley & Sons.
2. Means, B., Toyama, Y., Murphy, R, "Evaluation of Evidence-Based Practices in Online Learning: A Meta-Analysis and Review of Online Learning Studies", 2010.
3. Crews, T. B., Sheth, S. N., Horne, T. M, "Understanding the Learning Personalities of Successful Online Students. Educause Review", 2014.
4. Johnny Schneider, "Understanding Design Thinking, Lean and Agile", 2017.
5. Horton William, e-Learning by Design, Publisher : Pfeiffer, 2011.
6. Madhuri Dubey, "Effective E-learning Design, Development and Delivery", University Press 2011.
7. Arshavskiy, M. Instructional design for Elearning: Essential guide to creating successful Elearning courses. CreateSpace.,2013

RM5151	RESEARCH METHODOLOGY AND IPR	L	T	P	C
		2	0	0	2
OBJECTIVES					
<ul style="list-style-type: none"> ● To identify the problem and analyze the solutions. ● To write a technical paper and presentation ● To formulate patent drafting and filing patents. 					
UNIT I	RESEARCH PROBLEM FORMULATION	6			
Meaning of research problem- Sources of research problem, criteria characteristics of a good research problem, errors in selecting a research problem, scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, necessary instrumentations					
UNIT II	LITERATURE REVIEW	6			
Effective literature studies approaches, analysis, plagiarism, and research ethics.					
UNIT III	TECHNICALWRITING/PRESENTATION	6			
Effective technical writing, how to write report, paper, developing a research proposal, format of research proposal, a presentation and assessment by a review committee					
UNIT IV	INTRODUCTION TO INTELLECTUAL PROPERTY RIGHTS (IPR)	6			

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT

UNIT V INTELLECTUAL PROPERTY RIGHTS (IPR)	6
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Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System, IPR of Biological Systems, Computer Software etc.
Traditional knowledge Case Studies, IPR

TOTAL	30
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OUTCOMES

1. To formulate research problem
2. To carry out research analysis
3. To follow research ethics and Integrity
4. To formulate patent on IPR and filing patents in R &D.

REFERENCES

1. Asimov, "Introduction to Design", Prentice Hall, 1962.
2. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.
3. Mayall, "Industrial Design", McGraw Hill, 1992.
4. Niebel, "Product Design", McGraw Hill, 1974.
5. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners" 2010.

EDUCATIONAL TECHNOLOGY LAB	L	T	P	C
	0	0	2	1

The Educational Technology lab course will help students in understanding tools useful for creating online learning content, online assessment, using visualization, analyzing data, etc.

PRACTICAL EXERCISES:

E-Content Development

1. Concept Mapping Tools: e.g. CMAP, MindMap, Freemind
2. Graphics and Animation Tools :GIMP, Blender
3. Camstudio for screencast, image editing, audio editing (audacity), video management, etc
4. Assessment Tools like Hot Potato
5. Online Collaboration Tools: e.g. Wiki

Learning Management System : MOODLE

1. Creation of Users and Schedule users Vs Courses in Moodle.
2. Preparation and Organization of Multimedia Course Contents in Moodle.
3. Aligning the course objectives, Assessments and evaluation methods of Courseware in Moodle.
5. Courseware Content generation with various Multimedia instructional formats.
6. Adding communication tools in Moodle for effective collaboration.
7. Creation of instructor led courses in Moodle.
8. Creation of self-Learning courses in Moodle.
9. Implementation of various Evaluation strategies of Courseware in Moodle .
10. Implementation of various delivery strategies in Moodle.

			LEARNING ANALYTICS			
			L	T	P	C
			4	0	0	4
OBJECTIVES						
<ul style="list-style-type: none"> ● To know how to derive meaning form huge volume of data and information ● To understand how knowledge discovering process is used in educational decision making. ● To acquire knowledge about the techniques of analysing student learning data. ● To practice of data pre-processing techniques to analyse student performance ● To learn application of models to the educational datasets. ● To take appropriate decisions based on the analytics data to meet the institutional vision and mission 						
UNIT I	INTRODUCTION TO LEARNING ANALYTICS IN EDUCATION					10
Learning analytics in Education - Challenges in the adoption of Learning Analytics in Education - Benefits for Stakeholders - Learning analytics Policies - Learning analytics for Quality Assurance - Data Collection – How Big is Education data- Data Collection from Learning Environment -Pre-Processing - Ethics and privacy issues						
UNIT II	EDUCATIONAL DATA MINING					12
Educational Data mining – Data from Learning Management System - Data preprocessing and preparation – Student Discussion forum - Text mining – Web mining –Spatial mining – Process mining Relationship mining models and techniques						
UNIT III	DESCRIPTIVE ANALYTICS					12
Introduction to Descriptive analytics – Collection of data through Questionnaire – Stakeholder participation (Students, teachers, parents, industries and etc..) in collecting data - Visualizing and Exploring Data - Descriptive Statistics - Sampling and Estimation - Probability Distribution for Descriptive Analytics						
UNIT IV	PREDICTIVE MODELING					14
Introduction to Predictive analytics - Predictive models vs. explanatory models - The predictive modeling lifecycle - Predictive models of student success - Ethical considerations with predictive models – educational predictive models - Supervised machine learning techniques - including Decision Trees and Naive Bayes - Model evaluation and comparison						
UNIT V	PRESCRIPTIVE ANALYTICS					12
Introduction to Prescriptive analytics - Prescriptive Modeling - Non Linear Optimization – Analysis of Educational Institution Performance - Decision making						
					TOTAL	60
OUTCOMES						

- Analyse, plan, and deploy a small learning analytics pilot, including the intent of LA
- Evaluate current state of learning analytics technologies and describe the benefits and drawbacks to open source and proprietary tool sets.
- Apply various data mining techniques into various areas of different domains.
- Explore the basics of data mining processes, algorithms, & systems.
- Apply various prediction techniques.
- Use different supervised and unsupervised learning technique to classify and cluster educational data.

REFERENCES

1. Jared P.L., R for Everyone - Advanced Analytics and Graphics, Addison Wesley Data and Analytics series,2015.
2. Samira ElAtia, Donald Ipperciel, Osmar R. Zaïane, Data Mining and Learning Analytics, Willey Publications, 2016
3. G. K. Gupta, Introduction to Data mining with Case Studies, Prentice hall of India,2011
4. George A. Tsihrintzis, Dionisios N.,Machine Learning Paradigms: Advances in Data Analytics, Springer, 2019

		L	T	P	C
MIXED REALITY		3	0	0	3
OBJECTIVES					
<ul style="list-style-type: none"> • To impart the fundamental aspects and principles of mixed reality technologies. • To know the internals of the hardware and software components involved in the development of mixed reality enabled applications. • To learn about the graphical processing units and their architectures. • To gain knowledge about mixed reality application development. • To know the technologies involved in the development of mixed reality based applications. 					
UNIT I	INTRODUCTION				9

Introduction to Virtual Reality and Mixed Reality – Definition – Introduction to Trajectories and Hybrid Space-Three I's of Virtual Reality – Virtual Reality Vs 3D Computer Graphics – Benefits of Virtual Reality – Components of VR System – Introduction to AR-AR Technologies-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.

Suggested Activities:

- Flipped classroom on uses of MR applications.
- Videos – Experience the virtual reality effect.
- Assignment on comparison of VR with traditional multimedia applications.

Suggested Evaluation Methods:

- Tutorial – Applications of MR.
- Quizzes on the displayed video and the special effects

UNIT II MR COMPUTING ARCHITECTURE

9

Computing Architectures of VR – Rendering Principle – Graphics and Haptics Rendering – PC Graphics Architecture – Graphics Accelerators – Graphics Benchmarks – Workstation Based Architectures – SGI Infinite Reality Architecture – Distributed VR Architectures – Multi-pipeline Synchronization – Collocated Rendering Pipelines – Distributed Virtual Environments-MR architecture.

Suggested Activities:

- Flipped classroom on basic graphics pipeline.
- External learning – Different types of Graphics architectures and workstations.
- Practical – GPU programming.

Suggested Evaluation Methods:

- Tutorial – Graphics pipelines.
- Brainstorming session on GPU architecture.
- Quizzes on graphical architectures.
- Demonstration on GPU related simple modeling and rendering programs

UNIT III MR MODELING

9

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.

Suggested Activities:

- Flipped classroom on modeling three dimensional objects.
- External learning – Collision detection algorithms.
- Practical – Creating three dimensional models.

Suggested Evaluation Methods:

- Tutorial – Three dimensional modeling techniques.
- Brainstorming session on collision detection algorithms.
- Demonstration of three dimensional scene creation.

UNIT IV PROGRAMMING AND APPLICATIONS

9

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-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 – MR in Business – MR in Entertainment – MR in Education.

Suggested Activities:

- External learning – Different types of programming toolkits and Learn different types of available VR applications.
- Practical – Create VR scenes using any toolkit and develop applications.

Suggested Evaluation Methods:

- Tutorial – VR tool comparison.
- Brainstorming session on tools and technologies used in VR.
- Demonstration of the created VR applications

UNIT V MIXED REALITY TECHNOLOGIES

9

Synchronizing Time – Tangible & Ubiquitous – Vision Based Tracking – Sensing Technologies – Seamless Design – Assembling Interaction – Trajectories Through Mixed Reality Performance – Mobile Interface Design – Wearable Computing – Games.

Suggested Activities:

- External learning – Different types of sensing and tracking devices for creating mixed reality environments.
- Practical – Create MR scenes using any toolkit and develop applications.

Suggested Evaluation Methods:

- Tutorial – Mobile Interface Design.
- Brainstorming session on wearable computing devices and games design.
- Demonstration and evaluation of the developed MR application.

Total	45
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OUTCOMES

On completion of the course, the students will be able to:

- Demonstrate the understanding of the basic concepts of Mixed Reality
- Use the tools and technologies related to Mixed Reality
- Develop the Virtual Reality applications in different domains
- Design of various models using modeling Techniques
- Implement the concept of Virtual Reality and Mixed Reality Programming with Toolkits.

REFERENCES

1. Charles Palmer, John Williamson, “Virtual Reality Blueprints: Create compelling VR experiences for mobile”, Packt Publisher,2018
2. John Vince, “Introduction to Virtual Reality”, Springer-Verlag,2004.
3. William R. Sherman, Alan B. Craig: Understanding Virtual Reality – Interface, Application, Design”, Morgan Kaufmann,2003.

MM5005	GAME PROGRAMMING	L	T	P	C
		3	0	0	3
OBJECTIVES					

- To know the basics of 2D and 3D graphics for game development.
- To know the stages of game development.
- To understand the basics of game engine.
- To survey the gaming development environment and tool kits.
- To learn and develop simple games using Pygame environment.

UNIT I	3D GRAPHICS FOR GAME DESIGN	9
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Game – Definition – Genres of Games, Basics of 2D and 3D Graphics for Game Avatar, Game Components – 2D and 3D Transformations – Projections – Colour Models – Illumination and Shader Models – Animation – Controller Based Animation.

Suggested Activities:

- Discussion about computer and video games origin and history.
- Discussion of graphics objects, open source language for game development like Pygame and Processing.py – a Language for creative arts.
- External learning – Algorithms in translation, scaling, zooming and rotation of 3D objects.
- Practical – Installation of Pygame and Pygame Zero and Implementation of colour models and shading models in Python.

Suggested Evaluation Methods:

- Tutorial – 2D and 3D transformations.
- Practical – Programming exercises in animations.
- Assignments on image projections and colour models.
- Quizzes on 2D and 3D Game Object transforms.

UNIT II	GAME DESIGN PRINCIPLES	9
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Character Development, Storyboard Development for Gaming – Script Design – Script Narration, Game Balancing, Core Mechanics, Principles of Level Design – Proposals – Writing for Preproduction, Production and Post – Production.

Suggested Activities:

- Flipped classroom on animation.
- Practical – Creation of game script.
- External learning – Problems on game level design.
- Assignment on preparation of game level design document, detailed document.

Suggested Evaluation Methods:

- Tutorial – Scriptwriting.
- Assignments on game proposal writing.
- Quizzes on game design document.

UNIT III GAME ENGINE DESIGN

9

Rendering Concept – Software Rendering – Hardware Rendering – Spatial Sorting Algorithms – Algorithms for Game Engine– Collision Detection – Game Logic – Game AI – Path Finding.

Suggested Activities:

- Flipped classroom on rendering.
- External learning – Problems on rendering and animation.
- Practical – Implementation of simple animations in Pygame andProcessing.py

Suggested Evaluation Methods:

- Tutorial – Collision detection.
- Assignments on game AI and pathfinding.
- Quizzes on rendering.

UNIT IV OVERVIEW OF GAMING PLATFORMS AND FRAMEWORKS

9

Pygame Game development – Unity – Unity Scripts – Mobile Gaming, Game Studio, Unity Single player and Multi-Player games.

Suggested Activities:

- Flipped classroom on gaming environments.
- External learning – Problems on Installation of Unity and scripts.
- Practical – Pygame routines for character rendering, transformations and sound processing.

Suggested Evaluation Methods:

- Tutorial – Mobile gaming.
- Assignment on game logic.
- Quizzes of all topics related to Unity and Pygame.

UNIT V GAME DEVELOPMENT USING PYGAME

9

Developing 2D and 3D interactive games using Pygame – Avatar Creation – 2D and 3D Graphics Programming – Incorporating music and sound – Asset Creations – Game Physics algorithms Development – Device Handling in Pygame – Overview of Isometric and Tile Based arcade Games – Puzzle Games.

Suggested Activities:

- External learning – Writing Unity scripts and assets.
- Practical – Implementation of simple games.

Suggested Evaluation Methods:

- Tutorial problems in 2D and 3D graphics Programming.
- Practical – Programming problems like asset creation.
- Quizzes on game development in Pygame.

TOTAL 45

OUTCOMES

- Explain the concepts of 2D and 3D graphics
- Design game design documents.
- implementation of gaming engines.
- Survey gaming environments and frameworks.
- Implement a simple game in Pygame.

References

1. Sanjay Madhav, "Game Programming Algorithms and Techniques: A Platform Agnostic Approach", Addison Wesley, 2013.
2. Will McGugan, "Beginning Game Development with Python and Pygame: From Novice to Professional", Apress, 2007.
3. Paul Craven, "Python Arcade games", Apress Publishers, 2016.
4. David H. Eberly, "3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics", Second Edition, CRC Press, 2006.
5. Jung Hyun Han, "3D Graphics for Game Programming", Chapman and Hall/CRC, 2011.

MM5003	SHORT FILM DEVELOPMENT	L	T	P	C
		3	0	2	4
OBJECTIVES					
<ul style="list-style-type: none"> ● To understand the fundamentals of Short Film Making. ● To know the working principles camera. ● To acquire knowledge about the editing software. ● To train the student as a member or leader in diverse teams of short film development. ● To inculcate aesthetic sense involved in creativity and transform creative ideas into short-film. 					
UNIT I INTRODUCTION TO SHORT FILM					9
<p>Introduction – Different Types of Short Film – Documentary and Non Fiction Film – Animated Short Films – Challenges in Developing Short Films – Creative Approaches.</p> <p>Suggested Activities:</p> <ul style="list-style-type: none"> ● Blended Learning – Displaying Different types short films. ● Flipped classroom on issues in short film production. ● External learning – Practical problems related to interacting with people related public issues. <p>Suggested Evaluation Methods:</p> <ul style="list-style-type: none"> ● Assignment on different types of short film. ● Tutorial – Various issues related to short films production. ● Assignment on different interviews style. 					
UNIT II PREPRODUCTION					9

Developing and Researching Short Film Project – Considering and Selecting an Idea – Developing Questions – Research Techniques- Writing a Concept and Treatment - Shooting Script – Hiring Crew – Crew Position and Responsibilities – Producing and Budgeting – Visual Scope and Visual Evidence – Permission – Funding – Proposals – Attracting Funding – Ethics in Short Film Making.

Suggested Activities:

- Blended learning – People interest towards short films.
- Flipped classroom on discussion on selection of crew members based on their talents.
- External learning – Survey on funding agencies and legal details regarding short films productions.

Suggested Evaluation Methods:

- Assignment on preparing survey question to known people interest towards short film.
- Tutorial – Crew and their responsibilities.
- Assignment on project proposal preparation.

UNIT III PRODUCTION

9

Research Leading up to the Shoot – Production Team, Production –Camera Equipment and Shooting Procedure – Lighting Location Sound – Interviewing – Directing Participants – Working Together – Team Work – Scheduling – Problems and Issues.

Suggested Activities:

- Blended learning – Research regarding the locations and pervious stories.
- Flipped classroom on different types of cameras.

Suggested Evaluation Methods:

- Quizzes on research and scheduling the locations.
- Assignment on the usage of cameras in shooting procedures.

UNIT IV POST PRODUCTION

Designing a Structure – Working with Editor – Visual Effects – Transition – Adding Sound Effects and Music – Special Effect Dubbing – Rerecording – Narration – Voiceover — Titles –Graphics – Color Exposure and Color Correction – Credits and Acknowledgements.

Suggested Activities:

- Flipped classroom on various visual and color effects.
- External learning – Interaction with media peoples.

Suggested Evaluation Methods:

- Tutorial – Color theory.
- Assignment on recording and editing.

UNIT V SCREENING

9

Impact of Short Film on the Society – Various Media Techniques used in Short Film Production – Identifying Important Current Social Issues for Short Film – Exploring Background Research Current Social Issues – Making Short Film for Television and Theatrical Release – Non Fiction Presentation – Production of an individually or Group Authored Short Film Based on Historical – Corporate – Institutional – Current Social Issues.

Suggested Activities:

- External learning – Survey on current public issue.
- Flipped classroom on discussion on innovative short film production.

Suggested Evaluation Methods:

- Quizzes on public issues.
- Tutorial – Various new techniques in short film production.

Total 45

OUTCOMES

- Apply the knowledge of concepts and techniques used in short film development.
- Understand the social issues and projecting them effectively through short film.
- Conduct various experiments for effective short film.
- Design and implement various techniques in to short film that brings impact on the society.
- Apply various tools and software for lighting and sound to uphold the professional and social obligation.
- Manage and Develop a short film as a life-long activity as a team.

REFERENCES

1. Clifford Thurlow, "Making Short Films – The Complete Guide from Script to Screen" , Berg Publishers,2008
2. James R. Matin, "Create Documentary Films, telling Techniques Videos and Multimedia: A Comprehensive Guide to Using Documentary Storytelling Techniques for Film Video, The internet and Digital Media Nonfiction project", Real Deal Press, 2010.
3. Michael Rabiger, "Directing the Documentary", Focal Press,2004.
4. Daniel Faltesek, "Selling Social Media The Political Economy of Social Networking", Bloomsbury Academic, 2018.

	GAME PROGRAMMING AND MIXED REALITY LAB	L	T	P	C
		0	0	4	2

GAME PROGRAMMING

1. Implement a small avatar in Pygame/Unity.
2. Implement a canvas and colour models in Pygame/Unity.
3. Implement a Lighting and Shade model in Pygame/Unity.
4. Write a Proposal document for a Game.
5. Write a Game Level design document and detailed document.
6. Implementation of simple animations in Pygame/Unity.
7. Implement Pygame routines for Character rendering and transformations.
8. Implement routines for creation and playing of Sounds in Pygame.
9. Implement a simple game logic.
10. Implement a simple Tile game using Pygame/Unity.

MIXED REALITY

1. Study of tools like Unity, Maya, 3DS MAX, AR toolkit, Vuforia and Blender.
2. Use the primitive objects and apply various projection methods by handling camera.
3. Download objects from asset store and apply various lighting and shading effects.
4. Model three dimensional objects using various modelling techniques and apply textures over them.
5. Create three dimensional realistic scenes and develop simple virtual reality enabled mobile applications which have limited interactivity.
6. Add audio and text special effects to the developed application.
7. Develop VR enabled applications using motion trackers and sensors incorporating full haptic interactivity.
8. Develop AR enabled applications with interactivity like E learning environment, Virtual walkthroughs and visualization of historic places.
9. Develop MR enabled simple applications like human anatomy visualization, DNA/RNA structure visualization and surgery simulation.
10. Develop simple MR enabled gaming applications.

	PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES	
<ul style="list-style-type: none"> ● To understand the basics of python programming structure ● To use control structures, looping structures and functions ● To practice object oriented concepts in python ● To write a game program using python pygame 	
UNIT I PYTHON BASICS	6
Programming Languages – Algorithmic Problem Solving – Building Blocks of a Program – Fundamentals of Python Programming– Syntax and Styles: Data types – Literals – Variable – Operators and Expressions - Control Flow and Looping structures.	
UNIT II PYTHON OPERATORS AND FUNCTIONS	9
Dictionaries: Making a Dictionary – Basic Operations – Dictionary Operations – Sets – Iterators and Generators – Functions: Introduction – Defining Functions – Calling Functions – Passing Arguments – Keyword Arguments – Default Arguments – Required Arguments – Variable –length Arguments – Return Statement – Nesting of Passing Arguments – Anonymous Functions – Recursive Function – Scope of Local and Global Variable – Sample Programs – Modules.	
UNIT III PYTHON OBJECT ORIENTED PROGRAMMING AND PACKAGES	9
Object Oriented Programming Principles: Class Statement – Class Body – Objects – Class Methods – Self Variable – Class Properties and Instance Properties – Static Method – Data Hiding – Deleting an Object – Constructor – Method Overriding – Inheritance – Packages – Strings and Regular Expressions	
UNIT IV PYTHON FILES AND THREAD	9
Files and Directory Access: Files and Streams – Opening a File – Reading/Writing Operations on a File – Other File Operations – Iterating through Files – Splitting Words – Serialization and De-serialization – Hash files – Directory Access – Errors and Exceptions – Multithreading: Introduction to Thread – Differences between Process and Thread – Threading Module – Thread Synchronization.	
UNIT V PYTHON GAME PROGRAMMING	12
PyGame Concepts - Initialization and Modules - Displays and Surfaces - Importing and Initializing PyGame - Setting Up the Game Loop - Processing Events - Drawing on the Screen - Using .blit() and .flip() – Sprites – Players - User Input – Enemies - Sprite Groups - Custom Events - Collision Detection - Sprite Images -Altering the Object Constructors -Adding Background Images -Game Speed - Sound Effects	
	TOTAL 45
OUTCOMES	

- To use control structures in the programming
- To design program with object oriented features
- To import and use packages in the programming
- To access and modify files
- To write a python game program with pygame packages

REFERENCES

1. Python The Complete Reference, Martin C. Brown, MG Graw Hill Publications,2018
2. Beginning Game Development with Python and Pygame: From Novice to Professional, Will McGugan,Apress, 2012
3. Python Game Programming By Example By Alejandro Rodas de Paz, Joseph Howse Packt publishing,2015
4. Programming in Python 3: A Complete Introduction to the Python Language, Mark Summerfield ,Adison Wesley 2nd Edition, 2018

STUDENT PSYCHOLOGY			L	T	P	C
			3	0	0	3
OBJECTIVES						
<ul style="list-style-type: none"> • Understand the basics of Educational Psychology • Comprehend the stages of growth and development • Comprehend the factors influencing learning • Develop awareness on the influence of intelligence and creativity • Comprehend the aspects of Motivation and Personality 						
UNIT I INTRODUCTION TO EDUCATIONAL PSYCHOLOGY						9
Educational Psychology - Definition, meaning, scope and relevance of Educational Psychology – Schools of thought- Methods of Studying Behavior - Introspection, Observation and Experimental method						
UNIT II CHARACTERISTICS OF LEARNERS						9
Growth and Development – Meaning, stages; Physical, Mental, Emotional and Social Development during - childhood, adolescence - Individual Differences - Meaning, significance and causes.						
UNIT III TEACHING LEARNING PROCESS						9
Learning – concept, characteristics, learning process, learning Curve – Factors influencing learning - Theories of Learning - Trial and Error, Classical Conditioning - Transfer of Learning – Principles of teaching and learning- Mental Processes Related to Learning – Thinking, Memory and forgetting						
UNIT IV INTELLIGENCES						9

Intelligence - Concept – Theories - Gardner’s Theory of Multiple Intelligence – Measurement of Intelligence - Creativity - concept, characteristics - educational implications.	
UNIT V STUDENT MOTIVATION AND PERSONALITY	9
Motivation – Theories, Models - Strategies - Personality - Self concept, Self Esteem - Theories of Personality – Personality assessment - Group dynamics – Sociometry	
TOTAL	45
OUTCOMES	
<ul style="list-style-type: none"> ● Demonstrate the understanding the basics of Educational Psychology ● Explain the stages of growth and development ● Identify the factors influencing learning ● Develop awareness on the influence of intelligence and creativity ● Implement Motivation strategies for learning in designing and delivering the course 	
REFERENCES	
<ol style="list-style-type: none"> 1. Aggarwal J. C.(2018). Essentials of Educational Psychology, NewDelhi : Vikas Publishers 2. Sharma, R.A. (2007). Training Technology. Meerut : Surya Publications 3. Mangal, S.K. (2005) Educational Psychology, NewDelhi :PHI 4. Santrock John W. (2010) Educational Psychology. New Delhi : Irwin Professional Publishers. 5. Woolfolk Anita. (2008) Educational Psychology. New Delhi : Pearson. 	

DIGITAL MARKETING			L	T	P	C
			3	0	0	3
OBJECTIVES						
<ul style="list-style-type: none"> ● To create new opportunities for businesses to reach and engage consumers through smart, social, and mobile media technologies. ● To understand the impacts of digital technologies on marketing communication strategies and practices. ● To strategically select the appropriate channels to deliver the right marketing message to the right audience at the right moment. 						
UNIT I INTRODUCTION TO DIGITAL MARKETING AND SEO						9
Strategies in Digital Marketing - Aligning Internet with Business Objectives - User Behaviour & Navigation - Branding & User Experience - Stakeholders in Search - Customer Insights - On & off-page Optimization - Meta Tags, Layout, Content Updates - Inbound Links & Link Building						
UNIT II SEARCH MARKETING AND WEB SITE ANALYTICS						9

Campaign Management - Conversion Tracking - Targeting & Analytics - Keyword Selection - Conversion Metrics: CPA, CTR - Goal Configuration & Funnels - Intelligence Reporting - Conversions, Bounce Rate, Traffic Sources, Scheduling	
UNIT III	SOCIAL MEDIA MARKETING 9
Monitoring and Control, Project Status Reporting; Project Metrics; Earned Value Analysis (EVA); What is Social Media Marketing? - Overview of Facebook, Twitter, LinkedIn, Blogging, Youtube and Flickr - Building Brand Awareness Using Social Media - Social Media Management - Insights and Analytics – Revenue optimization tools – SEO & SEM – Ad text optimization – Best Practice Examples & case Studies	
UNIT IV	EMAIL AND MOBILE MARKETING 9
User Behaviour - Market Segmentation, Key Metrics - Best Practice Case Studies - Split Testing - Campaign Process Optimisation - SMS Strategy - Mobile Advertising - Mobile Optimized Websites - 7 Step Process for Mobile Apps - Proximity Marketing - Strategic Steps - Review & Testing	
UNIT V	DISPLAY ADVERTISING AND STRATEGIC PLANNING 9
Tracking your Campaign - Optimizing the Campaign - Campaign Planning - Running Effective Ads - Situation Analysis , Planning, Budget, Measurement - Information Gathering & Research - Key Strategy & Planning Concepts & Methodologies - Best Practice Case Studies	
TOTAL:45 PERIODS	
OUTCOMES	
<ul style="list-style-type: none"> ● Demonstrate the understanding of social media, the various channels through which it operates, and its role in marketing strategy ● Use principles of consumer and social psychology to develop social media content and campaigns that engage consumers ● Draw on knowledge about word-of-mouth marketing to develop effective approaches for propagating ideas, messages, products, and behaviors across social networks ● Measure the impact of a social media campaign in terms of a specific marketing objective ● Implement the camping strategy 	
REFERENCES	

1. Dave Chaffey, Fiona Ellis-Chadwick, Digital marketing 6th edition-2016
2. Shama Hyder, Chris Brogan, The Zen of Social Media Marketing-2016
3. Bell, D., J. Choi, and L. Lodish (2012), "What Matters Most in Internet Retailing" Sloan Management Review
4. Aleksej Heinze, Gordon Fletcher, Tahir Rashid, Ana Cruz, Digital and Social Media Marketing-2017

E-BOOKS

5. <https://www.pauladaunt.com/books/Social%20Media%20Marketing.pdf>
6. <http://netmining.com/wp-content/uploads/2015/09/Netmining-Marketing-Big-Book.pdf>

Online resources

- <https://www.smartinsights.com/social-media-marketing/>
<https://www.intechinc.com/blog/the-best-online-resources-for-digital-marketing/>
<https://www.wordstream.com/social-media-marketing>

TRAINING AND DEVELOPMENT		L	T	P	C
		3	0	0	3
OBJECTIVES:					
<ul style="list-style-type: none"> • Understand concepts of Training and Development • Comprehend the training Process • Comprehend the design and implementation of training • Understand Evaluation of training 					
UNIT I	INTRODUCTION TO TRAINING CONCEPT	9			
Introduction to Training Concept: Definition, Meaning, Need for Training, Importance of Training, Objectives of Training, Concepts of Education, Training and Development, Overview of Training Functions, Types of Training					
UNIT II	PROCESS OF TRAINING	9			
Process of Training: Steps in Training, Identification of Job Competencies, Criteria for Identifying Training Needs (Person Analysis, Task Analysis, Organization Analysis), Assessment of Training Needs, Methods and Process of Needs Assessment.					
UNIT III	DESIGNING AND IMPLEMENTING A TRAINING PROGRAM	9			
Designing and Implementing a Training Program: Trainer Identification, Methods and Techniques of Training, Designing a Training Module (Cross Cultural) Leadership, Training the Trainer, Change), Management Development Program, Budgeting of Training.					
UNIT IV	EVALUATION OF TRAINING PROGRAM	9			

Evaluation of Training Program: Kirkpatrick Model of Evaluation, CIRO Model, Cost-Benefit Analysis, ROI of Training.	
UNIT V	9
Learning: Principles of Learning, Theories of Learning, Reinforcement Theory, Social Learning Theory, Andragogy, Resistance to Training. Technology in Training: CBT, Multimedia Training, E-Learning/Online Learning, Distance Learning.	
TOTAL: 45 PERIODS	
OUTCOMES:	
<ul style="list-style-type: none"> • Explain the role of training and development in human resources management. • Describe the psychology of the learning process on which training is based. • Analyze the training needs of an organization. • Assess, design, access and implement various methods, techniques and sources of training. • Evaluate the value of the training once completed from the individual employee and the organization's viewpoint. 	
REFERENCES:	
<ol style="list-style-type: none"> 1. Tapamoy Deb (2009), Training and Development .NewDelhi :ANE Books 2. Janakiraman, B.(2007). Training and Development. NewDelhi ;Dreamtech Press 3. Craig, R.L, (1996). ASTD Training and Development Handbook, NY:McGrawHill 4. Raymond Noe.(2002). Employee Training And Development. Ny:McGrawHill. 5. DevendraAgochia.(2009). Every Trainers Handbook. New Delhi :Sage 	

		L	T	P	C
		3	0	0	3
LEARNING SCIENCE					
OBJECTIVES					
<ul style="list-style-type: none"> • To introduce major epistemic, theoretical positions and research approaches in learning sciences. • To understand cognitive and social perspectives on learning, concepts and approaches to learning environment. • To design that focuses on interaction and authentic practices for learners.. 					
UNIT I	INTRODUCTION TO LEARNING SCIENCES	9			
How people learn –How learning works – The new science of learning –Dimensions of human learning					
UNIT II	KNOWLEDGE AND EPISTEMOLOGICAL BELIEFS	9			

Knowledge structures and processes—A theoretical framework and approach for fostering metacognitive development –Epistemological understanding as a metacognitive process: Thinking aloud during online searching– The framework theory approach to the problem of conceptual change– Knowledge in Pieces-Knowledge outside of the head–The extended mind

UNIT III VIEWS OF LEARNING

9

Cognitive Structure—Implications, Media as lived environments – Ecological perspective of educational technology– Learning as Enculturation—Psychological tools and mediated learning– Learning as participation– Stativity of knowing, learning, and research– Learning as a cultural Process—Achieving equity through diversity Learning as knowledge creation –Rethinking learning– Problem and project-based learning –Theoretical foundations-Designing and Facilitating PBL – Traditional models – Anchored instructions—Situated Learning

UNIT IV MOTIVATION AND ENGAGEMENT

9

Motivation – Social cognitive approach to motivation and personality– Achievement goal orientations and identity formation styles. Towards a theory of personalized learning communities - Designs for learning environments of the future – Four Phase model of interest development– Learning environments and design approaches aligned with situated view of learning

UNIT V LEARNING WITH TECHNOLOGY

9

Cognitive tutors – Aids to Computer based multimedia learning—Computer assisted Language Learning – User Modeling and User-Adapted Interaction – Simulation based learning environment – Scaffolding – Videogames as designed experiences –Epistemic Game as education for innovation, Mobile learning –Multimodal literacies and new media – Online communities – Virtual worlds – Experiments in learning with technology

TOTAL:45 PERIODS

OUTCOMES

- Demonstrate a basic understanding of the main contemporary learning theories
- Apply a subset of these theories based on a more in-depth understanding
- Describe the current state of the art in educational technology
- Use a number of educational technologies for group learning
- Apply concepts from the learning and communication sciences to assess the potentials and problems of technological developments
- Implement ideas from conceptual knowledge in the design of learning experiences

REFERENCES

1. Sawyer, R. K. (Ed.). (2006). The Cambridge Handbook of the Learning Sciences. New York: Cambridge University Press
2. Khine, M. S. & Saleh (2010). The new science of learning: Cognition, computers, and collaboration in education. New York: Springer.
3. Alexander, P. A., Schallert, D. L., & Reynolds, R. E. (2009). What is learning anyway? A topographical perspective considered. Educational Psychologist, 44(3), 176-192.
4. Kolodner, J. (2004). The learning sciences: past, present, and future. Educational Technology: The Magazine for Managers of Change in Education
5. Lave, J. & Wenger, E. (1991). Situated Learning: legitimate peripheral participation. New York, NY: Cambridge University Press.
6. Fields, D., & Kafai, Y. B. (2009). A connective ethnography of peer knowledge sharing and diffusion in a tween virtual world. IJCSCL, 4, 47-68

		MULTIMEDIA DATABASES			
		L	T	P	C
		3	0	0	3
OBJECTIVES					
<ul style="list-style-type: none"> ● To understand about the database storage, retrieval of multimedia elements. ● To familiarize about the database indexing methods and different multidimensional data structures. ● To learn about text database and image database storage and retrieval. ● To understand design and architecture of a Multimedia Database. ● To understand about Audio and Video Storage. 					
UNIT I DATABASE INDEXING METHODS					9
<p>Hashing – B-trees – Secondary Key Access Methods – Inverted Files – Point Access Methods (PAMs) – Spatial Access Methods (SAMs) – Space Filling Curves – Transformation to Higher-D Points – Multidimensional Data Structures – K-D Trees – Point Quadtrees– The MX–Quadtree– R-Trees.</p> <p>Suggested Activities</p> <ul style="list-style-type: none"> ● Flipped classroom on traditional databases. ● External learning - Comparison of different data structures and its usage. ● Practical - Application development using multi-dimensional data structures. <p>Suggested Evaluation Methods</p> <ul style="list-style-type: none"> ● Assignments on hashing mechanisms ● Tutorials - Indexing and access methods. ● Demonstration of the application development. 					
UNIT II TEXT DATABASES					9

Precision and Recall – Stop Lists – Word Stems and Frequency Tables – Latent Semantic Indexing – TV-Trees – Indexing Text and DNA Strings – Access Methods for Text – Full Text Scanning – Inversion – Signature Files – Vector Space Model and Clustering.

Suggested Activities

- Flipped classroom on text databases.
- External learning - Comparison of other retrieval techniques for text databases and its usage.
- Practical - Application development in text databases.

Suggested Evaluation Methods

- Assignments on information retrieval techniques.
- Tutorials - Access methods for text databases.
- Demonstration of the practical implementation.

UNIT III IMAGE RETRIEVAL MECHANISMS	9
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Image Databases – Raw Images – Compressed Image Representations – Similarity Based Retrieval – Alternative Image DB Paradigms – Representing Image DBs with Relations – Representing Image DBs with R-Trees – Retrieving Images by Spatial Layout – Implementations.

Suggested Activities

- Flipped classroom on image databases.
- External learning – Retrieving Images.
- Practical - Application development in image databases.

Suggested Evaluation Methods

- Assignments on image retrieval mechanisms.
- Tutorials - R-trees.
- Demonstration of the practical implementation

UNIT IV AUDIO/VIDEO DATABASES	9
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Audio Databases – A General Model of Audio Data – Capturing Audio Content through Discrete Transformation – Indexing Audio Data–Video Databases – Organizing Content of a Single Video – Querying Content of Video Libraries – Video Segmentation.

Suggested Activities

- Flipped classroom on audio/video databases.
- External learning - Capturing and querying audio and video content.
- Practical - Application development in video databases.

Suggested Evaluation Methods

- Assignments on capturing audio/ video content.
- Tutorials - Indexing audio/video databases.
- Demonstration of the practical implementation

UNIT V MULTIMEDIA DATABASE DESIGN	9
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Design and Architecture of a Multimedia Database – Organizing Multimedia Data based on the Principle of Uniformity – Media Abstractions – Query Languages for Retrieving Multimedia Data.

Suggested Activities

- Flipped classroom on text databases.
- External learning - Query languages for retrieving multimedia data.
- Practical – Application development.

Suggested Evaluation Methods

- Assignments on organizing multimedia data.
- Tutorials - Query languages for retrieving multimedia data.
- Demonstration of the practical implementation

TOTAL 45

OUTCOMES

- Demonstrate the multidimensional data structures for multimedia applications
- Apply database indexing methods for efficient storage and retrieval of multimedia content.
- Work with Text databases, its storage and retrieval.
- Formulate and generalize the use of audio and video databases for real time multimedia applications.
- Demonstrate about Image database, its storage and retrieval.
- Apply multimedia database design for multimedia architecture.

REFERENCES

1. V. S. Subramanian, “Principles of Multimedia Database Systems”, Harcourt India Pvt Ltd., 2001.
2. Christos Faloutsos, “Searching Multimedia databases by Content”, Kluwer Academic Publishers,2011.
3. S. Khoshafian, A. B. Baker, “Multimedia and Imaging Databases”, Elsevier, 1996.
4. C. Kingsley Nwosu, “Multimedia Database Systems: Design and Implementation Strategies”, Kluwer Academic Publishers,1996.
5. Lynne Dunckley, “Multimedia Databases: An Object-ational Approach”, Pearson Education, 2003.
6. R. Elmasri, S. B. Navathe, “Fundamentals of Database Systems”, Seventh edition, Pearson Education,2017.

BA5023	SOFTWARE PROJECT MANAGEMENT AND QUALITY	L	T	P	C
		3	0	0	3
OBJECTIVES					

- To understand the various project management phases – Initiation, Planning, Tracking and Closure
- To explore various project estimation methodologies, process models and risk management
- To understand quality assurance in software development

UNIT I PROJECT MANAGEMENT OVERVIEW	8
Project and Project Management, Various phase of Project Management, Project Stakeholders, Project Management Organisation (PMO); Roles and Responsibilities of Project Manager. Brief introduction to various process models - Waterfall, RAD, V, Spiral, Incremental, Prototyping, Agile–SCRUM, Extreme Programming (XP) and Kanban Project Initiation - Project Charter; Statement of Work (SoW)	
UNIT -II PROJECT PLANNING	10
Project Planning Activities- Project Scope, Work Breakdown Structures (WBS), Software estimation methodologies - COCOMO Model and Function Point Project Scheduling Techniques – Program Evaluation and Review Technique (PERT), Gantt Chart and Critical Path Method (CPM)	
UNIT -III PROJECT TRACKING	10
Monitoring and Control, Project Status Reporting; Project Metrics; Earned Value Analysis (EVA); Project Communication Plan & Techniques; Steps for Process Improvement. Risk Management: Concepts of Risks and Risk Management; Risk Management Activities; Effective Risk Management; Risk Categories; Aids for Risk Identification; Potential Risk Treatments; Risk Components and Drivers; Risk Prioritization.	
UNIT -IV PROJECT CLOSURE	8
Project Closure Analysis, Lesson Learnt Software Quality Assurance -Software Quality Assurance Activities; Software Qualities; Software Quality Standards – ISO Standards for Software Organization, Capability Maturity Model (CMM), Comparison between ISO 9001 & SEI CMM, Other Standards.	
UNIT - V AGILE PROJECT MANAGEMENT WITH SCRUM	9
Agile Manifesto and Agile Principles Agile Scrum - Purpose, Values, Scrum Framework, Scrum Roles – Product Owner, Scrum Master & Team, Scrum Events – Sprint Planning, Daily Scrum/Stand-up Meeting, Sprint Review, Sprint Retrospective, Scrum Artefacts – Product Backlog, Sprint Backlog, Increment and Definition of Done (DoD), Agile estimation – Story Point	
TOTAL:45 PERIODS	
OUTCOMES	

At the end of this course, student should be able to:

- Identify the different project contexts and suggest an appropriate management strategy.
- Practice the role of professional ethics in successful software development.
- Identify and describe the key phases of project management.
- Determine an appropriate project management approach through an evaluation of the business context and scope of the project.
- Apply a thorough understanding of Agile principles and specific practices

REFERENCES

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012.
2. Robert K. Wysocki “Effective Software Project Management” – Wiley Publication, 2011.
3. Walker Royce: “Software Project Management”- Addison-Wesley, 1998.
4. Gopalaswamy Ramesh, “Managing Global Software Projects” – McGraw Hill Education (India), Fourteenth Reprint 2013.
5. Schwaber, Ken. Agile Project Management with Scrum. United States, Pearson Education, 2004.
6. Mike Cohn, Agile Estimating and Planning. India, Pearson Education, 2006.
7. Bernie Trilling, Walter Ginevri, Project Management for Education: The Bridge to 21st Century Learning, Publisher(s): Project Management Institute, October 2017

ONLINE RESOURCES:

- <http://agilemanifesto.org/>
- <https://www.scrum.org/Resources/What-is-Scrum>
- <http://www.scrumguides.org/scrum-guide.html#purpose>

KNOWLEDGE MANAGEMENT		L	T	P	C	
		3	0	0	3	
OBJECTIVES:						
❖ Understand the various KM models and tools						
❖ Develop awareness on Knowledge capture and sharing						
❖ Comprehend the various Knowledge management tools						
❖ Appreciate the importance of organizational culture in KM						
❖ Develop Knowledge on the roles and responsibility of KM Team						
UNIT I	OVERVIEW OF KNOWLEDGE MANAGEMENT					9

Introduction – Need for Knowledge Management, Valuation of Intellectual Capital, Intellectual Capital: Human vs. Structural Capital, Forces Driving Knowledge Management, Knowledge Management Systems, Issues in Knowledge Management, Types of knowledge, Types of Expertise, Types of Knowledge, Codifiability and Teachability of Knowledge, Specificity of Knowledge, Reservoirs of Knowledge, Characteristics of Knowledge	
UNIT II	TECHNOLOGIES TO MANAGE KNOWLEDGE
Cognitive Psychology , Data, Information and Knowledge , Kinds of Knowledge, Expert Knowledge, Thinking and Learning in Humans , Knowledge vs Intelligence, dumb search, Heuristic search in Knowledge-Based Systems, Knowledge Based Systems for KM, What kinds of knowledge are in Knowledge-Based Systems?, Knowledge Based Systems vs Expert Systems, Advantage and disadvantage of Knowledge Based Systems vs Expert Systems.	
UNIT III	KNOWLEDGE MANAGEMENT LIFE CYCLE
Challenges in KM Systems Development , Conventional Vs KM Systems Life Cycle(KMSLC), Key Differences , Key Similarities, KMSLC Approaches, Knowledge Creation, Nonaka’s Model of Knowledge Creation & Transformation, Knowledge Architecture , Acquiring the KM System. Capturing the Tacit Knowledge: Expert Evaluation, Developing Relationship with Experts , Fuzzy Reasoning & Quality of Knowledge Capture , Interviewing as a Tacit Knowledge Capture Tool, Some Knowledge Capturing Techniques: On-Site Observation (Action Protocol) , Brainstorming, Electronic Brainstorming, Protocol Analysis (Think-Aloud Method) , Consensus Decision Making, Repertory Grid ,Nominal Group Technique (NGT) , Delphi Method ., Concept Mapping, Blackboarding .	
UNIT IV	KNOWLEDGE CODIFICATION
Modes of Knowledge Conversion, Codifying Knowledge , Codification Tools/Procedures Knowledge Maps, Decision Table , Decision Tree ,Frames, Production Rules , Case-Based Reasoning , Knowledge-Based Agents , Knowledge Developer’s Skill Set , Knowledge Requirements , Skills Requirements, Learning from Data: The Concept of Learning , Data Visualization , Neural Network (Artificial) as Learning Model, Supervised/Unsupervised Learning ., Applications in Business , Relative Fit with KM , Association Rules , Classification Trees .	
UNIT V	KNOWLEDGE BASE SYSTEMS

User's View, Developer's View, Knowledge Representation: Rules, Inference chains, Knowledge Representation: Frames, Functional attributes, Frame-Based Reasoning, Rule-Based Reasoning, Forward chaining: Rule Interpretation Process, Backward chaining: Rule Interpretation Process, Backward chaining: Closed World Assumption, Knowledge engineering, Case-Based Reasoning Systems, Knowledge Elicitation –Converting Tacit Knowledge to Explicit, Discovering New Knowledge – Data Mining.

TOTAL: 45 PERIODS

OUTCOMES:

- Identify the types of knowledge and structure of knowledge management solutions
- Apply appropriate tool for information and knowledge visualization, representation and structuring
- Analyse and evaluate: organizational impacts of KM, factors influencing KM
- Implement knowledge management using coding strategy
- Apply concepts and tools of semantic modelling, knowledge reasoning and lateral reasoning in realization of KM solutions

REFERENCES:

1. Kimiz, Dalkir, Knowledge Management in Theory and Practice, Elsevier Butterworth-Heinemann, 2005
2. Madanmohan Rao Knowledge Management Tools and Techniques, Oxford: Elsevier, 2005
3. N Janardhan Rao ,Knowledge Management in Education, Chennai :ICFAI University Press, 2005
4. David G. Schwartz, Encyclopedia of Knowledge Management, London : Idea group, 2006

		WEB DESIGN			
		L	T	P	C
		3	0	2	4
OBJECTIVES					
<ul style="list-style-type: none"> ● To understand the HTML5 tags and design page using HTML5 ● To Integrate CSS in HTML page ● To devise layout using bootstrap functions ● To write javascript program in the webpage design ● To enable JQuery UI in the web page 					
UNIT – I HTML5					9

<p>What is Markup Language - Basic Structure of HTML - Head Section and Elements of Head Section - Meta Tags -CSS Tags - Script Tag - Table Tag - Div Tag - Header Tags - Paragraph, Span, Pre Tags - Anchor Links and Named Anchors - Image Tag - Object Tag - Iframe Tag - Introduction to HTML5 - New Structure Tags - Section – Nav – Article – Aside – Header – Footer - Designing a HTML - Structure of Page - New Media Tags - Audio Tag - Video Tag - Canvas and Svg Tag 0 Placeholder Attribute - Require Attribute - Pattern Attribute - Autofocus Attribute - email , tel, url types - umber type - date type - range type - voice search</p>	
UNIT – II CSS3	9
<p>Introduction to CSS 3 - New CSS 3 Selectors - Attribute Selectors - First-of-type - Last-of-type - Nth-child - Element:empty - New CSS3 Properties - Custom Fonts - Text-Shadow Property - Text-Stroke - Property - Rounded Corners - Box Shadows - CSS Gradients - CSS Multiple backgrounds - Opacity Property - Transition effect - Transform effect - Animation effects - CSS Media Queries - Using CSS3 in Practical Layout</p>	
UNIT – III WEB DESIGN WITH BOOTSTRAP	9
<p>Introduction to Responsive Design - Mobile first design concepts - Common device dimensions - View-port tag - Using CSS media queries - Menu conversion script - Basic Custom Layout -Introduction to Bootstrap - Installation of Bootstrap - Grid System – Forms – Buttons - Icons – Integration - Using CSS3 in Practical Layout</p>	
UNIT – IV JAVASCRIPT	9
<p>Introduction to Client Side Scripting - Introduction to Java Script - Javascript Types - Variables in JS - Operators in JS - Conditions Statements - Java Script Loops - JS Popup Boxes - JS Events - JS Arrays - Working with Arrays - JS Objects - JS Functions - Using Java Script in Realtime - Validation of Forms</p>	
UNIT – V JQUERY UI AND HOSTING	9
<p>Introduction to jQuery - jQuery Features - Installing jQuery - jQuery Syntax - jQuery Ready - Function - jQuery Selectors - jQuery Actions - jQuery plugins - jQuery Validation plugin - jQuery Slideshow - jQuery Dropdown - jQuery UI - Working with jQueryUI - jQuery Accordions - jQuery Tabs jQuery Tooltips - jQuery Autocomplete Web Hosting Basics - Types of Hosting Packages- Registering domains - Defining Name Servers - Using FTP Client - Maintaining a Website</p>	
Total	
75	
OUTCOMES	
<ul style="list-style-type: none"> ● Use HTML tags in the designing responsive pages ● Integrate CSS into HTML pages ● Prepare a layout using bootstrap functionalities ● Write javascript to implement event programming ● Use Jquery for responsive pages ● Host a site in a public environment 	

LIST OF EXPERIMENTS

1. Create dynamic web pages using CSS, JavaScript and AJAX
2. Develop mobile based web applications in cloud environment.
3. Simple GUI application development using applet and SWING.
4. Develop servlet and JSF application with JDBC access.
5. Android application for location based service.
6. Develop cloud based web application.
7. Deploy web applications in a cloud based environment

REFERENCES

1. Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics, Jennifer Robbins, O'Reilly ,5th Edition 2018
2. JavaScript & jQuery: The Missing Manual By David Sawyer McFarland O'Reilly, 3rd Edition 2019
3. HTML and CSS: Design and Build Websites By Jon Duckett, Wiley Publications, 2016

MULTIMEDIA INFORMATION STORAGE AND RETRIEVAL		L	T	P	C
		3	0	2	4
OBJECTIVES					
<ul style="list-style-type: none"> ● To introduce the basics of multimedia information storage technology, techniques for analysis, representation and retrieval that is commonly used in industry. ● To compare and contrast information retrieval models and internal mechanisms such as Boolean, Probability, and Vector Space Models. ● To outline the structure of queries and media elements. ● To use of machine learning methods on multimedia collections. ● To critically evaluate Multimedia retrieval system effectiveness and improvement techniques. 					
UNIT - I STORAGE AND PRESENTATION OF MULTIMEDIA					9

Introduction – Media Types – Media Understanding – Description of Audio, Visual Spectral and Video – Storage Networks, Storage Medium – Multidimensional Data Structures: K-D Trees – Point Quad trees – The MX-Quadtree – Rtrees – Comparison of Different Data Structures.

Suggested Activities:

- Install openCV and learn the functions which are used for Image retrieval.

Suggested Evaluation Methods:

- Quiz on applications of data structure

UNIT - II TEXT AND MUSIC RETRIEVAL

9

Text Information Retrieval: Information Retrieval System – Catalog and Indexing – Automatic Indexing – Term Clustering – User Search Techniques – Information Visualization – Fundamentals – Instantaneous Features – Intensity – Tonal Analysis – Musical Genre, Similarity and Mood.

Suggested Activities:

- Compute the tf-idf weights for the terms car, auto, insurance, best for each document, using the idf values from Figure.

	Doc1	Doc2	Doc3
Car	27	4	24
Auto	3	33	0
Insurance	0	33	29
Best	14	0	17

Consider the query best car insurance on a fictitious collection with N=1,000,000 documents where the document frequencies of auto, best, car and insurance are respectively 5000, 50000, 10000 and 1000. Compute the cosine similarities between the query vector and each document vector in the collection

Suggested Evaluation Methods:

- Discussion on applying various tf-idf variant and similarity measurements and comparing the results.

Unit - III IMAGE RETRIEVAL

9

Content-Based Image Retrieval – Techniques – Feature Extraction – Integration – Similarity –Feature in Indexing – Interactive Retrieval – MPEG-7 Standard.

Suggested Activities:

- Assignment on numerical problems on feature extraction techniques.

Suggested Evaluation Methods:

- Tutorial – MPEG-7standards.
- Tutorial on the problem of choosing the features to be extracted for a large image collection.

UNIT - IV VIDEO RETRIEVAL	9
<p>Content Based Video Retrieval – Video Parsing – Video Abstraction and Summarization – Video Content Representation, Indexing and Retrieval – Video Browsing Schemes – Example of Video Retrieval Systems.</p> <p>Suggested Activities:</p> <ul style="list-style-type: none"> • External learning – Survey on colour-based tracking and optical flow. • Practical – Learn any open source database software for database operations. <p>Suggested Evaluation Methods:</p> <ul style="list-style-type: none"> • Demonstration and quiz on the practical exercise and the EL component. 	
UNIT - V RETRIEVAL METRICS AND TRENDS	9
<p>Average Recall and Average Precision – Harmonic Mean – Evaluation of a Search Engine – Relevance Issue – Kappa Measure – Quality Versus Quantity, Possible Factors Which Influence Outcome of a Search – Grandfield Experimental Study – Introduction To Parallel IR – Distributed IR – Trends and Research Issue.</p> <p>Suggested Activities:</p> <ul style="list-style-type: none"> • External learning – Survey on image and video retrieval processing in a search engine such as Google, Yahoo and Bing. <p>Suggested Evaluation Methods:</p> <ul style="list-style-type: none"> • Group discussion and quiz on EL component. • Assignment on various metric calculations. 	
Practical	(30)
<p>Implement the following exercises using OpenCV:</p> <ol style="list-style-type: none"> 1. Develop a system to compute that representation for each of the images in a database and to change images between different colour spaces, transformations, about Contours (4hr) 2. Develop a system to search for an object in an image using Template Matching and segment images and extractions of foreground (4hr) 3. Implement to do the pre-processing for any document and construct a vector space model for the collection of text documents and also compute the similarity between them. (4hr) 4. Develop a system to compute spatial-temporal motion trajectory for a video dataset. (4hr) 5. Develop a system to compute any two Feature extraction techniques and dimension reduction procedure. (4hr) 	
	Total 75
OUTCOMES	

- Explain the basics of multimedia information storage technology, techniques for analysis, representation and retrieval.
- Compare and contrast information retrieval models and internal mechanisms such as Boolean, Probability, and Vector Space Models.
- Outline the structure of queries and media elements.
- Implement the process by exploring the open source tool for Image retrieval and video retrieval.
- Recognize the feasibility of applying machine learning for a particular problem.
- Critically evaluate Multimedia retrieval system effectiveness and improvement techniques.

REFERENCES

1. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze, "Introduction to Information Retrieval", Cambridge University Press, 2008.
2. Philip K. C. Tse, "Multimedia Information Storage and Retrieval: Techniques and Technologies", IGI Publishing, 2002.
3. Oge Marques, Borko Furht, "Content-Based Image and Video Retrieval", Springer, 2002.
4. V.S. Subrahmanian, "Principles of Multimedia Database Systems", Morgan Kaufmann, 1998.
5. Stefan Rürger, "Multimedia Information Retrieval", Morgan and Claypool Publishers, 2009.

		MOBILE APPLICATION DEVELOPMENT			
		L	T	P	C
		3	0	2	4
OBJECTIVES					
<ul style="list-style-type: none"> ● Understand system requirements for mobile applications ● Generate suitable design using specific mobile development frameworks ● Generate mobile application design ● Implement the design using specific mobile development frameworks ● Deploy the mobile applications in market place for distribution. 					
UNIT - I INTRODUCTION					8
Introduction to mobile applications – Embedded systems - Market and business drivers for mobile applications – Publishing and delivery of mobile applications – Requirements gathering and validation for mobile applications.					
UNIT - II BASIC DESIGN					10
Introduction – Basics of embedded systems design – Embedded OS - Design constraints for mobile applications, both hardware and software related – Architecting mobile applications – User interfaces for mobile applications – touch events and gestures – Achieving quality constraints – performance, usability, security, availability and modifiability					
UNIT – III ADVANCED DESIGN					9
Designing applications with multimedia and web access capabilities – Integration with GPS and social media networking applications – Accessing applications hosted in a cloud computing environment – Design patterns for mobile applications.					
UNIT - IV ANDROID					10
Introduction – Establishing the development environment – Android architecture – Activities and views – Interacting with UI – Persisting data using SQLite – Packaging and deployment – Interaction with server side applications – Using Google Maps, GPS and Wifi – Integration with social media applications.					
UNIT - V IOS					8
Introduction to Objective C – iOS features – UI implementation – Touch frameworks – Data persistence using Core Data and SQLite – Location aware applications using Core Location and Map Kit – Integrating calendar and address book with social media application – Using Wifi - iPhone marketplace.					
Practical					30

- Develop an application that uses GUI components, Font and Colours
- Develop an application that uses Layout Managers and event listeners.
- Develop a native calculator application.
- Write an application that draws basic graphical primitives on the screen.
- Develop an application that makes use of database.
- Develop an application that makes use of RSS Feed.
- Implement an application that implements Multi threading
- Develop a native application that uses GPS location information.
- Implement an application that writes data to the SD card.
- Implement an application that creates an alert upon receiving a message.
- Write a mobile application that creates alarm clock

Total 75

OUTCOMES

- Describe the requirements for mobile applications
- Explain the challenges in mobile application design and development
- Develop design for mobile applications for specific requirements
- Implement the design using Android SDK
- Implement the design using Objective C and iOS
- Deploy mobile applications in Android and iPone marketplace for distribution

REFERENCES

1. Charlie Collins, Michael Galpin and Matthias Kappler, "Android in Practice", DreamTech, 2012
2. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, "Beginning iOS 6 Development: Exploring the iOS SDK", Apress, 2013.
3. <http://developer.android.com/develop/index.html>.
4. James Dovey and Ash Furrow, "Beginning Objective C", Apress, 2012.
5. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox,2012.
6. Reto Meier, "Professional android Development", Wiley-India Edition, 2012.

		DESIGN AND DEVELOPMENT OF MOOC			
		L	T	P	C
		3	0	2	4
OBJECTIVES					
The objective of this course is to develop an effective, efficient and impactful Massive Open Online Course material and to create a satisfying teaching and learning experience					
UNIT- I	INTRODUCTION TO OPEN EDUCATION				9

Precursors of MOOC: OER, MIT OCW, Open University, Open course, Open source software, Open Philosophy, Timeline of MOOC Online Education Trends: MOOCs -About MOOCs, Why MOOCs, Structure of MOOC, Types of MOOCs, Success testimonials of MOOCs	
UNIT -II	MOOC PLATFORMS
Best MOOCs platforms, Functions of MOOCs platforms, Site Analysis, Comparative Analysis – MOOC Providers - Coursera, edX, Udemy, SWAYAM	
UNIT -III	MOOC FRAMEWORK AND PEDAGOGY
MOOC Framework: Event Management, Certification, Learning Analytics –Teacher Dashboard, Learner Dashboard, Assessments –Objective, Subjective assessment, Group assignment, Peer to Peer evaluation, Identity management Portfolio, Interactions –connect, collaborate, Discussion Forums, Educational Resources –Videos, Documents, Metadata, Learner Centric MOOCs	
UNIT -IV	BEST PRACTICES FOR MOOC DEVELOPMENT
Templates, Questionnaire and surveys to identify target group, design course prototype, Use of course planner - assign tasks and responsibilities, Quality dimension review, Tools for the development of Complex Equations, Charts and Graphs, Creation of professional-quality images and videos for more effective MOOCs, IPR issues, Copyrights and Owning rights etc., use of OERs MOOCs Preproduction process, MOOCs Production process and MOOCs Post production process, MOOCs Storyboard, Create Multimedia, Editing Images, Editing Videos, create presentation, possible roles of MOOCs development team	
Unit - V	CREATE MOOC COURSES
MOOC Technology - Open MOOC platform – Open edX, Course Builder - Create instructor-led courses, degree programs, and self-paced courses.	
TOTAL:45 PERIODS	
Practical	30
<ol style="list-style-type: none"> 1. Formulate the course template for MOOC 2. Design and develop Learner Centric E-content for a course 3. Design and develop Assessment tools and techniques (formative assessment, Evaluation, Group Work, Peer to Peer Evaluation) 4. Create and publish a MOOC course on Course builder/OpenedX 5. Prepare reports of Learning Analytics 	
OUTCOMES	

- Demonstrate the understanding of Open philosophy and OER
- Design and Develop Instructional Materials and assessment tools based on MOOC Pedagogy
- Appraise MOOCs best practices
- Develop quality and effective MOOCs

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3. <https://www.tonybates.ca/2016/12/01/5-ideas-for-a-pedagogy-of-online-learning/topographical> Sung-Wan Kim (December 14th 2016).
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9. Open edX <https://open.edx.org/>
10. Google Course builder <https://opensource.google/projects/course-builder>

		L	T	P	C
		ARTIFICIAL INTELLIGENCE		3	0
OBJECTIVES					
<ul style="list-style-type: none"> ● To know the underlying structure behind intelligence mathematically. ● To know the logical implications in computational intelligence. ● To know the automated learning techniques. ● To study the techniques of Knowledge Representation. ● To explore Artificial Intelligence techniques in real-time scenarios. 					
UNIT - I INTELLIGENT AGENTS AND KNOWLEDGE REPRESENTATION					9

Agents and Environments – Good Behavior: The concepts of Rationality – The Nature of Environments – The Structure of Agents – Knowledge Representation – Object Oriented Approach – Semantic Nets – Frames – Semantic Web – Ontology.

Suggested Activities:

- Flipped classroom on intelligent agents, means of knowledge representation
- Assignment on exercise questions on PEAS formulation from the text-book.
- Examples of knowledge representation through different methods and reasoning.
- Practical – Ontology creation using Protégé.

Suggested Evaluation Methods:

- Tutorial on intelligent agents and PEAS formulation.
- Assignments on semantic nets, frames.
- Quizzes on agents.

Practical – Programming exercises on object oriented structure, semantic nets and frames

UNIT - II SEARCH TECHNIQUES

9

Problem Solving by Search – Uninformed Search – Searching with Costs – Informed State Space Search – Heuristic Search: – Problem Reduction Search – Game Search – Constraint Satisfaction Problems.

Suggested Activities:

- Flipped classroom on uninformed search and searching with costs.
- In-class activity – Solve puzzles with uninformed and informed searches.
- Practical – Implementation of search through Python/ Other languages.

Suggested Evaluation Methods:

- Tutorial – Different types of searches.
- Assignments on uninformed and informed searches.
- Quizzes on heuristic methods.
- Practical – Programming exercises on different search strategies.

UNIT - III REASONING WITH LOWER ORDER LOGICS

9

Logical Agent – Proposition Logic – Syntax and Semantics – Theorem Proving – Model Checking – Inference in First Order Logic.

Suggested Activities:

- Reasoning methods through puzzles and real life scenarios.
- Implementation: Inference through prolog/python.

Suggested Evaluation Methods:

- Tutorial – Inference methods.
- Assignments on theorem proving and resolution.
- Quizzes on basics of logic – syntax and semantics.
- Practical – Programming exercises for theorem proving.

UNIT - IV ARTIFICIAL INTELLIGENCE PLANNING	9
<p>Classical Planning – Partial Order Planning – Graph Plan and SAT Plan – Hierarchical Planning – Planning and Acting in Nondeterministic Domains – Multiagent Planning.</p> <p>Suggested Activities:</p> <ul style="list-style-type: none"> ● Flipped classroom on planning methods. ● Assignments on derivation of plan through partial order plan, graph plan and hierarchical plan. <p>Suggested Evaluation Methods:</p> <ul style="list-style-type: none"> ● Tutorial – Different planning methods. ● Assignments on graph plan, SAT plan. ● Quizzes on planning in non-deterministic domains. ● Practical – Programming exercises on planning with PDDL/PDL/Python. 	
UNIT - V LEARNING TECHNIQUES	9
<p>Logical Formulation of Learning – Knowledge in Learning – Explanation–Based Learning – Learning using Relevance Information – Inductive Logic Programming – Statistical Learning</p> <p>Learning with Complete Data – Learning with Hidden Data – Applications.</p> <p>Suggested Activities:</p> <ul style="list-style-type: none"> ● Flipped classroom on theoretical study of learning methods ● Assignment on solving problem in statistical learning ● Practical – Programming exercises using Python/ other programming languages. <p>Suggested Evaluation Methods:</p> <ul style="list-style-type: none"> ● Tutorial – Learning methods. ● Assignments on statistical methods in learning. ● Quizzes on learning methods. <p>Practical – Programming exercises on Statistical learning</p>	
	Total 45
<p>OUTCOMES</p> <ul style="list-style-type: none"> ● Apply the search techniques to real–time problems. ● Apply the reasoning techniques to real world problems. ● Demonstrate the understanding of representation of knowledge. ● Demonstrate the understanding of learning techniques. ● Apply AI techniques in developing real world applications. 	
REFERENCES	

1. Stuart J. Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", Third Edition, Pearson Education, 2015.
2. Elaine Rich, Kevin Knight, Shivashankar B. Nair, "Artificial Intelligence", Third Edition, Tata McGraw-Hill, 2008.
3. Dheepak Khemani, "A First Course in Artificial Intelligence", McGraw-Hill, 2013.
4. NPTEL Artificial Intelligence Course by Prof. Dasgupta – <http://nptel.ac.in/courses/106105079/2>
5. Sebastian Thrun, Peter Norvig, Udacity: Introduction to Artificial Intelligence, <https://in.udacity.com/course/intro-to-artificial-intelligence—cs271>

		MEDIA SECURITY			
		L	T	P	C
		3	0	0	3
OBJECTIVES					
<ul style="list-style-type: none"> ● To understand the cryptanalysis on standard algorithms meant for confidentiality, integrity and authenticity. ● To know about the Digital rights management. ● To know about the concepts of Digital Watermarking techniques. ● To understand the concept of Steganography ● To learn the privacy preserving techniques on Multimedia data. 					
UNIT I CRYPTANALYSIS AND DIGITAL RIGHTS MANAGEMENT					9
Cryptanalysis Techniques – Encryption Evaluation metrics – Histogram Deviation - Introduction to DRM – DRM Products – DRM Laws					
Suggested Activities:					
<ul style="list-style-type: none"> ● External learning - cryptanalysis for algorithms such as AES, RSA. ● Analysis for DRM products. 					
Suggested Evaluation Methods:					
<ul style="list-style-type: none"> ● Group discussion on linear and differential cryptanalysis of cryptographic algorithms. ● Tutorial on DRM products. 					
UNIT II DIGITAL WATERMARKING BASICS					9

Introduction – Basics Models of Watermarking – Basic Message Coding – Error Correction coding – Mutual Information and Channel Capacity – Designing a Good Digital Watermark – Information Theoretical Analysis of Digital Watermarking.

Suggested Activities:

- Problems on Error Correction Coding.
- Designing a good watermark.

Suggested Evaluation Methods:

- Assignment on ECC.
- Tutorial on DRM products.

UNIT III DIGITAL WATERMARKING SCHEMES AND PROTOCOLS

9

Spread Spectrum Watermarking – Block DCT-domain Watermarking – Watermarking with Side Information – Dirty-paper Coding – Quantization Watermarking – buyer Seller Watermarking Protocol – Media Specific Digital Watermarking: Image WM, Video WM , Audio WM– Watermarking for CG-Models: Watermarking for Binary Images and 3D Contents – Data Hiding Through Watermarking Techniques.

Suggested Activities:

- Implementation of buyer seller watermarking protocol.
- Analyzing the performance of different media specific WM and WM for CG models.

Suggested Evaluation Methods:

- Tutorial - Media specific watermarking techniques.
- Group discussion on the performance evaluation of watermarking techniques.

UNIT IV STEGANOGRAPHY AND STEGANALYSIS

9

Stenographic Communication – Notation and Terminology – Information –Theoretic Foundations of Steganography – Cachin’s Definition of Steganographic Security – Statistics Preserving Steganography – Model-Based Steganography – Masking Embedding as Natural Processing – Minimizing the Embedding Impact – Matrix Embedding –Nonshared Selection Rule – Steganalysis Algorithms: LSB Embedding and the Histogram Attack – Sample Pairs Analysis.

Suggested Activities:

- An application development using Steganography.

Suggested Evaluation Methods:

- Project.

UNIT V MULTIMEDIA ENCRYPTION

9

Multimedia Processing in the Encryption Domain – Information Processing – Data Sanitization – Finger Printing – Digital Forensics: Intrusive and Non- Intrusive –Forgeries Detection– Privacy Preserving – Surveillance.

Suggested Activities:

- Case study on forensic data.
- Case study on forgery detection.

Suggested Evaluation Methods:

- Group discussion on case studies.

Outcomes

- Analyze the security algorithms required by any computing system.
- Identify the security challenges and issues that may arise in any system.
- Implement the concepts of steganography, digital watermarking techniques,etc.
- Design secure applications using steganography and water marking schemes
- Apply concepts on digital rights management while developing secure systems
- Design any secure system by preserving the privacy.

Total 45

References

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3. Douglas R. Stinson, “Cryptography Theory and Practice”, Third Edition, Chapman & Hall/ CRC,2006
4. Wenbo Mao, “Modern Cryptography – Theory and Practice”, Pearson Education, 2006.
5. Ingemar Cox, Matthew Miller, Jeffrey Bloom, Jessica Fridrich and TonKalker, “Digital Watermarking and Steganography”, Second Edition, Elsevier, 2007.

SOCIAL MEDIA WEB ANALYTICS			L	T	P	C	
			3	0	0	3	
OBJECTIVES							
To showcase the opportunities that exist today to leverage the power of the web and social media							
UNIT - I INTRODUCTION						9	
Evolution of online communities - History and Evolution of Social Media- Social Media vs. traditional media - Social Media Audience and Goals for using Social Media - Understanding Social Media: Strong and weak ties – Influencers - How ideas travel – Viralness - Social theory and social media - technological determinism in popular discourse on social media technologies.							
UNIT - II COMMUNITY BUILDING AND MANAGEMENT						9	
Science of Social Media - Keys to Community Building - Promoting Social Media Pages- Linking Social Media Accounts-The Viral Impact of Social Media-Digital PR-Encourage Positive Chatter in Social Media - Identity in social media: formation of identities, communities, activist movements, and consumer markets - Social Media as business.							
UNIT - III SOCIAL MEDIA POLICIES AND MEASUREMENTS						9	
Social Media Policies-Etiquette, Privacy- ethical problems posed by emerging social media technologies - The road ahead in social media- The Basics of Tracking Social Media - social media analytics- Insights Gained From Social Media- Customized Campaign Performance Reports - Observations of social media use.							
UNIT - VI WEB ANALYTICS						9	
Web Analytics - Present and Future, Data Collection - Importance and Options, Overview of Qualitative Analysis, Business Analysis, KPI and Planning, Critical Components of a Successful Web Analytics Strategy, Web Analytics Fundamentals, Concepts, Proposals & Reports, Web Data Analysis.							
UNIT - V SEARCH ANALYTICS						9	
Search engine optimization (SEO), non-linear media consumption, user engagement, user generated content, web traffic analysis, navigation, usability, eye tracking, online security, online ethics, content management system, data visualization, RSS feeds, Mobile platforms, User centered design, Understanding search behaviors.							
						Total	45
OUTCOMES							
<ul style="list-style-type: none"> • Evaluate social media messaging and data. • Apply aspects of social media monitoring to business decisions. • Evaluate and judge social media contributions. • Examine multiple social media metrics to monitor and identify deviations from typical social media activity. • Use the resulting insights to support website design decisions, campaign optimization, search analytics. 							
REFERENCES							

1. K. M. Shrivastava, Social Media in Business and Governance, Sterling Publishers Private Limited,2013
2. Christian Fuchs, Social Media a critical introduction, SAGE Publications Ltd,2014
3. Bittu Kumar, Social Networking, V & S Publishers,2013
4. Avinash Kaushik, Web Analytics - An Hour a Day, Wiley Publishing,2007
5. T. Peterson, Web Analytics Demystified, Celilo Group Media and Café Press,2004
6. TakeshiMoriguchi, Web Analytics Consultant Official Textbook, 7th Edition, 2016

EDUCATIONAL MANAGEMENT INFORMATION SYSTEM		L	T	P	C
		3	0	0	3
OBJECTIVES					
<ul style="list-style-type: none"> ● To explain about the Concept of educational information system ● To analyze the different data of educational information system ● To discuss the activities of educational transformation ● To explain the research issues educational management ● To discuss about the different educational application management 					
UNIT - I INFORMATION SYSTEM					9
Information System – Computer Based Information System – Business Information System – Ethical and societal issues – Data center – Green Computing – Software issues and trends – Utility Programs					
UNIT - II DATABASE SYSTEMS AND BIG DATA					9
Data fundamentals - Data Modelling and Database Characteristics – Student data- Teacher data – Institutional data - Relational Database Management Systems - Big Data - Characteristics of Big Data - Sources of Big Data - Big Data Uses - Challenges of Big Data - Data Management - Technologies Used to Process Big Data - Data Warehouses, Data Marts, and Data Lakes - NoSQL Databases – Hadoop - In-Memory Databases					
UNIT - III INSTITUTIONAL TRANSFORMATION					9
Introduction to Institutional Transformation and Educational Management – Theories of Leadership – styles and measurement of leadership - ERP for institutional transformation - Gender and Education management – e-school effectiveness and improvement					
UNIT - IV RESEARCH IN EDUCATIONAL MANAGEMENT					9
Aspect of educational management, planning, organizing and controlling human resources management, conflict management and time management Educational Administration, Leadership and Management					
UNIT - V EDUCATIONAL APPLICATIONS AND MANAGEMENT					9

Application of Educational Management in Academic Areas - Application of Educational Management in Administrative Areas - Quality Management in Education: Challenges - Total Quality Management - Quality Improvement Issues in Higher Education - Professional Learning Community (PLC) in Education	
Total	45
OUTCOMES	
<ul style="list-style-type: none"> ● To compare different information system with respect to operating environment ● To use different kind of data collected from the educational environment and process it ● To plan for the institutional transformation to achieve the vision of the institute ● To work on the collaborative research projects in the institutional level ● To design educational applications to use at the institutional level 	
REFERENCES	
<ol style="list-style-type: none"> 1. E-book on EDUCATIONAL MANAGEMENT, USI PUBLICATIONS, 2012 2. The principle of educational leadership and management, sage publications, 2nd Edition, 2009 3. E-book on Fundamentals of Information system, Ralph M. Stair, George W. Reynolds 8th Edition, 2016 4. E- Book on Principles of Information system, Ralph M. Stair, George W. Reynolds, 13th Edition, 2018 	

HUMAN COMPUTER INTERACTION TECHNIQUES		L	T	P	C
		3	0	0	3
OBJECTIVES					
<ul style="list-style-type: none"> ● To learn the principles and fundamentals of HCI. ● To understand components of interfaces and screens, including windows, menus and controls. ● To understand user interface design principles, and apply them to designing an interface. ● To learn user interface designs through usability inspection and user models. ● To understand the rationale and guidelines for an effective interface design methodology. 					
UNIT - I DESIGN PROCESS					9

Humans – Information Process – Computer – Information Process – Differences and Similarities between them – Need for Interaction – Framework and HCI – Models – Ergonomics – Style – Context – Paradigms – Designing of Interactive systems – Design rules: Golden Rules and Heuristics- Usability – Paradigm Shift – Interaction Design Basics – Design Process – Scenarios – Users need – Complexity of Design – Design Alternatives and Selection.

Suggested Activities:

- Flipped classroom on knowledge on the HCI design process.
- External learning – Exploration of various human computer interfaces.

Suggested Evaluation Methods:

- Tutorials – HCI design process.
- Assignment on comparison of various interfaces.

UNIT - II DESIGN AND EVALUATION OF INTERACTIVE SYSTEMS

9

Software Process – Usability Engineering – Issue Based Information Systems – Iterative Design Practices – Design Rules – Maximum Usability – Principles – Standards and Guidelines – Design Patterns – Programming Tools – Windowing Systems – Interaction Tool Kit – Interaction Devices – Layouts – Fragments – Widgets – Views – Adapters – Interaction styles – Direct Manipulation and Virtual Environments – Menu Selection – Form Fill – Dialog Boxes – Command and Natural Languages – User Interface Management System – Prototype Development– Evaluation Techniques – Evaluation Design – Evaluating Implementations – Observational Methods- Evaluation Strategies.

Suggested Activities:

- Flipped classroom on designing a good User Interface system based on design rules.
- External learning – Techniques related to evaluation of HCI design.

Suggested Evaluation Methods:

- Tutorial – Usage of design rules to create interfaces.
- Assignment on applying evaluation techniques on different user interfaces.

UNIT - III COMMUNICATION MODELS

9

Universal Design Principles – Multimodal Systems – User Support – Presentation and Implementation Issues – Types – Requirements – Approaches – Task Models – Task Analysis and Design – Face to Face Communication – Conversation – Text Based Communication – Group Working.

Suggested Activities:

- Flipped classroom on basic knowledge of various models used in HCI design.
- External learning – Design and implementation of various models used in HCI design.

Suggested Evaluation Methods:

- Tutorial – Task models.
- Assignment on dialog models and task models.

UNIT - IV EXPERIMENTAL DESIGN AND STATISTICAL ANALYSIS OF HCI	9
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Basic Design Structure – Single Independent Variable – Multiple Independent Variable – Factorial Design – Split-plot Design – Random Errors – Experimental Procedure – Statistical Analysis – T tests – Analysis of Variance Test – Regression – Chi-Square Test – Survey – Probabilistic Sampling – Non-probabilistic Sampling – Developing Survey Questions.

Suggested Activities:

- Flipped classroom on basic concepts of probability and statistics.
- External learning – Practical problems related to hypothesis testing.

Suggested Evaluation Methods:

- Tutorial – Statistical testing related to UI evaluation parameters.
- Assignment on problems on hypothesis testing for UI parameters.

UNIT - V DIALOGUE AND CURRENT TRENDS	9
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Dialogue Notations and Design – Dialogue Need – Dialogue Design Notations – Graphical – Textual – Representing Dialogue – Formal Descriptions – Dialogue Analysis – System Models – Interaction Models – Relationship with Dialogue – Formalisms – Formal Notations

Interstitial Behavior – Virtual Reality – Devices for Virtual Reality and 3D Interaction – Modeling Rich Interaction – Status Event Analysis – Properties – Rich Contexts – Sensor- Based systems – Groupware – Applications – Ubiquitous Computing – Applications – HCI for Smart Environment – HCI for Scientific Applications, Medical Applications – HCI for Assistive Technology.

Suggested Activities:

- Flipped classroom on basic concepts of dialogue notations and design.
- External learning – Study of how Virtual Reality interface are used in various real time applications.

Suggested Evaluation Methods:

- Tutorial – Recent trends in human computer interface systems.
- Assignment on dialogue notation representation for various interfaces.

Total 45

OUTCOMES

1. Interpret the contributions of human factors and technical constraints on human-computer interaction.
2. Evaluate the role of current HCI theories in the design of software.
3. Design and develop interfaces related to real applications.
4. Apply exploratory and experimental research methods in HCI.
5. Familiarize with principles and guidelines of user centered interface design process, evaluation methodologies and tools to analyze the interfaces.
6. Implement human computer interfaces for different applications using various tools and technologies.

REFERENCES

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", Third Edition, Prentice Hall, 2004.
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3. Jonathan Lazar, Heidi Feng, Harry Hochheiser, "Research Methods in Human-Computer Interaction", Wiley, 2010.
4. Ben Shneiderman, Catherine Plaisant, "Designing the User Interface: Strategies for Effective Human-Computer Interaction", Fifth Edition, Reading, Addison Wesley, 2009.
5. Jeff Johnson, "Designing with the Mind in Mind: Simple Guide to Understanding User Interface Design Rules", Morgan Kaufman, 2010.

VISUALIZATION TECHNIQUES		L	T	P	C
		3	0	0	3
OBJECTIVES					
<ul style="list-style-type: none"> • To understand the fundamentals of data visualization. • To know the working principles of various information visualization tools. • To acquire knowledge about the issues in data representation. • To visualize the complex engineering design. • To gain skill in designing real time interactive information visualization system. 					
UNIT - I INTRODUCTION					9
Introduction – Visualization Stages – Computational Support – Issues – Different Types of Tasks – Data representation – Limitation: Display Space, Rendering Time, Navigation Link.					
Suggested Activities:					
<ul style="list-style-type: none"> • Blended Learning - Displaying Different types visualization images. • Flipped classroom on task of representing information. • External learning - Problems related to acquiring data. 					
Suggested Evaluation Methods:					
<ul style="list-style-type: none"> • Tutorial - Different data visualizing images. • Assignment on different data acquiring methods. • Quizzes on issues and solutions in different visualization applications. 					
UNIT - II DATA REPRESENTATION					9

Human Factors – Foundation for a Science of Data Visualization – Environment- Optics – Optimal Display – Overview about Lightness, Brightness, Contrast, Constancy, Color –Visual Attention that Pops Out – Types of Data – Data Complexity – The Encoding of Values – Encoding of Relation – Relation and Connection – Alternative Canvass.

Suggested Activities:

- Blended learning - Human Visual and Auditory System.
- Flipped classroom on color formats.
- External learning - Survey on different human computer interaction and types of user interface.

Suggested Evaluation Methods:

- Assignment on human visual and auditory system.
- Quizzes on various color format.
- Assignment on human computer interaction user interface.

Unit - III DATA PRESENTATION

9

Human Vision – Space Limitation – Time Limitations – Design – Exploration of Complex Information Space – Figure Caption in Visual Interface – Visual Objects and Data Objects – Space Perception and Data in Space – Images, Narrative and Gestures for Explanation.

Suggested Activities:

- Blended learning - Drawing Charts for display.
- Flipped classroom on various presentation techniques.
- External learning - Different font and font styles, symbols and Gesture representation.

Suggested Evaluation Methods:

- Assignment on chart preparation.
- Tutorial - Various presentation techniques.
- Assignment on gesture presentation.

UNIT - IV INTERACTION AND DESIGN

9

Norman's Action Cycle – Interacting with Visualization – Interaction for Information Visualization – Interaction for Navigation – Interaction with Models – Interacting with Visualization – Interactive 3D Illustrations with Images and Text – Personal View – Attitude – user perspective – Convergence – Sketching – Evaluation.

Suggested Activities:

- Flipped classroom on various interacting Techniques.
- External learning - Interaction facilities and high level support for animation design.

Suggested Evaluation Methods:

- Tutorial - Interaction models.
- Assignment on animation design.

UNIT - V CURRENT TRENDS

9

Design – Virtual Reality: Interactive Medical Application – Tactile Maps for visually challenged People – Animation Design for Simulation – Integrating Spatial and Nonspatial Data – Innovating the Interaction – Small Interactive Calendars – Selecting One from Many – Web Browsing Through a Key Hole – Communication Analysis – Archival Galaxies.

Suggested Activities:

- Flipped classroom on implementation of virtual reality environment.
- Mini project for designing and implementing a innovative interfaces.

Suggested Evaluation Methods:

- Demonstration of the mini project.
- Tutorial - Virtual reality application.

Total 45

OUTCOMES

- Apply mathematics and basic science knowledge for designing information visualizing System.
- Collect data ethically and solve engineering problem in visualizing the information.
- Implement algorithms and techniques for interactive information visualization.
- Conduct experiments by applying various modern visualization tool and solve the space layout problem.
- Analyze and design system to visualize multidisciplinary multivariate Data individually or in teams.
- Develop a cost effective and a scale able information visualization system.

REFERENCES

1. Robert Spence, "Information Visualization: An Introduction", Third Edition, Pearson Education, 2014.
2. Colin Ware, "Information Visualization Perception for Design", Third Edition, Morgan Kaufmann, 2012.
3. Robert Spence, "Information Visualization Design for Interaction", Second Edition, Pearson Education, 2006.
4. Thomas Strothotte, "Computational Visualization: Graphics, Abstraction and Interactivity", Springer, 1998.
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6. Joerg Osarek, "Virtual Reality Analytics", Gordon's Arcade, 2016.

		SOUND ENGINEERING			
		L	T	P	C
		3	0	0	3
OBJECTIVES					
<ul style="list-style-type: none"> ● To make students aware of the basic principles of sound. ● To learn about sound production and hearing. ● To learn about designing sound techniques. ● To know about Studio environment. ● To know about Surround Sound. 					
UNIT - I PRINCIPLES OF SOUND					9
<p>Sound production – Characteristics of Sound – Compression & Rarefaction – Velocity, Amplitude and Phase – Loudness – Microphones – Types of Microphones – Microphone Selection and Use.</p> <p>Suggested Activities:</p> <ul style="list-style-type: none"> ● Flipped classroom on human speech production and voice box of human. ● External learning - Physical & psychological properties of sound, microphones and its types. ● Assignment on numerical problems in computing sound parameters. <p>Suggested Evaluation Methods:</p> <ol style="list-style-type: none"> 2. Tutorial - Sound characteristics. 3. Assignments on computation of phase, amplitude and loudness of sound. 4. Quizzes on sound properties. 					
UNIT - II LISTENING SOUND					9

Human Ear – Frequency and Human Hearing – Timbre and Sound Envelope – Analytical & Critical Listening – Dynamic Range – Acoustics & Psycho Acoustics of Sound – Binaural Hearing – Mono & Stereo effects – Direct & Reflected Sound – Reverberation and Echo Effect.

Suggested Activities:

- Flipped classroom on human auditory mechanisms, stereo sound.
- External learning - Binaural and stereo recording techniques, sound effects.
- Assignment on numerical problems in stereo signals.

Suggested Evaluation Methods:

- Tutorial - Sound acoustics.
- Assignments on mono and stereo sound.
- Quizzes on human auditory mechanisms.

UNIT - III DESIGNING SOUND

9

The Roles and Responsibilities of a Sound Designer – Elements of Sound – Perception of Various Sounds – Designing of Sound – Functions of Sound with Respect to Dialogue – Sound Aesthetics – Music Instruments – Music Production.

Suggested Activities:

- Flipped classroom on perception of sound.
- External learning - MIDI formats, music synthesis.
- Assignment on numerical problems in music signals processing.

Suggested Evaluation Methods:

- Tutorial - Audio perception.
- Assignments on sound design.
- Quizzes on music processing.

UNIT - IV STUDIO MANAGEMENT

9

Studio and Live Mixing Speech – Studio Management: Equipment Management – Transmission & Reception – Studio Operations – Studio Layout & Design – The Sound Control Room – The Sound Recording Room – Station Management.

Suggested Activities:

- Flipped classroom on sound mixing
- External learning - Studio instruments, studio layout and design

Suggested Evaluation Methods:

- Quizzes on studio equipment.
- Quizzes on studio management.

UNIT - V SURROUND SOUND

9

Principles of Loudspeaker – Types of Loudspeakers – Stereo, Two–Channel Signal Formats and Microphone techniques, Binaural Recording and Dummy Head Techniques, Surround Sound – Three Channel Stereo, Four Channel Surround, 5.1 Channel Surround, and Other Multichannel Configurations. Surround Sound Systems, Matrix Surround Sound Systems, Dolby Digital, DTS, and Ambisonics.

Suggested Activities:

- Flipped classroom on loudspeakers and its types.
- External learning - Survey of cinematic sound systems, layout and design of home theater.

Suggested Evaluation Methods

- Quizzes on types of loudspeakers and microphones.
- Quizzes on surround sound.

Total	45
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OUTCOMES

- Have knowledge about basics of sound.
- Know about the auditory mechanisms.
- Know about studio management.
- Compose a music using tools.
- Know about studio equipment and design.
- Know about surround sound.

REFERENCES

1. David Miles Huber, Robert E. Runstein, “Modern Recording Techniques”, Eighth Edition, Focal Press,2013.
2. Francis Rumsay, Tim McCormik, “Sound and Recording”, Sixth Edition, Focal press, 2009.

		VIDEO PROCESSING AND ANALYTICS			
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OBJECTIVES					
<ul style="list-style-type: none"> • To understand a better knowledge about videos representation and its formats • To know the fundamental concepts of data science and analytics • To explain the video processing for analytics • To understand the data analytics for processing video content • To expose the student to emerging trends in video analytics 					
UNIT - I VIDEO FUNDAMENTALS					9
<p>Basic Concepts and Terminology – Analog Video Standards – Digital Video Basics – Analog-to Digital Conversion – Color Representation and Chroma Sub Sampling – Video Sampling Rate and Standards Conversion – Digital Video Formats –Video Features – Colour, Shape and Textural Features.</p> <p>Suggested Activities</p> <ul style="list-style-type: none"> • In class activity – Numerical problems related to sampling and standards conversion. • Flipped classroom – Discussion on video features. <p>Suggested Evaluation Methods</p> <ul style="list-style-type: none"> • Online quiz on video features. • Assignments on sampling and standards conversion. 					
UNIT - II MOTION ESTIMATION AND VIDEO SEGMENTATION					9
<p>Fundamentals of Motion Estimation – Optical Flow – 2D and 3D Motion Estimation – Block Based Point Correspondences – Gradient Based Intensity Matching – Feature Matching – Frequency Domain Motion Estimation – Video Segmentation.</p> <p>Suggested Activities</p> <ul style="list-style-type: none"> • In-class activity – Numerical problems related to motion estimation. • External learning – Survey on optical flow techniques. <p>Suggested Evaluation Methods</p> <ul style="list-style-type: none"> • Online quiz on optical flow techniques. • Assignments on numerical problems in motion estimation. 					
UNIT - III FUNDAMENTAL DATA ANALYSIS					9

Exploratory Data Analysis – Collection of Data – Graphical Presentation of Data – Classification of Data – Storage and Retrieval of Data – Big Data – Challenges of Conventional Systems – Web Data – Evolution of Analytic Scalability – Analytic Processes and Tools – Analysis vs. Reporting.

Suggested Activities

- In class activity – Graphical presentation of data for visualization.
- External learning – Survey on Modern Data Analytic Tools.

Suggested Evaluation Methods

- Quiz on modern data analytic tools.
- Assignments on data visualization.

UNIT - IV MINING DATA STREAMS AND VIDEO ANALYTICS

9

Introduction to Streams Concepts – Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Analytic Processes and Tools – Video shot boundary detection – Model Based Annotation and Video Mining – Video Database – Video Categorization – Video Query Categorization.

Suggested Activities

- Flipped classroom on discussion on automatic video trailer generation.
- External learning – Survey on analytic processes and tools.

Suggested Evaluation Methods

- Quiz on video trailer generation.
- Assignments on analytic processes and tools.

UNIT - V EMERGING TRENDS

9

Affective Video Content Analysis – Parsing a Video into Semantic Segments – Video Indexing and Abstraction for Retrievals – Automatic Video Trailer Generation – Video In painting – Forensic Video Analysis.

Suggested Activities

- External learning – Survey on Affective Video Content Analysis.
- Flipped classroom on discussion on forensic video analysis.

Suggested Evaluation Methods

- Online quiz on forensic video analysis.
- Assignments on affective video content analysis.
- Compare the video features extracted from a given video dataset using graphical representation.

Total 45

OUTCOMES

- Discuss video processing fundamentals
- Analyze video features for segmentation purpose
- Derive numeric problems related to motion estimation
- Process video streams for analytics purpose
- Parse and index video segments
- Design applications for video analytics in current trend

REFERENCES

1. Roy, A., Dixit, R., Naskar, R., Chakraborty, R.S., "Digital Image Forensics: Theory and Implementation", Springer, 2018.
2. Paul Kinley, "Data Analytics for Beginners: Basic Guide to Master Data Analytics", CreateSpace Independent Publishing Platform, 2016.
3. Henrique C. M. Andrade, Bugra Gedik, Deepak S. Turaga, "Fundamentals of Stream Processing: Application Design, Systems, and Analytics", Cambridge University Press, 2014.
4. A. Murat Tekalp, "Digital Video Processing" Second Edition, Prentice Hall, 2015.
5. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley, 2014.
6. Oges Marques, "Practical Image and Video Processing Using MATLAB", Wiley-IEEE Press, 2011.