CXT 332	MULTIMEDIA TECHNOLOGIES	Category	L	T	P	Credits	Year of Introduction
		PEC	2	1	0	3	2021

Preamble:

This course helps the learner to study the relevance and underlying infrastructure of multimedia systems. It also enables the students to apply contemporary theories of multimedia learning to the development of multimedia products.

Prerequisite: NIL

Course Outcomes: After the completion of the course the student will be able to

CO#	Course Outcomes
CO1	Describe the basic concepts of multimedia data representations, color models, audio and video signals and different compression techniques. **(Cognitive Knowledge Level: Understand)**
CO2	Apply the knowledge of various compression algorithms for developing multimedia applications. **(Cognitive Knowledge Level: Apply)**
CO3	Summarize the image compression standards, audio and video compression techniques. (**Cognitive Knowledge Level: Understand)**
CO4	Discuss the concepts of content-based image retrieval. **(Cognitive Knowledge Level: Understand)**
CO5	Describe the concept of cloud computing and its application in multimedia technologies. **(Cognitive Knowledge Level: Understand)**

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	✓	✓										✓
CO 2	✓	✓	✓		✓							✓
CO 3	✓	✓										✓
CO 4	✓	✓										✓
CO 5	✓	✓										✓

Abstract POs Defined by National Board of Accreditation			
PO#	**Broad PO**	**PO#**	**Broad PO**
PO1	Engineering Knowledge	**PO7**	Environment and Sustainability
PO2	Problem Analysis	**PO8**	Ethics
PO3	Design/Development of solutions	**PO9**	Individual and team work
PO4	Conduct investigations of complex problems	**PO10**	Communication
PO5	Modern tool usage	**PO11**	Project Management and Finance
PO6	The Engineer and Society	**PO12**	Lifelong learning

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination Marks (%)
	Test 1 (%)	Test 2 (%)	
Remember	30	30	30
Understand	50	50	50
Apply	20	20	20

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3

Continuous Internal Evaluation Pattern:

Attendance	**10 marks**
Continuous Assessment Tests (Average of Series Tests 1 & 2)	**25 marks**
Continuous Assessment Assignment	**15 marks**

Internal Examination Pattern:

Each of the two internal examinations has to be conducted out of 50 marks. The first series test shall be preferably conducted after completing the first half of the syllabus and the second series test shall be preferably conducted after completing the remaining part of the syllabus. There will be two parts: Part A and Part B. Part A contains 5 questions (preferably, 2 questions each from the completed modules and 1 question from the partly completed module), having 3 marks for each question adding up to 15 marks for part A. Students should answer all questions from Part A. Part B contains 7 questions (preferably, 3 questions each from the completed modules and 1 question from the partly completed module), each with 7 marks. Out of the 7 questions, a student should answer any 5.

End Semester Examination Pattern:

There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 full questions from each module of which students should answer any one. Each question can have a maximum 2 subdivisions and carries 14 marks.

Syllabus

Module 1

Multimedia Basics: Multimedia, Hypermedia, WWW, Internet, Multimedia Software, Editing and Authoring Tools.
Graphics and Image Data Representation— Graphics/Image Data Types, Popular File Formats. Color in Image - Color Science, Color Models in Images.
Concepts in Digital Video-Digital Video.

Module 2

Basics of Digital Audio—Digitization of Sound, Musical Instrument Digital Interface (MIDI).
Lossless Compression Algorithms— Introduction, Basics of Information Theory, Run-Length Coding, Variable-Length Coding, Dictionary-Based Coding, Arithmetic Coding, Lossless Image Compression.

Module 3

Lossy Compression Algorithms - Distortion Measures, The Rate- Distortion Theory, Quantization, Transform Coding, Wavelet-Based Coding, Wavelet Packets.
Image Compression Standards— JPEG, JPEG2000, JPEG-LS, Bi-level Image Compression Standards.
Audio Compression Techniques-— ADPCM in Speech Coding, Vocoders, Psychoacoustics, MPEG Audio.

Module 4

Basic Video Compression Techniques - Introduction to Video Compression, Video Compression Based on Motion Compensation, MPEG-1-Video Bitstream, MPEG-2- Supporting Interlaced Video, MPEG-4 - Overview, MPEG-7- Introduction.
Content-Based Retrieval in Digital Libraries- Image Retrieval, CBIRD: A Case Study, Quantifying Search Results, Querying on Videos.

Module 5

Cloud Computing for Multimedia Services - Cloud Computing Overview, Multimedia Cloud Computing, Cloud Assisted Media Sharing, Computation Offloading for Multimedia Services, Interactive Cloud Gaming.

Text Book

1. Ze-Nian Li and M. S. Drew, Fundamental *of Multimedia.*, Pearson Education,2004

References

1. K. R. Rao, Zoran S. Bojkovic, D. A. Milovanovic, Introduction *to Multimedia Communications.*, Wiley.
2. V. S. Subrahmanian,. Principles *of Multimedia Database Systems.*,

   Morgan Kaufmann Publishers.

3. R. Steinmetz and K. Nahrstedt,. Multimedia*: Computing, Communication & Applications.*, Pearson Education.
4. John F.Koegel Buford, .*Multimedia Systems.*, Pearson Education.
5. Prabhat K. Andheigh, Kiran Thakrar, *Multimedia Systems design.*, Prentice Hall PTR.
6. Jerry D. Gibson,. Multimedia *Communications: Directions and Innovations*., Elsevier Science.

Course level assessment questions

Course outcome 1 (CO1):

1. Discuss the relation between multimedia and hypermedia.
2. The Pitch Bend opcode in MIDI is followed by two data bytes specifying how the control is to be altered. How many bits of accuracy does this amount of data correspond to? Why?

Course outcome 2 (CO2):

1. Work out the details of the encoder and decoder for adaptive arithmetic coding when the input symbols are 01111.
2. What are the advantages and disadvantages of arithmetic coding as compared to Huffman coding?
3. Assume we have an unbounded source we wish to quantize using an M-bit midtread uniform quantizer. Derive an expression for the total distortion if the step size is 1.

Course outcome 3 (CO3):

1. Could we use wavelet-based compression in ordinary JPEG? How?
2. Draw block diagrams for an MPEG-2 encoder and decoder for (a) SNR and spatial hybrid scalability, (b) SNR and temporal hybrid scalability.
3. What is the compression ratio of MPEG audio if stereo audio sampled with 16 bits per sample at 48 kHz is reduced to a bitstream of 256 kbps?

Course outcome 4 (CO4):

1. What is the need of content-based image retrieval?
2. How can you evaluate the performance of image search engines?

Course outcome 5 (CO5):

1. Differentiate between public and private cloud computing.
2. How does cloud help in live media streaming service?
3. Explain the modules and their relations in multimedia cloud computing.
4. What are the different requirements for computation offloading?
5. Explain different cloud service models.

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SIXTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: CXT332

Course Name: Multimedia Technologies

Max Marks :100 **Duration: 3 Hrs.**

PART A

(Answer all Questions. Each question carries 3 Marks)

1. Differentiate between multimedia & hypermedia.
2. What are the different types of tweening?
3. Explain about MIDI.
4. Mention the models used in lossless compression schemes.
5. State the rate- distortion theory.
6. Explain the need of vocoders.
7. What is the need of content-based image retrieval?
8. Draw the architecture for the layers of MPEG-1 video bit streams.
9. Differentiate between public and private cloud computing.
10. How does cloud help in live media streaming service?

(10x3=30)

Part B

(Answer any one question from each module. Each question carries 14 Marks)

11. a) Illustrate the different multimedia software & tools. (8)
    b) Explain about various color models. (6)

OR

12. Explain in detail the different image data types? (14)
13. Explain
    a) Variable length coding (7)
    b) Arithmetic coding. (7)

OR

14. a) Describe vector quantization theory. Discuss its merits over scalar quantization. (8)
    b) Explain the different techniques for digitization of sound. (6)

15. a) Describe the various steps of the JPEG compression process. (7)

b) Enumerate the difference between JPEG and JBIG standards. (7)

OR

16. a) Explain Bi-level image compression standards. (8)

b) Differentiate between uniform and non-uniform scalar quantization. (6)

17. a) Illustrate Similarity- Based Retrieval with example. (8)

b) How can you evaluate the performance of image search engines? (6)

OR

18. Outline the key features of the following

a) MPEG-2 (7)

b) MPEG-4 (7)

19. a) Explain different cloud service models. (8)

b) What are the different requirements for computation offloading? (6)

OR

20. a) Explain the modules and their relations in multimedia cloud computing. (8)

b) What are the issues and challenges of cloud gaming? (6)

(5 x 14 = 70)

Teaching Plan

No	Contents	No of Lecture37 Hrs
	Module 1 (6 hours)	
1.1	Multimedia Basics - Multimedia, Hypermedia, WWW, Internet.	1
1.2	Multimedia Software, Editing and Authoring Tools.	1
1.3	Graphics/Image Data Types, Popular File Formats.	1
1.4	Color Science.	1
1.5	Color Models in Images.	1
1.6	Concepts in Digital Video.	1
	Module 2 (9 hours)	
2.1	Digitization of Sound.	1
2.2	Musical Instrument Digital Interface(MIDI).	1
2.3	Lossless Compression Algorithms— Introduction.	1
2.4	Basics of Information Theory.	1
2.5	Run-Length Coding.	1
2.6	Variable-Length Coding.	
2.7	Dictionary-Based Coding,	1
2.8	Arithmetic Coding	
2.9	Lossless Image Compression.	1

Module 3 (8 hours)		
3.1	Lossy Compression Algorithms - Distortion Measures, The Rate- Distortion Theory.	1
3.2	Quantization, Transform Coding.	1
3.3	Wavelet-Based Coding, Wavelet Packets.	1
3.4	Image Compression Standards— JPEG, JPEG2000.	1
3.5	JPEG-LS, Bi-level image compression standards.	1
3.6	Audio Compression Techniques-—ADPCM in Speech Coding	1
3.7	Vocoders, Psychoacoustics.	1
3.8	MPEG Audio.	1
Module 4 (8 hours)		
4.1	Basic Video Compression Techniques - Introduction to Video Compression.	1
4.2	Video Compression Based on Motion Compensation.	
4.3	MPEG-1-Video Bitstream,MPEG-2- Supporting interlaced video.	1
4.4	MPEG-4 - Overview.	1
4.5	MPEG-7- Introduction.	1
4.6	Image Retrieval.	
4.7	CBIRD: A Case Study.	1
4.8	Quantifying Search Results, Querying on Videos.	1

Module 5 (6 hours)		
5.1	Cloud Computing Overview.	1
5.2	Multimedia Cloud Computing.	1
5.3	Cloud Assisted Media Sharing.	1
5.4	Computation Offloading -Requirements, Service Partitioning for Video Coding	1
5.5	Case Study: Cloud Assisted Motion Estimation	1
5.6	Interactive Cloud Gaming	1