SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology
Bachelor of Technology

B. Tech. Semester VII

Subject Name: **Video Processing** **Subject Code: BTEC14704**

Type of course: PEC

Prerequisite: Knowledge of Fourier Transform and Digital Signal and image Processing

Rational: This course provides basic concepts of digital video and video processing which is the core technology of the area of image processing and computer vision. Topics include digital video presentation, motion estimation/analysis, video conversion, video enhancement, video content analysis and recently issued new topics which helps students to apply this knowledge into recent and trendy approaches including sparse representation and deep learning. This course will strengthen fundamental knowledge about digital image and video processing techniques. Digital video processing is used in almost all engineering fields and a wide range of applications in industrial automation, medical, agriculture, security, entertainment, education and many more

Teaching and Examination Scheme:

Teaching Scheme				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	150
3	0	2	4	60	25	15	30	20	

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Content:

Sr. no.	Topics	Teaching Hrs.	Module % Weightage
1.	**Introduction** Basic Video Coding ,Digital Video Signals and Formats, Video sampling and Interpolation, Basic Linear filtering with applications to Image Enhancement, Computational models of Early Human vision	3	5
2.	**Motion Detection and Estimation:** Motion Detection , Hypothesis Testing with Fixed and Adaptive Threshold , MAP MRF Formulation , MAP Variation Formulation , Experimental Comparison of Motion Detection Methods, Motion Estimation, Motion Models, Estimation Criteria Practical Motion Estimation Algorithms, Global Motion Estimation , Block	7	15

	Matching, Phase Correlation , Optical Flow via Regularization , MAP Estimation of Dense Motion		
3.	**Video Enhancement and Restoration and quality measurement** Spatiotemporal Noise Filtering , Coding Artifact Reduction , Blotch Detection and Removal, Vinegar Syndrome Removal , Intensity Flicker Correction , Kinescope Moire Removal, Scratch Removal, Quality measurement methods, HVS Modelling based methods , Feature based methods (VQM) , Motion Modelling Based methods	7	15
4.	**Video Segmentation :** Scene Change Detection , Spatiotemporal Change Detection , Motion Segmentation Simultaneous Motion Estimation and Segmentation , Semantic Video Object Segmentation , Examples	6	15
5.	**Motion Tracking in Video :** Motion tracking method, Rigid Object Tracking(2D and 3D) , Articulated Object Tracking (2D and 3D), Method using Point Correspondences, Optical flow and Direct methods	5	10
6.	**Video Compression Techniques :** Entropy and Predictive coding, Block Transform Coding, Quantization, MC and Estimation Transform Coding.	6	15
7.	**Video Compression Standards :** MPEG-1 and MPEG-2 , Video structure and bit-stream, Video Input Resolution formats, Scalable coding , Data partitioning , Comparison of MPEG-1 and MPEG-2 MPEG-4 Visual and H.264/AVC: Standard for Modern Digital Video , High Efficiency Video Coding HEVC(H.265) , Object based Representation , Video Object coding , Mesh Object Coding , Model-based coding , Still Texture coding , Error Resilience	6	15
8.	**Applications of Video coding :** Video stabilization and Mosaicking, Unified framework for video indexing, Video retrieval , Video Surveillance.	5	10

Suggested Specification table with Marks (Theory/Practical):

% Distribution of Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
10	15	20	20	20	15

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **E:** Evaluate **C:** Create and above Levels **(Revised Bloom's Taxonomy)**

Note: This specification table shall be treated as a general guideline for students and teachers. The

actual distribution of marks in the question paper may vary slightly from above table.

Reference Text Books:

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1	Digital Image Processing	Rafael C. Gonzalez	Pearson	2018	5th
2	Digital Video Processing	Murat Tekalp	Pearson	2015	Latest
3	The essential guide to Video processing	Alan C. Bovik	Pearson	2018	2nd
4	Handbook of Image and Video Processing	Alan Bovik	Academic Press	2011	Latest
5	Video Processing and Communications	David Bull	Academic Press	2002	Latest
6	Practical Image & Video Processing using MATLAB	Oge Marques	IEEE press Wiley	2012	Latest
7	Digital Video Processing for Engineers: A Foundation for Embedded Systems Design	Michael Parker, Suhel Dhanani	Elsevier	2013	Latest

Course Outcome:

Sr. No.	CO Statement After learning this subject students will be able to	Marks % weightage
CO-1	Apply the concept of 2D and 3D model in Video Processing	10
CO-2	Explain the need of spatial and frequency domain techniques for Video compression.	20
CO-3	Comprehend different methods, models for video processing and motion estimation.	20
CO-4	Illustrate quantitative models of video segmentation.	15
CO-5	Apply knowledge in the area of intelligent video technology, with emphasis on representing, analyzing, compressing and processing video	20
CO-6	Develop new research frontier in selected topics of video processing in recent applications	15

Mapping with POs:

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

CO-3	2	3	3	3	2	3	2	2	2	2	2	-	2	3	3
CO-4	2	2	2	2	3	2	-	-	2	2	2	2	2	2	2
CO-5	2	3	3	3	2	3	2	2	2	2	2	-	2	3	3
CO-6	1	2	2	2	3	3	2	2	2	2	2	2	2	3	3

List of Practical:

1. Read, process, write (or save few frames) and play a video file.
2. Reading and playing video files in different formats.
3. Read, process and display YUV video data.
4. Convert aspect ratio of video.
5. Object Detection
6. Video enhancement and noise removal
7. Noise removal from video.
8. Video compression.

Major Equipment:

- Pynq board

List of Open Source Software:

- Python + associated libraries, OpenCV and Keras.