

Year: B. Tech III (Semester VI)

Subject Name: Machine Vision

Subject Code: BTCO14607

Type of course: Professional Elective II and III

Prerequisite (if any): Digital Image Processing, Python Programming

List of Courses where this course will be prerequisite: Computer Vision

Rationale: (should also include Description of the relevance of this course in the Program)

Teaching and Examination Scheme:

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

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.	Content	Total Hrs
1	Fundamentals of Image Processing : Image acquisition camera, imaging Transformation, Camera Transformation and Calibration, Spatial Domain processing	6
2	Segmentation: Fitting Lines. Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness Segmentation and Fitting Using Probabilistic Methods: Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice	12
3	Motion Segmentation: Optical flow, Simple tracking strategies: Detection, matching, Particle filtering	5
4	Object Recognition and Tracking Object recognition, Approaches to Object Recognition, Recognition by combination of views – objects with sharp edges, using two views only, using a single view, use of dept values, Tracking With Linear Dynamic Models: Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples.	12
5	Advanced Machine Vision: Convolutional Neural Networks architectures, Convolution and Pooling, training CNN, Data Augmentation and Transfer Learning, Recurrent Neural Networks, LSTM, GRU	7



6	Applications of Machine Vision : Visual Perception for Self-Driving Cars, Facial Expression Recognition, Recent trends in computational photography, Biometrics.	3
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Suggested Specification table with Marks (Theory): (For B.Tech only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	12	10	12	10	6

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and 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 Books:

Sr No	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication / Publication Edition
1	Computer and Machine Vision – Theory, Algorithms and Practicalities	E. R. Davies	Elsevier (Academic Press)	Latest Edition
2	Computer Vision – A Modern Approach	David A. Forsyth and Jean Ponce	PHI Learning	

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Understand fundamentals of building blocks of image processing	15%
CO-2	Evaluate various segmentation algorithm and solve real time problems	25%
CO-3	Create and analyze advanced machine vision based applications.	30%
CO-4	Understand and apply object recognition algorithms for developing real time machine vision based systems	30%

List of Open learning website:

List of Open Source Software:

FOR LAB SESSIONS:



List of Experiments:

Sr.No	Practical
1	Implement the following OpenCV Program for Object Tracking <ol style="list-style-type: none"> a. Face detection using haar-cascades b. Meanshift and Camshift algorithms to find and track objects in videos
2	Implement the following feature extraction algorithms <ol style="list-style-type: none"> c. SIFT(Scale-Invariant Feature Transform) d. SURF(Speeded-Up Robust Features) e. GIST f. FAST g. BRIEF h. ORB
3	Implement OpenCV Program that remove small noises, strokes etc in old photographs by a method called inpainting
4	Implement the algorithm for motion segmentation.
5	Demonstrate the application of advanced machine vision algorithms.
6	Mini Project for modeling of any one robotic application
7	Study on Jetson Nano Tool kit

Major Equipment Needed: -

