FACULTY OF ENGINEERING & TECHNOLOGY

First Year Master of Engineering

Semester II

Course Code: 102430201

Course Title: Computer Vision

Type of Course:Core Course III

Course Objectives: Computer Vision focuses on development of algorithms and techniques to analyze and interpret the visible world around us. This requires understanding of the fundamental concepts related to multi-dimensional signal processing, feature extraction, pattern analysis visual geometric modeling, stochastic optimization etc. Knowledge of these concepts is necessary in this field, to explore and contribute to research and further developments in the field of computer vision. Applications range from Biometrics, Medical diagnosis, document processing, mining of visual content, to surveillance, advanced rendering etc.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Internal		External		Total
Lecture	Tutorial	Practical		Theory	J/V/P*	Theory	J/V/P*	
3	0	2	4	30 / 15	20 / 10	70 / 35	30 / 15	150 / 75

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	Introduction to Computer vision: Background, requirements and issues, human vision; Image formation: Geometry, photometry (brightness and colour), quantization, camera calibration, Modelling pixel brightness and interreflection	08
2	Image segmentation and Feature Extraction: Various methods of image segmentation, edge detection, object proposals, SIFT features; Local image features- HoG/ SIFT features, Textures, Shape from texture; Feature-based alignment	10
3	Multi-view Geometry: Shape from stereo and motion, feature matching, surface fitting, Active ranging; Object Recognition, Bayes classifiers, SVM classifiers; Face recognition, Instance recognition, Category recognition	10
4	Object Recognition: Deep Learning Methods, Image classification, object detection and semantic segmentation, adversarial attacks. Various neural network architectures, visualization techniques	08
5	Motion analysis and Activity Recognition: Motion detection and tracking, Inference of human activity from image sequences	06

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Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks						**R**: Remembering; **U**: Understanding; **A**: Application, **N**: Analyze; **E**: Evaluate; **C**: Create
R	**U**	**A**	**N**	**E**	**C**	
20	30	30	20	0	0	

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:

1	Computer Vision: A Modern Approach by D. Forsyth and J. Ponce, Pearson, 2010.
2	Computer Vision: Algorithms and Applications by Richard Szeliski, Springer
3	Deep Learning: Algorithms and Applications by I. Goodfellow, Y. Bengio and A. Courville, MIT Press, 2017
4	Computer & Machine Vision by E. R. Davies, Fourth Edition, Academic Press, 2012
5	Computer Vision: Models, Learning, and Inference by Simon J. D. Prince, Cambridge University Press, 2012
6	Feature Extraction & Image Processing for Computer Vision by Mark Nixon and Alberto S. Aquado, Third Edition, Academic Press, 2012.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	To implement fundamental image processing techniques required for computer vision.	**20**
CO-2	To understand Image formation process.	**20**
CO-3	Extract features form Images and do analysis of Images.	**25**
CO-4	Understand video processing, motion computation and 3D vision and geometry.	**25**
CO-5	To develop applications using computer vision techniques.	**10**

List of Practicals / Tutorials: Click or tap here to enter text.

1	To implement image preprocessing and Edge detection
2	To determine depth map from Stereo pair
3	To construct 3D model from Stereo pair
4	To implement Segmentation methods
5	To implement object detection and tracking from video
6	To perform Face detection and Recognition.
7	To implement object detection from dynamic Background for Surveillance.
8	To implement various feature extraction methods.
9	To implement motion estimation.
10	To Construct 3D model from single image.

Supplementary learning Material:	
1	NPTEL Video Lectures

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Curriculum Revision:	
Version:	**1**
Drafted on (Month-Year):	Apr-20
Last Reviewed on (Month-Year):	Jul-20
Next Review on (Month-Year):	Apr-22

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