CENTRAL UNIVERSITY OF KERALA
DEPARTMENT OF COMPUTER SCIENCE
M.Sc. COMPUTER SCIENCE

ELECTIVE COURSE					
COURSE CODE	COURSE TITLE	CONTACT HRS/WEEK			CREDITS
		LEC	LAB	TUT	
CSC5010	Computer Vision	2	2	1	4

Lec = Lecture, Tut = Tutorial, Lab = Practical

This is a participatory, experimental and problem solving **skill development course**.

Course Objective:
The objective of the course is to provide theoretical and practical aspects of computer vision.

By completing this course, students will obtain the following course/learning outcomes:
1. Knowledge gained:
   (i) Theoretical concepts of achieving computer vision
2. Skill gained:
   (ii) Critical analyzing and logic skills in developing computer vision related methods and algorithms.
3. Competency gained:
   (iii) Modelling and development of computer vision based applications.

Prerequisites: Basic knowledge of image processing

Grading:

Lab implementation	– 15%
Participatory based group Project	– 10%
Assignment/Quiz/presentation	– 5%
Class Test	– 10%
Final Exam	– 60%

CSC5010 – Computer Vision

Module 1
Monocular imaging system, Orthographic & Perspective Projection, Camera model and Camera calibration, Binocular imaging systems. Recognition Methodology: Conditioning, Labeling, Grouping, Extracting, Matching, Edge detection, Gradient based operators, Morphological operators, Spatial operators for edge detection. Thinning, Region growing, region shrinking, Labeling of connected components.

Module 2
Binary Machine Vision: Thresholding, hierarchical segmentation, spatial clustering, split & merge, rule-based segmentation, motion-based segmentation. Area Extraction: Concepts, Data-structures, Edge, Line-Linking, Hough transform, Line fitting, Curve fitting (Least-square fitting). Region Analysis: Region properties, External points, Spatial moments, Mixed spatial gray-level moments, Boundary analysis: Signature properties, Shape numbers.

Module 3
Motion Estimation: Regularization theory, Optical computation, Stereo Vision, Motion estimation, Structure from motion, Shape Representation and Segmentation: Deformable curves and surfaces, Snakes and active contours, Level set representations, Fourier and wavelet descriptors, Medial representations, Multiresolution analysis, Tracking-basic concepts, kalman filter-particle filter.

Module 4
Object recognition: Hough transforms and other simple object recognition methods, Shape correspondence and shape matching, Principal component analysis, Shape priors for recognition. Labeling lines, understanding line drawings, Classification of shapes by labeling of edges, Photogrammetry - from 2D to 3D. Classifiers.

References:

1. David A. Forsyth, Jean Ponce, *Computer Vision: A Modern Approach*, Prentice Hall, US Ed., 2002.
2. Ramesh Jain, Rangachar Kasturi, Brian G. Schunck, *Machine Vision*, McGraw Hill, 1st Ed., 1995.
3. Berthold K. P. Horn, *Robot Vision*, MIT Press, 1986.
4. Milan Sonka, Vaclav Hlavac, Roger Boyle, *Image Processing, Analysis, and Machine Vision*, CL-Engineering, 3rd Ed., 2007.
5. Robert M. Haralick, Linda G. Shapiro, *Computer and Robot Vision*, Vol. I, Addison Wesley, 1991.
6. Robert M. Haralick, Linda G. Shapiro, *Computer and Robot Vision*, Vol. II, Prentice Hall, 2002.
7. Trucco, Alessandro Verri, *Introductory Techniques for 3-D Computer Vision*, Prentice Hall, 1998