FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: **BACHELOR OF TECHNOLOGY (Electronics and Communication)**

Semester: **VIII**

Course Code: **202060803**

Course Title: **Computer Vision**

Course Group: **Professional Elective Course**

Course Objectives: This course introduces students to the major ideas, methods, and techniques of computer vision and pattern recognition. Further develop an appreciation for various issues in the design of computer vision and object recognition systems. Also explore the domain with programming experience from implementing computer vision and object recognition applications.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		
Lecture	Tutorial	Practical		Internal	External	Internal	External	Total
3	0	2	4	50/18	50/17	25/9	25/9	150/53

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

Detailed Syllabus:

Sr.	Contents	Hours
1	**Review of Digital Image Processing:** Human visual system, Image as a 2D data, Image representation Gray scale and Colour images, Image sampling and quantization.	5
2	**Image enhancement and filtering in spatial domain:** Intensity transformation functions: Contrast stretching, Thresholding. Image histogram, Histogram equalization process. Fundamentals of spatial filtering, Correlation and convolution, Spatial filtering mask for low pass filtering (smoothing) and high pass filtering (sharpening).	7
3	**Filtering in frequency domain**: Edge detection, Edge detection performance, Hough transform, Segmentation, Morphological filtering, Fourier transform	7
5	**Local Image Descriptors and Mappings:** Harris corner detector, SIFT - Scale-Invariant Feature Transform, Matching Geotagged Images, Image to Image Mappings, Warping of Images, Creating Panoramas	7

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6	**Clustering and Searching Images:** K-means Clustering, Hierarchical Clustering, Spectral Searching Images, content-based Image Retrieval, Visual Words, Indexing Images, Searching the Database for Images, Ranking Results using Geometry Building Demos and Web Applications	7
7	**Robust methods for classification and segmentation:** Eigen decomposition and PCA, K-Nearest Neighbors, Bayes, Support Vector Machines, Optical Character Recognition, Image Segmentation: Graph Cuts, Segmentation using Clustering.	5
Total		45

List of Practicals / Tutorials:

1	Introduction of image format and image processing toolbox
2	Write a MATLAB program for image conversions. (IM2BW, RGB2GRAY, GRAYTHRESH)
3	Write a MATLAB program to implement contrast stretching and thresholding on input image.
4	To understand various image noise models and to write programs for image restoration
5	Write and execute programs for image frequency domain filtering.
6	Write a program for edge detection using different edge detection mask.
7	Implement Python Code on Harris corner Detection Algorithm.
8	Implement Python Code on Scale Invariant Feature Transform (SIFT).
9	Write Python Code for Translation, Rotation.
10	Write Python code for Scaling& Shearing.
11	Apply K-means Clustering code on Python.
12	Apply code on Eigen decomposition, PCA & K-Nearest Neighbours.

Reference Books:

1	S Jayaraman, S Esakkirajan, T Veerakumar, **Digital Image Processing,** Tata McGraw Hill Publication
2	Digital Image Processing, S Sridhar, Oxford University Press.
3	Digital Image Processing, Rafael C. Gonzalez and Richard E. Woods, Third Edition, Pearson Education
4	Programming computer vision with Python, Jan Erik Solem, Creative commons
5	Introductory Techniques for 3D Computer Vision", Emanuele Trucco and Alessandro Verri, Prentice Hall.
6	Robot Vision, by B. K. P. Horn, MIT Press (Cambridge).
7	Computer Vision: Algorithms and Applications, by Richard Szeliski
8	Computer Vision: A Modern Approach, Forsyth and Ponce, Pearson Education.

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Supplementary learning Material:	
1	https://nptel.ac.in/courses/108103174

Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment
- Interactive methods
- Seminar/Poster Presentation
- Industrial/ Field visits
- Course Projects

Internal Evaluation:

The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

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

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
10	35	25	20	5	5	

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.

Course Outcomes (CO):

After learning the course the students should be able to:

Sr.	Course Outcome Statements	% weightage
CO-1	Identify basic concepts, terminology, theories, models and methods in the field of computer vision.	**25**
CO-2	Describe basic methods of computer vision related to multi-scale representation, edge detection and detection of other primitives, stereo, motion and object recognition.	**25**
CO-3	Developed the practical skills necessary to build computer vision applications.	**25**
CO-4	To have gained exposure to object and scene recognition and categorization from images.	**25**

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Curriculum Revision:	
Version:	**2.0**
Drafted on (Month-Year):	June-2022
Last Reviewed on (Month-Year):	**-**
Next Review on (Month-Year):	June 2025

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