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B

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

THIRD SEMESTER M.TECH DEGREE EXAMINATION, DECEMBER 2017

**Electronics and Communication Engineering**

Signal Processing

01EC 7315: **Computer Vision**

Answer *any two full* questions from *each* part

Limit answers to the required points.

Max. Marks: 60 Duration: 3 hours





**PART A**

| | | | |
|---|---|---|---|
| 1. | a. | Explain in detail the steps for computing scale-invariant feature transform. | 7 |
| | b. | Prove that difference of Gaussian (DOG) function provides a close approximation to the scale-normalized Laplacian of Gaussian (LOG). | 2 |
| 2. | a. | Explain the k- means and mixture of Gaussians approaches for image segmentation. Highlight the difference between the two. | 5 |
| | b. | What is Laplacian of an image and derive an appropriate kernel for the same. Explain how Laplacian can be used for edge detection. | 4 |
| 3. | a. | Explain the use of Hough transform for line detection. | 5 |
| | b. | Write notes on camera intrinsic and extrinsic parameters. | 4 |

**PART B**

| | | | |
|---|---|---|---|
| 4. | a. | What is epipolar constraint? | 2 |
| | b. | Detail the steps involved in projective reconstruction of 3D structure from photos taken by unknown camera. | 7 |
| 5. | a. | What is aperture problem in optical flow? | 2 |

b. Consider estimating optical flow given two images I(x,y,t) and I(x,y,t+1) derive the brightness constancy constraint. Given an initial guess for the optical flow vectors, derive a linear system of equations to update the same. 7

6. a. Define fundamental matrix and essential matrix. 3

b. Explain triangulation and bundle adjustment in reference to structure from motion. 6

## PART C

7. a. Given reflectance map and a single image, explain a method to obtain surface normals corresponding to real 3D scene that is imaged. 7

b. Explain the shape from shading problem. Explain any one method to solve this problem. 5

8. a. Explain how texture and focus play a role in how we perceive shape. Explain how these cues can be used to reconstruct 3D geometry. 6

b. Mobile cameras use automated face detection. Explain any one face detection method that is currently in use. 6

9. a. Explain in detail the steps for pedestrian detection using histogram of oriented gradients. 6

b. Explain how Eigen faces can be used for face recognition in images. 6