

B.E/B.TECH DEGREE EXAMINATIONS: NOV/DEC 2024

(Regulation 2018)

Seventh Semester

MECHATRONICS ENGINEERING

U18MCT7002: Image Processing and Computer Vision

COURSE OUTCOMES**CO1:** Summarize the fundamentals of digital image processing**CO2:** Apply image enhancement techniques in the spatial and frequency domain.**CO3:** Apply image segmentation and clustering techniques**CO4:** Describe 3D vision concepts**CO5:** Choose appropriate techniques for different applications**Time: Three Hours****Maximum Marks: 100****Answer all the Questions:-****PART A (10 x 2 = 20 Marks)****(Answer not more than 40 words)**

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|---|-----|-------------------|
| 1. Distinguish between photopic and scotopic vision. | CO1 | [K ₂] |
| 2. List any four applications of digital image processing. | CO1 | [K ₁] |
| 3. Compare smoothing filters with sharpening filters. | CO2 | [K ₂] |
| 4. What is meant by bit plane slicing? | CO2 | [K ₂] |
| 5. Discuss K-means clustering? | CO3 | [K ₂] |
| 6. Mention the function of a region descriptor? | CO3 | [K ₂] |
| 7. Define scene reconstruction, and why is it important in computer vision? | CO4 | [K ₃] |
| 8. Why is camera calibration in 3D vision necessary? | CO4 | [K ₃] |
| 9. Mention some typical applications of gesture recognition in industrial settings. | CO5 | [K ₁] |
| 10. List the critical components of a computer vision system for industrial automation? | CO5 | [K ₁] |

Answer any FIVE Questions:-**PART B (5 x 16 = 80 Marks)****(Answer not more than 400 words)**

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|---|---|-----|-------------------|
| 11. a) Explain the fundamental steps in digital image processing. | 8 | CO1 | [K ₂] |
| b) An image segment is shown below. Let V be the set of grey-level values used to define connectivity in the image. Compute D ₄ , D ₈ , and D _m distances between pixels 'p' and 'q' for | 8 | CO1 | [K ₃] |
| 1. V = [2,3] | | | |
| 2. V = [2,6] | | | |

12. a) Explain in detail various smoothing filters in the frequency domain for image enhancement. 8 CO2 [K₂]
- b) Apply histogram equalization for the following image segment $F(x,y)$ 8 CO2 [K₃]
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|---|---|---|---|---|
| 4 | 4 | 4 | 4 | 4 |
| 3 | 4 | 5 | 4 | 3 |
| 3 | 5 | 5 | 5 | 3 |
| 3 | 4 | 5 | 4 | 3 |
| 4 | 4 | 4 | 4 | 4 |
13. a) Illustrate the advantages and disadvantages of various image segmentation techniques. 8 CO3 [K₂]
- b) Explain the various types of first-order edge detection in image segmentation. 8 CO3 [K₂]
14. a) Explain the process of two-camera stereopsis in 3D vision with example. 8 CO4 [K₂]
- b) Illustrate the concept of Epipolar geometry in computer vision with a neat sketch. 8 CO4 [K₂]
15. a) You are a robotics engineer tasked with developing a system to track a robotic arm's position and orientation precisely. You can access multiple cameras, a target object, and a computer with processing power. How would you design and implement this system, considering the principles of photogrammetry? 8 CO5 [K₄]
- b) Explain the process of identifying and locating objects within an image or video. 8 CO5 [K₂]
16. Illustrate the methods used to develop our hand gesture recognition system and brief the recent methods in vision based hand gesture recognition. 16 CO5 [K₃]
