1703CP003-**IMAGE PROCESSING AND ANALYSIS** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the basics of digital images
- To understand noise models
- To understand spatial domain filters
- To understand frequency domain filters
- To learn basic image analysis --- segmentation, edge detection, and corner detection
- To learn morphological operations and texture analysis
- To understand processing of color images
- To understand image compression techniques

UNIT I SPATIAL DOMAIN PROCESSING **9**

Introduction to image processing – imaging modalities – image file formats – image sensing and acquisition – image sampling and quantization – noise models – spatial filtering operations – histograms – smoothing filters – sharpening filters – fuzzy techniques for spatial filtering – spatial filters for noise removal

UNIT II FREQUENCY DOMAIN PROCESSING **9**

Frequency domain – Review of Fourier Transform (FT), Discrete Fourier Transform (DFT), and Fast Fourier Transform (FFT) – filtering in frequency domain – image smoothing – image sharpening – selective filtering – frequency domain noise filters – wavelets – Haar Transform – multiresolution expansions – wavelet transforms – wavelets based image processing

UNIT III SEGMENTATION AND EDGE DETECTION **9**

Thresholding techniques – region growing methods – region splitting and merging – adaptive thresholding – threshold selection – global valley – histogram concavity – edge detection – template matching – gradient operators – circular operators – differential edge operators – hysteresis thresholding – Canny operator – Laplacian operator – active contours – object segmentation

UNIT IV INTEREST POINTS, MORPHOLOGY, AND TEXTURE **9**

Corner and interest point detection – template matching – second order derivatives – median filter based detection – Harris interest point operator – corner orientation – local invariant feature detectors and descriptors – morphology – dilation and erosion – morphological operators – grayscale morphology – noise and morphology – texture – texture analysis – co-occurrence matrices – Laws' texture energy approach – Ade's eigen filter approach

UNIT V COLOR IMAGES AND IMAGE COMPRESSION **9**

Color models – pseudo colors – full-color image processing – color transformations – smoothing and sharpening of color images – image segmentation based on color – noise in color images. Image Compression – redundancy in images – coding redundancy – irrelevant information in images – image compression models – basic compression methods – digital image watermarking.

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to

CO1 Explain image modalities, sensing, acquisition, sampling, and quantization
CO2 Implement spatial filter, frequency domain operations and frequency domain transformations
CO3 Apply segmentation algorithms, edge detection techniques
CO4 Apply corner and interest point detection algorithms
CO5 Analyze color, images and Implement image compression algorithms

REFERENCES:

1. E. R. Davies, "Computer & Machine Vision", Fourth Edition, Academic Press, 2012.
2. W. Burger and M. Burge, "Digital Image Processing: An Algorithmic Introduction using Java", Springer, 2008.
3. John C. Russ, "The Image Processing Handbook", Sixth Edition, CRC Press, 2011.
4. R. C. Gonzalez and R. E. Woods, "Digital Image Processing", Third Edition, Pearson, 2008.
5. Mark Nixon and Alberto S. Aquado, "Feature Extraction & Image Processing for Computer Vision", Third Edition, Academic Press, 2012.
6. D. L. Baggio et al., "Mastering OpenCV with Practical Computer Vision Projects", Packt Publishing, 2012.
7. Jan Erik Solem, "Programming Computer Vision with Python: Tools and algorithms for analyzing images", O'Reilly Media, 2012.

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1703CP016-**ADHOC MOBILE WIRELESS NETWORKS**

L T P C
3 0 0 3

OBJECTIVES:

- To learn about the issues in the design of ad hoc and wireless sensor networks
- To understand the working of protocols in different layers of ad hoc and sensor networks
- To expose the students to different aspects in ad hoc and sensor networks
- To understand various standards and applications in ad hoc and sensor networks

UNIT I FUNDAMENTALS **9**

Introduction to ad hoc networks- Differences between cellular and ad hoc wireless networks- Challenges and issues in ad hoc networks-Introduction to WSN-Single node architecture-Network architecture-Localization and positioning-Operating systems for WSN.

UNIT II MAC AND LINK MANAGEMENT **9**

Fundamentals of wireless MAC protocols- Classification of MAC protocols for ad hoc networks-MAC for WSN-Low duty cycle protocols and wakeup concepts- Contention and schedule based protocols-WSN link layer-Error control-Framing-Link management.

UNIT III ROUTING **9**

Design issues of routing protocols for ad hoc networks- Classification of routing protocols-Proactive, Reactive and Hybrid routing protocols-Routing in WSN-Naming and addressing-Gossiping and agentbased unicast forwarding- Energy efficient unicast- Broadcast and multicast- Geographic routing-Data-centric and content-based networking.

UNIT IV TRANSPORT LAYER AND QoS **9**

Challenges of transport layer protocol in wireless environments- TCP"s challenges and design issues in ad hoc networks-Transport protocols for ad hoc networks-Transport control protocols for WSNs-Issues and challenges in providing QoS in ad hoc networks-Network layer QoS solutions- QoS Model-QoS in wireless sensor networks-Congestion control in network processing.

UNIT V STANDARDS AND APPLICATIONS **9**

Wireless sensor network standards-Standards on wireless mesh networks-Applications of ad hoc and WSNs-Case study: Building military border area surveillance system, Forest fire detection system and tsunami early warning system with wireless sensor networks.

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of this course students should be able to

CO1 Identify different issues in wireless ad hoc and sensor networks
CO2 Analyze the protocols developed for ad hoc and sensor networks
CO3 Analyse different routing protocols and its applications

CO4 Determine and analyse different QoS techniques in communication
CO5 Identify and discuss the standards and applications of ad hoc and sensor networks

REFERENCES:

1. SubirKumarSarkar, TGBasavaraju, C Puttamadappa, "Ad Hoc Mobile Wireless Networks", Auerbach Publications, 2008.
2. C.Siva Ram Murthy, B.S.Manoj, "Ad Hoc Wireless Networks- Architectures and Protocols", Pearson Education, 2004.
3. KazemSohraby, Daniel Minoli, TaiebZnati, "Wireless Sensor Networks-Technology, Protocols, and Applications", John Wiley & Sons, 2007.
4. WaltenegusDargie,Christian Poellabauer, "Fundamentals of Wireless SensorNetworks", John Wiley & Sons, 2010.
5. Holger Karl, Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, 2005.

1704CP106-**ADVANCED DATA STRUCTURES LABORATORY** **L T P C**
0 0 4 2

OBJECTIVES:

- To learn to implement iterative and recursive algorithms.
- To learn to design and implement algorithms using hill climbing and dynamic programming techniques.
- To learn to implement shared and concurrent objects.
- To learn to implement concurrent data structures.

LAB EXERCISES:

Each student has to work individually on assigned lab exercises. Lab sessions could be scheduled as one contiguous four-hour session per week or two two-hour sessions per week. There will be about 15 exercises in a semester. It is recommended that all implementations are carried out in Java. If C or C++ has to be used, then the threads library will be required for concurrency. Exercises should be designed to cover the following topics:

1. Implementation of Binary Search Tree
2. Implementation of Fibonacci Heaps
3. Implementation of Red-Black tree
4. Implementation of Spanning Tree
5. Implementation of Shortest Path Algorithms
6. Implementation of Graph Traversals
7. Implementation of Greedy Algorithms
8. Implementation of Approximation Algorithms

TOTAL :60 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to

CO1 Design and apply iterative and recursive algorithms
CO2 Design and implement algorithms using the hill climbing and dynamic programming and recursive backtracking techniques
CO3 Design and implement optimization algorithms for specific applications
CO4 Design and implement randomized algorithms
CO5 Design appropriate shared objects and concurrent objects for applications
C06 Implement and apply concurrent linked lists, stacks, and queues

REFERENCES:

1. Jeff Edmonds, "How to Think about Algorithms", Cambridge University Press, 2008.
2. M. Herlihy and N. Shavit, "The Art of Multiprocessor Programming", Morgan Kaufmann, 2008.
3. Steven S. Skiena, "The Algorithm Design Manual", Springer, 2008.
4. Peter Brass, "Advanced Data Structures", Cambridge University Press, 2008.
5. S. Dasgupta, C. H. Papadimitriou, and U. V. Vazirani, "Algorithms" , McGrawHill, 2008.
6. J. Kleinberg and E. Tardos, "Algorithm Design", Pearson Education, 2006.
7. T. H. Cormen, C.2 E. Leiserson, R. L. Rivest and C. Stein, "Introduction to Algorithms", PHI Learning Private Limited, 2012.

8. Rajeev Motwani and Prabhakar Raghavan, "Randomized Algorithms", Cambridge University Press, 1995.
9. A. V. Aho, J. E. Hopcroft, and J. D. Ullman, "The Design and Analysis of Computer Algorithms", Addison-Wesley, 1975.
10. A. V. Aho, J. E. Hopcroft, and J. D. Ullman,"Data Structures and Algorithms", Pearson,2006.

1704CP107-CASE STUDY – OPERATING SYSTEMS DESIGN

(Team Work)

L	T	P	C
0	0	2	1

OBJECTIVES:

- To develop capabilities to work at systems level
- To learn about issues in designing and implementing modern operating systems
- To understand team formation, team issues, and allocating roles and responsibilities
- To make effective presentations on the work done
- To develop effective written communication skills

LAB EXERCISES:

A team of three or four students will work on assigned case study / mini-project. Case Study / Mini-project can be designed on the following lines:

1. Development of a reasonably sized dynamically loadable kernel module for Linux kernel

2. Study educational operating systems such as Minix (http://www.minix3.org/), Weenix (http://weenix.cs.brown.edu/mediawiki/index.php/Weenix) and develop reasonably sized interesting modules for them

3. Study the Android open source operating system for mobile devices (http://source.android.com/) and develop / modify some modules.

4. Study any embedded and real-time operating system such as eCos (http://ecos.sourceware.org/) and develop / modify some modules.

TOTAL : 30 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to

- Develop assigned modules of operating systems design carrying out coding, testing, and documentation work involved.
- Describe team issuses and apply suitable methods to resolve the same.
- Demonstrate individual competence in building medium size operating system components.
- Demonstrate ethical and professional attributes of a computer engineer.
- Prepare suitable plan with clear statements of deliverables, and track the same.

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REFERENCES:

1. Watts S. Humphrey, "Introduction to Team Software Process", Addison-Wesley, SEI Series in Software Engineering, 1999.
2. Mukesh Singhal and Niranjan G. Shivaratri, "Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems", Tata McGraw-Hill, 2001.
3. T. W. Doeppner, "Operating Systems in Depth: Design and Programming", Wiley, 2010.

4. S. Tanenbaum and A. S. Woodhull, "Operating Systems Design and Implementation", Third Edition, Prentice Hall, 2006.
5. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Concepts", Ninth Edition, John Wiley & Sons, 2012.
6. Daniel P. Bovet and Marco Cesati, "Understanding the Linux kernel", 3rd edition, O'Reilly, 2005.
7. Rajib Mall, "Real-Time Systems: Theory and Practice", Pearson Education India, 2006.