SCHOOL OF ENGINEERING & TECHNOLOGY

COURSE FILE

Program: Computer Science Engineering
Course Code: CSE3022
Course Title: Digital Image Processing
Module Semester: 5th Sem C
Session: 5th Aug 2024

Index

16	Interventions made for slow performers and advanced learners, highlighting initiatives taken for student improvements (retest, resubmissions etc.)
17	End Semester Question papers with sample solutions
18	Detail of Marks in all components up to the End Semester
19	Attendance Report
20	Final record of Results (including the grades)
21	Analyzing Direct Feedback received on Course Outcomes
22	CO Attainment Measurement Analysis
23	Interventions made for slow performers and advanced learners, highlighting initiatives taken for student improvements (retest, resubmissions etc.)
24	End Semester Question papers with sample solutions
25	Feedback (class committee or otherwise) and corrective actions (if any)
26	Faculty Course Review (if any, like Use of Innovative Pedagogies; Technology; Experiential Learning; Integration with the Vision and Mission of the University; Feedback; Course Outcome attainment for the next run of the course)
27	Any other additional information

1. Course Details

- Course Code: CSE3022
- Course Title: Digital Image Processing
- **Module/Semester: 5th Sem C**
- Session: 5th Aug 2024

2. Vision, Mission of the University

Vision

BML Munjal University seeks to nurture ethical leaders who are skilled, knowledgeable and have the life skills required for leading their organizations to success. The university shall seek the advancement and dissemination of practically oriented knowledge benchmarked with the best global standards.

Mission

BML Munjal University aims to be a leading university for the quality and impact of its teaching, research and linkages with major stakeholders. The focus of the university is to find creative solutions to problems through application of knowledge. The university aims to create a talented community of students and faculty who excel in teaching, learning and research, in a creative and stimulating environment. The university will collaborate with other institutions for development of science, technology and arts in the global context.

3. Graduate Attributes

- Acquire and apply practical understanding of discipline knowledge.
- Demonstrate a sense of ethics and display excellence in both personal and professional life.
- Exhibit problem solving, critical thinking skills and investigative capability to address real world problems.
- Manifest leadership qualities and work effectively in teams across globally diverse environments.
- Be a lifelong learner with an entrepreneurial mindset to innovate in the constantly changing global scenario.
- Possess a strong sense of inquiry and design innovative solutions for positive societal impact.
- Be effective communicators and possess an empathetic outlook.

4. Vision, Mission of the School

Vision of School:

To be amongst the leading engineering schools of the country recognized globally for excellence in teaching and research with focus on experiential learning, innovation and entrepreneurship.

Mission of School:

* Providing high-quality learning experience to our students, preparing them to be global leaders, and contributing to the development of society through research, innovation, and entrepreneurship.
* Creating an inclusive and diverse learning environment that fosters creativity, critical thinking, and ethical values.
* Collaborating with industry, government, and other institutions to address complex societal challenges and promote sustainable development.

5. PEOs and POs & PSOs of the Program

Program Educational Objectives (PEO):

PEO 1: Identify real-life problems and develop creative and innovative hardware/software-based solutions.

PEO 2: Achieve professional development through self-learning to adapt to the technological changes in the ever changing field of computing.

PEO 3: Engage in life-long learning of computer engineering technologies, critical thinking and continuous ingenuity and apply them in real-life applications.

PEO 4: Accomplish leadership roles by imbibing ethics and professionalism with emphasis on sustainable development of the society.

Program Outcomes (PO):

PO1: Apply the foundational concepts of mathematics, science and computer engineering to find novel solutions for complex real-life engineering problems.

PO2: Identify, formulate, review literature and analyze complex computer engineering problems reaching substantiated conclusions and derive a coherent logic that can be implemented by computers.

PO3: Design analytical and computational models for solving complex engineering problems giving due consideration to issues related to public health and safety, cultural and societal constraints, and environmental concerns.

PO4: Use research-based knowledge, methods, tools and techniques for data collection, designing digital computing systems, analyzing and interpreting the results to provide substantiated conclusions.

PO5: Use appropriate tools to model complex computer engineering problems through identification of the limitations and creating solutions to predict the real-world phenomena.

PO6: Use appropriate contextual knowledge of computer engineering to review and assess societal, health, legal, cultural, safety and contemporary issues and rationalize the ensuing responsibilities towards the society.

PO7: Adopt computer engineering practices in congruence with societal need, understand the working practices and its impact on natural resources for sustainable development.

PO8: Use ethical principles to pursue excellence in developing computer engineering systems and behave appropriately to develop a reliable and trustworthy relationship with others.

PO9: Function effectively as a reliable and responsible individual, and as a member or leader in diverse computer engineering teams, and in multidisciplinary settings, thereby placing team goals ahead of individual interests.

PO10: Communicate effectively by capturing the desirable computer system requirements for preparation of specification documents, write clear and concise report such as laboratory files, research papers, thesis, and presentation materials.

PO11: Demonstrate knowledge of computer engineering and management principles for the completion of individual or group projects in multidisciplinary environments.

PO12: Recognize the evolving technological changes and engage as an independent and life-long learner

in both computing and non-computing fields.

Program Specific Outcomes (PSO):

PSO1: Identify applicable tools and techniques related to data science practice such as data collection, cleaning, analysis, modelling, evaluation and result interpretation and apply them for deriving hidden and meaningful patterns for appropriate actionable insights.

PSO2: Develop intelligent systems for various real-life domains like healthcare, transportation, finance etc. using Artificial Intelligence methodologies.

PSO3: Understand the foundational concepts and techniques to protect computing systems against constantly evolving cybersecurity threats and analyze security breaches and violations of cyber systems and networks to provide appropriate solutions.

PSO4: Design effective security systems to mitigate risks, threats and vulnerabilities for protecting the organizations against cyber threats.

6. Course Description and its objectives

There is a high demand of professionals knowing image processing and related field of studies, in the industry. There are tons of interesting applications which require capturing, storing and processing digital images – e.g. automatic face recognition from images, medical image processing, automated robotic movements, surveillance, document processing etc. With the popularity of social media and consumer electronic devices like smart phone, millions of images are being captured and shared on a daily basis on the internet. This has opened up the horizon of developing smart applications involving images for a better quality of service. In view of this, the Digital Image Processing course is designed to give the students an overview of what digital images are, and how they are captured and processed. The course contains hands-on sessions to be conducted using open-source tools. This will help the students to practice the theoretical concepts learned during lecture sessions. Upon successful completion of the course, the students should be able to write programs for capturing, manipulating, and processing digital images.

7. Course Outcomes and CO-PO Mapping

Course Outcomes:

CO1: Understand fundamental concepts and principles of digital image processing.

CO2: Apply and demonstrate different image pre-processing and enhancement techniques in the spatial and frequency domains.

CO3: Analyze various state of art algorithms to process images for various applications.

CO4: Design framework to solve real-life and societal problems using appropriate methods, interpreting results, and reporting

CO/PO Mapping:

Course Outcomes (CO)	CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	1	1	3	2	0	0	0	0	0	0	0	0	0	0	0	0
CO2	2	3	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0
CO3	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO4	2	1	2	2	3	2	0	0	0	0	0	0	0	0	0	0	0

8. Course Syllabus

Sr. No.	Content	CO	Sessions
1	Visual Perception • Image Sensing and Acquisition • Image Sampling and Quantization • Representing Digital Images • Spatial and Intensity Resolution	CO1	2
2	Gray-level transformations and processing in the spatial domain, Enhancement using arithmetic/logic operations, Image derivatives, filtering- smoothing, sharpening, convolution and correlation. Histogram processing – stretching, equalization, and matching. Image interpolation.	CO1, CO2, CO3	3
3	Fourier transformation and processing in the frequency domain – DFT, FFT, Inverse Fourier transformation, Filtering: smoothing and sharpening in the frequency domain, convolution.	CO1, CO2, CO3	3
4	Wavelet Transform and Multi-resolution Processing: Introduction to Wavelet Transform, Continuous and Discrete Wavelet Transform, Wavelet-based image processing techniques, Multi-resolution analysis, Applications of Wavelet Transform in image compression and denoising	CO1, CO2, CO3	3
5	Noise models, restoration in the spatial domain, periodic noise reduction using frequency domain filtering, and Inverse filtering.	CO1	4
6	Color models and transformations, Smoothing and sharpening, and segmentation.	CO1, CO2	2
7	Dilation • Erosion • Opening • Closing • Boundary extraction • Thinning.	CO1	5
8	Image compression fundamentals • Lossless compressions and Lossy compression Techniques.	CO1, CO3, CO4	5
9	Detection of discontinuities, Edge linking, and boundary detection, Thresholding, Region-based segmentation, Segmentation using morphology.	CO1, CO3	5
10	Introduction to Image Representation and Description: - Chain code, Polynomial approximation, Signatures, Skeletons; Regional description – Texture -- gray-level-cooccurrence matrix.	CO1	4

9. Learning Resources

Text Books:

✓ Rafael C. Gonzalez, Richard E. Woods; Digital Image Processing; 3rd Ed., Pearson, ISBN: 978-0131687288

Reference Links:

- https://www.coursera.org/learn/digital

10. Weekly Timetable

Time	Monday	Tuesday	Wednesday	Thursday	Friday
9:15-10:10					
10:15-11:10					
11:15-12:10					
12:15-13:10					
13:15-14:10					
14:15-15:10					
15:15-16:10					
16:15-17:10					
17:15-18:10					

13. Student Learning Categories for Partial Semester

Learner Categories Summary for Partial Semester

Learner Category	Number of Students
Advanced Learners	0
Medium Learners	0
Low Performers	0

Student Learning Classification for Partial Semester

Student Name	Category

13. Student Learning Categories

Learner Categories Summary

Learner Category	Number of Students
Advanced Learners	0
Medium Learners	0
Slow Learners	0

Student Learning Classification

Student Name	Category

14. Actions taken for weak students

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