<table>
<tr><td>1.</td><td colspan="3">Name of Course</td><td colspan="5">Digital Image Processing</td></tr>
<tr><td>2.</td><td colspan="3">Course Code</td><td colspan="5">CCPS4583</td></tr>
<tr><td>3.</td><td colspan="3">Name(s) of academic staff</td><td colspan="5"></td></tr>
<tr><td>4.</td><td colspan="3">Rationale for the inclusion of the course/module in the programme</td><td colspan="5"><u>Major</u>
Digital image processing is a rapidly evolving field with a wide range of scientific and industrial applications. On the other hand MATLAB is a high-performance fourth generation programming language for technical computing. MATLAB is rapidly ubiquitous in education and industry. This is a single module giving a broad grounding in MATLAB programming and associated theory/mathematical skills with image processing. It is ideal for students who wish to work in industry or advance their knowledge and skills in these two constantly evolving areas.</td></tr>
<tr><td>5.</td><td colspan="3">Semester and Year offered</td><td colspan="5">1/4</td></tr>
<tr><td rowspan="2">6.</td><td>Total Student Learning Time (SLT)</td><td colspan="4">Face to Face</td><td colspan="2">Total Guided and Independent Learning</td></tr>
<tr><td>L = Lecture
T = Tutorial
P = Practical
O= Others</td><td>L
28</td><td>T</td><td>P
28</td><td>O</td><td colspan="2">Independent =70
Total=126</td></tr>
<tr><td>7.</td><td colspan="3">Credit Value</td><td colspan="5">3</td></tr>
<tr><td>8.</td><td colspan="3">Prerequisite (if any)</td><td colspan="5"><u>CCPS1543</u> Computer Programming</td></tr>
<tr><td>9.</td><td colspan="8">Objectives:
• To provide an introduction to the field of Image Processing and to acquaint students with the main theories and techniques employed in the field.
• To provide students a broad grounding in MATLAB programming skills necessary for Scientific Computing.</td></tr>
<tr><td>10.</td><td colspan="8">Learning outcomes:
After undergoing this module, students will be able to:
• Explain the main concepts of image processing.
• Apply, Categorize and contrast major image processing and manipulation techniques.
• Critically appraise and Analyze imaging solutions for practical applications.
• Implement a range of image processing algorithms using matlab.</td></tr>
<tr><td>11.</td><td colspan="8">Transferable Skills:
• Be aware of the applications of image processing and identify the most appropriate processing steps for a range of applications.
• Proficiently use MATLAB tools to perform a variety of operations.
• Practical experience of basic digital signal processing and manipulation techniques
• Practical experience of some general mathematical data processing and Fourier transforms using MATLAB.</td></tr>
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12. **Teaching-learning and assessment strategy**

A variety of teaching and learning strategies are used throughout the course, including:

- Classroom lessons. Lectures and Power Point presentations
- Laboratory sessions: Practice exercises
- brainstorming;
- student-Lecturer discussion
- collaborative and co-operative learning;
- Independent study.

Assessment strategies include the following:

- Ongoing quizzes
- Midterm tests
- Performance Assessment (Participation, project, Assigned exercises)
- Lecturer Observation

13. **Synopsis:**

This module concentrates on developing the fundamentals necessary to design and develop a wide range of imaging solutions. The module includes Image formation, image sampling, morphological operations, 2D Fourier transform, image enhancement in spatial and frequency domains, colour image processing, image segmentation, edge detection, , object representation and description, This module will make extensive use of matlab development environment to reinforce all the issues covers during the lectures.

14. **Mode of Delivery:**

- Classroom lessons. Lectures and Power Point presentations
- Laboratory sessions: Practice exercises

15. **Assessment Methods and Types:**

The assessment for this course will be based on the following:

Coursework **50%**

1. Quizzes and Assignments 15%
2. Project 15%
3. Mid-Semester Exam 20%

Final Examination **50%**

100%

16. **Mapping of the course/module to the Programme Aims**

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12
4	1	2	0	2	1	0	2	0	3	2	0

17. **Mapping of the course/module to the Programme Learning Outcomes**

LO1	LO2	LO3	LO4	LO5	LO6	LO7	LO8	LO9	LO10	LO11	LO12
4	4	0	3	0	0	2	2	2	1	0	0

18. **Content outline of the course/module and the SLT per topic**

	Details	SLT			
		L	P	Indep.	Total

	Topic 1	**Introduction** human visual perception, signal processing overview, basic principles of machine vision, History & Terminology, digital image formats, Review of existing coding standards, Monochrome and colour displays, image processing technology, Image Processing applications,	2	2	5	9
	Topic 2	**Introduction to MATLAB Programming:** MATLAB Integrated Development Environment, Basic MATLAB Commands, Vectors and Arrays, Matrix Operations, built-in functions, user-defined functions, M-files, basic plotting and figure commands, 2D/3D plotting , GUI elements, callbacks,	6	6	18	30
	Topic 3	**Image Acquisition** Slow scan and video rate image acquisition. Analogue to digital conversion. Image Digitisation issues. Computer video cards. Colour palettes. Conventional and CCD cameras. line scan cameras, DSP cameras,	2	2	6	10
	Topic 4	**Basic Image Processing** Image sampling, Thresholding (manual, grey, colour, auto), Histograms normalisation and equalisation, Arithmetic and logic operations. Spatial filtering: convolution and non-linear filters. masks, convolution, Gaussian, median, mode filters, Frequency filtering, discrete Fourier Transform DFT , Fast Fourier Transform (FFT), FFT filters, inverse FFT,1-2D, Discrete cosine and Hartley transforms	6	6	18	30
	Topic 5	**Image Analysis** Basic morphology, opening, closing, erosion, dilation,, external and internal edges, thinning and thickening, area. Advanced morphology analysis applied to binary and grey level images: labelling /connectivity, skeleton	4	4	8	16
	Topic 6	**Image Enhancement and Segmentation** Noise reduction/deblurring, Image Enhancement in Spatial Domain and Frequency Domain, Image Segmentation techniques, Region identification.	2	2	5	9
	Topic 7	**Feature Extraction and representation** Edge detection, Prewitt, Sobel, Laplacian, LOG, Image curvature, basic contour representations, chain code, FFT descriptors, moments, Hough transform for lines and circles, snakes	4	4	5	13
	Topic 8	**Applications and Future of Digital Image Processing** Pattern recognition, content based image retrieval, Biometrics, medical image , industrial inspection , Remote sensing applications, Expert Systems Parallel Processing and Neural Networks	2	2	5	9
		Total	28	28	70	126
		Laboratory Details Exercises based on topics covered in each lecture. programming work must include the following: **Basic MATLAB Commands**, **Introductory examples (MATLAB)** • Vectors and Arrays, Matrix Operations, built-in functions, user-defined functions, M-files, • basic plotting and figure commands, • 2D/3D plotting , • GUI elements, callbacks, **Image Analysis:** • opening, closing, erosion, dilation,, external and internal edges, thinning and thickening, area. connectivity, skeleton **Image Enhancement and Segmentation:** • Noise reduction/deblurring, Image Segmentation, Region identification **Feature Extraction and representation:** Edge detection, Prewitt, Sobel, Laplacian, chain code, FFT descriptors, moments				

19.	**Main references supporting the course:** • R.C. Gonzalez , R.E. Woods, **Digital Image Processing,3rd Ed.,** Prentice Hall,2007
	Additional references supporting the course: 1. John G. Proakis, and Dimitris G. Manolakis , **DIGITAL SIGNAL PROCESSING, Principles, Algorithms, and Applications**", 4th Edition, Prentice Hall 2007. 2. R.C. Gonzalez , R.E. Woods, and Steven L. Eddins **Digital Image Processing Using MATLAB**, Prentice Hall,2003 3. John C. Russ, **The Image Processing Handbook**, 5 edition CRC ,2006
20.	**Other additional information** All materials will be available to the students online.