Mathematical Image Processing (MSM4494)

<table>
<tr><td>Course Code</td><td colspan="9">MSM4494</td></tr>
<tr><td>Course Name</td><td colspan="9">Mathematical Image Processing</td></tr>
<tr><td>Credit Hour</td><td colspan="9">4</td></tr>
<tr><td>Prerequisite Course</td><td colspan="9">Computational Methods in Industry (MSM4413)</td></tr>
<tr><td rowspan="3">Contact Hours</td><td colspan="3">Lecture:</td><td>3</td><td>units</td><td colspan="4">(3 hour(s) per week)</td></tr>
<tr><td colspan="3">Tutorial:</td><td>0</td><td>unit</td><td colspan="4">(0 hour(s) per week)</td></tr>
<tr><td colspan="3">Laboratory:</td><td>2</td><td>units</td><td colspan="4">(2 hour(s) per week)</td></tr>
<tr><td>Course Rationale</td><td colspan="9">Mathematical image processing is the study of an image as input to improve its quality, recognize objects in it and produce an analysis as output. Digital images are ubiquitous in today's world, and the number of images available on the internet is exploding. Images are an important form of data in many fields. Some real world applications of image processing are microscopy in biology, MRI and CT in medicine, satellite imagery in geology and agriculture, fingerprint and face images in security, and many others.</td></tr>
<tr><td>Course Objective</td><td colspan="9">The goals of this course are to give students the understanding of how image processing algorithms work and what algorithms to apply to a given problem, and also the foundation necessary to develop image processing algorithms.</td></tr>
<tr><td>Course Synopsis</td><td colspan="9">This course provides an introductory approach to image processing with strong emphasis on the mathematical concepts and model buildup. Discussion on mathematical fundamentals including low-level arithmetics, and computational geometry such as convex hull, Voronoi diagram, spline interpolation and approximation, Hough transform, discrete Fourier transform and frequency domain. Fundamental algorithms in image enhancement, filtering, geometric transforms, color processing, and compression, edge detection, feature extraction, segmentation and classification. Case studies on some of today's hot problems such as aerial surveillance and medical imaging using Matlab will be covered.</td></tr>
<tr><td rowspan="2">Program Outcomes</td><td>PO1</td><td>PO2</td><td>PO3</td><td>PO4</td><td>PO5</td><td>PO6</td><td>PO7</td><td>PO8</td><td>PO9</td></tr>
<tr><td>/</td><td>/</td><td>/</td><td></td><td></td><td>/</td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">Soft Skills</td><td colspan="2">Code</td><td>CTPS</td><td>CS</td><td>TS</td><td>LL</td><td>ES</td><td>EM</td><td>LS</td></tr>
<tr><td colspan="2">KIM</td><td>5</td><td></td><td></td><td>2</td><td></td><td></td><td></td></tr>
<tr><td rowspan="5">Course Outcomes</td><td colspan="9">By the end of semester, students should be able to:</td></tr>
<tr><td>CO1</td><td colspan="8">Relate the mastery knowledge of image acquisition, sampling, and noise.</td></tr>
<tr><td>CO2</td><td colspan="8">Integrate properties of human color perception to image processing algorithms to solve real life problems.</td></tr>
<tr><td>CO3</td><td colspan="8">Discuss various image processing approaches and other related skills for problem solving.</td></tr>
<tr><td>CO4</td><td colspan="8">Construct mathematical solutions using MATLAB for some selected image processing problems.</td></tr>
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	Methods	Weighting	CO1	CO2	CO3	CO4	
Assessment Methods	Test	20%	/	/			
	Project/Assignment	40%	/	/	/	/	
	Final	40%	/	/			
	Total	**100%**					

Learning References	1	R.C.Gonzales and R.Woods, Digital image processing using Matlab, 2nd Edition, Pearson International, 2007 (latest version-Main Reference)
	2	R.C.Gonzales and R.Woods, Digital image processing, Third Edition, Pearson International, 2007 (latest version)
	3	W. Burger and M. J. Burge, Digital Image Processing: An Algorithmic Introduction Using Java, 2007 (latest version)
	4	C.Solomon and T.Breckon, Fundamentals of digital image processing, Wiley-Blackwell, 2010 (latest version)
	5	M.Seul, L.O'Gorman and M.J.Sammon, Practical algorithms for image analysisCambridge University Press, 2000 (latest version).