Course descriptor B31SE

Course code	**B31SE**
Course title	Image Processing
Credits	15
School	Engineering and Physical Sciences
SCQF Level	11
Semester	2
Aims	This course aims to: • To provide a critical understanding of the principal theories and concepts of image analysis, modelling, enhancement and coding. • To apply these theories and concepts to a range of digital images and video sequences • To provide a critical awareness of current issues in image processing. • To provide the ability to analyse problems and develop applications in image processing.
Syllabus	**Core topics** • An introduction to Image Processing: Image representation, continuous and discrete, light and colour • Single Pixel Processing in the Spatial Domain: gray level transformations, histogram processing: equalisation, modification and matching • Image Transformations and the Frequency Domain: 2D analogue and digital Fourier transforms, convolution and correlation • Image Filtering: smoothing and enhancement, simple linear filtering in the frequency domain, gradient/edge and corner detection, image restoration and Wiener filtering • Image Formats and Compression: transmission and storage of images, image and video compression **Advanced topics: two selected from** • Texture analysis (statistical, fractals, Markov random fields and co-occurrence matrices) • Segmentation: Nearest-neighbour segmentation and grouping; global thresholding and Hough transformation, clustering techniques • Image classification: Supervised and unsupervised, naïve classifiers (e.g., boxcar), minimum distance means, maximum likelihood • Bayesian decision theory, k-means clustering • The Haar transform, wavelet transforms in one and two dimensions, face detection using Haar wavelets

	• Motion and video: the aperture and correspondence problems, frame differencing and motion detection, affine motion (Lukas-Kanade algorithm) and optical flow • Geometric and wave theories of image formation, fundamental optical instruments (camera, microscope, telescope), polarisation imaging.

Learning Outcomes	
Subject Mastery	• Critical understanding of an extensive range of image processing problems & potential solutions. • Practical knowledge of limitations of techniques to accompany detailed theoretical knowledge. • Skill in the use of specialist image processing tools in the implementation of techniques. • Knowledge of current research in imaging and image processing
Personal Abilities	Ability to analyse and develop mathematical descriptions of image transformations. Ability to critically review, evaluate and implement a range of techniques in image processing.

Assessment method	80% written examination, 20% continuous assessment