Course Outline (Higher Education)

School / Faculty: Faculty of Science and Technology
Course Title: DIGITAL IMAGING AND ARTIFICIAL INTELLIGENCE
Course ID: ENGIN3405
Credit Points: 15.00
Prerequisite(s): MATHS3001
Co-requisite(s): Nil
Exclusion(s): Nil
ASCED Code: 303101
Grading Scheme: Graded (HD, D, C, etc.)

Program Level:

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<th>5</th>
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<th>7</th>
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<tr>
<td>Level</td>
<td>Introductory</td>
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<td></td>
<td>Intermediate</td>
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<td>Advanced</td>
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Learning Outcomes:

On successful completion of the course the students are expected to be able to:

Knowledge:

K1. Demonstrate understanding of image processing, image representation, image segmentation, feature extraction and low-level image analysis techniques.
K2. Demonstrate understanding of spatial and frequency filtering.
K3. Interpret and analyse image analysis algorithms in edge and shape detection, colour based segmentation and image thresholding.
K4. Demonstrate understanding of pattern recognition and classification process.
K5. Explain and outline the advanced concepts and historical development of artificial intelligence.
K6. Interpret and discriminate the development of various optimization and machine learning algorithms / techniques.

Skills:

S1. Test and critically analyse results from the performed image analysis.
S2. Perform spatial and frequency filtering and feature extraction.
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S3. Develop and analyse image analysis algorithms.
S4. Perform classification and pattern recognition using artificial intelligence and suitable methodologies.
S5. Evaluate optimization / network learning algorithms.

Application of knowledge and skills:

A1. Apply digital imaging and artificial intelligence techniques in areas of robot vision, condition monitoring, quality control, environmental sensing and interaction, object recognition and classification.
A2. Design, develop and optimize intelligent models based on artificial intelligence methodologies.
A3. Develop advanced learning algorithms for a neural network model to achieve the required design objectives.
A4. Implement the knowledge and skills gained through this subject in designing and developing intelligent mechatronics product / system.

Course Content:

Topics may include:

- Introduction to digital imaging and image representation, addition and subtraction of images, spatial and frequency filtering.
- Image analysis algorithm with methods involving feature extraction, image segmentation, edge detection, object counting and measurement and other low-level image analysis techniques.
- Pattern recognition and classification techniques.
- Artificial intelligence, reasoning, search and different machine learning and optimization algorithm / techniques.
- Introduction to artificial neural network, classifier, classification errors, perceptron update rule, perceptron convergence, generalisation, regularisation, regression, boosting, Markov models and hidden Markov models.
- Introduction to fuzzy logic, fuzzy set and fuzzy logic expert systems.
- Use of artificial intelligence techniques in classification and pattern recognition.

Values and Graduate Attributes:

Values:
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V1. Appreciate the contribution of artificial intelligence and digital imaging in control and automation of an industrial mechatronic system.

Graduate Attributes:

FedUni graduate attributes statement. To have graduates with knowledge, skills and competence that enable them to stand out as critical, creative and enquiring learners who are capable, flexible and work ready, and responsible, ethical and engaged citizens.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Brief Description</th>
<th>Focus</th>
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<tbody>
<tr>
<td>Knowledge, skills and competence</td>
<td>Mechatronics is a fast-changing technological area which impacts on our every-day life. Students will develop an appreciation that learning is a life-long process.</td>
<td>High</td>
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<td>Critical, creative and enquiring learners</td>
<td>Development of independent, critical and creative learners is an essential feature of engineering education. Assessments tasks are individualised, so students need to rely on their personal efforts to arrive at their conclusions.</td>
<td>High</td>
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<td>Capable, flexible and work ready</td>
<td>Mechatronics is an interdisciplinary engineering philosophy. It requires a team work approach to execute tasks to achieve common objectives. Training for engagements is built in to the Mechatronics program. A student will graduate with a new outlook as an engaging capable, flexible and work ready individual.</td>
<td>Low</td>
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<td>Responsible, ethical and engaged citizens</td>
<td>Through the project-based learning of Mechatronics programme delivery, a student will value the engineering input for the advancement of humanity. Students are made aware that the engineer does not work or act in isolation, but is part of a wider community that includes many stakeholders, some of which may have no technical knowledge of what the engineer does. An awareness of community as a responsible, ethical and engaged citizen is important when finding a design solution.</td>
<td>Low</td>
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Learning Task and Assessment:

<table>
<thead>
<tr>
<th>Learning Outcomes Assessed</th>
<th>Assessment Task</th>
<th>Assessment Type</th>
<th>Weighting</th>
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<tbody>
<tr>
<td>S1-S6, A1-A4</td>
<td>Experimental work and / or projects to verify students ability to apply knowledge and skills acquired in the course</td>
<td>Reports, demonstrations</td>
<td>10 - 30%</td>
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<tr>
<td>K1-K7, S1-S6</td>
<td>Relevant tasks and problems to enforce understanding of the students and help in gradual development of knowledge and skills throughout the course</td>
<td>Assignments, quizzes</td>
<td>10 - 30%</td>
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<tr>
<td>K1-K7</td>
<td>Questions and problems related to the course contents</td>
<td>Mid and / or End of semester examination</td>
<td>40 - 60%</td>
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Adopted Reference Style:
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Other (IEEE: Refer to the library website for more information)