PAPER CODE NO.	EXAMINER : **Dr A Antonacopoulos**
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THE UNIVERSITY
of LIVERPOOL

SUMMER 2002 EXAMINATIONS

Bachelor of Arts : Year 3
Bachelor of Engineering : Year 3
Bachelor of Science : Year 3
Bachelor of Science : Year 4

PATTERN RECOGNITION AND IMAGE ANALYSIS IN PRACTICE

TIME ALLOWED : Two Hours and a Half

INSTRUCTIONS TO CANDIDATES

Answer ***all*** questions in Section A
Answer any ***two*** question from Section B

If you attempt to answer more than the required number of questions (in any section), the marks awarded for the excess questions will be discarded (starting with your lowest mark).

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Section A

Answer **ALL** questions. This section is worth 50% of the marks available.

A1. Describe what is meant by a "pattern". Give a definition and describe what the term relates to in different situations. [7 marks]

A2. Give two examples of domains where pattern recognition can be applied. In addition to naming particular applications, list the input patterns available and the main classes to which we may wish to assign objects. [7 marks]

A3. What are the stages to be followed when *designing* a pattern recognition system (the design cycle)? Explain briefly, and illustrate your discussion with a diagram. [7 marks]

A4. How do the stages *Image Processing*, *Image Analysis* and *Image Understanding* differ? Give examples of operations carried out in each stage and state what the input and output are in each stage. [7 marks]

A5. Explain what is *feature extraction*. Describe its goal and discuss the key desirable characteristics regarding the number and nature of features that should be extracted. [10 marks]

A6. What can the *Hough transform* be used for? Explain how the transform works with the aid of an example using two points (x_1, y_1) and (x_2, y_2) in the xy plane. [12 marks]

Section B

Answer **TWO** questions. This section is worth 50% of the marks available.

B1. a) Describe what is meant by *image enhancement* and what operations can be used to achieve it. [8 marks]

b) Describe the three operations that an edge detection method (implicitly) performs? [8 marks]

c) Give two examples of edge detection methods and illustrate the kernels used. [9 marks]

B2. You are given a book and you are told that there is no electronic source available. Your task is to devise a system that will convert the printed book into a computer-editable form. Looking at some sample pages, you discover that on a single page, apart from the text, there may be illustrations in the form of pictures (images) and line art.

a) Describe the steps you would take to design such a conversion system (based on the principles of Pattern Recognition system design). [10 marks]

b) In the resulting system, describe the stages involved in the processing and analysis of the image data. For each stage, describe possible methods that you could use. [15 marks]

B3. You are given the task to produce a system that extracts information from images of circular tachograph charts.

a) Describe the application domain and any special characteristics/difficulties present in the image. [10 marks]

Describe each of the stages involved in the extraction system and give a brief outline of the processes involved in each stage. [15 marks]