NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF APPLIED SCIENCE

DEPARTMENT OF COMPUTER SCIENCE

PATTERN RECOGNITION AND IMAGE PROCESSING

SCS 5103

Main Examination Paper: NOVEMBER 2024

This examination paper consists of 3 pages

Time Allowed: **3 hours**

Total Marks: **100**

Examiner's Name: **Dr S. S. Dube**

External Examiner: Dr C. Gombiro

INSTRUCTIONS

1. This question paper consists of five questions
2. Answer any FOUR questions

MARK ALLOCATION

QUESTION	MARKS
1.	**25**
2.	**25**
3.	**25**
4.	**25**
5.	**25**
TOTAL	**100**

Question One

a) Compare and contrast supervised and unsupervised learning techniques. Provide an example of how each technique can be applied to a real-world pattern recognition task. (15)

b) Write a program that converts an RGB image into a grayscale image. (10)

Question Two

a) Discuss the seven steps of machine learning and show how they assist in pattern recognition tasks. (15)

b) Explain the concept of Bayesian Decision Theory in the context of pattern recognition. Derive the decision rule for minimum error classification. (10)

Question Three

a) Develop code that captures a video and recognises a frame that contains a face and eyes. (15)

b) Modern techniques use automated image segmentation algorithms and deep learning for both binary and multi-label segmentation problems. State why this is so. (10)

Question Four

a) Discuss the following image processing techniques. Use examples in each of them.

i. Image enhancement (3)
ii. Image restoration (3)
iii. Image manipulation (3)
iv. Image detection (3)
v. Image compression (3)

b) Explain what is involved during the training of a Convolutional Neural Network (CNN).

(10)

Question Five

a) Explain the process of object detection in images. Use the following object detection algorithms in your answer:

i. YOLO (You Only Look Once), and (8)
ii. Faster R-CNN. (7)

b) How can one integrate machine learning with image processing algorithms to enhance image analysis tasks? Provide an example.

(10)

END OF QUESTION PAPER