

**NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY**  
**DEPARTMENT OF TEXTILE TECHNOLOGY**  
**FINAL EXAMINATION JANUARY 2008**  
**TEXTILE DYEING I TXT 2116**  
**TIME: 3HOURS**

**INSTRUCTIONS**

1. Answer **Questions 1 and 2 AND ANY OTHER THREE** Questions. Each question carries 20 marks.
2. The first fifteen minutes should be spent reading the question paper and making notes
3. **Do not** open you answer sheet until told to do so
4. Marks will be awarded for skill in appreciating the scope of questions, clarity of argument and conciseness of presentations as well as for the knowledge displayed by you.

1. EITHER

- i. (a) List chemical bleaching agents that may be used for the bleaching of cellulose fibre/fabrics. (3marks)
- (b) One of the bleaching agents listed in (a) above is generally preferred; account for the reasons why this is so. (5 marks)
- (c) Give the reaction mechanisms (equations) that are thought to take place during bleaching with hydrogen peroxide, clearly indicating the species that are said to be responsible for the bleaching action. (8 marks)
- (d) Account for reasons for the use of a stabilizer in bleaching with hydrogen peroxide. State some of the commonly used stabilizers. (4marks)

OR

- (ii) (a) Define or explain the following terms
  - colour fastness
  - chromophore
  - auxochrome
  - metamerism
  - carrier dyeing(5 marks)
- (b) Give examples of the most common chromophores found in dyes, in each case state the 'application' and 'chemical' class for the chromophore. (10marks)

- (c) What is meant by ; liquor ratio, stock solution  
Given that:  
500kg of fabric is to be dyed with the formulation;  
2% dye  
20% sodium chloride  
20:1 liquor ratio  
Calculate weight of dye and salt, and volume of bath. (5 marks)
2. (a) (i) Explain why it is necessary to desize cotton woven fabrics.  
(ii) Discuss the different methods that can be used to desize cotton woven fabrics, highlighting any advantages and limitations of these methods.  
(iii) List or state the reasons that may result in poor desizing . (10 marks)
- (b) (i) Write a concise account of the mercerisation treatment on cotton fabrics, indicating the changes that take place in the fibres during the process. Explain how mercerisation is carried out on woven fabrics. Discuss the improvements in fabric appearance and performance that may be observed as a result of the mercerisation process. (8 marks)  
(ii) Briefly discuss the advantages and limitations of anhydrous liquid ammonia treatment compared with mercerisation for woven cotton fabrics. (2 marks)
3. (a) Write a concise account of the different modes of dye-fibre attachments. List the specific examples of the different dye classes on different fibres and the respective modes of attachments involved. (6 marks)  
(b) Discuss the application of direct dyes to cellulosic fabrics. In your answer give details of how the dyeing process may be controlled to provide level, well-penetrated dyeing. (6 marks)  
(c) Explain the reasons why direct dyes exhibit low wash fastness on cellulosic fabrics and discuss the after-treatments that have been employed to overcome the problem. List any associated disadvantages of the after-treatments you discuss. (8 marks)
4. (a) (i) Describe and explain the chemical mechanisms in the dyeing of cellulosic based fabrics with reactive dyes. Discuss how the dyeing process can be controlled to yield level dyeing with high colour fastness to washing. (8 marks)  
(ii) Why have reactive dyes with two-reactive groups become important? (2 marks)  
(b) (i) Discuss the mechanisms for the dyeing of cellulosic fabrics with vat

dyes explaining the reasons for their generally high fastness to washing.  
(8 marks)

(ii) Briefly explain the classification of vat dyes based on application method.  
(2 marks)

5. (a) (i) Give a classification of acid dyes. (3 marks)

(ii) Discuss the properties of the classes you listed; how they affect the wool dyeing methods used in practice. (7 marks)

(b) (i) Discuss the dyeing of wool using chrome dyes. (8 marks)

(ii) Explain some of the drawbacks resulting from the use of chrome dyes.  
(2 marks)

6. (a) “Water quality is critical in achieving level and well penetrated dyeing”  
Write a detailed explanation in support of this statement. (15 marks)

(b) Discuss the various preparation problems that may originate from the cotton fibre itself. (5 marks)

7. (a) With the aid of clearly labelled diagrams, describe the following machinery used in wet processing, indicating the functions of the main components, where or what they can be used for and also highlight some of their limitations for their chosen purposes.

(i) Jet dyeing machine

(ii) Jig dyeing (10marks)

(b) Write an essay on “ the problems associated with laboratory-to-bulk reproducibility in dyeing”. (5 marks)

(c) How would modern instrumental based laboratory systems minimise such problems? (5 marks)

**END OF QUESTION PAPER**