

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

APPLIED PHYSICS DEPARTMENT

**SRA 2101 – RADIOGRAPHIC IMAGING
SUPPLEMENTARY EXAMINATION**

BSc HONOURS PART II: August 2004 DURATION 3 HOURS

ANSWER **ALL** PARTS OF QUESTION 1 IN SECTION A AND ANY **THREE** QUESTIONS FROM SECTION B. SECTION A CARRIES 40 MARKS AND SECTION B 60 MARKS

SECTION A

- 1 (a) With reference to film emulsion, differentiate between monochromatic, orthochromatic and panchromatic emulsions (3)
- (b) With reference to the following terms, state the relationship between transmitted light and incident light
- (i) transmission ratio
 - (ii) percentage transmission
 - (iii) opacity
 - (iv) optical density (4)
 - (v)
- (c) Define the term aerial oxidation. Explain how the problem can be minimized in developer solutions (3)
- (d) (i) Define a latent image (1)
- (ii) With respect to latent image formation, differentiate between a sensitivity speck and a development centre. (2)
- (e) Differentiate between fluorescence and phosphorescence, indicating the significance of the two in radiographic imaging. (4)

- (f) Explain why it is important for the pH of fixer to be maintained within a narrow range (3)
- (g) For the following types of intensifying screens, suggest and justify a possible application in radiography
 (i) high resolution
 (ii) fast
 (iii) graduated (3)
- (h) Indicate **FOUR** ways by which damage to cassettes may be minimized (4)
- (i) With reference to automatic exposure devices, state 3 factors that may govern the success of an examination (3)
- (j) With reference to sensitometry, explain how kV_p is related to exposure latitude (3)
- (k) A radiograph is obtained using a focus to film distance of 100cm with a focal spot size of 1.8mm x 1.8mm. The object to film distance is 10cm. Calculate the
 (i) magnification of the image (1)
 (ii) width of the penumbra (2)
- (l) As a category of optical density, state what is meant by 'specular density' (2)
- (m) State the meaning of the term 'net density' (1)

SECTION B

2. (a) Describe the **FOUR** stages of film emulsion manufacture. [8]
 (b) List the desirable physical characteristics for the base material suitable for transparency radiographic film. [3]
 (c) Describe the construction of a duplitized x-ray film. [3]
 (d) Give 2 advantages and 2 disadvantages of duplitized film. [4]
 (e) State one advantage of using iodobromide film emulsion over a bromide only emulsion. [2]
3. Explain the meaning and practical significance of the following

desirable characteristics of intensifying screens.

- (i) Spectral emission matched to film sensitivity
 - (ii) Minimum screen unsharpness
 - (iii) High quantum detection efficiency [5x3]
- (b) What is reciprocity law? What is the significance of this law in radiographic practice. [5]
4. (a) Name **FIVE** different causes of base or gross fog explaining how each occurs and showing clearly their different causes.
- (b) With reference to a store for unexposed x-ray film discuss:
- (i) the location and construction [4]
 - (ii) temperature and humidity [2]
 - (iii) stock control [4]
5. (a) Explain the function of a sensitometer [2]
- (b) With reference to sensitometry describe how a sensitometer and a densitometer may be used for producing a D log E (characteristic curve) [5]
- (c) Explain the relationship between subject contrast and exposure latitude. [5]
- (d) Describe the features of a characteristic curve which indicate the sensitometric properties of a duplitized film [8]
6. (a) The following chemicals are all constituents of a fixer or developer solution for use in an automatic film processor. State the function of each constituent and briefly explain its action during processing.
- (i) ammonium thiosulphate
 - (ii) sodium sulphite
 - (iii) aluminium chloride
 - (iv) phenidone
 - (v) potassium metabisulphite
 - (vi) sodium hydroxide [6x3]
- (b) Explain the effect on image quality of decreased developer temperature. [2]

END OF EXAMINATION