

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

APPLIED PHYSICS DEPARTMENT

SRA 2101 – RADIOGRAPHIC IMAGING

BSc HONOURS PART II: JANUARY 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 sensitometry, state the relationship between:
 - (i) average gradient \bar{G} and film latitude
 - (ii) kV_p and exposure latitude[2]
- (b) With reference to developer action, explain the charged barrier theory. [3]
- (c) State FOUR features of an ideal cassette. [3]
- (d) Explain the purpose of replenishing the chemical solutions used in processing. [3]
- (e) State FOUR features of intensifying screen construction which affect speed or sharpness. [2]
- (f) A radiograph is obtained using a focus to film distance (FFD) of 90cm with a focal spot size of 1.2mm x 1.2mm. The object to film distance is 10cm. Calculate
 - (i) the width of the penumbra [2]
 - (ii) the magnification of the image [2]
- (g) With reference to intensifying screens, explain the following terms:
 - (i) quantum detection efficiency
 - (ii) conversion efficiency[3]
- (h) With reference to the storage of unexposed, unprocessed x-ray film, explain the significance of:
 - (i) expiry date [2]
 - (ii) stock rotation [3]

- (i) Explain how you would identify the emulsion side of a single sided emulsion film. [2]
- (j) State FOUR physical characteristics desirable in the supercoat of an x-ray film. [2]
- (k) Differentiate between the terms:
 - (i) Halation
 - (ii) Irradiation
 - (iii) Crossover
 Explain why a radiation monitoring film has two emulsions? [3]
- (m) State 3 reasons why optical density is used to indicate radiographic density. [3]
- (n) Explain how a latent image is formed in a film emulsion. [3]

SECTION B

- 2. (a) Explain the effect on image quality of the following processing faults:
 - (i) inadequate wash [3]
 - (ii) no starter solution in the developer [4]
 - (iii) increased fixer replenishment [2]
 - (iv) decreased developer temperature [3]
 - (v) poorly mixed chemicals [3]
- (b) Explain the possible causes of films emerging wet from the automatic processor. [5]
- 3. With reference to film storage and stock control:
 - (a) identify FOUR potential hazards that may have a damaging effect on stored, unexposed, unprocessed films. [2]
 - (b) What effect will adverse storage conditions have on:
 - (i) film speed
 - (ii) film contrast
 - (iii) gross fog. [3]

- (c) Outline the advantages and limitations of the following methods of film ordering:
- (i) fixed quantity: variable time interval [5]
 - (ii) fixed quantity: fixed interval [5]
 - (iii) fixed interval: variable quantity [5]
4. (a) With reference to sensitometry: describe how a sensitometer and densitometer may be used for producing a D log E (characteristic) curve. [5]
- (b) Explain the relationship between subject contrast and exposure latitude. [5]
- (c) For a postero-anterior projection of the chest, it is found that the range of radiation intensities transmitted by the patient is greater than can be accommodated by the film latitude. Explain ways in which the radiographer could overcome this problem indicating the disadvantages of each method. [10]
5. (a) The following chemicals are all constituents of a fixer solution suitable for use in an automatic film processor. State the function of each constituent and briefly explain its action during the fixation process:
- (i) ammonium thiosulphate
 - (ii) acetic acid
 - (iii) sodium sulphite
 - (iv) sodium acetate
 - (v) aluminium chloride [15]
- (b) (i) List any FOUR constituents of the developer solution [2]
(ii) Explain how the developer converts the latent image into a visible image. [3]
6. (a) Explain how the following factors have contributed to reducing patient dose and/or improving image quality.
- (i) rare earth phosphors
 - (ii) flat shaped halide grains
 - (iii) light absorbing dyes [12]
- (b) Describe the construction of a duplitized x-ray film [3]
- (c) With respect to desirable characteristics of the intensifying screen, explain the meaning and practical significance of spectral emission matched to film sensitivity. [5]

- END OF EXAMINATION -