THE OPEN UNIVERSITY OF SRI LANKA

FACULTY OF HEALTH SCIENCES

DEPARTMENT OF MEDICAL LABORATORY SCIENCES

ACADEMIC YEAR 2023/2024 – SEMESTER I

BACHELOR OF MEDICAL LABORATORY SCIENCES (BMLS) HONOURS

MDU5407 – LABORATORY AUTOMATION AND INSTRUMENTATION

FINAL EXAMINATION **DURATION:03 HOURS**

DATE: 27th March 2024 TIME: 1.30 PM – 4.30 PM

INDEX NO: .....

Part B: Structured Essay Questions (40 marks)

Q1.

Three patients (A, B, C) were admitted to the hospital with distinct conditions:

A. Presented with abdominal pain and neurological symptoms, leading to stool fluorescence testing to screen for porphyria.
B. Exhibited potential kidney dysfunction, prompting observation of hemoglobin absorption patterns.
C. Presented with rheumatoid arthritis and underwent blood testing for C-reactive protein levels.

The Medical Laboratory Technician is uncertain about the optimal method among **nephelometry, fluorometry, and spectrometry** for the components mentioned above.

1.1 Identify the most appropriate method for detecting the disease condition of the above patients. (03 marks)

	Type of the sample	Method
i.	Porphyria	
ii.	Haemoglobin absorption patterns	
iii.	C-reactive protein levels	

1.2 Mention three (03) factors that can interfere with fluorescence measurements. (03 marks)

i. .....

ii. .....

iii. .....

1.3 Compare the difference between nephelometry and turbidimetry techniques. (02 marks)

	Nephelometry	Turbidimetry
i.		
ii.		
iii.		
iv.		

1.4 Briefly explain the effect of stray light in spectrophotometer. (02 marks)

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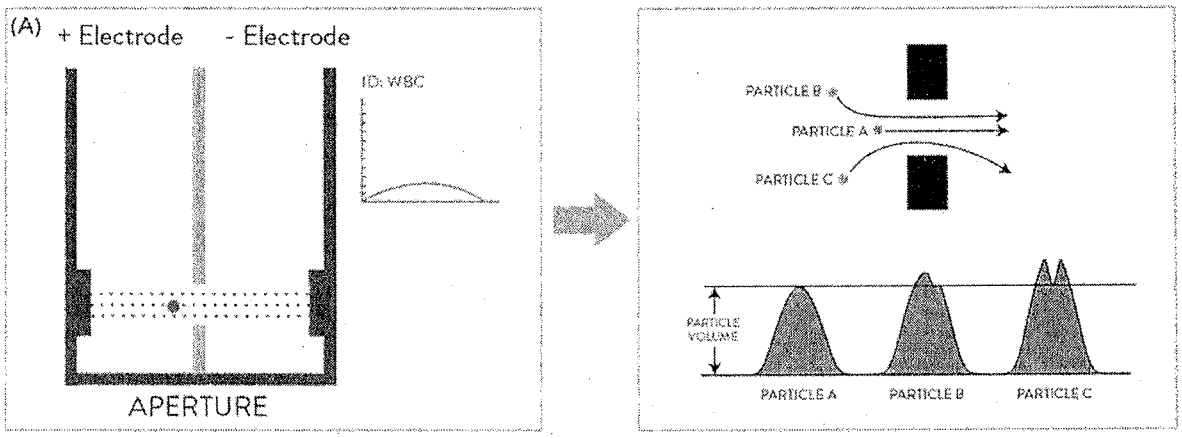
(Total 10 marks)

Q2.

The below diagram explains one of the principles of automation.



2.1.

a) State the principle of hematology analyzer which relates to the principle shown above. (01 mark)

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b) Briefly explain the principle stated in 2.1 (a). (03 marks)

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2.2 What is meant by "hydrodynamic focusing" according to the principle stated in 2.1(a)? (02 marks)

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2.3 Mention two (02) other principles used in an automated haematology analyzer.(02 marks)

i. .....

ii. .....

2.4 List two (02) red blood cell parameters that can be derived from the histogram generated by automated haematology analyzer. (02 marks)

i. .....

ii. .....

(Total 10 marks)

Q3.

A medical laboratory upgraded their biochemistry testing by installing a biochemistry analyzer with a new integrated closed system to increase speed and efficiency. This machine uses pre-packaged cartridges to minimize human errors. However, low blood glucose readings were observed among diabetic patients consistently. The Medical Laboratory Technician (MLT) confirmed that is not due to any preanalytical error but suggested that there is a problem with the functioning of the machine.

3.1 What is meant by "integrated closed system" in laboratory analyzers? (02 marks)

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3.2 State three (03) factors to be considered when installing new automation into a medical laboratory. (03 marks)

i. .....

ii. .....

iii. .....

3.3 Mention two (02) analytical errors and provide methods for troubleshooting them.

(02 Marks)

	Analytical error	Troubleshooting method
i.		
ii.		

3.4 Mention three (03) disadvantages of automation in a medical laboratory. (03 marks)

i. .....

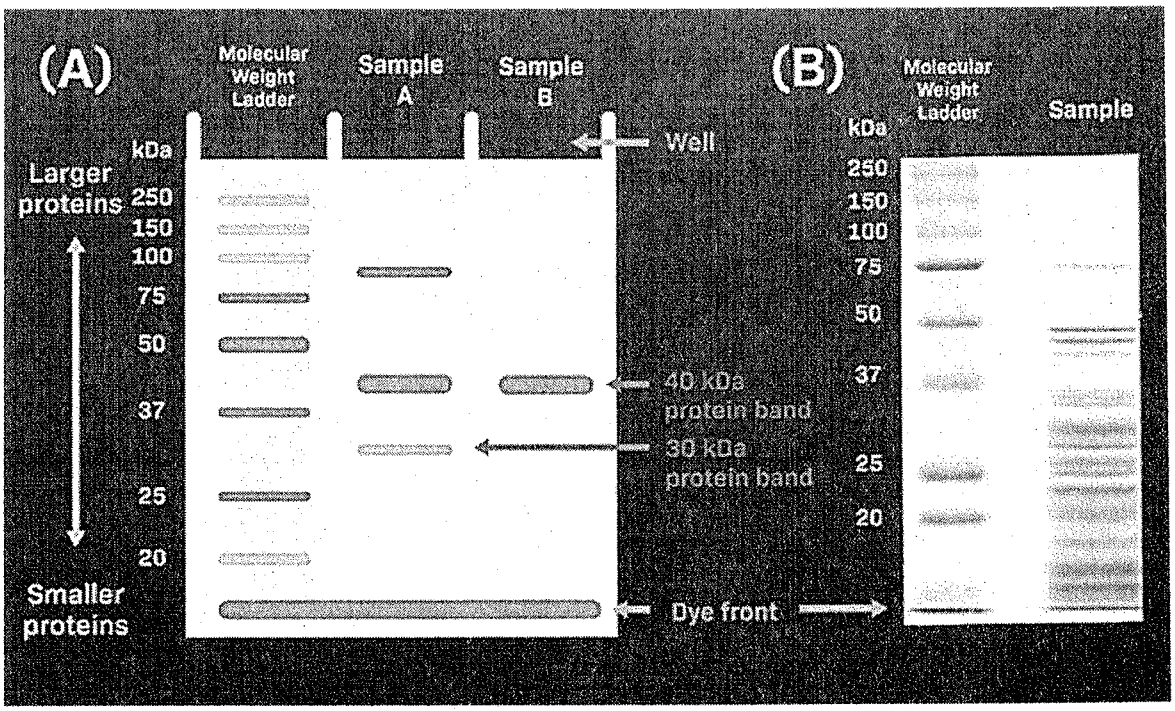
ii. .....

iii. .....

(Total 10 marks)

Q4.

You are required to purify Protein A and Protein B from a cell extract using ion exchange chromatography with a cation exchange resin. Protein A (pI 8.5) and Protein B (pI 6.0) are positively charged under certain pH conditions. After purification, you are required to integrate SDS-PAGE electrophoresis to confirm presence and purity of protein.



4.1 Briefly explain how cation exchange chromatography separates proteins based on their charge interactions. (03 marks)

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4.2 Considering the isoelectric points of protein A and protein B, which protein elutes first at a buffer pH of 7? Justify your answer. (03 marks)

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4.3 How would you adjust the pH and ionic strength to enhance the separation efficiency of protein A and protein B? (02 marks)

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4.4

a) What is the purpose of using a molecular ladder? (01 mark)

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b) Comment on the purity level of the sample run as shown in image B. (01 mark)

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(Total 10 marks)

Part C: Essay Question. (30 marks)

Q1. Write a brief account on blotting techniques. (15 marks)

1. Southern Blotting
2. Northern Blotting
3. Western Blotting

Q2.

Explain the principles underlying the diagnosis of HIV/AIDS using direct and indirect enzyme immunoassay techniques. Include a labeled diagram illustrating the process.

(15 marks)

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