

### **TECHNICAL UNIVERSITY OF MOMBASA**

# FACULTY OF APPLIED AND HEALTH SCIENCES

# DEPARTMENT OF PURE & APPLIED SCIENCES

# **UNIVERSITY EXAMINATION FOR:**

### BTAC YEAR 3 SEMESTER 1

#### ACH 4302 : ANALYTICAL INSTRUMENTATION II PAPER 2

## END OF SEMESTER EXAMINATION

### **SERIES:** DECEMBER 2016

# TIME: 2 HOURS

#### DATE: Pick Date Dec 2016

#### **Instructions to Candidates**

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **FIVE** questions. Attempt question ONE (Compulsory) and any other TWO questions. **Do not write on the question paper.** 

#### Question ONE

a.	Differentiate between		
	i. selectivity factor and retention factor	(2 marks)	
b.	ii. Ion exchange chromatography and size exclusion chromatography Name 3 sources used in UV spectrophotometer	(2 marks) (3 marks)	
c.	Define the following terms		
	i. background correction	(1 mark)	
	ii. protecting agent	(1 mark)	
	iii. fluorescence	(1 mark)	
	iv. Atomization	(1 mark)	
	v. selectivity factor	(1 marks)	
d.	Explain why is background correction necessary for the analysis?	(2 marks)	
e.	State the vibrational modes for water.	(3 marks)	

Question TWO <ul> <li>Differentiate between the following terms</li> <li>Reverse and normal phase chromatography</li> <li>Reverse and normal phase chromatography</li> <li>Reverse and normal phase chromatography</li> <li>Size exclusion and partition chromatography</li> <li>Camarks)</li> <li>Explain using a diagram the working principle of an electron captured detector.</li> <li>G marks)</li> <li>Explain three applications of TLC</li> <li>State four advantages of thin layer chromatography</li> <li>State four advantages of Harch 20H                 <ul> <li>calculate number of multiplets for each band and relative area</li> <li>calculate number of multiplets for each band and relative area</li> <li>State the following terms</li> <li>i. Loop injector</li> <li>i. Loop injector sused in gas chromatography</li> <li>d. marks)</li> <li>Name 2 detectors used in gas chromatography</li> <li>d. marks)</li> <li>State three advantages of Electrothermal over Flame Atomization</li></ul></li></ul>	f. g. h. i.	Briefly explain working principle of photomultiplier tube Name two different types of IR spectrometers Give the advantages and disadvantages of Fourier transform IR spectrophotometer What are the various parts of the Mass spectrometer? (3marks)	(4 marks) (2 marks) rs (4 marks)		
i. Reverse and normal phase chromatography       (2 marks)         ii. Size exclusion and partition chromatography       (2 marks)         b. Explain using a diagram the working principle of an electron captured detector.       (6 marks)         c. Explain three applications of TLC       (6 marks)         d. State four advantages of thin layer chromatography       (4 marks) <b>Question THREE</b> (2 marks)         a. Biefly explain principle of NMR       (2 marks)         b. For the following compound CH3CH2OH       (6 marks)         i. calculate number of multiplets for each band and relative area       (6 marks)         ii. sketch the nmr spectra of CH3CH2OH       (1 marks)         ii. loop injector       (1 marks)         iii. loop injector       (1 marks)         iii. loop injector       (1 marks)         iii. isocratic elution       (1 marks)         c. Name 2 detectors used in gas chromatography       (2 marks)         b. Describe the inductively coupled plasma (ICP) torch and explain working principle.       (5 marks)         c. Using diagrams differentiate between single and double beam spectrophotometers       (4 marks)         e. State three advantages of Electrothermal over Flame Atomization       (3 marks)         b. Describe the inductively coupled plasma (ICP) torch and explain working principle.       (5 marks)      <	Question TWO				
ii. Size exclusion and partition chromatography       (2 marks)         b. Explain using a diagram the working principle of an electron captured detector.       (6 marks)         c. Explain three applications of TLC       (6 marks)         d. State four advantages of thin layer chromatography       (4 marks)         Question THREE         a. Biefly explain principle of NMR       (2 marks)         b. For the following compound CH <sub>3</sub> CH <sub>2</sub> OH       (3 marks)         i. calculate number of multiplets for each band and relative area       (6 marks)         ii. sketch the nmr spectra of CH <sub>3</sub> CH <sub>2</sub> OH       (3 marks)         c. Define the following terms       (1 marks)         ii. Loop injector       (1 marks)         iii. isocratic elution       (1 marks)         d. State 4 factors to consider when selecting a detector in liquid chromatography?       (4 marks)         c. Name 2 detectors used in gas chromatography       (2 marks)         b. Describe the inductively coupled plasma (ICP) torch and explain working principle.       (5 marks)         c. Using diagrams differentiate between single and double beam spectrophotometers       (4 marks)         d. Differentiate between flame emission and flame absorption spectrometry       (6 marks)         e. State the selection criteria for carrier gas.       (2 marks)         d. Differentiate between non-dispersive and disper	a.	Differentiate between the following terms			
<ul> <li>b. Explain using a diagram the working principle of an electron captured detector. (6 marks)</li> <li>c. Explain three applications of TLC (6 marks)</li> <li>d. State four advantages of thin layer chromatography (4 marks)</li> <li>Question THREE <ul> <li>a. Biefly explain principle of NMR (2 marks)</li> <li>b. For the following compound CH<sub>3</sub>CH<sub>2</sub>OH (2 marks)</li> <li>b. For the following compound CH<sub>3</sub>CH<sub>2</sub>OH (3 marks)</li> <li>c. Calculate number of multiplets for each band and relative area (6 marks)</li> <li>ii. sketch the nmr spectra of CH<sub>3</sub>CH<sub>2</sub>OH (1 marks)</li> <li>ii. Loop injector (1 marks)</li> <li>iii. isocratic elution (1 marks)</li> <li>iii. isocratic elution (1 marks)</li> <li>e. Name 2 detectors used in gas chromatography (2 marks)</li> </ul> </li> <li>c. Using diagrams differentiate between single and double beam spectrophotometers (6 marks) (5 marks)</li> <li>c. Using diagrams differentiate of carrier gas. (2 marks)</li> <li>c. Using a diagram expain how an FTIR works (10 marks)</li> <li>b. Differentiate between non-dispersive and dispersive spectrophotometers? (6 marks)</li> </ul>		i. Reverse and normal phase chromatography	(2 marks)		
c. Explain three applications of TLC (6 marks) d. State four advantages of thin layer chromatography (4 marks) Question THREE a. Biefly explain principle of NMR (2 marks) b. For the following compound CH <sub>3</sub> CH <sub>2</sub> OH (2 marks) ii. sketch the num spectra of CH <sub>3</sub> CH <sub>2</sub> OH (3 marks) c. Define the following terms i. Pulse damper (1 marks) iii. Loop injector (1 marks) iii. isocratic elution (1 marks) iii. isocratic elution (1 marks) e. Name 2 detectors to consider when selecting a detector in liquid chromatography? (4 marks) b. Describe the inductively coupled plasma (ICP) torch and explain working principle. c. Using diagrams differentiate between single and double beam spectrophotometers d. Differentiate between flame emission and flame absorption spectrometry (2 marks) c. State the selection criteria for carrier gas. (2 marks) c. Using a diagram expain how an FTIR works (10 marks) b. Differentiate between non-dispersive and dispersive spectrophotometers? (6 marks)		ii. Size exclusion and partition chromatography	(2 marks)		
Question THREE       a. Biefly explain principle of NMR       (2 marks)         b. For the following compound CH <sub>3</sub> CH <sub>2</sub> OH       (6 marks)         i. calculate number of multiplets for each band and relative area       (6 marks)         ii. sketch the nmr spectra of CH <sub>3</sub> CH <sub>2</sub> OH       (3 marks)         c. Define the following terms       (1 marks)         ii. Loop injector       (1 marks)         iii. isocratic elution       (1 marks)         iii. isocratic elution       (1 marks)         e. Name 2 detectors used in gas chromatography       (4 marks)         e. Name 2 detectors used in gas chromatography       (2 marks)         b. Describe the inductively coupled plasma (ICP) torch and explain working principle.       (5 marks)         c. Using diagrams differentiate between single and double beam spectrophotometers       (4 marks)         e. State three advantages of Electrothermal over Flame Atomization       (3 marks)         (5 marks)       (5 marks)       (5 marks)         (2 Using diagrams differentiate between single and double beam spectrophotometers       (4 marks)         (2 marks)       (2 marks)       (3 marks)         (3 bifferentiate between flame emission and flame absorption spectrometry       (6 marks)         (4 marks)       (2 marks)       (2 marks)         (5 marks)       (2 marks)       (2			, ,		
a. Biefly explain principle of NMR       (2 marks)         b. For the following compound CH <sub>3</sub> CH <sub>2</sub> OH       (6 marks)         i. calculate number of multiplets for each band and relative area       (6 marks)         ii. sketch the nmr spectra of CH <sub>3</sub> CH <sub>2</sub> OH       (3 marks)         c. Define the following terms       (1 marks)         ii. Loop injector       (1 marks)         iii. isocratic elution       (1 marks)         d. State 4 factors to consider when selecting a detector in liquid chromatography?       (4 marks)         e. Name 2 detectors used in gas chromatography       (2 marks)         b. Describe the inductively coupled plasma (ICP) torch and explain working principle.       (5 marks)         c. Using diagrams differentiate between single and double beam spectrophotometers       (4 marks)         e. State the selection criteria for carrier gas.       (2 marks)         guestion FIVE       (2 marks)       (2 marks)         e. State the selection criteria for carrier gas.       (10marks)         b. Differentiate between non-dispersive and dispersive spectrophotometers?       (6 marks)	d.	State four advantages of thin layer chromatography	(4 marks)		
<ul> <li>b. For the following compound CH<sub>3</sub>CH<sub>2</sub>OH <ol> <li>calculate number of multiplets for each band and relative area</li> <li>sketch the nmr spectra of CH<sub>3</sub>CH<sub>2</sub>OH</li> <li>sketch the nmr spectra of CH<sub>3</sub>CH<sub>2</sub>OH</li> <li>marks)</li> </ol> </li> <li>c. Define the following terms <ol> <li>Pulse damper</li> <li>Loop injector</li> <li>Loop injector</li> <li>state 4 factors to consider when selecting a detector in liquid chromatography?</li> <li>Name 2 detectors used in gas chromatography</li> </ol> </li> <li>Question FOUR <ol> <li>State three advantages of Electrothermal over Flame Atomization</li> <li>Describe the inductively coupled plasma (ICP) torch and explain working principle.</li> <li>Using diagrams differentiate between single and double beam spectrophotometers</li> <li>State the selection criteria for carrier gas.</li> </ol> </li> <li>Question FIVE <ul> <li>Using a diagram expain how an FTIR works</li> <li>Differentiate between non-dispersive and dispersive spectrophotometers?</li> <li>Differentiate between non-dispersive and dispersive spectrophotometers?</li> <li>Marks)</li> </ul></li></ul>	Question THREE				
<ul> <li>i. calculate number of multiplets for each band and relative area         <ul> <li>ii. sketch the nmr spectra of CH<sub>3</sub>CH<sub>2</sub>OH</li> <li>(3 marks)</li> </ul> </li> <li>c. Define the following terms         <ul> <li>i. Pulse damper</li> <li>(1 marks)</li> <li>ii. Loop injector</li> <li>(1 marks)</li> <li>iii. isocratic elution</li> <li>(1 marks)</li> <li>e. Name 2 detectors used in gas chromatography</li> <li>(4 marks)</li> <li>(2 marks)</li> </ul> </li> <li>e. Name 2 detectors used in gas chromatography</li> <li>(3 marks)</li> <li>(2 marks)</li> <li>(2 marks)</li> <li>(3 marks)</li> <li>(2 marks)</li> <li>(2 marks)</li> <li>(3 marks)</li> <li>(2 marks)</li> <li>(2 marks)</li> <li>(3 marks)</li> <li>(4 marks)</li> <li>(2 marks)</li> <li>(2 marks)</li> <li>(2 marks)</li> <li>(3 marks)</li> <li>(4 marks)</li> <li>(2 marks)</li> <li>(4 marks)</li> <li>(2 marks)</li> <li>(2 marks)</li> <li>(3 marks)</li> <li>(4 marks)</li> <li>(5 marks)</li> <li>(4 marks)</li> <li>(5 marks)</li> <li>(6 marks)</li> <li>(6 marks)</li> <li>(2 marks)</li> <li>(3 marks)</li> <li>(4 marks)</li> <li>(6 marks)</li> <li>(6 marks)</li> <li>(6 marks)</li> <li>(10 marks)</li> <li>(10 marks)</li> <li>(10 marks)</li> <li>(10 marks)</li> <li>(10 marks)</li> </ul>			(2 marks)		
ii. sketch the nmr spectra of CH <sub>3</sub> CH <sub>2</sub> OH       (3 marks)         c. Define the following terms       (1 marks)         i. Pulse damper       (1 marks)         ii. Loop injector       (1 marks)         iii. isocratic elution       (1 marks)         d. State 4 factors to consider when selecting a detector in liquid chromatography?       (4 marks)         e. Name 2 detectors used in gas chromatography       (2 marks)         Question FOUR         a. State three advantages of Electrothermal over Flame Atomization       (3 marks)         b. Describe the inductively coupled plasma (ICP) torch and explain working principle.       (5 marks)         c. Using diagrams differentiate between single and double beam spectrophotometers       (4 marks)         e. State the selection criteria for carrier gas.       (2 marks)         Question FIVE         a. Using a diagram expain how an FTIR works       (10marks)         b. Differentiate between non-dispersive and dispersive spectrophotometers?       (6 marks)	b.	•			
<ul> <li>c. Define the following terms         <ol> <li>Pulse damper</li> <li>Pulse damper</li> <li>Loop injector</li> <li>Loop injector</li> <li>State 4 factors to consider when selecting a detector in liquid chromatography?</li> <li>State 4 factors to consider when selecting a detector in liquid chromatography?</li> <li>Name 2 detectors used in gas chromatography</li> <li>Pulse damper</li> <li>State 4 factors to consider when selecting a detector in liquid chromatography?</li> <li>Mame 2 detectors used in gas chromatography</li> <li>Pulse detectors usetof th</li></ol></li></ul>		-			
i. Pulse damper(1 marks)ii. Loop injector(1 marks)iii. isocratic elution(1 marks)d. State 4 factors to consider when selecting a detector in liquid chromatography?(4 marks)e. Name 2 detectors used in gas chromatography(2 marks)Question FOURa. State three advantages of Electrothermal over Flame Atomization(3 marks)b. Describe the inductively coupled plasma (ICP) torch and explain working principle.(5 marks)c. Using diagrams differentiate between single and double beam spectrophotometers(4 marks)d. Differentiate between flame emission and flame absorption spectrometry(6 marks)e. State the selection criteria for carrier gas.(2 marks)Question FIVEa. Using a diagram expain how an FTIR works(10marks)b. Differentiate between non-dispersive and dispersive spectrophotometers?(6 marks)	C	-	(5 marks)		
ii. Loop injector       (1 marks)         iii. isocratic elution       (1 marks)         d. State 4 factors to consider when selecting a detector in liquid chromatography?       (4 marks)         e. Name 2 detectors used in gas chromatography       (2 marks)         Question FOUR       (3 marks)         a. State three advantages of Electrothermal over Flame Atomization       (3 marks)         b. Describe the inductively coupled plasma (ICP) torch and explain working principle.       (5 marks)         c. Using diagrams differentiate between single and double beam spectrophotometers       (4 marks)         d. Differentiate between flame emission and flame absorption spectrometry       (6 marks)         e. State the selection criteria for carrier gas.       (2 marks)         Question FIVE       a. Using a diagram expain how an FTIR works       (10marks)         b. Differentiate between non-dispersive and dispersive spectrophotometers?       (6 marks)	с.		(1 marks)		
iii. isocratic elution(1 mark)d. State 4 factors to consider when selecting a detector in liquid chromatography?(4 marks)e. Name 2 detectors used in gas chromatography(2 marks)Question FOURa. State three advantages of Electrothermal over Flame Atomization(3 marks)b. Describe the inductively coupled plasma (ICP) torch and explain working principle.(3 marks)c. Using diagrams differentiate between single and double beam spectrophotometers(4 marks)d. Differentiate between flame emission and flame absorption spectrometry(6 marks)e. State the selection criteria for carrier gas.(2 marks)Question FIVEa. Using a diagram expain how an FTIR works(10marks)b. Differentiate between non-dispersive and dispersive spectrophotometers?(6 marks)		-			
<ul> <li>e. Name 2 detectors used in gas chromatography</li> <li>Question FOUR <ul> <li>a. State three advantages of Electrothermal over Flame Atomization</li> <li>b. Describe the inductively coupled plasma (ICP) torch and explain working principle.</li> <li>c. Using diagrams differentiate between single and double beam spectrophotometers</li> <li>d. Differentiate between flame emission and flame absorption spectrometry</li> <li>e. State the selection criteria for carrier gas.</li> </ul> </li> <li>Question FIVE <ul> <li>a. Using a diagram expain how an FTIR works</li> <li>b. Differentiate between non-dispersive and dispersive spectrophotometers?</li> <li>(6 marks)</li> </ul> </li> </ul>			· · · · · · · · · · · · · · · · · · ·		
Question FOUR       a. State three advantages of Electrothermal over Flame Atomization       (3 marks)         b. Describe the inductively coupled plasma (ICP) torch and explain working principle.       (5 marks)         c. Using diagrams differentiate between single and double beam spectrophotometers       (4 marks)         d. Differentiate between flame emission and flame absorption spectrometry       (6 marks)         e. State the selection criteria for carrier gas.       (2 marks)         Question FIVE       a. Using a diagram expain how an FTIR works       (10marks)         b. Differentiate between non-dispersive and dispersive spectrophotometers?       (6 marks)	d.	State 4 factors to consider when selecting a detector in liquid chromatography?	(4 marks)		
a. State three advantages of Electrothermal over Flame Atomization(3 marks)b. Describe the inductively coupled plasma (ICP) torch and explain working principle.(5 marks)c. Using diagrams differentiate between single and double beam spectrophotometers(4 marks)d. Differentiate between flame emission and flame absorption spectrometry(6 marks)e. State the selection criteria for carrier gas.(2 marks)Question FIVEa. Using a diagram expain how an FTIR works(10marks)b. Differentiate between non-dispersive and dispersive spectrophotometers?(6 marks)	e.	Name 2 detectors used in gas chromatography	(2 marks)		
<ul> <li>b. Describe the inductively coupled plasma (ICP) torch and explain working principle. (5 marks)</li> <li>c. Using diagrams differentiate between single and double beam spectrophotometers</li> <li>d. Differentiate between flame emission and flame absorption spectrometry</li> <li>e. State the selection criteria for carrier gas. (2 marks)</li> <li>Cuestion FIVE</li> <li>a. Using a diagram expain how an FTIR works</li> <li>b. Differentiate between non-dispersive and dispersive spectrophotometers? (6 marks)</li> </ul>	Question FOUR				
c. Using diagrams differentiate between single and double beam spectrophotometers(4 marks)d. Differentiate between flame emission and flame absorption spectrometry(6 marks)e. State the selection criteria for carrier gas.(2 marks)Question FIVEa. Using a diagram expain how an FTIR works(10marks)b. Differentiate between non-dispersive and dispersive spectrophotometers?(6 marks)	a.	•			
d. Differentiate between flame emission and flame absorption spectrometry e. State the selection criteria for carrier gas.(6 marks) (2 marks)Question FIVEa. Using a diagram expain how an FTIR works b. Differentiate between non-dispersive and dispersive spectrophotometers?(10marks) (6 marks)					
<ul> <li>e. State the selection criteria for carrier gas. (2 marks)</li> <li>Question FIVE <ul> <li>a. Using a diagram expain how an FTIR works</li> <li>b. Differentiate between non-dispersive and dispersive spectrophotometers? (6 marks)</li> </ul> </li> </ul>					
<ul> <li>a. Using a diagram expain how an FTIR works (10marks)</li> <li>b. Differentiate between non-dispersive and dispersive spectrophotometers? (6 marks)</li> </ul>					
b. Differentiate between non-dispersive and dispersive spectrophotometers? (6 marks)	Question FIVE				
	a.	Using a diagram expain how an FTIR works	(10marks)		
	b.	· · · ·	(6 marks)		

c. Describe how to prepare the following samples using IR spectrophotometer

 Gases
 Nonvolatile Liquid
 (2 marks)
 (2 marks)