****

**GARISSA UNIVERSITY**

**UNIVERSITY EXAMINATION 2019/2020 ACADEMIC YEAR TWO**

**SECOND SEMESTER EXAMINATION**

**SCHOOL OF PURE AND APPLIED SCIENCES**

**FOR THE DEGREE OF BACHELOR OF EDUCATION**

**COURSE CODE: CHE 201**

**COURSE TITLE: CHEMICAL ANALYSIS AND STRUCTURE DETERMINATION**

**EXAMINATION DURATION: 2 HOURS**

**DATE: 12/02/2020 TIME: 2.00-4.00 PM**

**INSTRUCTION TO CANDIDATES**

* **The examination has FIVE (5) questions**
* **Question ONE (1) is COMPULSORY**
* **Choose any other TWO (2) questions from the remaining FOUR (4) questions**
* **Use sketch diagrams to illustrate your answer whenever necessary**
* **Do not carry mobile phones or any other written materials in examination room**
* **Do not write on this paper**

**This paper consists of FOUR (4) printed pages *please turn over***

**QUESTION ONE (COMPULSORY)**

1. Define the following Analytical Chemistry terms of Analysis **[8 marks]**
2. Adjusted retention time (tr’):
3. Spectrophotometry
4. Fluorescence and Phosphorescence
5. Resolution in chromatography
6. The following data were obtained for four compounds separated on a 20-m capillary column.

|  |  |  |
| --- | --- | --- |
|  Compound |  Tr(min) | W (min) |
|  A |  8.04 | 0.15 |
|  B |  8.26 |  0.15 |
|  C |  8.43 | 0.16 |

1. Calculate the number of theoretical plates for each compound and the average number of theoretical plates for the column. **[3 marks]**
2. Calculate the average height of a theoretical plate. **[2 marks]**
3. Give 2 practical application each of the following techniques of analysis: **[8 marks]**
4. Potentiomentry
5. Voltammetry
6. GC-MS
7. NMR
8. A 5.00 x 10–4 M solution of an analyte is placed in a sample cell that has a cell path of 1.00 cm. When measured at a wavelength of 490 nm, what is the absorbance if analyte’s molar absorptivity at this wavelength is 676 cm-1 M-1? **[3 marks]**
9. State 6 points that should be considered when choosing an instrument for any measurement or analysis? **[6 marks]**

**QUESTION TWO**

1. Name three different interphases of analytical techniques of chemical analysis **[3 marks]**
2. Name three most commonly Calibration methods in an analytical analysis **[3 marks]**
3. Why are electrochemical methods of analysis preferred more as compared to other techniques like spectroscopic and chromatography **[3 marks]**
4. Name 4 electro-analytical techniques of Chemical analysis **[4 marks]**
5. With schematic diagram differentiate between a single beam spectrophotometer and double beam spectrophotometer **[6 marks]**

**QUESTION THREE**

1. Look at the mass spectra of benzoic acid (Figure 1) and identify the ions responsible for the major peaks. **[10 marks]**



**Figure 1**

1. Look at the mass spectra of methyl benzoate (Figure 2) and identify the ions responsible for the major peaks**. [10 marks]**



**Figure 2**

**QUESTION FOUR**

1. Using the below low-resolution NMR spectra and other information given, suggest a possible structure for each substance. Figure 3 shows the 1H NMR spectrum of a hydrocarbon. **[15 marks]**

****

**Figure 3**

1. State and Explain 3 factors that affect Height Equivalent of a Theoretical Plate (H) **[5 marks]**

**QUESTION FIVE**

The spectra below are IR of ethanoic acid, CH3COOH (Figure-4), and ethanoic anhydride, (CH3CO)2O (Figure-5). Draw the full structural formulas for both compounds and then determine, giving reasons, which spectrum is due to which compound.



**Figure 4**



**Figure 5**