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**Department of Chemistry**

**College of Education**

**University of Salahaddin**

**Subject: Organic identification**

**Course Book – *Stage* 4)**

**Lecturer's name PhD Hashim Jalal Azeez**

**Academic Year: 2019/2020**

**Course Book**

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| **1. Course name** | **Organic Identification** | |
| **2. Lecturer in charge** | **Dr.Hashim Jalal Azeez** | |
| **3. Department/ College** | **Chemistry/Education** | |
| **4. Contact** | **e-mail:** [**hashim.Azeez@su.edu.krd**](mailto:hashim.Azeez@su.edu.krd)  **Tel: (optional)07504849774** | |
| **5. Time (in hours) per week** | **Theory; 4 hr**  **Practical:3x4 hr** | |
| **6. Office hours** | **8,30-10,30 Sunday , 10,30-12,30 Sunday** | |
| **7. Course code** |  | |
| **8. Teacher's academic profile** | **Dr.Hashim Jalal Azeez, Professor of Organic Chemistry, Synthesis , Spectroscopic identification of heterocyclic. Compounds .Dr.Hashim finished his Bachelor degree in 1983 at university of Salahaddin, Master degree at college of science , university of Salahaddin 1986 in industrial organic chemistry and PhD in 2000 at college of science , university of Baghdad . He is interested in Synthesis of bioactive heterocyclic compounds. He has Supervised 16 of postgraduate students for their thesis for Diploma , master degree and PhD . He has published 30 articles in local and international journal’s** | |
| **9. Keywords** | **Spectroscopy , IR, H-NMR , UV-Visible spectroscopy** | |
| **10. Course overview:**  ▪ **The importance of studying the subject** : The students learn 1-how to identify the unknown compounds by using combination of different instruments like IR , H-NMR  2- determination of λmax of several compounds like dienes , trienes , tetraenes , alpha-beta unsaturated carbonyl compounds **▪ Understanding of the fundamental concepts of the course**   1. An introduction about electromagnetic radiation 2. Infrared spectroscopy 3. Proton NMR 4. UV-Visible spectroscopy **▪ Principles and theories of the course:**   About the principle IR :  If any compound exposed (irradiated) to ir radiation , it will absorb a frequency which is corresponds (equal to) to the frequency of the bond. The absorbed frequencies are recorded on a chart as a spectrum. The ir radiation composed from a huge number of frequencies range from 200-4000cm-1, all these frequencies are not absorbed simultaneously (at the same time), unless the frequency of the radiation correspond to the frequency of the bond between two at atoms.  About the principle NMR:     1. ▪ A sound knowledge of the major areas of the subject ▪ Sufficient knowledge and understanding to secure employment | | |
| **11. Course objective:**  **The aim of this course was to know the students the identify the unknown compounds by using different technique’s like Infra-red, Nuclear magnetic resonance spectroscopy and ultraviolet spectroscopy** | | |
| **12. Student's obligation**  The student must be present in all classes and was ready for Quiz and for examination according to date which decided by chemistry department | | |
| **3. Forms of teaching: 1-Data Show ( power point)**  **2- black board and white board** | | |
| **14. Assessment scheme: a- Examination b- Quiz c- don’t come to class ( presence of student in hall)**  ؟‌ | | |
| **15. Student learning outcome: The aim of this course was to know the students the identify the unknown compounds by using different technique’s like Infra-red, Nuclear magnetic resonance spectroscopy and ultraviolet spectroscopy and this was related with the market for example from the market they need to know the composition the structure of some samples like the composition of the crude oils , solutions like juices .**  **The student learn at the end of the course; (a) the principles of the work of these techniques IR, 1H-NMR and UV-Visible and (b)the factors which affect the position of absorption in above techniques (c) deduce the structure of compounds through combination spectra IR and H1-NMR** | | |
| **16. Course Reading List and References‌:**  Required books:  1-"Introduction to Spectroscopy ", by Donald L.Pavia , Gary M.Lampman , George S. Kriz , James R .Vyvyan , 2009 , Books / Cole Cennagage learning  2-Spectrometric identification of organic compounds ,7th edition , Robert M.Silverstein , Francis X. Webster, David J. Kiemle. Jhon Wiley & Sons , INC. 2005 | | |
| **17. The Topics:** | | **Lecturer's name** |
| Spectroscopy is a powerful tool for studying biological systems. It often provides a convenient method for  analysis of individual components in a biological  system such as proteins, nucleic acids, and metabolites. It can also provide detailed information about the  structure and mechanism of action of molecules. In order to obtain the maximum benefit from this tool and to use  it properly, a basic understanding of spectroscopy is necessary. | | Dr.Hashim Jalal  8:30-10:30 Sunday  10:30-12:30 Sunday |
| **18. Practical Topics (If there is any)** | |  |
| Week1:  Contents and references  Electromagnetic radiation , Spectroscopy, Electromagnetic regions.  Week2:  effect of the different Electromagnetic radiation on the molecule. IR: principle of IR, Far IR, Near IR,  Week3:  Calculation of vibrational frequency (Hook's law), Molecular vibrations (stretching & bending).  Week4:  , Fundamental and non Fundamental vibrations, Requirements for absorption of the compounds in IR, Types of peaks (bands), Regions of Aromatic compounds in IR.  Week5: Factors influencing vibration frequency 1- Vibrational coupling  2- Hydrogen bonding  .    Week6:  3- Electronic effect: a- Mesomeric effect, b- Inductive effect,  c- Field effect. 4- Bond angles, 5- hybridization  Week7: Block diagram of an IR single beam instrument  Block diagram of an IR double beam instrument  Infrared sources, equipments used in infrared sampling technique  Week8: Calibration of an IR instrument ( Calibration of the frequency scale), measurement of path length of liquid cells, A survey of the important functional group frequencies with examples .  Week9: Applications of IR spectroscopy  Week10: First Examination  Week11: Nuclear magnetic resonance (NMR)  Introduction, origin of the peaks (signals), chemical shift, TMS,  Basic features of an NMR spectrometer  Week12:  Factors influencing the chemical shift:  1-Electonegativity  2- Vander waals deshilding  3- hybridization effects  Week13:  4- magnetic anisotropy : alkenes ,carbonyl compounds , benzene ring , alkyne compounds  Week14:  5- Acidic and exchangeable protons: hydrogen bonding  , solvent shifts – concentration and temperature effects  6. Influence of restricted rotation.  Week15:  Spin –spin splitting (spin-spin coupling) (n+1 rule)  Pascal's triangle , Determination of number of hydrogen atoms from Integrals ( areas)  Week 16:  Application of NMR spectroscopy (Problems & solution)  Week 17: Second Examination  Week 18:  UV-Visible spectroscopy , comparison between the principle of IR and UV-visible, absorption band, absorption line, chromophore, auxochrome,bathochromic shift, hypsochromic shift, hyperchromic effect, hypochromic effect, Week 19: vacuum ultraviolet, most of the transitions that occur in different compounds, distinguish of compounds by UV-Visible .  Week 20:  Many factors influence the relative energies of molecular orbital  1-solvent effect 2- substitution 3- conjugation 4- sterochemical  Factors a- biphenyl and binaphthyls  b-cis and trans isomers Week 21:  5-temperature effect  Applications of electronic spectroscopy:  1-λmax determination for conjugated dienenes , trienes , α,β-unsaturated carbonyl compounds (Wood ward rules)  Week 21 : 2-Fisher-Kuhns rules( λmax for polyenes)  Week 22 : 3-For benzene and its derivatives  4-Tautomerism  Week 23 :  5-Control and industrial laboratories  6-Absorption spectra of charge transfer complexes 7-Distinguish between saturated and α,β-unsaturated ketones  8-Qualitative analysis and mixture analysis:  Week 24:  9-Study of chemical reactions  a- Acid-base dissociation constant  b-Rate constant  c-Equlibrium constant  Week 25th : 3rd examination | | Dr.Hashim Jalal  8:30-10:30 Sunday  10:30-12:30 Sunday |
| **19. Examinations:**  ***1. Compositional:***  :Explain the following :  1-Vibrational coupling takes place between two bonds in many cases.  2-Free OH str.in some compounds not be seen at low concentrations…………  3-C-H str.in alkane , alkene and alkyne.  4- C=C str.in cyclobutene and other cycloalkenes  5-Carboxylic acids could be distinguished from aminoacids by IR  6- C=O str. in two different alpha chloroketone derivatives of steroids  ***2.******True or false type of exams:***  / Select True or False of the following sentences and correct the false sentences  1-Classese of alcohols may be distinguished through the OH str. only  2-Carboxylic acid and amino acids could be distinguished only through the OH str. and +NH str. ?  3-Aldehydes and Ketones are distinguished through the CH str. of CHO group?  4-primary amide can be distinguished from acid chloride only through wave number of C=O bond?  ***3. Multiple choices:***  Select suitable answer of the following states :  1-the unit of IR is :   1. nm b- ppm c- Mm d- cm-1   2- the region of far infrared is:   1. 400 - 4000 cm-1 b- 200-700 cm-1 c- 2500- 3300 cm-1 d-4000-14290 cm-1   3- The Role of IR is :  a-to know the No. of different protons  b-to detect the free radicals  c-To detect the functional groups  d- count different No. of different carbons | | |
| **20. Extra notes**  Here the lecturer shall write any note or comment that is not covered in this template and he/she wishes to enrich the course book with his/her valuable remarks. | | |
| **21. Peer review پێداچوونه‌وه‌ی هاوه‌ڵ**  This course book has to be reviewed and signed by a peer. The peer approves the contents of your course book by writing few sentences in this section.  *(A peer is person who has enough knowledge about the subject you are teaching, he/she has to be a professor, assistant professor, a lecturer or an expert in the field of your subject).*  ئه‌م کۆرسبووکه‌ ده‌بێت له‌لایه‌ن هاوه‌ڵێکی ئه‌کادیمیه‌وه‌ سه‌یر بکرێت و ناوه‌ڕۆکی بابه‌ته‌کانی کۆرسه‌که‌ په‌سه‌ند بکات و جه‌ند ووشه‌یه‌ک بنووسێت له‌سه‌ر شیاوی ناوه‌ڕۆکی کۆرسه‌که و واژووی له‌سه‌ر بکات.  هاوه‌ڵ ئه‌و که‌سه‌یه‌ که‌ زانیاری هه‌بێت له‌سه‌ر کۆرسه‌که‌ و ده‌بیت پله‌ی زانستی له‌ مامۆستا که‌متر نه‌بێت.‌‌ | | |