**ATTACHMENT 5.**

**Kingdom of Saudi Arabia**

**The National Commission for Academic Accreditation & Assessment**

**T6. Course Specifications**
**(CS)**

# Modern Techniques

# in Organic Spectroscopy

# (402632–3)

# Course Specifications

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| Institution: **Umm Al-Qura University** | Date of Report: **2017** |
| College/Department : **Faculty of Applied Science / Department of Chemistry** | |

## A. Course Identification and General Information

1. Course title and code: **Modern Techniques in Organic Spectroscopy / 402632-3**
2. Credit hours: **3 hrs (theoretical)**
3. Program(s) in which the course is offered: **M. Sc. in Chemistry**
4. Name of faculty member responsible for the course: **Prof. Dr. Mohamed Rabie**
5. Level/year at which this course is offered: **2nd / 1st**
6. Pre-requisites for this course (if any): **not applicable**
7. Co-requisites for this course (if any): **not applicable**
8. Location if not on main campus: **El-Abedyah, El-Azizya, and El-Zaher**
9. Mode of Instruction (mark all that apply)

| | | | |
|---|---|---|---|
| a. Traditional classroom | ☐ | What percentage? | ☐ |
| b. Blended (traditional and online) | ■ | What percentage? | **100%** |
| c. e-learning | ☐ | What percentage? | ☐ |
| d. Correspondence | ☐ | What percentage? | ☐ |
| f. Other | ☐ | What percentage? | ☐ |

Comments:

## B Objectives

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| 1. What is the main purpose for this course?<br>By the end of this course student will be familiar with compounds analysis by modern techniques in structure elucidation of organic molecules (such as; UV-spectroscopy, infra-red spectroscopy, NMR-Spectroscopy, mass spectrometry). |
| 2. Briefly describe any plans for developing and improving the course that are being implemented. (e.g. increased use of IT or web based reference material, changes in content as a result of new research in the field):<br>The students will be training to use highly advanced data base services, and/or websites to improving interpretation of compounds with advances spectroscopy |

## C. Course Description (Note: General description in the form to be used for the Bulletin or handbook)

1. Topics to be Covered

| List of Topics | No. of Weeks | Contact Hours |
|---|---|---|
| Review of principals of spectroscopy and index of hydrogen deficiency. | **1** | **3** |
| Proton NMR spectra. Chemical shifts- Spin-spin coupling- Chemical and magnetic equivalence in $^{1}$H NMR. | **1** | **3** |
| First order spectra. Non-First order spectra. Simplification of complex spectra. | **1** | **3** |
| $^{13}$C-NMR spectra. NMR spectra of other nuclei. | **1** | **3** |
| Two-dimensional NMR. H-H-COSY. H-C-COSY. | **2** | **6** |
| Inversed H-C-COSY (HMQC). Long range H-C-COSY (HMBC). | **2** | **6** |
| Factors affecting coupling constant. Chemical shifts in $^{13}$CNMR. | **1** | **3** |
| IR in elucidation of organic compounds structures. | **1** | **3** |
| Advanced mass spectrometry and fragmentation patterns. | **2** | **6** |
| UV in accounting the organic structural analysis. | **1** | **3** |

| 2. Course components (total contact hours and credits per semester): | | | | | | |
|---|---|---|---|---|---|---|
| | Lecture | Tutorial | Laboratory | Practical | Other: | Total |
| Contact Hours | **13** | | | | | **39** |
| Credit | **3** | **-** | | | | **3** |

3. Additional private study/learning hours expected for students per week. 4hr

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategy

| | **NQF Learning Domains And Course Learning Outcomes** | **Course Teaching Strategies** | **Course Assessment Methods** |
|---|---|---|---|
| **1.0** | **Knowledge** | | |
| 1.1 | Remember the general principals of different types of spectroscopy. | • Lectures<br>• Scientific discussion<br>• Library visits<br>• Web-based study | • Exams<br>• web-based student performance systems<br>• portfolios<br>• long and short essays<br>• posters<br>• lab manuals |
| 1.2 | Know factors affecting chemical shift and spin-spin coupling in $^{1}$HNMR. Factors affecting coupling constant. | | |
| 1.3 | Describe chemical shifts in $^{13}$CNMR. Broadband proton decoupling in $^{13}$C-NMR; Off-resonance proton decoupling. | | |
| 1.4 | Familiar with distortionless enhancement by polarization transfer (DEPT) | | |
| 1.5 | Identify nuclear overhauser and exchange spectroscopy (NOESY). Heteronuclear correlation spectroscopy. Inversed H-C-COSY (HMQC).Long range H-C-COSY (HMBC). | | |

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|---|---|---|---|
| 1.6 | | | |
| **2.0** | **Cognitive Skills** | | |
| 2.1 | Apply dstortionless enhancement by polarization transfer (DEPT) | • Scientific discussion<br>• Library visits<br>• Web-based study | • Exams<br>• web-based student performance systems<br>• portfolios<br>• posters<br>• individual and group presentations<br>• video analysis<br>• lap manuals |
| 2.2 | Predict nuclear overhauser enhancement (NOE) in $^{1}H$- and $^{13}C$-NMR; Pulse fourer transform NMR | | |
| 2.3 | Compare between COSY, NOESY, Inversed H-C-COSY (HMQC), and Long range H-C-COSY HMBC. | | |
| 2.4 | Summarize the spectroscopy of organic compounds | | |
| 2.5 | development reverse thinking skill (back thinking) | | |
| **3.0** | **Interpersonal Skills & Responsibility** | | |
| | • Use the advanced spectroscopy to elucidate the structure of compounds.<br>• justify the structure of compound according to spectroscopy<br>• Ability to communicate results of work to classmates.<br>• Ability to work in a team to perform a specific task. | • Library visits<br>• Scientific discussion<br>• Web-based study | • web-based student performance systems<br>• individual and group presentations |
| **4.0** | **Communication, Information Technology, Numerical** | | |
| | • Demonstrate structure for organic compounds with Advanced spectroscopy<br>• Use information and communication technology.<br>• The ability to use e-mail to communicate with the | • Scientific discussion<br>• Library visits | • web-based student performance systems<br>• individual and group presentations |

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| | instructor and other students.<br>• Scientific writing.<br>• Use his/her observations to solve problems. | • Web-based study | |
| **5.0** | **Psychomotor** | | |
| 5.1 | NOT APPLICABLE | | |
| 5.2 | | | |

| 5. Schedule of Assessment Tasks for Students During the Semester | | | |
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| | Assessment task (e.g. essay, test, group project, examination, speech, oral presentation, etc.) | Week Due | Proportion of Total Assessment |
| 1 | Assignments and activities. | -- | 10 % |
| 2 | Midterm Exam. | 8 | 30 % |
| 4 | Final Exam. | 15-16 | 60 % |
| 5 | **Total** | **100 %** | |

### D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice. (include amount of time teaching staff are expected to be available each week)

- We have faculty members to provide counseling and advice.
- Office hours: During the working hours weekly.
- Academic Advising for students.

### E. Learning Resources

1. List Required Textbooks

- F. M. Mirabella, *Modern Techniques in Applied Molecular Spectroscopy*, 3rd ed., New York, Jhon Wiley and Sons (1998).
- T. D. W. Claridge, *High-Resolution NMR Techniques in Organic Chemistry*, 3rd ed., UK, Elsevier Ltd. (2016).

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| • 2. List Essential References Materials (Journals, Reports, etc.)<br>• Journal of Organic Chemistry.<br>• Russian Journal of Organic Chemistry.<br>• Optics and Spectroscopy. |
| 3. List Recommended Textbooks and Reference Material (Journals, Reports, etc)<br>Any other journals in the field of the course will be considered. |
| 4. List Electronic Materials (eg.Web Sites, Social Media, Blackboard, etc.)<br>• **http://www.chemweb.com**<br>• **http://www.sciencedirect.com**<br>• **http://www.rsc.org**<br>• http://stream.hebust.edu. |
| 5. Other learning material such as computer-based programs/CD, professional standards or regulations and software.<br><br>**Non**. |

## F. Facilities Required

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| Indicate requirements for the course including size of classrooms and laboratories (i.e. number of seats in classrooms and laboratories, extent of computer access etc.) |
| 1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)<br>• Classrooms capacity (10) students.<br>• Providing hall of teaching aids including computers and projector. |

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| 2. Computing resources (AV, data show, Smart Board, software, etc.)<br>▪ Room equipped with computer and projector and TV. |
| 3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)<br>• **No other requirements.** |

## G Course Evaluation and Improvement Processes

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| 1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching<br>Complete the questionnaire evaluation of the course in particular. |

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| 2 Other Strategies for Evaluation of Teaching by the Program/Department Instructor<br>• Observations and the assistance of colleagues.<br>• Independent evaluation for extent to achieve students the standards.<br>• Iindependent advice of the duties and tasks. |
| 3 Processes for Improvement of Teaching<br>• Workshops for teaching methods.<br>• Continuous training of member staff.<br>• Providing new tools for learning.<br>• The application of e-learning.<br>• Eexchange of experiences internal and external. |
| 4. Processes for Verifying Standards of Student Achievement (e.g. check marking by an independent member teaching staff of a sample of student work, periodic exchange and remarking of tests or a sample of assignments with staff at another institution)<br>▪ Check marking of a sample of exam papers, or student work.<br>▪ Exchange corrected sample of assignments or exam basis with another staff member for the same course in other faculty. |

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| 5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.<br>• Periodic Review of the contents of the syllabus and modify the negatives.<br>• Consult other staff of the course.<br>• Hosting a visiting staff to evaluate of the course.<br>• Workshops for teachers of the course. |

Name of Instructor: **Prof. Dr. Mohamed Rabie**
Signature: Date Report Completed: **2017**

Name of Field Experience Teaching Staff:

Program Coordinator:

Signature: _____ Date Received: **2017**