# COURSE SPECIFICATIONS

## Form

Course Title:

# Modern Techniques in Organic Spectroscopy

Course Code: **4026821-3**

| | |
|---|---|
| **Date:** 27-10-2018 | **Institution:** **Umm Al-Qura University**. |
| **College:** **Faculty of Applied Science** | **Department:** **Department of Chemistry** |

## A. Course Identification and General Information

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| 1. Course title and code: **Modern Techniques in Organic Spectroscopy / 4026821-3** |
| 2. Credit hours: **3 hrs. (theoretical)** |
| 3. Program(s) in which the course is offered. **M. Sc. in Chemistry**<br>(If general elective available in many programs indicate this rather than list programs) |
| 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 | | percentage? | |
| b. Blended (traditional and online) | | percentage? | 100% |
| c. E-learning | | percentage? | |
| d. Correspondence | | percentage? | |
| f. Other | | percentage? | |

Comments:

## B Objectives

1. The main objective of this course

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. Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field)

- 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 used in the program's bulletin or handbook)

**Course Description:**

**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 |

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| Advanced mass spectrometry and fragmentation patterns. | 2 | 6 |
| UV in accounting the organic structural analysis. | 1 | 3 |

**2. Course components (total contact and credit hours per semester):**

| | | Lecture | Tutorial | Laboratory/ Studio | Practical | Other | Total |
|---|---|---|---|---|---|---|---|
| Contact Hours | Planned | 39 | -- | -- | -- | -- | 39 |
| | Actual | 39 | -- | -- | -- | -- | 39 |
| Credit | Planned | 3 | -- | -- | -- | -- | 3 |
| | Actual | 3 | -- | -- | -- | -- | 3 |

**3. Individualstudy/learning hours expected for students per week.** 4

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

**On the table below are the five NQF Learning Domains, numbered in the left column.**

**First**, insert the suitable and measurable course learning outcomes required in the appropriate learning domains (see suggestions below the table). **Second**, insert supporting teaching strategies that fit and align with the assessment methods and targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

**Curriculum Map**

| Code # | 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 | • Exams<br>• web-based student performance systems<br>• portfolios |
| 1.2 | Know factors affecting chemical shift and spin-spin coupling in $^{1}$HNMR. Factors affecting coupling constant. | | |

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|---|---|---|---|
| 1.3 | Describe chemical shifts in $^{13}$CNMR. Broadband proton decoupling in $^{13}$C-NMR; Off-resonance proton decoupling. | • Web-based study | • long and short essays<br>• posters<br>• lab manuals |
| 1.4 | Familiar with distortionless enhancement by polarization transfer (DEPT) | | |
| 1.5 | Identify nuclear overhauser and exchange spectroscopy (NOESY). | | |
| 1.6 | Familiar with Heteronuclear correlation spectroscopy. Inversed H-C-COSY (HMQC).Long range H-C-COSY (HMBC). | | |
| **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** | | |
| 3.1 | Use the advanced spectroscopy to elucidate the structure of compounds. | • Library visits<br>• Scientific discussion<br>• Web-based study | • web-based student performance systems<br>• individual and group presentations |
| 3.2 | justify the structure of compound according to spectroscopy | | |
| 3.3 | Ability to communicate results of work to classmates. | | |
| 3.4 | Ability to work in a team to perform a specific task. | | |
| **4.0** | **Communication, Information Technology, Numerical** | | |
| 4.1 | Demonstrate structure for organic compounds | • Scientific | • web-based student |

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|---|---|---|---|
| | with Advanced spectroscopy. | discussion<br>• Library visits<br>• Web-based study | performance systems<br>• individual and group presentations |
| 4.2 | Use information and communication technology. | | |
| 4.3 | The ability to use e-mail to communicate with the instructor and other students. | | |
| 4.4 | Scientific writing. | | |
| 4.5 | Use his/her observations to solve problems. | | |
| **5.0** | **Psychomotor(if any)** | | |
| 5.1 | Not applicable | | |
| 5.2 | | | |

| **5. Assessment Task Schedule for Students During the Semester** | | | |
|---|---|---|---|
| | **Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)** | **Week Due** | **Proportion of Total Assessment** |
| 1 | Mid-term exam | 8 | 30% |
| 2 | Assignments and activities | | 10% |
| 3 | Final Exam | 15-16 | 60% |

## D. Student Academic Counseling and Support

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

- We havefaculty membersto providecounselling andadvice.
- Office hours: During the working hoursweekly.
- Academic advisingforstudents.

## E Learning Resources

1. List Required Textbooks

- T. D. W. Claridge, High-Resolution NMR Techniques in Organic Chemistry, 3rd ed., UK, Elsevier Ltd. (2016).
- D. H. Williams and I. Fleming, Spectroscopic Methods in Organic Chemistry, 6th ed., McGraw-Hill Education, (2007).

2. List Essential References Materials (Journals, Reports, etc.)

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| 1. Journal of Organic Chemistry.<br><br>2. Russian Journal of Organic Chemistry.<br><br>1. Optics and Spectroscopy.<br>2. Any other journals in the field of the course will be considered. |
| 3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.<br><br>• http://www.chemweb.com<br>• http://www.sciencedirect.com<br>• http://www.rsc.org<br>• http://stream.hebust.edu. |
| 4. Other learning material such as computer-based programs/CD, professional standards or regulations and software.<br><br>• ChemDraw Ultra 11.0 |

## 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><br>• Classrooms capacity (10) students.<br>• Providing hall of teaching aids including computers and projector. |
| 2. Technology resources (AV, data show, Smart Board, software, etc.)<br><br>• Room equipped with computer, projector and TV. |
| 3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)<br><br>• No other requirements. |

## G Course Evaluation and Improvement Procedures

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| 1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching<br><br>• Complete the questionnaire evaluation of the course in particular. |
| 2. Other Strategies for Evaluation of Teaching by the Instructor or the Department |

- Observationsandthe assistance ofcolleagues.
- Independent evaluation forextent toachieve students the standards.
- Independent adviceofthe dutiesandtasks.

3. Procedures for Teaching Development

- Workshopsforteaching methods.
- Continuous trainingofmember staff.
- Providing new tools for learning.
- The application ofe-learning.
- Exchangeof experiencesinternal andexternal.

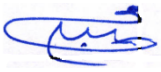
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution)

- Check markingof a sampleofexam papers, orstudent work.
- Exchange corrected sample of assignments or exam basis with another staff member for the same course in other faculty.

5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it.

- Periodic reviewofthecontents ofthe syllabusandmodify thenegatives.
- Consultotherstaff ofthe course.
- Hostinga visiting staffto evaluate of thecourse.
- Workshopsfor teachers ofthe course.

**Name of Course Instructor:** **Prof. Dr. Mohamed Rabie**

**Signature:**  **Date Completed: 27- 10 - 2018**

**Program Coordinator: Dr. Ismail Ibrahim Althagafi**

**Signature:**  **Date Received: 28/10/2018**