|  |  |
| --- | --- |
| **Course Title:** | **Different Subjects in Analytical Chemistry** |
| **Course Code:** | **CHEM-653** |
| **Program:** | **Ph.D. program** |
| **Department:** | **Chemistry** |
| **College:** | **College of Science** |
| **Institution:** | **King Saud University** |

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# A. Course Identification

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **1. Credit hours:** | | **3 (3+0)** | | |
| **2. Course type** | | | | |
|  | Required | | Elective | |
| **3. Level/year at which this course is offered:** | | | | **Second level in Ph.D. Program** |
| **4. Pre-requisites for this course** (if any)**: Non** | | | | |
| **5. Co-requisites for this course** (if any)**: Non** | | | | |
|  | | | | |

## 6. Mode of Instruction (mark all that apply)

| **No** | **Mode of Instruction** | **Contact Hours** | **Percentage** |
| --- | --- | --- | --- |
| **1** | **Traditional classroom** |  | **80** |
| **2** | **Blended** |  |  |
| **3** | **E-learning** |  | **10** |
| **4** | **Correspondence** |  | **10** |
| **5** | **Other** |  |  |

**7. Actual Learning Hours** (based on academic semester)

|  |  |  |
| --- | --- | --- |
| **No** | **Activity** | **Learning Hours** |
| **Contact Hours** | | |
| **1** | **Lecture** | **40** |
| **2** | **Laboratory/Studio** | **--** |
| **3** | **Seminars** | **--** |
| **4** | **Others** (specify) | **--** |
|  | **Total** | **40** |
| **Other Learning Hours\*** | | |
| **1** | **Study** |  |
| **2** | **Assignments** |  |
| **3** | **Library** |  |
| **4** | **Projects/Research Essays/Theses** |  |
| **5** | **Others** (specify) |  |
|  | **Total** |  |

**\*** The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

# B. Course Objectives and Learning Outcomes

|  |
| --- |
| 1. Course Description |
| 2. Course Main Objective |
| 1. Providing students with the basic principles of Quantitative Methods of Analysis 2. Providing students with the basic principles of Automatic Methods of Analysis 3. Providing students with Instrumental Analysis and Applications in drugs, food, water and environments |

## 3. Course Learning Outcomes

| **Course Learning Outcomes (CLOs)** | | **Aligned****PLOs\*** |
| --- | --- | --- |
| 1 | **Knowledge** |  |
| 1.1 | Describe the nature of errors in analytical measurements and their elevation via statistical tests | K1 |
| 1.2 | Define the principal standardization of analytical methods | K2 |
| 1.3 | Outline the various tools for quality assurance in analytical chemistry | K3 |
| 1... |  |  |
| **2** | **Skills** |  |
| 2.1 | Explain the statistical evaluation of analytical data | S1 |
| 2.2 | Recognize the concept of quality insurance in analytical chemistry | S2 |
| 2.3 | Analyze practical problems in analytical measurements | S3 |
| 2... | Analyze practical problems in analytical methods | S4 |
| **3** | **Competence** |  |
| 3.1 | Use the internet to find the required information. | C1 |
| 3.2 | Use of computer programs such as Microsoft Excel to deal with the experimental data and to evaluate the work statistically | C2 |
| 3.3 |  |  |
| 3... |  |  |

\* Program Learning Outcomes

# C. Course Content

|  |  |  |
| --- | --- | --- |
| **No** | **List of Topics** | **Contact Hours** |
| 1 | Introduction to statistical for chemical analysis | 2 |
| 2 | The nature and origin of errors | 2 |
| 3 | Confidence limits | 4 |
| 4 | The application of statistical tests | 6 |
| 5 | Calibration and Standardization of analytical methods | 6 |
| 6 | Standard addition method and Internal standard method | 2 |
| 7 | Analysis of variance (Anova) | 2 |
| 8 | The concept of Chemometrics | 4 |
| 9 | Quality control charts | 4 |
| 10 | Quality assurance in analytical chemistry | 4 |
| 11 | Certified reference materials | 4 |
|  |  |  |
| **Total** | |  |

# D. Teaching and Assessment

## 1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

| **Code** | **Course Learning Outcomes** | **Teaching Strategies** | **Assessment Methods** |
| --- | --- | --- | --- |
| **1.0** | **Knowledge** | | |
| 1.1 | Describe the nature of errors in analytical measurements and their elevation via statistical tests | -Lectures  -Homework  -Case study | -Homework assignments  -Midterm exam  -Final exam |
| 1.2 | Define the principal standardization of analytical methods | -Lectures  -Homework  -Case study | -Homework assignments  -Midterm exam  -Final exam |
| 1.3 | Outline the various tools for quality assurance in analytical chemistry | -Lectures  -Homework  -Case study | -Homework assignments  -Midterm exam  -Final exam |
| **2.0** | **Skills** | | |
| 2.1 | Explain the statistical evaluation of analytical data | -Lectures  -Homework  -Case study | -Homework assignments  -Midterm exam  -Final exam |
| 2.2 | Recognize the concept of quality insurance in analytical chemistry | -Lectures  -Homework  -Case study | -Homework assignments  -Midterm exam  -Final exam |
| … | Analyze practical problems in analytical measurements | Discussion the findings in oral discussion | -Written presentation of assignments  -Direct contact during office hours |
|  | Analyze practical problems in analytical methods | Discussion the findings in oral discussion | -Written presentation of assignments  -Direct contact during office hours |
| **3.0** | **Competence** | | |
| 3.1 | Use the internet to find the required information. | Discussion the findings in oral discussion | -Written presentation of assignments  -Direct contact during office hours |
| 3.2 | Use of computer programs such as Microsoft Excel to deal with the experimental data and to evaluate the work statistically | Discussion the findings in oral discussion | -Written presentation of assignments  -Direct contact during office hours |
| … |  |  |  |

## 2. Assessment Tasks for Students

| **#** | **Assessment task\*** | **Week Due** | **Percentage of Total Assessment Score** |
| --- | --- | --- | --- |
| **1** | Midterm exam | Week 6 | 20% |
| **2** | Oral presentation | Week 8 | 20% |
| **3** | Writing assays | Week 10 | 20% |
| **4** | Final exam | Week 14 | 40% |
| **5** |  |  |  |
| **6** |  |  |  |
| **7** |  |  |  |
| **8** |  |  |  |

**\*Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

# E. Student Academic Counseling and Support

|  |
| --- |
| **Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:** |
| Office hours (6 per week for all students)  Help session in lectures. |

# F. Learning Resources and Facilities

## 1. Learning Resources

|  |  |
| --- | --- |
| **Required Textbooks** | 1."Statistics for analytical chemistry", J.C. Miller.  2."Analytical Chemistry", R. Kellner.  3. "Fundamentals of Analytical Chemistry", Skoog, West  and Holler (5Ed.) |
| **Essential Reference Materials** |  |
| **Electronic Materials** | Science Direct (Web Site.) |
| **Other Learning Materials** | Handouts and Power Point Presentations |

## 2. Educational and research Facilities and Equipment Required

| **Item** | **Resources** |
| --- | --- |
| **Accommodation**  (Classrooms, laboratories, demonstration rooms/labs, etc.) | - Classroom with 20 seats  - Smart board and projector |
| **Technology Resources**  (AV, data show, Smart Board, software, etc.) | Computer lab containing 20 computers set |
| **Other Resources**  (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list) |  |

# G. Course Quality Evaluation

| **Evaluation**  **Areas/Issues** | **Evaluators** | **Evaluation Methods** |
| --- | --- | --- |
| 1. Strategies for Obtaining Student Feedback on Effectiveness of Teaching | -Course evaluation by students.  -Course evaluation by postgraduate students. | - Online Survey on Edugate.  - Direct consultation in class.  - Group discussion. |
| 2. Other Strategies for Evaluation of Teaching by the Instructor or by the Department | -Peer consultation on teaching  -Specialty council meetings  -Department council meetings | - Suggestions and complaints boxes for the department and the college. |
| 3. Processes for Improvement of Teaching | -Workshops presented by experts on new teaching methodologies  -Consultation with colleagues of Chemistry Department | - Attending workshops organized periodically by the department/college  - Attending related seminars, workshops recommended by the lecturer. |
| 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) | - Grading questions by some members of the analytical group, who teach the same course.  - Faculty member from other universities to review and evaluate the accuracy of grading policy. | - 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.  - Cross check with colleague. |
| 5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement. | - The chairman of the department and faculty council take the responsibility.  - The course material should be reviewed by departmental, faculty and higher council. | - Regular updating for the course and relevant computer software taking into account the student feedback. |
|  |  |  |
|  |  |  |

**Evaluation Areas/Issues** (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)

**Evaluators** (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

**Assessment Methods** (Direct, Indirect)

# H. Specification Approval Data

|  |  |
| --- | --- |
| **Council / Committee** |  |
| **Reference No.** |  |
| **Date** | **2019** |