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| **logoDepartment of Chemistry, School of Science****University of Management and Technology** |
| Quality Assurance in Analytical ChemistryCH-653 (Section A)Outcome Based Education (OBE) |
| **Lecture Schedule** | Friday (06:30 – 09:15 PM) | **Semester** | Spring 2024 |
| **Pre-requisite** | -NA- | **Credit Hours** | 03 |
| **Instructor** | Dr. Muhammad Azeem Akbar Rana | **Contact** | azeem.rana@umt.edu.pk |
| **Office** | Second Floor, South Block,3S-32 (Office # 06) | **Office Hours** | Displayed on the office door& on Moodle |
| **Align with the SDGs** | **SDG 3** - Good Health and Well-being**SDG 9** - Industry, Innovation, and Infrastructure**SDG 12 -** Responsible Consumption and Production**SDG 17** - Partnerships for the Goals |
| **Attendance Policy** | Participant Handbook Clause 2.10: Class Attendance – A minimum of 75% attendance is required for a participant to be eligible to sit in the final examination/assessment. Participants with less than 75% attendance in a course shall be awarded a grade ‘SA’ (Short attendance) and shall not be allowed to take end-term exams. |
| **Plagiarism Policy** | UMT follows the HEC Plagiarism policy, which is available at: <https://www.hec.gov.pk/english/services/faculty/Plagiarism/Pages/default.aspx> |
| **Program Education Objectives (PEOs)** | In line with the vision and mission of the Department of Chemistry, the Program Educational Objectives (PEOs) of the field of study, BS Chemistry, are to produce: **PEO 1:** Graduates will apply the scientific knowledge acquired to solve problems associated with the various disciplines of chemistry. [*Knowledge, Problem Solving*] **C3****PEO2:** Graduates will critically analyze and articulate chemical concepts coherently through oral and written discourse. [*Critical Thinking, Knowledge*] **C4****PEO3:** Graduates will design and implement research methodologies using emerging technologies. [*Communication, Team member, Project management, Modern tool usage, Lifelong learning*] **P3****PEO4:** Graduates, will Comply with challenges in their future academic or professional careers with the ethical and safety standards fostered throughout the program. [*Professionalism, Ethics, Environment and Sustainability*] **A2** |
| **Program Learning Outcomes (PLOs)** | The graduates will:**PLO 1:** Relate and demonstrate a comprehensive understanding of fundamental concepts integrating theories, principles, and recent knowledge [*Knowledge* 1] - PEO1- **C2****PLO 2:** Apply proficiency in the use of laboratory equipment and techniques. [Skills 1: *Skill*] – PEO1-**C3****PLO 3:** Analyze the scientific data to develop local and native solutions. [*Analyze and evaluate*] – PEO2**-C4****PLO 4:** Demonstrate problem-solving skills to analyze experimental results, identify patterns, and draw logical conclusions. [*Knowledge*: *Critical Thinking*] – PEO2**-C4****PLO 5:** Align the scientific concepts, research findings, and ideas by exhibiting exceptional collaborative skills, actively engaging in multidisciplinary teams, and effectively contributing to project management. [Skill 2: *Team member, Project management*] – PEO3-**P2****PLO 6:** Grasp cutting-edge skills, tools, and methodologies, accumulating a diverse range of experiences to propel their lifelong career trajectories within the rapidly evolving field. [Skill 3: *Modern tool usage, Lifelong learning*] – PEO3-**P2** **PLO 7:** Acquire proficiency in research methodologies, assess their effectiveness and explore alternative approaches to address research-specific needs. [*Problem analysis, Critical thinking, lifelong learning*] – PEO3-**P3****PLO 8:** Follow principles of professional integrity and social responsibility with exceptional commitment and adherence to environment-friendly and sustainable protocols, regulations, and industry best practices. [Ethics 1: *Professionalism, Ethics, Environment and sustainability*] – PEO4-**A2** |
| **Course Learning Outcomes (CLOs)** | Upon successful completion, **CLO 1.** Students will be able to understand the calibration, validation, and quality control procedures to ensure the reliability of analytical data. **(Mapped with PLO1, PEO1- C2)****CLO 2.** Students will be able to select appropriate analytical techniques to quantify and identify chemical compounds accurately. **(Mapped with PLO6, PEO3-P2)****CLO 3.** Students will be able to critically assess analytical data, identify errors, and communicate findings effectively. **(Mapped with PLO4, PEO2- C4)****CLO 4.** Students will be able to apply ISO standards and FDA guidelines to ensure compliance and ethical standards in analytical chemistry laboratories. **(Mapped with PLO8, PEO4**-**A2)** |
| **Course Content** | The following topics will be included in this course: * Covers various principles of quality assurance and quality control and sample preparation methods.
* Focuses on calibration, validation, and quality control measures including certified reference materials and control charts for reliable analytical data.
* Teaches statistical methods for data analysis, accurate interpretation of results, and effective reporting techniques.
* Emphasizes adherence to ISO/IEC standards, FDA regulations, and the implementation of quality management systems and ethical laboratory practices.
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| **Learning Resources** | Textbook | * Elizabeth Prichard and Vicki Barwick, Quality Assurance in Analytical Chemistry, John-Wiley & Sons, Ltd (2007).
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| Reference Book | * Christian, G. D., Analytical Chemistry, 7th ed., John-Wiley & Sons, New York, (2014).
* Douglas A. Skoog, F. James Holler, and Stanley R. Crouch, Principles of Instrumental Analysis, Cengage Learning (2017)
* James P. Dux, Handbook of Quality Assurance for the Analytical Chemistry Laboratory, Springer New York, NY (2012)
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| **Teaching Kits** | All didactic material will be shared on:* PowerPoint slides and books shared on LMS
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| **Grading Policy** | Clause 3.1 & 6.1 of undergraduate and graduate Participant Handbook respectively: Evaluation/Assessment– The final standing of each participant, in each course is assessed through various assessment tools which are mentioned below:**For theoretical subjects*** Quizzes: 10%
* Assignments: 10%
* Term Project: 10%
* Presentation: 05%
* Midterm: 25%
* Final Exam: 35%
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**Important**: PTO to see next page for course calendar

**COURSE CALENDAR**

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| **Date****(DD-MM-YYYY)** | **Week** | **Topic** | **Chapter** | **CLOs** | **PLOs** |
| 08-03-2024 | 1 | The Need for Reliable Results:* Why Analytical Work is Required, Social and Economic Impact of a ‘Wrong Analysis’, What do we mean by ‘Quality’, Customer Requirements, Purpose of Analysis
 | 01 | 01 | 01 |
| **Last date of ADD/DROP** |
| 15-03-2024 | 2 | General Principles of Quality Assurance and Quality Control:* Introduction to Quality Assurance, Quality Management System, Quality Assurance (QA) and Quality Control (QC), Different Standards and their Main Features, Good Laboratory Practice (GLP), Best Practice
 | 02 | 01 | 01 |
| 22-03-2024 | 3 | Sampling: * Sampling Defined, Types of Samples, The Sampling Plan
 | 03 | 01 | 01 |
| 29-03-2024 | 4 | Sampling: * Sample Numbers and Sample Size, Subsampling, Sample Handling and Storage
 | 03 | 01 | 01 |
| 05-04-2024 | 5 | Preparing for Analysis * Selecting the Method, Sources of Methods, Factors to Consider when Selecting a Method
 | 04 | 02 | 06 |
| 12-04-2024 | 6 | Preparing for Analysis * Performance Criteria for Methods Used, Reasons for Incorrect Analytical Results, Method Validation
 | 04 | 02 | 06 |
| **Last date of course withdrawal** |
| 19-04-2024 | 7 | Making Measurements* Good Laboratory Practice, Calibration of Measurement, Achieving Metrological Traceability, Quality Control
 | 05 | 02 | 06 |
| 26-04-2024 | 8 | Making Measurements* Environment, Equipment and Glassware, Chemicals and Consumables, Maintenance and Calibration of Equipment
 | 05 | 02 | 06 |
| 03-05-2024 | 9 | **Midterm Exam** |
| 10-05-2024 | 10 | Data Treatment * Essential Statistics, Control Charts
 | 06 | 03 | 04 |
| 17-05-2024 | 11 | Data Treatment * Measurement Uncertainty
 | 06 | 03 | 04 |
| 24-05-2024 | 12 | Benchmarking Your Laboratory * Proficiency Testing Schemes, Organization of Proficiency Testing Schemes, The Statistics Used in Proficiency Testing Schemes
 | 07 | 03 | 04 |
| 31-05-2024 | 13 | Benchmarking Your Laboratory * Making the Most of Participation in Proficiency Testing Schemes, Collaborative Studies
 | 07 | 03 | 04 |
| 07-06-2024 | 14 | Documentation and its Management * Documentation, Opinions and Interpretations
 | 08 | 04 | 08 |
| 14-06-2024 | 15 | Managing Quality * The Management System, Standards Available for Laboratories, Quality Manual and other documentation
 | 09 | 04 | 08 |
| 21-06-2024 | 16 | Managing Quality * Audit, Management Review, Responsibilities of Laboratory Staff for Quality
 | 09 | 04 | 08 |
| 28-06-2024 | 17 | Presentations |  | 03, 04 | 04, 08 |
| 05-07-2024 | 18 | **End Term Exam** |

**Mapping of CLOs to Direct Assessments**

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| CLOs | Bloom Taxonomy Level | PLO | Q 1 | Q 2 | Q 3 | Q 4 | Q 5 | Q 6 | Q 7 | Assign 1 | Assign 2 | Term Project | Presentation | Mid Term Exam | Final Term Exam |
| 1 | C2 | 1 | ✔ | ✔ |  |  |  |  |  |  |  |  |  | ✔ | ✔ |
| 2 | P2 | 3 |  |  | ✔ | ✔ | ✔ |  |  | ✔ | ✔ | ✔ |  | ✔ | ✔ |
| 3 | C4 | 4 |  |  |  |  |  | ✔ | ✔ |  |  | ✔ | ✔ | ✔ | ✔ |
| 4 | A2 | 8 |  |  |  |  |  |  |  | ✔ | ✔ | ✔ | ✔ |  | ✔ |