

Course Outlines

1. **Course Code:** CHEM-415
2. **Course Title:** Chemistry Research Methodology
3. **Course Type (GE/Ed/Core Course/Electives/.....):** Core Course
4. **Year/Semester:** 4th Year 1st Semester
5. **Academic Session:** 2019-20
6. **Course Teacher:** Mohammad Sayadur Rahaman, PhD
7. **Pre-requisite (If any):** Not Required
8. **Credit Value:** 3.0
9. **Contact Hours:** 42.0
10. **Total Marks:** 100
11. **Rationale of the Course:**

Chemistry research methodology consists with the identification of research problems or issues regarding chemical science and research design employing the pertinent research methods through hypothesis setting. It includes experimental designs, data collection, data analysis and report/article writing. By studying the course, it would be possible to address/define the problems or issues related to chemical phenomena and to design the framework in order to solve the problems/issues through writing/dissemination.

12. Course Objectives

- To provide a concept on research and its importance.
- To study research problem
- To equip students to develop research design in chemistry
- To familiarize the research areas in chemical science
- To make capable to prepare research proposal, research report and research article

13. Course Learning Outcomes (CLOs)

After completion of the Course, the Student will be able to –

CLOs	LT	LD	Learning Outcome Statements
CLO1	C2	FS	Demonstrate the overview concepts of research and its importance in chemistry
CLO2	C3	FS	Explain the types of research applicable to chemical science
CLO3	C3	FS	Identify research question and state research problem
CLO4	C4	FS	Formulate research hypothesis and test the hypothesis
C:LO5	C4	FS	Describe data collection methods and analyze the data
CLO6	C5	FS	Design of Experiments with different methods for chemical research
CLO7	C6	TS	To wright and demonstrate research synopsis, research proposal, research report, and impact of research

LT: Learning Taxonomy (Appendix-1); LD: Learning Domain (Appendix-2); C: Cognitive; P: Psychomotor; A: Affective; FS: Fundamental Skill; TS: Thinking Skill; SS: Social Skill

Part-B:**14. Course Plan**

Week	Topic	Teaching-Learning Strategy	Assessment Strategy	Corresponding CLOs
1	L-1: Course Rational, Objectives and Learning Outcomes			
	L-2: Introduction to Research and Implications on Chemical Science.			
	L-3: Steps of Research			
2	L-4: Types of Research			
	L-5: Qualitative Research			
	L-6: Quantitative Research			
3	L-7: Activity on Identification of types of research			
	L-8: Research Problem			
	L-9: Activity on Stating Research Problem			
4	L-10: Research Question			
	L-11: Hypothesis: Types and Formulation			
	L-12: Hypothesis Testing			
5	L-13: Errors of Hypothesis Testing			
	L-14: Exercise on Hypothesis Testing			
	L-15: Review on above classes			
6	L-16: Research Design			
	L-17: Selecting a Study Design			
	L-18: Research Area in Chemistry			
7	L-19: Experimental Design			
	L-20: Factorial Design			
	L-21: Response Surface Methodology			
8	L-22: Exercise on Factorial Design			
	L-23: Exercise on Response Surface Methodology			
	L-24: Review on Experimental Design			

9	L-25: Sampling Design			
	L-26: Sampling Statistics			
	L-27: Calculation of Sample Size			
10	L-28: Data Collection: Types and Methods			
	L-29: Data Treatment and Analysis			
	L-30: Exercise on Data Analysis			
11	L-31: Tools and Techniques used in Chemistry			
	L-32: Exercise on Selection of Tools and Techniques used in Chemistry			
	L-33: Review on above classes			
12	L-34: Mid-Semester on Experimental Design and Data Analysis			
	L-35: Research Proposal Preparation			
	L-36: Exercise on Research Proposal Preparation			
13	L-37: Writing a report/thesis			
	L-38: Writing a Scientific Papers			
	L-39: Quality of Publication and Publishers			
14	L-40: Research Proposal Presentation-1			
	L-41: Research Proposal Presentation-2			
	L-42: Review of the course			

Part-C

15. Assessment and Evaluation

(1) Assessment Strategy:

Assessment will measure the achievement of learning outcomes. Assessment methods would be consisted with both formative and summative assessment. Students are required to attain all learning outcomes of the course. Summative assessment can be used to great effect in conjunction and alignment with formative assessment.

(2) Marks distribution:

- a) Continuous Assessment (Formative): 40%
- (i) Class Activity (Formative Assessment) 05
 - (ii) Assignment/Presentation 05
 - (iii) Class Attendance 10
 - (iv) Mid-Semester (Formative Assessment) 20
- b) Summative Assessment:60%
- Semester Final Examination 60

Assessment Matrix of the Course

Course Learning Outcomes (CLOs)	Assessment			
	Mid-Semester (20%)	Final Examination (60%)	Class Activities (5%)	Presentation (5%)
CLO1:				
CLO2				
CLO3				
CLO4				
CLO5				
CLO6				
CLO7				

(3) Make-up Procedures:

No make-up test will be arranged for a student who fails to appear in his/her in-course test/tests. Absence in any in-course test will be counted as zero for calculating the average in-course test for that course. However, a student can request special permission for re-take of in-course test if recommended by the course teacher through the academic committee of the Department only under extraordinary circumstances (e.g., accident, death of a close-relative, etc.)

Part-D

<i>(g) Learning Materials</i>
(i) Recommended Readings
<ul style="list-style-type: none"> • Chakraborty, T. and Ledwani, L. Research Methodology in Chemical Science: Experimental and Theoretical Approach, CRC Press • Kothari, C.R. Research Methodology, 2nd Edition, New Age International (P) Limited, New Delhi, 2004
(ii) Supplementary Readings
<ul style="list-style-type: none"> • Ranjit Kumar. Research Methodology, 4th Edition, Sage Publications Asia-Pacific Pte Ltd, Singapore, 2014. • Nehru, R.S.S. and Suryanway, N.V.S. Research Methodology, A P H Publishing Corporation, New Delhi, 2012. • Cochran, W.G. and Cox, G.M., Experimental Design, , John Wiley and Sons Inc., London