Course title: DSE-Research Methodology for Chemistry *w.e.f. the session 2024-25 and onwards*	
Class: **B.Sc. Pt.-III / Semester-VI**	Course code: BCH-E601
Lectures: 75	Credits: 06 (Theory-05, Tutorials-01)
MM:70	Exam Hrs:03

NOTE: The question paper shall consist of Two sections (Sec.-A and Sec.-B). Sec.-A shall contain 10 short answer (about 150 words) type questions of SIX marks each and student shall be required to attempt any five questions. Sec.-B shall contain 08 descriptive type questions of TEN marks each and student shall be required to attempt any four questions. Both sections shall have questions from the entire syllabus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

Course Contents:
Literature Survey:
Print: Sources of information: Primary, secondary, tertiary sources;
Journals: Journal abbreviations, abstracts, current titles, reviews, monographs, dictionaries, text-books, current contents, Introduction to Chemical Abstracts, Subject Index, Substance Index, Author Index, Formula Index, and other Indices with examples.
Digital: Web resources, E-journals, Journal access, Citation index,
Impact factor, H-index, UGC infonet, E-books, Internet discussion groups and communities, Blogs, Preprint servers, Search engines, Google Scholar, Chem Industry, Wiki- Databases, Science Direct, SciFinder, Scopus.

Information Technology and Library Resources: The Internet and World Wide Web.
Internet resources for chemistry. Finding and citing published information.

Methods of Scientific Research and Writing Scientific Papers:
Reporting practical and project work. Writing literature surveys and reviews. Organizing a poster display. Giving an oral presentation.
Writing scientific papers – justification for scientific contributions, bibliography, description of methods, conclusions, the need for illustration, style, publications of scientific work. Writing ethics.Avoiding plagiarism.

Chemical Safety and Ethical Handling of Chemicals:
Safe working procedure and protective environment, protective apparel, emergency procedure and first aid, laboratory ventilation. Safe storage and use of hazardous chemicals, procedure for working with substances that pose hazards, flammable or explosive hazards, procedures for working with gases at pressures above or below atmospheric – safe storage and disposal of waste chemicals, recovery, recycling and reuse of laboratory chemicals, procedure for laboratory disposal of explosives, identification, verification and segregation of laboratory waste, disposal of chemicals in the sanitary sewer system, incineration and transportation of hazardous chemicals.

Data Analysis
The Investigative Approach: Making and Recording Measurements. SI Units and their use.Scientific method and design of experiments.
Analysis and Presentation of Data: Descriptive statistics. Choosing and using statistical tests. Chemometrics.Analysis of variance (ANOVA), Correlation and regression, Curve fitting, fitting of linear equations, simple linear cases, weighted linear case, analysis of residuals, General polynomial fitting, linearizing transformations, exponential function fit, *r* and its abuse. Basic aspects of multiple linear regression analysis.

Reference Books

- Dean, J. R., Jones, A. M., Holmes, D., Reed, R., Weyers, J. & Jones, A. (2011) Practical skills in chemistry. 2nd Ed. Prentice-Hall, Harlow.
- Hibbert, D. B. & Gooding, J. J. (2006) Data analysis for chemistry. Oxford University Press.
- Topping, J. (1984) Errors of observation and their treatment. Fourth Ed., Chapman Hall, London.
- Harris, D. C. Quantitative chemical analysis. 6th Ed., Freeman (2007) Chapters 3-5.
- Levie, R. de, How to use Excel in analytical chemistry and in general scientific data analysis. Cambridge Univ. Press (2001) 487 pages.
- Chemical safety matters – IUPAC – IPCS, Cambridge University Press, 1992.37
- OSU safety manual 1.01.

Course Objectives:

1. To impart the knowledge on the different ways such as print (Journal abbreviations, abstracts, current titles, reviews, monographs, dictionaries, text-books, chemical abstracts etc.) and digital (Web resources, E-journals, Impact factor, H-index, Search engines, Google Scholar, Science Direct, SciFinder, Scopus) for the literature survey.
2. To explain the preparation of practical and project report, reviews, presentation and posters to help the students in the area of research.
3. To provide knowledge on plagiarism. Basic knowledge on writing research papers, writing ethics will also be delivered in the course.
4. To make aware students about the good laboratory practices such as safe storage and use of acids and hazardous chemicals , wearing apparel, first- aid and disposal of waste chemicals etc.
5. To deliver the knowledge about the analysis and presentation of data by various approaches.

Course Outcomes (COs):

CO1. Students will be able to understand how literature survey can be done by using print and digital methods discussed in the course so that they can be able to identify the problems in the different research areas.

CO2. The students will able to understand the preparation of posters, review papers, presentations and scientific research papers. and avoiding plagiarism so that they will be able to understand the seriousness of the research and contribute to the good research works.

CO3. Students will be able to understand importance of plagiarism and possible ways to avoid it.

CO4. Good laboratory practices, such as wearing apparel, emergency procedure and first aid awarness about the storage of hazardous chemicals and reuse of laboratory chemicals can be developed in the students.

CO5. Students can be able to do the analysis of data by means of Statistical methods, Analysis of variance (ANOVA), Correlation and regression, Curve fitting, fitting of linear equations, simple linear cases, weighted linear case, analysis of residuals, General polynomial fitting, linearizing transformations, exponential function fit, r and its abuse and Basic aspects of multiple linear regression analysis.

CO6. Students opting for higher studies will be beneficial at end of course, regarding their project/dissertation/thesis works

Mapping of course Outcomes (COs) with program outcomes (POs)

Course Outcomes/Program outcomes	1	2	3	4	5	6	7	8
CO1					X		X	
CO2					X		X	
CO3					X			
CO4				X			X	
CO5	X				X			
CO6								X

Note: put 'X' in relevant column of mapping