Shivaji University,

Kolhapur

Accredited By NAAC with 'A^{++}' Grade

Syllabus for

Bachelor of Science Part-II

(B. Sc. II)

SKILL ENHANCEMENT COURSES

IN CHEMISTRY

(NEP-2.0)

To be implemented from

June 2025 onwards

Structure of B. Sc. II

Skill Enhancement Courses in Chemistry

Sr. No.	Semester	Course Code	Title of Paper
1	III	BSU0325SEP207C01	CHSECPR-301 Practical Skills in Chemistry-Practical Paper-I (2 credits, 60 Hours)
2	IV	BSU0325SEP207D01	CHSECPR-401 Practical Skills in Chemistry-Practical Paper-II (2 credits, 60 Hours)

B. Sc. II, Semester III SKILL ENHANCEMENT COURSE- Practical Papers		
BSU0325SEP207C01	**CHSECPR-301 Practical Skills in Chemistry-Practical Paper-I**	**Credits:** 2 **Hours:** 60

Course Outcomes:
completion of the course, the students will be able to:
CO1: Understand the principles of GLP and safety in the laboratory.
CO2: Interpret the safety data sheets to categorize chemicals according to their hazards.
CO3: Enhance their overall knowledge of handling Glassware and apparatus used in the laboratory.
CO4: Enhance their overall skills of preparation of various reagents used in the laboratory.

Practicals:

Note: An explanation and understanding of theoretical concepts, mechanisms, reactions, and instrumentation are expected.

1. Identify the Safety symbol on the labels of a pack of chemicals and its meaning.
2. Study precautions in handling hazardous substances like Conc. acids, ammonia, organic solvents, etc.
3. Understand the toxicity of the compounds used in the Chemistry laboratory and classification of toxicity.
   a) MSDS sheets, points in MSDS Find out MSDS sheets of at least hazardous chemicals ($K_2Cr_2O_7$, Benzene, Cadmium Nitrate, sodium metal, etc.)
   b) Prepare charts for Laboratory Safety Rules.
   c) Prepare SOP for laboratory.
4. Demonstrative Experiment: Use of Fire Extinguisher.
5. Calibration of Volumetric apparatus.
6. Preparation of Indicators and their uses in different titrations. (Phenolphthalein, Methyl Orange, Diphenyl amine, Starch, Eriochrome Black-T etc.)
7. Preparation of commonly used lab solutions and reagents. (10% NaOH, Sat. $NaHCO_3$, 1:1 NH_3, Bromine water, Ferric Chloride solution, Iodine solution, $NaNO_2$ solution, 2,4-DNP, Tollens, Nesselers, Schiffs, Fehling and Benedict reagents etc).

8. Preparation of Buffer solutions. (pH 4 buffer, pH 10 ammonical buffer, acetate buffer)
9. Separation of two miscible solvents by distillation.
10. Separation of immiscible solvents by separating funnel.
11. Demonstrative Experiment: Preparation of H_2S gas using Keep's Apparatus.

References:

1. Laboratory Safety for Chemistry Students, Second edition, Robert H. Hill, Jr. David C. Finster,John Wiley & Sons.
2. Handbook of Good Laboratory Practice (GLP), UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases (TDR) https://fctc.who.int/publications/i/item/handbook-good-laboratory-practice-%28-glp%29
3. Solid Waste Management, Principles and Practice, Ramesha Chandrappa, Diganta Bhusan Das, Springer.
4. Production-Integrated Environmental Protection and Waste Management in the Chemical Industry, Claus Christ, WILEY-VCH.
5. Fundamentals of Industrial Safety and Health Dr. K.U. Mistry, Siddharth Prakashan.
6. VOGELS QUALITATIVE INORGANIC ANALYSIS, 7TH EDN by G. Svehla and B. Shivshankar.
7. Hazardous Waste Management Rules-2016, 1st editon, Ministry of environment, forest & climate change, govt. of India.
8. Vogel's Quantitative Chemical Analysis, 6th Edition by J Mendham.

B. Sc. II, Semester IV, SKILL ENHANCEMENT COURSE- Practical Paper Course		
BSU0325SEP207D01	**CHSECPR-401 Practical Skills in Chemistry-Practical Paper-II**	**Credits:** 2 **Hours:** 60

Course Outcomes:
completion of the course, the students will be able to:
CO1: Gain the knowledge of preparation and standardization of solutions.
CO2: Gain knowledge of separation techniques.
CO3: Enhance their knowledge of the calibration of instruments.
CO4: Enhance their knowledge of maintenance of electrodes and equipment.

Practicals:

Note: An explanation and understanding of theoretical concepts, mechanisms, reactions, and instrumentation are expected.

1. Preparation of TLC plates using silica gel, identifying suitable solvent systems and applications in the separation of amino acids.
2. Preparation of Column, identifying suitable solvent system and applications in separating organic components.
3. Preparation of Ion exchange resin columns and applications in separating cations/anions.
4. Preparation of potassium hydrogen phthalate and its use as a primary standard for standardization of NaOH/KOH solution.
5. Preparation and standardization of HCl/HNO_3, H_2SO_4 solution. (Molar and Normal).
6. Preparation and standardization of sodium thiosulphate solution.
7. Demonstrative Experiment: Preparation of KCl and KNO_3 salt bridges.
8. Draw the structure of organic molecules using software like CHEM Draw/ISIS draw/ChemSketch.
9. Plot experimental results (Graphs) using Excel and Origin software.
10. Calibration of electronic Balance and Maintenance of electrodes in the laboratory

(Glass, Calomel etc).

11. Standardization of i) pH meter by using pH 4 buffer (Buffer to be prepared by students), ii) conductivity meter and iii) potentiometer.
12. Recrystallization of organic compounds using suitable solvents.
13. Purification of compounds by sublimation.
14. Extraction of DNA from mashed onion.
15. **Activity:** Preparation of charts to learn the Periodic table innovatively.

References:

1. Fundamentals of Analytical Chemistry; Skoog, West. Holler and Crouch 9th edition; Mary Finch. (2014).
2. Principles of Instrumental Methods of Analysis; Skoog, Holler and Nieman, 5th edition, Saunders College Publishing, International Limited (1999).
3. Analytical Chemistry; Gary D Christian; 6th edition; John Wiley and Sons (2010).
4. Modern Analytical Chemistry; David Harvey; McGraw Hill Higher education publishers, (2000).
5. Analytical Chemistry Principles; John H Kennnedy, 2nd edition, Published by Cengage Delmar Learning India Pvt (2011).
6. Vogel's Text book of Quantitative Chemical Analysis; 6th edition, Pearson Education Limited (2007).
7. Industrial Chemistry by B. K. Sharma.

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SKILL ENHANCEMENT COURSE

Semester III & IV

Nature of Practical Exam

Semester-III Practical Paper-I (50 Marks)

Q. 1 Experiment- 20 Marks

Q. 2 Experiment- 20 Marks

Q. 3 Oral - 5 Marks

Q. 4 Journal- 5 Marks

Semester-IV Practical Paper-II (50 Marks)

Q. 1 Experiment- 20 Marks

Q. 2 Experiment- 20 Marks

Q. 3 Oral- 5 Marks

Q. 4 Journal- 5 Marks