Sem. - I

Vocational Skill Course (VSC)
Semester I
F. Y. B. Sc. (Chemistry)

Title of the course
VSCCH1: Laboratory Techniques: Solution Preparation and Calibration of Equipment

Sr. No.	Heading	Particulars
1	**Description the course:**	The aim of Vocational Skill Courses (VSC) is to provide experiential learning for students, which helps to develop their technical skills through hands-on training and also develop abilities of critical thinking, analytical skills, collaboration, teamwork, problem-solving, and communication, which mold their careers.
2	**Vertical:**	Vocational Skill Course
3	**Type:**	Practical
4	**Credits:**	Practical: 2 credits. (1 Credit = 30 Hours for Practical)
5	**Hours Allotted:**	Hours per Semester Practicals: 60 Hours.
6	**Marks Allotted:**	50 Marks
7	**Course Objectives (CO):** CO1: To demonstrate the ability to calibrate essential laboratory glassware and instruments to ensure accuracy in quantitative analysis. CO2: To prepare and handle primary standard solutions with precision for use in standardization and titration experiments. CO3: To perform standardization procedures for acids and bases using classical titrimetric methods. CO4: To execute various volumetric titration techniques, including acid-base and redox titration with appropriate indicators. CO5: To analyze and compare water quality through conductivity measurement. CO6: To standardize and operate digital instruments CO7: To apply turbidimetric methods to estimate ionic concentrations in environmental water samples.	
8	**Course Outcomes (OC):** After completion of the course, the learner will be able to OC1: Calibrate laboratory glassware (burette, pipette, volumetric flask, measuring	

	cylinder) to ensure volume accuracy. OC2: Prepare accurate primary standard solutions. OC3: Standardize acids and bases using titration with appropriate indicators. OC4: Analyze water samples for conductivity to interpret the presence of dissolved ions. OC5: Calibrate and operate digital instruments such as pH meters and conductometers. OC6: Estimate sulfate ions in the given samples using a turbidimeter
9.	**Module: I**

Semester	Unit	Description	Credits
	I Practical	Practical Component	**02**

Semester I

Laboratory Techniques: Solution Preparation and Calibration of Equipment

Unit	Description	Hours
Practical Minimum 10 Experiments)	**Calibration of Laboratory Glassware** 1. To calibrate the burette for accurate volume delivery of solution 2. To calibrate a pipette for correct volume transfer. 3. To calibrate a standard measuring flask for its accurate volume capacity. 4. To calibrate a measuring cylinder to make its volume markings accurate. 5. To prepare Primary Standard Solution (any two from sodium carbonate or potassium hydrogen phthalate, succinic acid, or potassium dichromate) 6. Standardization of secondary standard. (Any two from hydrochloric acid, sodium hydroxide, and sodium thiosulphate.) 7. Standardization of potassium permanganate solution using Mohr's salt by redox titration. Note: All primary standards solutions should be prepared by students.	**30**

	Calibration of Laboratory Instruments 8. Calibration of a pH meter using standard buffer solutions of pH 4, 7, and 10 . 9. Calibration of conductometer and measurement of conductance for a given salt sample (minimum two samples, e.g., NaCl and KCl) 10. To compare the conductivity of tap water and distilled water using a conductometer. 11. To determine the strength of an acid in a given sample by titration with sodium hydroxide potentiometrically and determination of the equivalence point using a first derivative graph. (Demonstration) 12. To calibrate a turbidimeter and estimate sulphate ions in a given sample**.** **(Demonstration)**	

References

1) Skoog, D. A., Holler, F. J., & Crouch, S. R. (2006). *Instrumental Analysis*. Cengage Learning.

2) Skoog, D. A., West, D. M., Holler, F. J., & Crouch, S. R. (2009). The book titled 'Fundamentals of Analytical Chemistry' is in its 8th edition. Cengage Learning.

3) Harvey, D. (1999). *Modern Analytical Chemistry*. McGraw-Hill Higher Education.

4) Khopkar, S. M. (2004). *Basic Concepts of Analytical Chemistry* (2nd ed.). New Age International Publishers.

5) Skoog, D. A., Holler, F. J., & Crouch, S. R. (2007). The book, Principles of Instrumental Analysis, is currently in its 6th edition. Cengage Learning.

6) Vogel, A. I. (1989). *Vogel's Textbook of Quantitative Chemical Analysis* (5th ed.). Longman Scientific & Technical.

7) Sharma, B. K. (2005). *Instrumental Methods of Analysis*. Goel Publishing House.

Semester II
Vocational Skill Course (VSC)
F.Y.B. Sc (Chemistry)
Title of the course
VSCCH2: Commercial Analysis of Food Samples

Sr. No.	Heading	Particulars
1	**Description the Course**	The aim of Skill Enhancement Courses (SECs) is to introduce the students with opportunities to develop required skills in Chemistry
2	**Vertical**	Skill Enhancement Course (SEC)
3	**Type**	Theory and Practical
4	**Credits**	2 Credits (2 Credits = 60 Hours for Practical)
5	**Hours Allotted**	60 hours
6	**Marks Allotted**	50 Marks

7	**Course Objectives (CO)** CO1: To provide hands-on training in using pH meters and other basic instruments for food analysis. CO2: To develop skills in estimating key nutrients such as vitamin C, carbohydrates, calcium, and acetic acid in food products. CO3: To introduce students to qualitative and quantitative tests for macronutrients in various food samples. CO4: To enable identification and analysis of food adulterants in common items like milk, spices, and oils using chemical and physical methods. CO5: To train students in performing gravimetric and titrimetric techniques for food component estimation, such as moisture, dietary fiber, and iodine value. CO6: To enhance knowledge and practical experience in food safety and quality control by testing real-world food samples. CO7: To promote awareness of food adulteration and contamination while equipping students with the tools necessary to detect and prevent these practices**.**

8	**Course Outcomes (OC)**
	After completion of the course, the learner will be able to **OC1:** Determine the pH nature of food samples using a calibrated pH meter. **OC2:** Estimate vitamin C concentration in beverages using redox titration with visual indicators. **OC3:** Perform qualitative tests for detection of proteins and carbohydrates in food samples. **OC4:** Evaluate calcium content in milk powder using complexometric titration. **OC5:** Identify adulterants in common food items using standard chemical tests. **OC6:** Estimate moisture and dietary fiber content in food samples using gravimetric methods. **OC7:** Assess the iodine value of edible oils to understand the degree of unsaturation.

9	**Modules I**

Unit	Description	Hours
I Practical (Perform Any 10 Practicals)	1. Measure the pH of the the given food sample (acidic/basic) using a pH meter. 2. Estimation of Vitamin C (Ascorbic Acid) in lemon squash or any vitamin C-containing artificial product sample by using a 2,4-Dichlorophenol indicator 3. Qualitative analysis of macronutrients (two samples each): proteins (Biuret test) and carbohydrates (Benedict's test) 4. Estimation of calcium in milk powder by complexometric titration 5. Estimation of acetic acid in preservative (vinegar) potentiometry. (Demo) 6. Detection of contaminants or adulterants in the following food samples (any one adulterant) i) Milk ii) Tea powder. iii) Turmeric powder iv) Chili powder 7. Estimate moisture percentage in a food sample using the laboratory	**60**

	oven drying method. (Any two samples) 8. Analyze milk-based products for the presence of adulterants using suitable chemical tests. Any four (urea, detergent, sugar, hydrogen peroxide.) 9. Detection of adulteration of aniline dyes, papaya seeds, and brick powder in spice and condiment samples using standard identification techniques. 10. Estimation of the reducing sugar content in the selected sample. 11. To estimate dietary fiber content in a food sample using the gravimetric method. 12. Quantitative analysis in % of iron flakes in tea and coffee samples using a simple magnetic detection method. (Two samples each) 13. Arrange an industrial visit with a report. 14. Demonstrate the procedure for estimating hydroxymethylfurfural (HMF) content in honey samples. **Industrial Visit (Online/Offline mode) based on practical syllabi should be organized, and certified reports of the same should be submitted with journal.**	

10. References

1) Nielsen, S. S. (2017). *Food analysis laboratory manual* (5th ed.). Springer.

2) Brennan, J. G. (2006). *Food analysis* (2nd ed.). Springer.

3) Jeffery, G. H., & Bassett, J. (2002). The 5th edition of Vogel's textbook on quantitative chemical analysis was published by Pearson Education. Pearson Education.

4) Vogel, A. I., Tatchell, A. R., Furnis, B. S., Hannaford, A. J., & Smith, P. W. G. (1996). *T*he textbook was published in its 5th edition by Prentice-Hall. Prentice-Hall.

5) Food Safety and Standards Authority of India (FSSAI). (2017). *Manual of methods of food analysis: food additives*. Food Safety and Standards Authority of India.

6) Lembre, P. (2018). *Handbook of food analysis: Physical characterization and nutrient analysis* (2nd ed.). CRC Press.

7) Cauvain, S. P., & Young, L. S. (2017). *Baking problems solved: A practical guide to the diagnosis and correction of baking problems*. Woodhead Publishing.

8) Miller, J. N., & Miller, J. C. (2010). The book, Statistics and Chemometrics for Analytical Chemistry, is in its 6th edition. Pearson Education.

9) William, M. G., & Garret, T. L. (2010). *Food quality assurance: Principles and practices*. Wiley.

10) Ramanathan, S., & Subramanian, K. (2018). CRC Press published a book on food chemistry and food processing in 2018.