SOPHIA COLLEGE FOR WOMEN (EMPOWERED AUTONOMOUS)

Affiliated to

UNIVERSITY OF MUMBAI

Syllabi for the Common Courses

Based on the National Education Policy 2020

Vocational Skill Course

Course Code: SVSC

S.Y.B.Sc.

2024-25 (NEP)

Programme Outline: Vocational Skill Course
SYBSc (SEMESTER III)

Course Code	Name of the Course	Credits
SVSC301	Separation and Identification Techniques	2
SVSC302	Introduction to Bioinformatics	2
SVSC303	Quantitative Techniques	2
SVSC304	Enrichment, Cultivation, and Detection of	2
SVSC305	Laboratory & Field Exercises in Ecology	2

ASSESSMENT DETAILS:

Continuous Assessment (50 marks)

1. A minimum of two activities will be given in each semester.
2. Each will be for 20 marks.
3. The nature of the activities will be decided by the Examiner
4. 10 marks will be given for Class participation.

NAME OF THE COURSE	**SEPARATION AND IDENTIFICATION TECHNIQUES**
CLASS	SYBSc
COURSE CODE	**SVSC301**
NUMBER OF CREDITS	2
NUMBER OF HOURS PER WEEK	4
TOTAL NUMBER OF HOURS PER SEMESTER	60
EVALUATION METHOD TOTAL MARKS PASSING MARKS	CONTINUOUS ASSESSMENT 50 20

COURSE OBJECTIVES:

CO 1.	To know the fundamental concepts of safe laboratory practices.
CO 2.	To learn the techniques of handling chemicals, apparatus and instruments.
CO 3.	To understand the basic principles involved in quantitative and qualitative analysis.
CO 4.	To get exposed to various separation and purification methods.

COURSE LEARNING OUTCOME:

CLO 1.	Create a report of experiment, MSDS and Chemical safety
CLO 2.	Frame an outline/ flowsheet of experimental set up.
CLO 3.	Separate and analyze various organic and inorganic compounds.
CLO 4.	Investigate the experimental findings and record the results.

Description of experiments
1.1 Calibration, Chemical Handling & Safety Measures 1. Handling of acids and bases 2. Handling of instruments-pH meter, conductometer and colorimeter 3. Preparing Material Safety Data Sheet (MSDS) for commonly used chemicals (**any 3**)
1.2. Calibration of glassware i) Pipette ii) Burette iii) Standard flask ($25cm^3$)
1.3 Semi-micro qualitative analysis of binary inorganic mixtures (4-5 mixtures) Cations (from amongst): Pb^{2+}, Ba^{2+}, Ca^{2+} , Sr^{2+} , Cu^{2+}, Fe^{2+} , Ni^{2+}, Mn^{2+}, Mg^{2+}, Al^{3+}, Cr^{3+}, K^+, NH_4^+ Anions (from amongst): CO_3^{2-} , S^{2-} , SO_3^{2-} , NO_2^- , NO_3^- , Cl^-, Br^-, I^- , SO_4^{2-} , PO_4^{3-} (sulfide scheme of analysis will be followed)
1.3. Purification Techniques (One/two compounds by each technique) **1.3.1 Purification of organic compounds by:-** i) Crystallization (from water and alcohol) ii) Sublimation iii) Solvent extraction Purified compounds to be identified by carrying out M.P/B.P
1.3.2 Simple distillation i) Purification of binary organic liquid mixtures (one volatile-one non-volatile) by simple distillation. ii) Identification of separated liquids by refractometry/density.
1.3.3. Chromatography: Separation and identification of a mixture of two sugars by ascending paper chromatography
1.4 Project work
i) Extraction and identification caffeine from tea/coffee sample using TLC **OR**

ii) Extraction and identification of food colours from *Mithai*/tablets using TLC

(Students will prepare a report and present their work)

REFERENCE:

1. Vogel's qualitative inorganic analysis, G. Svehla, Orient Longman, sixth edition
2. Semi-micro qualitative analysis, Velcher and Hahn, East West Press
3. A textbook of quantitative inorganic analysis, Athur I. Vogel, Longman, 3rd edition
4. A. I. Vogel's *Quantitative Chemical Analysis,* Mendham, Pearson ,*6th Edition*
5. Analytical Chemistry By Kripadanam

NAME OF THE COURSE	**INTRODUCTION TO BIOINFORMATICS**
CLASS	SYBSc
COURSE CODE	**SVEC302**
NUMBER OF CREDITS	2
NUMBER OF LECTURES PER WEEK	4
TOTAL NUMBER OF LECTURES PER SEMESTER	15
EVALUATION METHOD	CONTINOUS ASSESSMENT
TOTAL MARKS	50
PASSING MARKS	20

COURSE OBJECTIVES:

CO1	Understand the scope, importance, and applications of bioinformatics in biological research.
CO2	Learn to navigate and retrieve information from major biological databases such as GenBank, UniProt, and NCBI.
CO3	Gain proficiency in sequence alignment techniques (pairwise and multiple sequence alignment) and understand their applications in molecular biology.

COURSE LEARNING OUTCOMES:

Students will be able to:

CLO1	effectively navigate and retrieve information from major biological databases, such as GenBank, UniProt, and NCBI.
CLO2	perform pairwise and multiple sequence alignments using appropriate bioinformatics tools and interpret the results.
CLO3	predict and analyze protein structures, visualize them using software tools, and infer structural features relevant to function.

Practical of VSC :

1. Introduction to bioinformatics, History, Applications of bioinformatics
2. Biological databases and their types – Primary and secondary databases
3. With examples, specialized databases with examples of species database (Human/Yeast/Dicty) as well as disease database (HIV base), possible limitations of databases.
4. Important databases: NCBI, EMBL, DDJB, Uniprot/SwissProt, NextProt, PDB
5. Finding ORF in prokaryotes – manual/NCBI ORF finder
6. Sequence alignments: Pairwise versus multiple, Local and global
7. BLAST and its variants NCBI: Searching for protein and nucleotide sequence in FASTA and GenBank formats using NCBI
8. Use of BLAST to search for a single nucleotide or protein sequence
9. Use of BLAST to compare two sequences.
10. Phylogenetic analysis using Globin gene and Mitochondrial DNA
11. Project proposal based on Bioinformatics/Biostatistics/ Population Genetics/Evolution

REFERENCES:

1. Jonathan Pevsner (2015) “Bioinformatics and Functional Genomics” 3 rd Ed. Wiley.
2. Arthur M. Lesk. (2013) Introduction to Bioinformatics. 4th Ed. Oxford University Press.
3. Zhumur Ghosh, Bibekanand Mallick. (2008). Bioinformatics: Principles and Applications Oxford University Press. 4. David W. Mount. (2004)
4. Bioinformatics: Sequence and Genome Analysis. 2nd Ed. Cold Spring Harbor Laboratory Press, New York. 5. S C Rastogi, N Mendiratta, P Rastogi.
5. Bioinformatics: Methods and Applications– Genomics, Proteomics and Drug Discovery. 3rd Ed. PHI Learning Pvt. Ltd., New Delhi. 6. University websites (Online).

NAME OF THE COURSE	**QUANTITATIVE TECHNIQUES**
CLASS	SYBSc
COURSE CODE	**SVSC303**
NUMBER OF CREDITS	2
NUMBER OF PRACTICAL HOURS PER WEEK	4
TOTAL NUMBER OF PRACTICAL HOURS PER SEMESTER	60
EVALUATION METHOD	CONTINUOUS ASSESSMENT
TOTAL MARKS	50
PASSING MARKS	20

COURSE OBJECTIVES:

CO 1.	To familiarize students with the fundamentals of linear programming problems (LPP), including their formulation, graphical representation, and applications.
CO 2.	To equip students with techniques to solve optimization problems using methods like the Simplex method and duality principles.
CO 3.	To enable students to apply linear programming techniques to solve practical problems in business, logistics, and other industries.
CO 4.	To develop students' proficiency in using statistical software for data analysis and interpretation.

COURSE LEARNING OUTCOMES:

CLO 1.	The learner will be able to formulate a mathematical model for a given data.
CLO 2.	The learner will be able to apply graphical techniques to solve two-variable linear programming problems and interpret the solutions.
CLO 3.	The learner will be able to use the Simplex method and duality principles to solve complex linear programming problems efficiently..
CLO 4.	The learner will be able to solve business, industrial, and vocational challenges using linear programming and statistical techniques.

UNIT 1	Linear Programming Problem
1.1	Definition, Mathematical Formulation(Maximization and Minimization) Concepts of Solution, Feasible Solution, Basic Feasible Solution, Optimal solution, Slack, Surplus & Artificial variable
1.2	Standard form, Canonical form.

1.3	Graphical Method & Simplex Algorithm to obtain the solution to an L.P.P. Problems involving Unique Solution, Multiple Solution, Unbounded Solution and Infeasible Solution.
1.4	Big M method.
1.5	Concept of Duality & its economic interpretation.
UNIT 2	Statistical Analysis Using a Software
2.1	Introduction to the software.
2.2	Formulation of data table.
2.3	Graphical Representation of data
2.4	Descriptive Statistical Analysis.

REFERENCES:

1. Schaum Series book in O.R. Richard Broson. 2nd edition Tata Mcgraw Hill Publishing Company Ltd.

2. Operations Research: Methods and Problems: Maurice Sasieni, Arthur Yaspan and Lawrence Friedman,(1959), John Wiley & Sons.

3. Mathematical Models in Operations Research : J K Sharma, (1989), Tata McGraw Hill Publishing Company Ltd.

4. Principles of Operations Research with Applications to Management Decisions: Harvey M. Wagner, 2nd Edition, Prentice Hall of India Ltd.

5. Operations Research: S.D.Sharma.11th edition, KedarNath Ram Nath& Company.

6. Operations Research: H. A.Taha.6th edition, Prentice Hall of India.

7. Kantiswarup, P.K. Gupta, Manmohan : Operations Research, Twelfth edition, Sultan Chand & sons

8. Bronson R. : Theory and problems of Operations research, First edition, Schaum's Outline series

9. Vora N. D. : Quantitative Techniques in Management, Third edition, McGraw Hill Companies.

10. Bannerjee B. : Operation Research Techniques for Management, First edition, Business Books.

NAME OF THE COURSE	**ENRICHMENT, CULTIVATION AND DETECTION OF**
CLASS	SYBSc
COURSE CODE	**SVSC304**
NUMBER OF CREDITS	2
NUMBER OF LECTURES PER WEEK	4
TOTAL NUMBER OF LECTURES PER SEMESTER	60
EVALUATION METHOD	CONTINUOUS ASSESSMENT
TOTAL MARKS	50
PASSING MARKS	20

COURSE OBJECTIVES:

CO 1.	To learn the enrichment, isolation and detection of cellulose degrading, pectinase, amino acid and antibiotic producing microorganisms
CO 2.	To determine the antimicrobial spectrum of the antibiotic produced by the isolated bacterial/fungal strain.
CO 3.	To learn to cultivate anaerobes using Gaspak chamber
CO 4.	To calculate enzyme activity of invertase on the basis of enzyme assay
CO 5	To detect beta-lactamase producing microorganisms

COURSE LEARNING OUTCOMES:

CLO 1.	The learner will be able to set up experiments for enrichment, isolation and detection of various groups of microorganisms from natural samples
CLO 2.	The learner will be able to examine and interpret the spectrum of the antibiotic produced by the isolates
CLO 3.	The learner will be able to carry out the cultivation of anaerobes
CLO 4.	The learner will be able to compute the activity of enzymes

	PRACTICAL (60 LECTURES)
1	Mesophilic and thermophilic cellulose degrading bacteria and fungi.
2	Pectinase producing microorganisms.

3	Anaerobes using Gaspak chamber.
4	Amino acid producers
5	Antibiotic producers and study of antibacterial spectrum using Agar strip and Agar Streak methods.
6	Invertase producers.
7	Beta lactamase producers.
8	Revision of basic techniques in microbiology: Cultivation and control of microorganisms (Sem 1 and 2)

REFERENCES:

1. Willey, J.M., Sherwood, L.M., and Woolverton, C.J. (2008). Prescott, Harley and Klein's Microbiology, 7th edn. *New York, McGraw Hill International Edition.*
2. Casida L. E. J. R. (2016). Industrial Microbiology, Reprint, *New Delhi, New Age International (P) Ltd. Publishers.*
3. Patel, A. H. (2007). Industrial Microbiology First edn, *New Delhi, Macmillan Publishers.*
4. Plummer, David T. (1998). An introduction to practical biochemistry, 3rd edn, *Tata McGraw Hill edition.*
5. Mims, Cedric., Dockrell, Hazel M., Goering, Richard V., Roitt, Ivan M., Wakelin, Derek., Zuckerman, Mark. (2004). Medical Microbiology, 3rd edn, *Mosby.*

NAME OF THE COURSE	**LABORATORY & FIELD EXERCISES IN ECOLOGY**
CLASS	SYBSc
COURSE CODE	**VSC305**
NUMBER OF CREDITS	2
NUMBER OF LECTURES PER WEEK	4
TOTAL NUMBER OF LECTURES PER SEMESTER	60
EVALUATION METHOD	CONTINUOUS ASSESSMENT
TOTAL MARKS	50
PASSING MARKS	20

COURSE OBJECTIVES:

CO 1.	Learners will gain proficiency in environmental monitoring techniques related to water and soil quality assessment
CO 2.	Learners will gain proficiency in environmental monitoring techniques related to population dynamics

COURSE LEARNING OUTCOMES:

CLO 1.	The learner will be able to demonstrate the laboratory techniques for analyzing water and soil quality
CLO 2.	The learner will be able to perform experiments related to various parameters related to population dynamics

1	Study of air microflora by sedimentation method
2	Estimation of dissolved oxygen from the given water sample
3	Estimation of free CO_2 from the given water sample

4	Estimation of hardness from the given water sample
5	Estimation of salinity from the given water sample
6	Estimation of nitrates and nitrites from the given water sample
7	Estimation of silicates from the given water sample
8	Study of primary productivity
9	Estimation of phosphates from the given water sample
10	Estimation of pH and texture of soil
11	Determination of population density using subsampling and capture-recapture method
12	Determination of population density using quadrat and line transect method
13	Study of population dynamics - Mortality and natality
14	Study of biodiversity in college campus and submission of report
15	Field visit - Estimation of forest biomass and submission of report

REFERENCES:

1. Bhargava S.K. (2008). *Practical Methods for water and Air Pollution Monitoring*. New Age International.
2. Chatwal G.R. and Sharma H. (2016). *A Text Book of Environmental Studies*. (Reprint ed.). Himalaya Publishing House.
3. De A.K. (2003). *Environmental Chemistry*. (5th ed.) New Age Publisher International Pvt Ltd.
4. Dogra S.S. (2007). *Text book of Environmental Chemistry and Pollution Control.* SwastiK Pub.
5. Kanwaljit K. (2020). *Hand Book of Water and waste water Analysis*, Atlantic Publishers & Distributors Pvt Ltd.
6. Laws, E. A. (2018). Aquatic Pollution: An Introductory Text (4th ed.). Hoboken, NJ: John Wiley. S.E.
7. Manahan S.E. (2006). *Environmental Science and Technology.* (2nd ed.) CRC Press.