Sion (West), Mumbai – 400022.

(Autonomous)

Faculty: Humanities
Programme: B.A.M.M.C.
B.A. in Multimedia and Mass Communication
Programme Code: SIUA3

Academic Year: 2021-2022

Choice Based Credit System
Syllabus approved by
Board of Studies in B.A.M.M.C with effect from 1st June 2021

Syllabus for First Year Courses of
Multimedia and Mass Communication 2021-22

Preamble

The Department of Mass Media:

To create communication leaders dedicated and committed towards our Nation's upliftment and growth.

The First Year Bachelor of Multimedia and Mass Communication programme aims to mentor the students and develop their communication skills, computer skills, awareness about society and media.

The course is designed to provide the students with an elementary knowledge of media theories and understanding concepts involving mass communication, marketing, advertising, journalism.

The key goal is to offer students with facilities that can enhance their potential talents and make way for a suitable career in the vast arena of Multimedia and Mass Communication.

SIES College of Arts, Science & Commerce, Sion-West
(Autonomous)
Programme Code: SIUA3 – B.A. in Multimedia and Mass Communication (B.A.M.M.C.)
Choice Based Credit Grading System

Department of Mass Media

✤ **Course Assessment Scheme:**
   Classification of Assessment Work Plan: Each Term course wise weightage:

A. Internal Assessment:	40 Marks
B. Term End External Theory Examination:	60 marks
Total Marks:	100 marks

A. Internal Assessment: 40 Marks

Serial Number	Marks distribution	Components
1.	20	Class Test/Mid-term examination/Viva-Voce
2.	15	List of the assessment modes: a. Extension/Field work/Projects/Survey/Polls b. Viva-voce/Quiz/Objective Test/Assignments c. Case let/review writing/photo essays/journals d. Presentations (audio/visual, PowerPoint slides clips, documentaries, short-films, storyboard)/poster exhibitions/ Role-plays e. Customization of assessment mode 1 to 4 mentioned above according to the course paper requirement equivalently.
3.	05	Overall attendance of students and class participation and mannerisms during the instructional deliveries and showcase of talent in extra-curricular activities/ volunteering on various front and back end festive platforms, correspondingly.

B. Term End External Theory Examination: Objectives and descriptive type of questions carries total of 60 marks and duration of 2hours each course respectively.

◆ **External Theory Examination: 60 Marks (60%) [***ONLINE]***

Duration: 1 Hour; Total Marks: 60; All Questions are Compulsory

External Exam paper pattern: Objective questions 60 marks:
o   Section 1: *30 questions of 1 mark each* = 30 marks
o   Section 2: *15 questions of 2 marks each* =30 marks

◆ **External Theory Examination: 60 Marks (60%) [***OFFLINE]***
Duration: 2 hours.   Total Marks: 60
All Questions are Compulsory carrying 15 Marks each.

Q1.	Application based/ Case Study/ any practical area related to respective industry - Compulsory	15 Marks
Q2 Q2. a + b	Full Length Concept based in detail OR Short Essay	15 Marks or (8 + 7)
Q3. Q3. a + b	Full Length Concept based in detail OR Short Essay	15 Marks or (8 + 7)
Q4.	Write Short notes on/ Expand terminologies with Illustrations (Any 3 out of 5)	15 Marks

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Department of Mass Media

Class: F.Y.B.A.M.M.C   Semester: I   Number of Lectures Allotted: 60

Course name: Visual Communication   Marks: 100

Course code: SIUBAMMC13   Course Credit: 4 points

Course Learning Objectives:

This course will develop the students' ability to:
- Explain the development of Visual Communication.
- Discuss the theories of Visual Communication.
- Identify the impact of colours and design in Visual Communication.
- Demonstrate the tools or channels of Visual Communication from traditional, folk to modern media.
- Analyse the impact of language and culture in the age of social media under Visual Communication.

Course Outcomes:

At the end of the completion of this course the learner will be able to:
1. Discuss the developmental history, need, and importance, process- visible and invisible concepts of Visual Communication.
2. Examine the sensual and perceptual theories of visual communication.
3. Identify the psychological implication of colours, theories of design, and types of layout under fundamentals of design.
4. Illustrate the visual art medium namely painting, photography, film, television, digital art, comics, animation, dtp, printmaking, folk, performing arts, theatre, sculpture, architecture, video games and web design technologies.
5. Indicate internet, print, interactive media and devices used in communication design.
6. Analyse the impact of language, culture, audience behaviour, ethics, citizen journalism and visual stereotyping in social media.

Course Contents:

Unit 1: Development Of Visual Communication   (10 lectures)

Introduction to Visual Communication-
a) History and development of Visuals
b) Need for and importance of visual communication
c) Visual Communication as a process and as an expression, Language, and visual communication
d) Visible concepts
- Plans and organisational charts
- Maps
- Chronologies
e) Invisible Concepts
- Generalization Theories
- Feelings or attitudes

Unit 2: Theories of Visual Communication:

    i. <u>Sensual Theories</u>-   **(10 lectures)**
        a) Gestalt
        b) Constructivism
        c) Ecological
    ii. <u>Perceptual Theories</u>-
        a) Semitics
        b) Cognitive

Unit 3: Fundamentals of Design   **(12 lectures)**

<u>Understanding Design</u>
    a. Elements of Design
    b. Principles of Design

<u>Colours and Design in Visual Communication</u>-
    a. Colour theory
    b. Psychological implications of color
    c. Colours and visual pleasure
    d. Elements of Design

<u>Typography</u>-
    a. Importance of choosing the right typeface
    b. Classification of Typefaces
    c. Different elements of typography

<u>Layout and Composition</u>
    a. Introduction to layout and composition
    b. Types of Layouts
    c. Types of Composition

Unit 4: Mediums Of Visual Arts   **(12 lectures)**

<u>Visual Mediums and Technologies</u>-
    a. Painting & Photography
    b. Film & Television
    c. Digital Art, Comics and Animation
    d. DTP, Printmaking
    e. Folk & Performing Arts, Theatre
    f. Sculptures, Architecture
    g. Video Games
    h. UI/UX, Web Design

Unit 5: Communication Design   **(08 lectures)**

<u>Technologies used in Communication Design</u>
    a. Introduction to Communication Design
    b. Designing for Internet and Communication Devices
    c. Designing for Print Media
    d. Interactive Media
    e. Accessible, Universal and Usable Design

Unit 6: Language and Culture in the Age of Social Media:

                                       (08 lectures)

<u>Visual communication in the age of social media</u>-
    a) Ethics

b) Impact of Language and culture, Images and messages, Signs & Symbols (GIF, etc.)
c) Audience Behavior
d) Citizen Journalism, Going Viral
e) Visual stereotyping in social media

References: -
1. Handbook of Visual Communication Edited by Ken Smith/Sandra Moriarty/Gretchen Barbatsis & Keith Kenny
2. Visual Communication Theory and Research By Shahira Fahmy, Mary Angela Bock & Wayne Wanta
3. Visual Communication by Ralph E Wileman

Internal assessment methodology: -
1. Oral & Practical Presentations
2. Projects / Assignments
3. Debates /Group Discussion
4. Open Book Tests
5. Quiz

Department of Mass Media

Class: F.Y.B.A.M.M.C   Semester: II   Number of Lectures Allotted: 48

Course name: Effective Communication – II   Marks: 100

Course code: SIUBAMMC21   Course Credit: 3 points

Course Learning Objectives:

This course will develop the students' ability to:

- Outline the basics and format of various types of general and news report under report writing.
- Review organizational writing skill in English, Hindi, or Marathi for communicating with internal and stakeholders.
- Write for publicity materials in English, Hindi, or Marathi.
- Illustrate principles of Editing, Coherence and cohesion in newspaper and magazine editing.
- Evaluate the use of paraphrase, plagiarism, translation, and summarization of content brief in communication.
- Interpret graphs, maps, charts on technical data.

Course Outcomes:

At the end of the completion of this course the learner will be able to:

1. Write general reports, types of news report, press release, letters to editors and consumer grievance letters.
2. Review email, letters, circulars for internal and stakeholders' communication under organisational writing.
3. Compose publicity material for print and radio in English, Hindi, or Marathi   from Headline to Spot.
4. Illustrate newspaper and magazine editing and write synopsis, abstracts, and précis writing.
5. Evaluate the use of paraphrasing in plagiarism, translation in communication and summarisation of content.
6. Infer graphs, maps, and charts related content based on the technical data.

Course Contents:

1. **Writing: Media of written communication**
   a) Report writing-
      Report Writing (English, Hindi or Marathi) General report and News report writing - Basics and Format (Headline, Sub-headline, various type of report
   b) Organizational communication and writing-
      Organizational writing : (English, Hindi or Marathi) Internal communication , E-mails - Email E-mail Etiquette; Overcoming Problems in E-mail Communication, Stake holder communication Circulars- Guidelines for writing a circular- Languages and writing style of a circular- Format of a circular; Notices- Purpose- Format- Important points to remember while writing a notice, Letters of complaint, claim and adjustment, Consumer grievance letters, Letters under the

Right to Information Act, Press Release, Letter to the Editor.

7Cs by Francis Bergin of successful communication

c) Writing for Publicity materials

Writing for Publicity materials (English, Hindi or Marathi) Headline, sub- headline, Body copy, Slogan, Jingle, Radio spot

2. **Editing:**
   a) Editing-
      Editing: (English, Hindi and Marathi) Principles of editing (Punctuation, Substitution of words, restructuring of sentences, Re-organizing sentence sequence in a paragraph, Use of link words, Principles of Coherence and Cohesion), writing synopsis, abstracts, précis writing, newspaper editing and magazine editing.

3. **Paraphrasing and Summarizing:**
   a) Paraphrasing-
      Meaning, how to use paraphrase in communication, Paraphrase in plagiarism, Translation
   b) Summarization-
      Summarizing content, the points and sub- points and the logical connection between the points

4. **Interpretation of technical data:**
   a) Interpret technical data-
      Read graphs, maps, charts, write content based on the data provided

References: -
- Business Communication - Rhoda A. Doctor and Aspi H. Doctor
- Communication Skills in English – Aspi Doctor
- Teaching Thinking - Edward De Bono De Bono's
- Thinking Course – Edward De Bono Serious Creativity –
- Edward De Bono The Mind Map Book – Buzan Tony
- Becoming a Translator: An Introduction to the Theory and Practice of Translation - by Douglas Robinson
- A Textbook of Translation - by Peter Newmark, Newmark

Internal assessment methodology: -
   Project/Assignment
   b) Clipping files on various current topics.
   c) Publish letters to editors in news media.
   d) Reporting of college events.

Department of Mass Media

Class: F.Y.B.A.M.M.C   Semester: II   Number of Lectures Allotted: 60

Course name: Content Writing   Marks: 100

Course code: SIUBAMMC23   Course Credit: 4 points

Course Learning Objectives:

This course will develop the students' ability to:

- Recall the foundation of grammar, vocabulary, common errors, usage of phrases and idioms.
- Demonstrate editing skills in words, sentences, and story.
- Recognise the basics of writing techniques and tips.
- Demonstrate presentation tools, search technique and checks.
- Examine the importance of writing for the web and copy writing for print and social media.

Course Outcomes:

At the end of the completion of this course the learner will be able to:

1. Restate the grammar, vocabulary, common errors, creative phrases in English usage and writing structure.
2. Illustrate editing skills through editing redundant words, captions, headlines and copy in writing.
3. Rewrite the use of writing for news tickers, social media post, briefs, snippets, captions, and headlines.
4. Evaluate the use of power point presentation, advance search techniques and conduct plagiarism checks.
5. Explain the importance of content, writing for print and social media with reference to usage of SEOs and Ad campaigns.

Course Syllabus

1.Foundation: **(12 lectures)**
   a) Grammar Refresher-   (4)
      With special emphasis on use of punctuations, prepositions, capital letters and lower case, figures of speech
   b) Vocabulary building -   (3)
      Meaning, usage of words, acronyms, antonyms, synonyms, connectors, misspelt words
   c) Common errors -   (2)
      Homophones and common errors in English usage, identifying common mistakes
   d) Essentials of good writing -   (3)
      With emphasis on writing with clarity, logic and structure and connectors
      The ABCD of Media Writing: Accuracy, Brevity, Clarity & Discernment
      Create critical thinking skills and behaviours

2.Editing Skills: **(12 lectures)**
   e) Redundant words   (1)
      Identifying redundant words and phrases and eliminating these.

f) Editing sentences - (2)
Editing redundant words/ phases and replacing wrong words/ punctuation/ grammatical error

g) Editing captions- (2)
Editing redundant words/ phases and replacing wrong words/ punctuation/ grammatical error

h) Editing headlines- (3)
Editing redundant words/ phases and replacing wrong words/ punctuation/ grammatical error

i) Editing copy - (4)
Structuring a story, creating a flow, editing redundant words/ phrases, and replacing wrong words/punctuation/grammatical error, proof reading symbols

3. **Writing Tips and Techniques:** **(12 lectures)**
   a) Writing tickers/ scrolls- (2)
   For television new
   b) Writing social media post - (2)
   Twitter and for other social networks
   c) Writing briefs/snippets - (3)
   News briefs, Lifestyle, and entertainment snippets
   d) Caption writing- (3)
   Picture stories, photo story, click-a-tale.
   e) Writing headlines- (2)
   News headlines and feature headlines

4. **Presentation Tools And Techniques:** **(12 lectures)**
   a) Power Point Presentation- (2)
   Use of Power Point tools
   Power Point to Pdf
   Power Point to self-animated presentation
   Auto timing of Power Point presentation
   b) Info graphic- (2)
   Colour selection
   Use of clip art
   Use of Power Point smart tools
   Minimalist animation for maximum impact
   c) Three-minute presentation- (3)
   Content for single slide
   Uses of phrases
   Effective word selection
   Effective presentation
   d) Google Advance search- (2)
   How to select relevant information
   Locating authentic information
   How to gather information for domestic and international websites
   e) Plagiarism- (3)
   How to do a plagiarism check
   Paraphrasing
   Citation and referencing style

5.Writing for the Web : **(12 lectures)**
   a) Content is King- (2)
      Importance of content, tools, tips.
   b) Less is more - (2)
      Writing for print media/ social media like Twitter, etc
   c) Copy writing - (4)
      Ad campaigns (creative, witty and attractive), writing appeals, posters, leaflet
   d) Real time content - (2)
      Difference in writing for print vs digital
   e) Keywords- (2)
      Designing keywords for Search Engine Optimization

References: -
   1. The Editor's Toolbox by Buck Ryan and Michael O' Donnell, Surjeet Publication
   2. Writing for the Mass Media by James Glen Stovall
   3. Handbook of Rhetorical Devices by Robert A Harris

Internal assessment methodology: -
   The objective of internal exercise is to help the learner develop the skills of writing briefly and effectively.
   Project/Assignment:
   1. Writing Captions and Headlines-
      Simple writing is difficult. This assignment will help the learners to grasp the most essential aspect of a story and present these as headlines and captions
   2. A three- minutes power point presentation-
      This assignment challenges the learners to draw the essence of elaborate reports, research papers and present in three minutes
   3. Word Game/ Quiz-
      This is an exciting way to get learners engaged in vocabulary building

Department of Mass Media

CClass: F.Y.B.A.M.M.C	Semester: II	Number of Lectures Allotted: 60
Course name: Introduction to Journalism		Marks: 100
Course code: SIUBAMMC25		Course Credit: 4 points

Course Learning Objectives:

This course will develop the students' ability to:
- Introduce the history of journalism in India from press technology to advancement.
- Examine the news and acquaint with its process from the event to the reader with story and beats.
- Identify the principles and compare the various news formats.
- Describe roles and careers in journalism.
- Plan covering an event from research to writing a news story.

Course Outcomes:

At the end of the completion of this course the learner will be able to:
1. Describe the changing face of journalism from publications post-independence to post liberalisation.
2. Relate with the technology and new media with the rise in the citizen journalism.
3. Explain the news process and the anatomy of a good news story with the help of types of beats.
4. Correlate the principles and criteria for news worthiness and compare the difference in the roles with the news formats.
5. Discuss and classify the careers from reporter to journalist under the fields of journalism.
6. Conduct research on an event, capture pictures, and compose headlines, captions and leads for a news story.

Course Contents:

1. **History of Journalism in India:**   **(12 lectures)**
   a) Changing face of journalism from Guttenberg to new media
   b) Journalism in India:
      - Earliest publications
      - The rise of nationalist press, Post 1947
      - The emergency, 1975, Post Emergency
      - Post liberalization of the economy boom in magazine
      - Niche journalism
   c) How technology advancement has helped media
   d) New media with special reference to rise the Citizen Journalism to hyper local journalism

2. **News and is process:**   **(12 lectures)**
   a) Definition of News
   b) The news process from the event to the reader
   c) What makes a good story?
   d) Anatomy of a news story

    e) Types of Beats- Crime, Environmental, Entertainment, Educational, Agricultural, Sports, Politics, etc.

3. Principles and format: **(12 lectures)**
    a) What makes a great journalist: Objectivity, Accuracy, Without fear or favour Balance Proximity
    b) Difference between a PR and a journalist
    c) Criteria for news worthiness
    d) Hard News / Soft News and blend of the two
    e) News Reports, Features Editorials
    f) Traditional vs Web Journalism
    g) Elements of a Web newspaper
    h) Duties, responsibilities of a journalist

4. Types and Careers in Journalism: **(12 lectures)**
Reporter, Feature Writer, Mojo, Data journalist, Real time journalist, investigative journalist, rural journalist, In-depth journalist, lifestyle journalist.
Arts, Science and Education journalism

5. Covering an event (flip class): **(12 lectures)**
Background research
Finding a news angle
Capturing the right pictures for a photo feature
Writing Headline, captions, and lead

References:
1) Writing and Reporting News by Carole Rich; Thomson Wadsworth
2) Journalism: Principles and Practice by Tony Harcup, Sage Publication, 2011 edition
3) Recommended reading Nalin Mehta on Indian TV
4) M V Kamath: 'Behind the by-line' journalist's Handbook, Professional Journalism.
5) Introduction to Journalism: Essential Technique Richard Rudin
6) Introduction to Journalism: Carole Fleming
7) Introduction to Journalism: James glen Stowal

Internal assessment methodology: -
    a. Live classroom assignments
    b. Reporting through presentations
    c. Opinion polls and surveys
    d. Writing articles and editorials

College of Arts,
Science &
Commerce (Autonomous)

RISE WITH EDUCATION

NAAC REACCREDITED - 'A' GRADE
Sion (West), Mumbai – 400022

Syllabus under NEP effective from June 2023

Programme: B.Com

Subject: Vocational Skill Course

Class: F.Y.B.Com

Semester I

Choice Based Credit System (CBCS)

Semester I

Semester - I
FYBCOM

Paper Name: Vocational Skill Course (VSC)						
Class	**Semester**	**Course Code**	**Course Name**	**No. of lectures per week**	**Credits**	**Marks**
FYBCOM	I	SIUCOVS111	Entrepreneurship	2	2	50

LEARNING OBJECTIVES:
1] To familiarize the students with the concept of entrepreneurship.
2] To develop knowledge and understanding of project planning.

COURSE OUTCOME:
The successful completion of the course will enable the students to:
1. Define entrepreneurship and describe various aspects of entrepreneurship like significance, qualities and types.
2. Understand and explain the concept and various aspects of project planning.

SYLLABUS

Module	Topics	No. of lectures
I	**ENTREPRENEURSHIP** • Entrepreneurship: Concept & Features. • Importance of Entrepreneurship in India. • Growth of entrepreneurship in India. • Types of Entrepreneurs. • Competencies of Entrepreneurs. • Role of Government in entrepreneurship. • Intrapreneurship: Concept & Elements • Case studies	11
II	**PROJECT PLANNING** • Project planning: Concept, Project report and importance, Contents of project report. • Feasibility Study: Concept, Types, Importance. • Steps in setting up a business unit. • Location: Concept and factors influencing. • Role Government in promotion of business units. • Case studies.	11

Reference Books
1. Cherunilam, F. (2013). *Business Environment*. Himalaya Publishers.
2. David, F. R. (2011). *Strategic Management*. Prentice Hall India Learning Pvt. Ltd.
3. Hisrich, R. D. (2013). *Entrepreneurship*. McGraw Hill.
4. Kapoor, V. (2012). *Strategic Management*, Taxman.
5. Maheshwari, R. P. Mahajan, J. (2011). *Business Organization*. International Books House.
6. Sharma K.C. (2012). *Entrepreneurship Development*. Regal Book Depot.

<u>EVALUATION PATTERN</u>
Internal Assessment – 50 Marks

Semester – I

- ❖ Online Test   (20)
- ❖ Project / Presentation / Assignment / Viva given by the subject teacher with the approval of the Head of Department   (30)

Semester II

Semester – II
FYBCOM

Paper Name: Vocational Skill Course (VSC)						
Class	**Semester**	**Course Code**	**Course Name**	**No. of lectures per week**	**Credits**	**Marks**
FYBCOM	II	SIUCOVS121	Accounting for Special Transactions	2	2	50

LEARNING OBJECTIVE:

To enable the students:

✧ To understand the impact of consignment transactions in the books of accounts.

✧ To understand the treatment of hire purchase transactions in the books of accounts.

COURSE OUTCOME:

Successful completion of the course will enable a student to :

1. Record Hire purchase transactions by Asset purchase method, in the books of hirer and vendor.
2. Present the consignment transactions in the books of accounts of consignor and consignee.

SYLLABUS

Module	Topics	No of lectures
I i ii iii iv v vi	**Accounting for Hire Purchase** Concept of Time Value of Money (only theory) Meaning of Hire Purchase Calculation of interest Accounting for hire purchase transactions by asset purchase method based on full cash price. Calculation of cash price Recording transactions and drafting accounts in the books of Hirer and Vendor. (excluding default and repossession) (Theory and Problems)	15
II i ii iii iv	**Consignment Accounts** Meaning of consignment, its features Accounting for consignment transactions in the books of consignor and consignee Treatment of goods invoiced at higher price (excluding overriding commission, normal/abnormal losses) Valuation of inventory (Theory and Problems)	15

Reference Books

1. Anthony, R.N. and Reece, J.S. (1994). *Accounting Principles*: Richard Irwin Inc.
2. Chadwick, L. (2001). *Financial Accounting*. Pentice Hall of India Adin Bakley (P) Ltd.
3. Grewal, T.S. (2009). *Introduction to Accountancy*. S. Chand and Company (P) Ltd.
4. Gupta, R.L. Radhaswamy, M. (2010). *Advanced Accountancy*. S.Chand and Company (P) Ltd.
5. Horngren. (1981). Introduction to *Financial Accounting*. Pearson Publications.
6. Rajasekaran, V. (2011). *Financial Accounting*. Pearson Publications.
7. Shukla. Grewal (2013). *Advance Accounts*. S. Chand and Company (P) Ltd.
8. Tulsian, P.C. (2002). *Financial Accounting*. Pearson Publications.

Semester – II

❖ Online Test   (20)
❖ Project / Presentation / Assignment / Viva given by the subject teacher
   with the approval of the Head of Department   (30)

College of Arts,
Science &
Commerce (Autonomous)

SIES

R I S E   W I T H   E D U C A T I O N

NAAC REACCREDITED - 'A' GRADE

SIES College of Arts, Science and Commerce

(Autonomous)

Affiliated to University of Mumbai

Syllabus under NEP effective from June 2023

Programme: B.Sc.

Subject: Biochemistry

Skill Enhancement Course (SEC)

Class: F.Y.B.Sc.   Semester : I and II

Choice Based Credit System (CBCS)

Content

Preamble

Biochemistry is a branch of biological science that delves into the chemical processes and information pathways governing the survival and propagation of life. It is an interdisciplinary science providing the learner an opportunity to elucidate molecular mechanisms and explore the intricate world of biomolecules and their applications. Under the aegis of New Education Policy-2020, the department offers a three-year BSc program and a four-year BSc Honours program with Biochemistry (major or minor). At the first year level, along with core Biochemistry course, the department also offers Vocational skill enhancement course and Skill enhancement course. In this program, we will embark on a comprehensive journey from the structure and function of biomolecules to their interactions and implications in health and disease. Through lectures, laboratory sessions, and interactive discussions, the student will not only gain insights of the biochemical processes and pathways, but also develop skills for employability and aptitude for research.

Objectives:
The goal of this interdisciplinary Biochemistry program is
1. Foundational knowledge: To build the foundation of Biochemistry and encourage the student to pursue Biochemistry at higher level.
2. Application of Biochemistry: To enable the student to recognize the application of biochemistry in areas of nutrition and food, pharmaceuticals, diagnostics, clinical research, bioinformatics, forensics, etc.
3. Laboratory skills: To develop essential laboratory skills for the experimental analysis of biochemical principles.

Program Outcome
At the end of the first year, the student should be able to:
- Comprehend the concepts in nutrition and importance of proper nutrition thus laying a foundation for the field of nutrition and dietetics
- Understand the physical and chemical properties of biomolecules
- Co-relate the structure of biomolecules with their properties and functions
- Explain the role of biomolecules in maintaining structural integrity as well as their role in cellular pathology
- Apply the experimental skills in studying biomolecules and cellular processes
- Recognize the application of biochemistry in diverse fields of food, nutrition, clinical research, drug discovery, diagnostics, forensics, genomics, proteomics and bioinformatics.
- Use basic computational skills in documentation and scientific data presentation.

Evaluation: Student's understanding of biochemistry will be evaluated through a combination of examinations, quizzes, laboratory reports, and class participation. These assessments are designed to gauge learner's comprehension of both theoretical concepts and practical applications.

Overall Credit Structure for F.Y. B.Sc.

Semester	Core I	Core II	OE	VSC, SEC (VSEC)	AEC, VEC, IKS	OJT, FP, CEP, CC	Credits/ semester	Degree/ cumulative credits
I	4C	4C	4C	VSC-2C SEC-2C	AEC-2C VEC-2C IKS-2C	Nil	22C	UG Certificate 44C
II	4C	4C	4C	VSC-2C SEC-2C	AEC-2C VEC-2C	CC-2C	22C	
Total Credits	8C	8C	8C	8C	10C	2C	44C	

OE: Open Elective/Generic open elective
VSC: Vocational Skill Course
SEC: Skill Enhancement Course
AEC: Ability Enhancement Course
VEC: Value Education Course
IKS: Indian Knowledge System
OJT: On-job training
FP: Field Project
CEP: Community engagement and service
CC: Co-curricular courses

Credit Structure of courses offered by Biochemistry department for
F.Y. B.Sc. Biochemistry

Name of Program:		B.Sc. Biochemistry		**Name of Department:**		
Biochemistry						
Class	**Semester**	**Course Code**	**Course Title**	**Credits**	**No. of lectures/ per week**	**Marks**
FYBSc	I	SIUBCCC111	Foundations of Biochemistry	03	03	75
		SIUBCCCP111	Biochemistry Practical	01	02	25
		SIUBCVS111	Basic tools & techniques in Biochemistry	02 (01Th + 01P)	03 (01Th + 02P)	50
		SIUBCSE111	Good Laboratory Practices & Soft Skills	02 (01Th + 01P)	03 (01Th + 02P)	50
FYBSc	II	SIUBCCC121	Cell Biology	03	03	75
		SIUBCCCP121	Cell Biology Practical	01	02	25
		SIUBCVS121	Basic tools & techniques in Biochemistry	02 (01Th + 01P)	03 (01Th + 02P)	50
		SIUBCSE121	Good Laboratory Practices & Soft Skills	02 (01Th + 01P)	03 (01Th + 02P)	50

SI: SIES
U: Undergraduate
BC: Biochemistry
CC: Core Course
VS: Vocational Skill Course
SE: Skill Enhancement Course

Semester I and II
Syllabus- Skill Enhancement Course (SEC)

Course Title: Good laboratory practices & soft skills	
Course code: SIUBCSE111 and SIUBCSE121	
Credits: 02	**Hours/week: 01L + 02 P**

Course Outcome

On completing the Course, the learner should be able to

1. Identify and follow good laboratory practices. Implement safety protocols.
2. Identify safe handling and storage procedures of chemicals.
3. Comprehend the working of common equipments and instruments and employ them in laboratory work.
4. Follow and create standard operating procedures for instruments.
5. Participate in group discussions. Express and communicate ideas effectively.
6. Apply basic MS office tools in scientific writing, data analysis and presentations.

Sr no	Title	Theory (T)/ Practical (P)
1.	a. Reading & understanding of labels & symbols used on reagent bottles. b. Handling & storage of chemicals. c. Studying the physical & chemical changes that take place in a chemical. d. Safety protocols & hazard management. e. Introduction to MSDS	P
2.	a. Introduction to routinely used apparatus & equipment in a laboratory (Weighing balance, Desiccator, Fumehood, Buchner Funnel, UV Chamber) b. Determination of moisture content of sample.	T + P
3.	a. Sterilization & disinfection. b. Use of an autoclave & hot air oven c. Preparing SOPs	T
4.	Introduction to soft skills a. Oral communication (Group discussions, Presentation) b. Written communication (Email/Letter Writing)	T + P
5.	Introduction to MS Office a. MS Word b. MS Excel (plotting of graph) c. MS Powerpoint	T + P

REFERENCES FOR SEC

1. Microbiology, 5th edition- Michael Plczar Jr, E.C.S Chan, Noel Krieg.
2. Biophysical Techniques- Upadahyay, Upadhyay & Nath
3. Research Methodology- C.R Kothari
4. Butterfield Jeff Soft Skills for everyone.
5. Communication Skills for Engineers & Scientists- Sharma, Sangita and Binod Mishra.

Scheme of Examination:

Course Type	Credits	Distribution of Credits	Sem end	Internal	Practical	Total
SEC	2	without sem end exam	---	50	---	50

Details for Internal Assessment:

Weightage for Internal (marks)	Min. marks required for passing	Pattern of Evaluation
SEC 50 marks (without sem end exam)	20	20 marks- class test (No retest) + 30 marks- Open to Department OR 50 marks from Practical- journal+ viva+ exam etc (continuous evaluation)

Options for internal evaluation: Quizzes, Presentations, Surveys, Internship, Tutorials, Role Play,

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SIES COLLEGE OF ARTS,SCIENCE AND COMMERCE
Sion (West), Mumbai – 400022
(Autonomous)

Faculty: Science

Program: M.Sc.

Subject: BIOTECHNOLOGY

Academic Year: 2023 – 2024

M.Sc. Program

Credit Based Semester and Grading Syllabi approved by Board of Studies in Biotechnology to be brought into effect from June 2023.

PREAMBLE

Biotechnology, broadly defined, includes any technique that uses living organisms, or parts of such organisms, to make or modify products, to improve plants or animals, or to develop microorganisms for specific use. The interdisciplinary nature of biotechnology integrates living systems including animal, plant and microbes and their studies from molecular biology to cell biology, from biochemistry to biophysics, from genetic engineering to stem cell research, from bioinformatics to genomics-proteomics, from environmental biology to biodiversity, from microbiology to bioprocess engineering, from bioremediation to material transformation and so on.

Biotechnology is the science of today and tomorrow. It has applications in all major service sectors. i.e. health, agriculture, industry, environment etc. Biotechnology as an application science has taken firm footing in many countries, abroad where a number of transgenic crops, genetically modified food and recombinant therapeutic molecules for human and animal health are available in the market. Biotechnology as a science of service to human society is yet to make inroads in India

With the advent of the World Wide Web in the early nineties and its subsequent growth, the latest research trends have become accessible from drawing rooms across the globe. This acted as a positive feedback mechanism in increasing the pace of research in all fields including Chemical Engineering and Bio-technology. This was the motivation for an in depth analysis of what is actually required for today's technology. It is also important to take advantage of the freely available software to enhance the quality and quantity of material that can be covered in the class room.

This restructured syllabus is therefore intended to combine the principles of physical, chemical and biological sciences along with developing advanced technology. The postgraduate curriculum is prepared to impart primarily basic knowledge of the respective subject from all possible aspects. In addition, students will be trained to apply this knowledge particularly in day-to-day applications of biotechnology and hence get a flavor of research

PROGRAM OUTCOMES

The expected graduate attributes are directed towards the following:

- Applying the knowledge of various courses learned under the program to break down complex problems to simple components by designing processes for problem solving

- Utilizing the acquired contextual knowledge in an interdisciplinary framework. Integrating research-based knowledge and research-based methods involving problem definition, analysis and interpretation of data followed by its consolidation to arrive at valid conclusions

- Facilitating to write and document effectively; make crisp presentations and reports and convey the message/ instructions/findings clearly

- Equipping to select, create and apply the appropriate tools and techniques through electronic media for the purpose of understanding and analyzing data and drawing inference keeping in mind its limitations and disadvantages

- Understanding the need for sustainable development and concern for environmental issues

- Applying the acquired contextual knowledge in assessing public health and safety; addressing gender, ethnic and environmental issues in addition to performing with decisive responsibility.

PROGRAM SPECIFIC OUTCOMES

The program has been designed to expose the students to the latest developments in the areas of diagnostics, therapeutic techniques and instrumentation. This program is aimed at empowering students for a career in research and also to provide trained manpower for the fast-growing Biotech companies.

A Postgraduate student upon completion of this program is expected to gain the following attributes:

- Competence for research and innovation in the field of Biotechnology
- Design and execute experiments applying the concepts learnt and thereby being able to translate theoretical knowledge to practical knowledge
- Prepare, plan and execute a research project independently.
- Critically evaluate and interpret results

Semester I

Course Type	Course Title	Credits	Lectures (Hrs.)/ week
Major 1	Biochemistry I	4	4
Major 2	Molecular Biology I	4	4
Major 1 Practical	Biochemistry I practical	2	
Major 2 Practical	Molecular Biology I practical	2	
Major	IPR	2	2
Elective	Biochemical and Biophysical Techniques	3	3
Elective Practical	Biochemical and Biophysical Techniques Practical	1	
Research Methodology	Research Methodology	4	4
Total		22	

Semester II

Course Type	Course Title	Credits	Lectures (Hrs.)/ week
Major 1	Immunology I	4	4
Major 2	Molecular Biology II	4	4
Major 1 Practical	Immunology I practical	2	
Major 2 Practical	Molecular Biology II practical	2	
Major	Regulatory affairs	2	2
Elective	Bioprocess technology	3	3
Elective Practical	Bioprocess technology practical	1	
OJT	OJT	4	4
Total		22	

SEMESTER 1

COURSE CODE	TITLE	CREDITS	LECTURES
	BIOCHEMISTRY I	**4**	**60**
Course Outcomes	On successful completion of the course the learner is expected to demonstrate and explain the understanding of		
Unit I	**DNA topology** DNA topology: Different forms of DNA – A, B, C, Z and RL form of double helical DNA, triple helix. Nucleic acid binding proteins – Leucine zipper, zinc finger, OB fold, B- barrel, helix turn-helix, helix -loop -helix. Linking number, supercoiling, Topoisomerases.	**1**	**15**
Unit II	**Metabolism** Lipid metabolism: Phospholipids, Cerebrosides and Gangliosides; Alzheimer's disease; Steroid hormones, lipid storage diseases Biosynthesis of purines and pyrimidines with regulation, disorders of Nucleic acid metabolism. Biosynthesis of essential amino acids. Disorders of amino acid metabolism Glycosaminoglycans- Heparin, Chondroitin sulphate, Hyaluronic acid Glycoproteins & Glycolipids, Acidic sugars – ascorbic, glucuronic acid.	**1**	**15**
Unit III	**Membrane Dynamics** Membrane dynamics and transport of solutes across the membrane; States of bilayer lipids, Trans-bilayer Movement of Lipids, Flip-flop diffusion. Measurement of lateral diffusion rates of lipids by fluorescence recovery after photobleaching (FRAP). Hop diffusion of individual lipid molecules; Caveolins and cadherins; Membrane Fusion; Transporter classification system channel ($Na+$ channel of neurons) and ligand (acetylcholine) mediated transport with examples. ABC transporters and Ionophores, Diseases associated with Defective Ion Channels	**1**	**15**
Unit IV	**Enzymology** Enzyme classification, kinetics, Bisubstrate reaction, stable state kinetics, enzyme inhibitions, examples of enzymatic reaction – chymotrypsin, induced fit hypothesis, Catalytic antibodies, Ribozymes Regulatory enzymes and their mode of action and covalent modification of enzymes. Enzyme immobilization techniques, Enzyme biosensors.Basics of	**1**	**15**

	Enzyme engineering (Rational protein design and directed evolution).		

COURSE CODE	TITLE	CREDITS	LECTURES /WEEK
	MOLECULAR BIOLOGY I	**4**	**60**
Course Outcomes	On successful completion of the course, the student will understand the basic concepts of … Learner will be skilled in…..		
Unit I	**Gene evolution and the human genome** Human mitochondrial genome, content of the human nuclear genome: cis-trans regulatory elements, Introns, pseudogenes, non-coding RNA genes, tandemly repeated DNA, interspersed genome-wide repeats, Mobile genetic elements, Transposable elements in bacteria (Insertion elements, Transposons, Bacteriophage Mu) and eukaryotes (Plant transposable elements, Yeast transposable element, Drosophila transposable elements, Human retrotransposons) Genome evolution - Acquisition of New Genes by gene duplication: causes of gene duplication, whole genome duplication, smaller duplication, rearrangement of existing genes, Acquisition of New Genes from other species	**1**	**15**
Unit II	**Mapping techniques** Genetic Mapping: DNA markers for genetic mapping, Physical Mapping: Restriction Mapping, Fluorescent in situ hybridization (FISH), Sequence tagged site (STS) mapping, Next Gen sequencing, Human genome project	**1**	**15**
Unit III	**Transcription** Transcription in prokaryotes and eukaryotes, Types of RNA polymerases, Transcription in cell organelles, RNA processing in eukaryotes, Synthesis of eukaryotic mRNAs by RNA polymerase II, Intron splicing. Synthesis and processing of Non-coding RNAs: Transcript elongation and termination by RNA polymerases I and III, Introns in eukaryotic pre-rRNA and pre-tRNA. Processing of Pre RNA. Degradation of mRNAs	**1**	**15**
Unit IV	**Regulation of gene expression** Regulatory proteins: Activators, Enhancers, Insulators, Regulation of Transcription in Prokaryotes: Allostery,	**1**	**15**

	action at distance, DNA looping, cooperative binding, Examples: *lac* genes, NtrC & MerR, araBAD operon, regulation of bacteriophage λ, Eukaryotic Gene Regulation: Eukaryotic regulators, Recruitment of protein complexes to genes by activator, Signal integration and Combinatorial control, Transcriptional repressors & its mechanism, Signal transduction and control of transcriptional regulators		

COURSE CODE	TITLE	CREDITS	LECTURES
	BIOCHEMISTRY I – PRACTICAL	**2**	
	1. Isolation of starch from potato and its estimation by Anthrone method.		
	2. Estimation of Protein by Bradford's method.		
	3. Purification of protein by ammonium sulfate fractionation, dialyze and separate using PAGE		
	4. Study of protein complexes using SDS-PAGE and visualization using silver staining.		
	5. Determination of Lactate Dehydrogenase (LDH) Activity in Blood Serum.		
	6. Extraction of lipids (Essential oils) from the plant materials using clevenger apparatus.		
	7. Saponification value of oils.		
	8. Isolation of cholesterol and lecithin from egg yolks.		
	9. Study of effect of inhibitors on Enzyme activity		
	10. Study of Km and Vmax. 11. Titration curve of amino acids		

COURSE CODE	TITLE	CREDITS	LECTURES
	MOLECULAR BIOLOGY I – PRACTICAL	**2**	
	1. Extraction of genomic DNA from a. bacteria b. blood 2. Perform transformation of bacteria 3. Expression of recombinant protein 4. Restriction digestion 5. Ligation 6. Induction of β-Galactosidase in *E. coli* (and effect of inducers) 7. Problems on gene mapping and restriction mapping 8. RFLP analysis		

COURSE CODE	TITLE	CREDITS	LECTURES /WEEK
	INTELLECTUAL PROPERTY RIGHTS	**2**	**30**
Course Outcomes	On successful completion of the course, the student will understand the basic concepts of … Learner will be skilled in…..		
Unit I	**Introduction to IPR** Introduction to intellectual property; types of IP: patents, trademarks, trade secrets, copyright & related rights, industrial design, geographical indications, Biodiversity importance and legislation, International convention and treaties; plant variety protection and farmers rights act, traditional knowledge.	**1**	**15**
Unit II	**Basics of Patent** Eligibility criteria, concept of novelty, concept of inventive step; Patentable and Non-patentable inventions in India and abroad. Patenting systems. Process of Patenting, Types of patent applications, Patent Search, Rights of the patent holder, Assignment and licensing of patents and patent Infringement, case studies. Patent Agent. Biotechnological Inventions as Patentable Subject Matter, Patentability of Biotechnology Inventions in India, Statutory Provisions Regarding Biotechnological Inventions Under the Current Patent Act 1970 (as Amended 2005).	**1**	**15**

COURSE CODE	TITLE	CREDITS	LECTURES
ELECTIVE	**BIOCHEMICAL AND BIOPHYSICAL TECHNIQUES**	**3**	**45**
Course Outcomes	On successful completion of the course, the student will understand the basic concepts of … Learner will be skilled in…..		
Unit I	**Microscopic techniques** Confocal microscopy, Scanning Probe microscope, AFM, cryotomy scanning and transmission microscopes, different fixation and staining techniques for EM, freeze-etch and freeze- fracture methods for EM, image processing methods in microscopy, single cell imaging. Environmental	**1**	**15**

	SEM and its advantages, Immunoelectron microscopy.		
Unit II	**Spectroscopy**: Introduction and principle of: fluorescence spectroscopy, Light scattering spectroscopy, Luminometry, circular dichroism, NMR and ESR spectroscopy, Molecular structure determination using X-ray diffraction, X ray crystallography and NMR, Molecular analysis using light scattering, IR, Atomic absorption Spectroscopy.	1	15
Unit III	**Other techniques:** Introduction, principle and analysis using HPTLC, Capillary electrophoresis, Gel free electrophoresis, Types of PCR, mass spectrometry and LC-MS, GCMS, In–situ gene expression techniques; Microarrays, Flow cytometry. Introduction to cell imaging techniques.	1	15

COURSE CODE	TITLE	CREDITS	LECTURES
ELECTIVE	**BIOCHEMICAL AND BIOPHYSICAL TECHNIQUES - PRACTICALS**	1	
	1. Polymerase Chain Reaction		
	2. Separation of pigments using column chromatography		
	3. Viscosity of Proteins		
	4. Demonstration and interpretation of NMR, HPLC, GC readouts.		
	5. Separation of sugars using TLC.		
	6. Use of affinity chromatography for purification of antibodies from serum.		
	7. Technique based - Paper presentation.		

COURSE CODE	TITLE		CREDITS	LECTURES
	RESEARCH METHODOLOGY		**4**	**60**
Course Outcomes	On successful completion of the course, the student will understand the basic concepts of … Learner will be skilled in…..			
Unit I	**Foundations of Research:** Meaning, Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method – Understanding the language of research – Concept, Construct, Definition, Variable. Research and its types The research process: Problem Identification & Formulation – Research Question – Investigation Question –Measurement Issues – Hypothesis – Qualities of a good Hypothesis –Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance		**1**	**15**
Unit II	Research Design: Concept and Importance in Research – Features of a good research design, The functions of a research design, The theory of causality and the research design, Study designs in quantitative and qualitative research Data Collection : Data and its types, Selecting a method of data collection Data Analysis: Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association.		**1**	**15**
Unit III	**Sampling** - The concept of sampling, Sampling terminology, Principles of sampling, Factors affecting the inferences drawn from a sample, Aims in selecting a sample. Concepts of Statistical Population, Sample, Sampling Frame, Sampling Error, Sample Size, Non-Response. Characteristics of a good sample. Probability Sample – Simple Random Sample, Systematic Sample, Stratified Random Sample & Multi-stage sampling. Determining size of the sample– Practical considerations in sampling and sample size.		**1**	**15**
Unit IV	Research proposal and its contents, Types of research paper, Layout of a Research Paper, Reviewing the			

| | literature, Methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office. Journals in Life Science, Impact factor of Journals, When and where to publish? Ethical issues related to publishing, Plagiarism and Self-Plagiarism, Software for detection of Plagiarism. | 1 | 15 |

SEMESTER II

COURSE CODE	TITLE	CREDITS	LECTURES
	IMMUNOLOGY I	**4**	**60**
Course Outcomes	On successful completion of the course, the student will understand the basic concepts of … Learner will be skilled in…..		
Unit I	**Understanding the Immune system** Mechanisms of Innate immune system (pattern recognition receptors, complement system, ADCC) and Adaptive immune system (cells involved, Antigen recognition by B cells and T cells, Effector mechanisms) Cytokines: Properties, Classification, Receptors, Signaling, Cytokine secretion by T_H1 and T_H2, Cytokine related diseases, Cytokine expression.	**1**	**15**
Unit II	**Humoral Immunity** B cell development: development in Bone marrow, B cell lineages (B1 and B2), Negative regulation of B cells, T dependent and independent responses, Generation of Antibody Diversity: Germ line and Somatic theory, Dreyer and Bennett model, Tonegawa's Bombshell experiment Multigene organization of Ig gene, Variable gene rearrangements, Generation of antibody diversity, Synthesis, assembly, and secretion of immunoglobulins, Antibody engineering, Chimeric antibodies.	**1**	**15**
Unit III	**Cell mediated immunity** T cell Development: Early thymocyte development, positive and negative selection, Differentiation, maturation, Apoptosis. Transplantation: Basis of Graft rejection, clinical manifestation of graft rejection; immunosuppressive therapy; immune tolerance; clinical transplantation. Cancer immunology: Malignant transformation of cells, Cancer induction, Tumor Antigens, Immunosurveillance, tumor evasion, Cancer immunotherapy.	**1**	**15**
Unit IV	**Diseases of the immune system** Hypersensitivity: Classification and types Primary immunodeficiencies: Combined immunodeficiency (Reticular dysgenesis, SCID, BLS, DiGeorge syndrome, Wiskott-Aldrich syndrome, Hyper IgM, Job syndrome), B-cell immunodeficiency (CVID, X linked agammaglobulinemia), Disruption of	**1**	**15**

	immune regulation (APECED, IPEX), Disruption in innate immunity (LAD, CGD, CHS) Autoimmunity: Organ Specific and Systemic autoimmune diseases		

COURSE CODE	TITLE	CREDITS	LECTURES
	MOLECULAR BIOLOGY II	**4**	**60**
Course Outcomes	On successful completion of the course, the student will understand the basic concepts of … Learner will be skilled in…..		
Unit I	**Translation** Translation in Prokaryotes and Eukaryotes, Inhibitors of translation, Post translational modification:Protein folding, Processing by proteolytic cleavage, Processing by chemical modification and Inteins splicing. Protein targeting and degradation.	**1**	**15**
Unit II	**Histone modification & Genome activity** Chromatin & Nucleosome, Histone & histone variants, Gene silencing by Histone modification, Nucleosome remodeling, Regulatory RNAs in Prokaryotes: sRNAs, Riboswitches, CRISPRs, Regulatory RNAs in eukaryotes: miRNA, siRNA, long non-coding RNAs & their role. Regulation of Genome Activity During Development: Sporulation in *Bacillus*, Vulva development in *Caenorhabditis elegans*, Development in *Drosophila melanogaster*	**1**	**15**
Unit III	**Model organisms** *Saccharomyces cerevisiae*- Genome, existence of haploid and diploid cells, facilitating genetic analysis, generating mutations in yeast. *Arabidopsis*- genome life cycle, ease of transformation epigenetics, response to environment. *Mus musculus*- mouse embryonic development and stem cells, ease of introduction of foreign DNA, epigenetic inheritance.	**1**	**15**
Unit IV	**DNA Vectors** DNA cloning with single-stranded DNA vectors: M13 phages cloning vector, Specialist purpose vectors: M13 based vector for ssDNA, Expression vectors - Vectors for making RNA probes, vectors for maximizing protein synthesis, vectors to facilitate protein purification, vectors to promote protein solubilization, vectors to promote protein export, Gateway system, combination vectors-	**1**	**15**

	LITMUS, Pin-point series vectors, BACs, Phage P1 derived vectors & PACs. Cloning in *S.cerevisiae*: YEPs, YRPs, YCPs, YACs, Retrovirus – like vectors, Expression of cloned genes, Specialist vectors & Yeast surface display		

COURSE CODE	TITLE	CREDITS	LECTURES
	IMMUNOLOGY I - PRACTICAL	**2**	
Course Outcomes	On successful completion of the course, the student will understand the basic concepts of … Learner will be skilled in…..		
	1. DOT-ELISA 2. Quantification of antigen using Single Radial Immuno-Diffusion. 3. Immuno-diffusion and immune-electrophoresis 4. Serum electrophoresis 5. Western Blotting 6. Demonstration of HLA typing. 7. In-vitro demonstration of phagocytosis and calculating phagocytic index. 8. Latex bead agglutination / precipitation test for detection of rheumatoid factor (RF) 9. Separation of lymphocytes on Ficoll-Histopaque, viability count.		

COURSE CODE	TITLE	CREDITS	LECTURES
	MOLECULAR BIOLOGY II	**2**	
Course Outcomes	On successful completion of the course, the student will understand the basic concepts of … Learner will be skilled in…..		
	1. Mutagenesis 2. AMES test		

	3. Conjugation		
	4. Detection of GMO using PCR		
	5. Plasmid DNA extraction and detection using agarose gel electrophoresis		
	6. Elution of extracted plasmid from Agarose gel and quantification		
	7. Characterization of DNA by Spectrophotometric Assay and Melting Temperature (Tm)		

COURSE CODE	TITLE	CREDITS	LECTURES
	REGULATORY AFFAIRS	**2**	**30**
Course Outcomes	On successful completion of the course, the student will understand the basic concepts of … Learner will be skilled in…..		
Unit I	The Concepts of innovator and generic drugs, drug development process. Basic ICH Requirement and ICH topics. Basic regulatory framework with respect to Regulated and Non-regulated market practices and procedures. Regulatory Approval Process Approval processes and timelines involved in Investigational New Drug (IND), New Drug Application (NDA), Abbreviated New Drug Application (ANDA). Changes to an approved NDA / ANDA. Regulatory authorities and agencies Overview of regulatory authorities of India, United States, European Union, Australia, Japan, Canada (Organization structure and types of applications). Registration of Indian drug product in overseas market Procedure for export of pharmaceutical products, Technical documentation, Drug Master Files (DMF)	**1**	**15**
Unit II	Common Technical Document (CTD), electronic Common Technical 163 Document (eCTD), ASEAN Common Technical Document (ACTD)research. CTD-Module 1, 2, 3, 4, 5 (including QOS, quality design concept and bioequivalence). Clinical trials Developing clinical trial protocols, Institutional Review Board / Independent Ethics committee - formation and working procedures, Informed consent process and procedures, GCP, obligations of Investigators, sponsors	**1**	**15**

	& Monitors, Managing and Monitoring clinical trials, Pharmacovigilance - safety monitoring in clinical trials.		

COURSE CODE	TITLE	CREDITS	LECTURES
ELECTIVE	**BIOPROCESS TECHNOLOGY**	**3**	**45**
Course Outcomes	On successful completion of the course, the student will understand the basic concepts of … Learner will be skilled in…..		
UNIT I	**Fermentation** Strain improvement for increased yield and other desirable characteristics; Upstream processing: Media formulation; Sterilization, Bioreactor designs; classification of fermenters: Batch, fed batch and continuous; Solid state, surface and submerged fermentation; Conventional fermentation v/s biotransformation; Basics of bioreactor kinetics and mathematical equations regarding bioreactors, scale-up and aeration of bioreactors in detail, Kinetics of microbial growth, substrate utilization and product formation (Batch, Fed- Batch and continuous processes), Scale up concepts with respect to fermenter design and product formation, Gas exchange and mass transfer: O_2 transfer, critical oxygen concentration, determining the oxygen uptake rate.	**1**	**15**
UNIT II	**Applications of enzymes and microbes in fermentation** Mechanism of enzyme function and reactions in process techniques; Enzymic bioconversions e.g. starch and sugar conversion processes; High-Fructose Corn Syrup; Interesterified fat; Hydrolyzed protein etc. and their downstream processing; baking by amylases, deoxygenation and desugaring by glucose oxidase, beer mashing and chill proofing; cheese making by proteases and various other enzyme catalytic actions in food processing. Microbes and their use in pickling, producing colours and flavours, alcoholic beverages and acids; Process wastes-whey, molasses, starch substrates and other food wastes for bioconversion to useful products; Bacteriocins from lactic acid bacteria – Production and applications in food preservation**.**	**1**	**15**

UNIT III	**Food processing** Fermented foods and beverages; Food ingredients and additives prepared by fermentation and their purification; Fermentation as a method of preparing and preserving foods; Food Processing: Ambient-temperature processing, heat processing and processing by removal of heat. Post processing operations: Coating or enrobing, packaging and storage.	**1**	**15**

COURSE CODE	TITLE	CREDITS	LECTURES
ELECTIVE	**BIOPROCESS TECHNOLOGY PRACTICAL**	**1**	
Course Outcomes	On successful completion of the course, the student will understand the basic concepts of … Learner will be skilled in…..		
	1. Demonstration of Plackett-Burman design for formulation of fermentation media. 2. Pigment production and isolation from a microbial source (yeast, fungi or bacteria). 3. Study of enzyme activity of cellulase. 4. Immobilization of yeast cells and determination of its invertase activity. 5. Detection of different food enzymes by simple tests (amylase, catalase, invertase, papain, pectinase, pepsin). 6. Study of pickling process (sauerkraut / pickled cucumbers) with respect to physical, chemical / biochemical and biological changes occurring during the pickling process.		

COURSE CODE	TITLE	CREDITS	LECTURES
OJT	**OJT**	**4**	

33 to 50% continuous internal evaluation and remaining at the end of each semester.

References

1. Abbas, A. K., Lichtman, A. H., & Pillai, S. (2014). Cellular and molecular immunology E-book. Elsevier Health Sciences.
2. Ahmed, F. E. (2002). Detection of genetically modified organisms in foods. TRENDS in Biotechnology, 20(5), 215-223.
3. Amarger, N. (2002). Genetically modified bacteria in agriculture. Biochimie, 84(11), 1061-1072.
4. Ananthanarayan, R. (1984). Introduction to medical microbiology. Orient Longman Limited
6. Bailey, J. E., & Ollis, D. F. (2006). Biochemical engineering fundamentals. New York: McGraw-Hill.Berg, J. M., Stryer, L., & Tymoczko, J. L. (2012). Biochemistry: 7th Edition, W.H.Freeman and company, NY
7. Berg, J. M., Tymoczko, J. L., & Stryer, L. (2002). Biochemistry, ; W. H.
8. Berne, R. M., & Levy, M. N. (2000). Principles of physiology. Mosby Incorporated.
9. Biochemical Calculations, 2nd Ed., (1997) Segel Irvin H., Publisher: John Wiley and Sons, New York.
10. Boyer, R., & Boyer, R. (2005). Modern Experimental Biochemistry. Delhi: Pearson Education (Singapore) Pvt. Ltd.
11. Campbell, A. M., & Heyer, L. J. (2006). Discovering genomics, proteomics, and bioinformatics. San Francisco, Calif. [u.a.: CSHL Press.
12. Conn, E., & Stumpf, P. (2009). Outlines of biochemistry. John Wiley & Sons.
13. Daniel, W. W. (1999). Biostatistics: A Foundation for Analysis in the Health Sciences, 7[th]edR Wiley. New York.
14. Davidson, S. S., Meiklejohn, A. P., & Passmore, R. (1960). Human Nutrition and Dietetics. Academic Medicine.
15. Delves, P. J., & Roitt, I. M. (1994). Roitt's essential immunology. Oxford, Blackwell Scientific Pub.
16. Devlin, R. M., & Withan, F. H. (1988). Plant physiology 4th Ed.
17. Devlin, T. M. (Ed.). (2006). Textbook of biochemistry: with clinical correlations.
18. Dey, P. M., & Harborne, J. B. (Eds.). (1997). Plant biochemistry. Elsevier
19. Diwan, P., & Bharadwaj, A. (Eds.). (2005). The Nanoscope: Encyclopedia of Nanoscience and Nanotechnology Vol: 1,V,VI. Pentagon Press.
20. Dubey, R. C. (1999). A text book of biotechnology, Publication, S. Chand and Co., New Delhi.
21. El-Mansi, M., Bryce, C. F. A., Dahhou, B., Sanchez, S., Demain, A. L., & Allman, A. R. (2012). Fermentation microbiology and biotechnology.

22. Freshney, R. I. Culture of animal cells: a manual of basic technique. Wiley‑Liss

23. Friedman, H., Klein, T. W., & Friedman, A. L. (1995). Psychoneuroimmunology, stress, and infection. CRC Press

24. Gangal, S. (2007). Principles and practice of animal tissue culture. Universities Press.

25. Gerstman, B. B. (2014). Basic biostatistics. Jones & Bartlett Publishers.

26. Gilbert, S. F., & Barresi, M. J. F. (2018). Developmental biology.8th edn. Sinauer Associates, Inc.

27. Godkar, P.B. (2005).Text Book of Medical Biochemistry. Bahalani Publishers.

28. Goodsell, D. S. (2004). Bionanotechnology: lessons from nature. John Wiley & Sons.

29. Goodwin, T. W., & Mercer, E. I. (1972). Introduction to plant biochemistry (No. 572.82 G6I5).

30. Grahame-Smith, D. G., & Aronson, J. K. (2002). Oxford textbook of clinical pharmacology and drug therapy. Oxford: Oxford University Press.

31. Granner, D. K., Murray, R. K., Mayes, P. A., & Rodwell, V. W. (1988). Harper's Biochemistry (Vol. 21) 27th edn. Appleton & Lange.

32. Gurumani, N. (2005). An Introduction to Biostatistics. 2ndedR. MJP Publishers.

33. Guyton, A., & Hall, J. (2006). Textbook of medical physiology, 11th.

34. Hall, J. E. (2015). Guyton and Hall textbook of medical physiology e-Book. Elsevier Health Sciences.

35. Hamsten. Drug interaction. Kven stockley

36. Hatch, R. T. (July 01, 1974). Biochemical engineering, second edition, S. Aiba, A. E. Humphrey, and N. F. Millis, Academic Press, Inc., New York(1973)

37. Heldt, H. W., & Piechulla, B. (2004). Plant biochemistry 3rd edn. Elsevier.

38. Hudson, L., Hay, F. C., & Hudson, L. (1989). Practical immunology (pp. 348-350). Oxford: Blackwell Scientific Inc. USA

39. IGMORIS. (2013). Indian GMO Research Information System.

40. Jackson, A.T. (1991). Bioprocess Engineering in Biotechnology. Engelwood Cliffs, Prentice Hall.

41. Katzung, B. G., Masters, S. B., & Trevor, A. J. (2012). Basic and Clinical Pharmacology (LANGE Basic Science). McGraw-Hill Education.

42. Kindt, T. J., Goldsby, R. A., Osborne, B. A., & Kuby, J. (2007). Kuby immunology. Macmillan.

43. Krebs, J. E., Lewin, B., & Goldstein, E. S. (2012). Genes XI, 11th edition. Jones & Bartlett Publishers

44. Krishna, D. R., & Klotz, U. (1990). Clinical Pharmacokinetics: A Short Introduction. Springer.

45. Kulkarni, S. K. (2015). Nanotechnology: principles and practices (p. 403). Berlin, Germany:Springer.

46. Laurence, D. R., Bennet, P. N., & Brown, M. J. (1997). Clinical Pharmacology 8th edition Churchill Livingstone.

47. Maniatis, T., Fritsch, E. F., & Sambrook, J. (1982). Molecular cloning: a laboratory manual (Vol. 545). Cold Spring Harbor, NY: Cold spring harbor laboratory.
48. Mehra. Drug interaction. Basic Business Publ
49. Meneely, P. (2014). Genetic analysis: genes, genomes, and networks in eukaryotes. Oxford University Press.
50. Moo-Young, M. (1985). Comprehensive biotechnology: The principles, applications and regulations of biotechnology in industry, agriculture and medicine. Oxford [etc.: Pergamon Press.
51. Moore, T. C. (2012). Biochemistry and physiology of plant hormones. Springer Science & Business Media.
52. Mount David, W. (2001). Bioinformatics–Sequence and Genome Analysis. CSHL, New York.
53. Mu, P., & Plummer, D. T. (1988). Introduction to practical biochemistry. Tata McGraw-Hill Education.
54. Nelson, D. L., Lehninger, A. L., & Cox, M. M. (2008). Lehninger principles of biochemistry. 5th ed. Macmillan.
55. Norman, G. R., &Streiner, D. L. (2008). Biostatistics: the bare essentials. Hamilton: BC Decker Inc, 3.
56. Orten, J. M., Neuhaus, O. W., & Kleiner, I. S. (1975). Human biochemistry (No. 574.192 O7). CV Mosby.
57. Pal, J. K., & Ghaskadbi, S. S. (2009). Fundamentals of molecular biology. New Delhi: Oxford University Press.
58. Palmer, T., & Bonner, P. L. (2007). Enzymes: biochemistry, biotechnology, clinical chemistry. Elsevier.
59. Paul, W. E. (2013). Fundamental immunology. Philadelphia: Wolters Kluwer Health/Lippincott Williams & Wilkins.
60. Payne, G. F., Bringi, V., Prince, C., & Shuler, M. L. (1992). Plant cell and tissue culture in liquid systems (Vol. 13). Munich: Hanser Publishers.
61. Pevsner, J. (2003). Bioinformatics and Functional Genomics. Hoboken: John Wiley & Sons
62. Prokscha, S. (2006). Practical guide to clinical data management. CRC Press.
63. Rastogi, V. B. (2009). Fundamentals of Biostatistics 2Nd Ed. Ane Books Pvt Ltd.
64. Remington, J. P. (2006). Remington: the science and practice of pharmacy (Vol. 1). Lippincott Williams & Wilkins.
65. Rondel, R. K., Varley, S. A., & Webb, C. F. (Eds.). (2000). Clinical data management. John Wiley & Sons.
66. Sadasivam, S. (1996). Biochemical methods. New age international.
67. Sadler, T. W. (2011). Langman's medical embryology. Lippincott Williams & Wilkins.
68. Salisbury, F. B., & Ross, C. W. (1992). Plant physiology. 4th. Edn. CBS publishers and Distributors

69. Sauer, K. (1995). Biochemical spectroscopy. Vol 246 of Methods in Enzymology. San Diego, Calif. USA: Acad. Press.

70. Sharon, M., & Sharon, M. (2007). Nano Forms of Carbon and its Applications, Monad Nanotech Pvt. Ltd., Mumbai, India.

71. Shortliffe, E. H., & Cimino, J. J. (Eds.). (2013). Biomedical informatics: computer applications in health care and biomedicine. Springer Science & Business Media.

72. Shuler, M. L., Kargi, F., & DeLisa, M. (2002). Bioprocess engineering: Basic concepts, 2nd edn. Engelwood Cliffs, Prentice Hall.

73. Slack, J. M. (2009). Essential developmental biology. John Wiley & Sons.

74. Smyth, M. R. (1998). Analytical Biochemistry: David J. Holme and Hazel Peck, 3rd edn., Longman, Harlow

75. Stanbury, P. F., Whitaker, A., & Hall, S. J. (1995). Principles of fermentation technology. Oxford u.a.: Pergamon.

76. Swaminathan, M. (1974). Essentials of food and nutrition. Vol. II. Applied aspects. Essentials of food and nutrition. Vol. II. Applied aspects.

77. Talwar, G. P., & Gupta, S. K. (Eds.). (2009). A Handbook of practical and clinical immunology. CBS Publishers & Distributors.

78. Talwar, G. P., & Srivastava, L. M. (2002). Textbook of biochemistry and human biology. PHI Learning Pvt. Ltd.

79. Taylor, R. B. (2011). Medical writing. Springer Fachmedien.

80. Tropp, B. E. (2011). Molecular Biology. Jones & Bartlett Publishers.

81. Varley, H. (2006). Practical clinical biochemistry.6th edn. Practical clinical biochemistry.

82. Voet, D., Voet, J. G., & Pratt, C. W. (2002). Fundamentals of Biochemistry 2002 Update. John Wiley & Sons.

83. Walsh, G. (2002). Proteins: biochemistry and biotechnology. John Wiley & Sons.

84. Watson, J. D. (2008). Molecular biology of the gene. San Francisco: Pearson education.

85. Weaver, R. F., & Wassarman, D. A. (2011). Molecular biology. McGraw Hill Science. USA

86. Wilson, K., & Walker, J. (2010). Principles and techniques of practical biochemistry and molecular biology. Cambridge: Cambridge University Press.

87. Wilson, M., Kannangara, K., Smith, G., Simmons, M., & Raguse, B. (2002). Nanotechnology: basic science and emerging technologies. CRC Press.

88. Zubay, G. (1983). Biochemistry Addison-Wesley. Read Mass, 138-206.

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College of Arts,
Science &
Commerce (Autonomous)

R I S E   W I T H   E D U C A T I O N

NAAC REACCREDITED - 'A' GRADE

**SIES College of Arts, Science and Commerce (Autonomous)
Sion (West) Mumbai: 400022**

Affiliated to Mumbai University

Syllabus under NEP effective from June 2023

Offered by: Department of Botany

Program: F. Y. B.Sc.

Course: Botany (VSC)

Choice Based Credit System (CBCS)

with effect from the academic year 2023-24

PROGRAMME SPECIFIC OUTCOMES (PSO'S)

After completing the graduation (B.Sc.) course in Botany, the learners would be able to -

PSO1: Identify the different groups of plants and gain the knowledge about plant biodiversity and its conservation.

PSO2: Learn different techniques, protocols, methodologies during study and apply them in future.

PSO3: Utilize the botanical knowledge for problem solving and for taking real time decisions while working with plants.

PSO4: Learn good laboratory practices and acquire research skills required for industrial support services.

PSO5: Inculcate scientific temperament, good reasoning power, technological and analytical skills while designing the experiments.

PSO6: Develop interest in pursuing higher studies in plant sciences and developbetter future.

PSO7: Understand the scope, current trends, job prospects and career avenues in Botany.

PSO8: Share social and environmental consciousness with the fellow citizens and motivate them towards taking fundamental steps towards environmental conservation.

VSC: BOTANY FYBSC SEMESTER – I & II (Credits: 2)			
VSC – Advanced Techniques in Plant Sciences			
Paper Code	**Paper Name**	**Credits**	**Practicals/week**
	Practicals based on Advanced Techniques in Plant Sciences	02	04

VSC - Advanced Techniques in Plant Sciences (Practical)	**Hr. 30**
	Cr. 02

Learning Objectives: The course entitled 'Advanced Techniques in Plant Sciences' would be offered in Semester – I and/or Semester – II. It includes practicals based on advanced techniques and instrumentation in plant sciences. It would provide insight into the field of microscopy, micrometry, colorimetry, pH metry, and bioinformatics.

Course Outcomes:

After completion of the course, learners would be able to:

CO1: Get hands-on training in cutting and mounting the plant sections.

CO2: Understand and comment upon the principle and working of microscopy, micrometry, colorimetry, and pH metry.

CO3: Identify and comment upon the applications of different types of microscopes and micrometres.

CO4: Use the microscope, micrometre, colorimeter, and pH meter for practical purposes.

CO5: Observe and understand the effects of different chemicals on mitosis.

CO6: Separate and determine the chlorophyll content of a given plant sample.

CO7: Understand the significance of anthocyanins in plants.

CO8: Acquire proficiency in staining of bacteria and understand the significance of dermatoglyphics.

CO9: Get hands-on experience in using Bioinformatics tool - BLAST.

1	Sectioning & mounting of plant materials using microscopes.	
2	Study of types and applications of microscopes.	
3	Study of effect of chemicals on plant cell mitosis.	
4	Study of measurement of stomata from betel leaf using micrometre.	
5	Study of absorbance curve of a coloured solution/ plant pigment and to find λ_{max}.	
6	Study of Beer-Lambert's Law.	
7	Study of measurement of pH of the water sample using pH-meter.	
8	Separation of Chlorophyll pigments by paper chromatography.	
9	Determination of chlorophyll content.	
10	Study of effect of pH change on colour of Anthocyanin pigments.	
11	Study of bacteria using Gram's staining method.	
12	Study of Dermatoglyphics of Fingers and Palms.	
13	Study of Bioinformatic tool – BLAST	

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College of Arts,
Science &
Commerce (Autonomous)

SIES

R I S E   W I T H   E D U C A T I O N

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Sion (West) Mumbai: 400022**

Affiliated to Mumbai University

Syllabus under NEP effective from June 2023

Offered by: Department of Botany

Program: F. Y. B.Sc.

Course: Botany (SEC)

Choice Based Credit System (CBCS)

with effect from the academic year 2023-24

PROGRAMME SPECIFIC OUTCOMES (PSO'S)

After completing the graduation (B.Sc.) course in Botany, the learners would be able to -

PSO1: Identify the different groups of plants and gain the knowledge about plant biodiversity and its conservation.

PSO2: Learn different techniques, protocols, methodologies during study and apply them in future.

PSO3: Utilize the botanical knowledge for problem solving and for taking real time decisions while working with plants.

PSO4: Learn good laboratory practices and acquire research skills required for industrial support services.

PSO5: Inculcate scientific temperament, good reasoning power, technological and analytical skills while designing the experiments.

PSO6: Develop interest in pursuing higher studies in plant sciences and developbetter future.

PSO7: Understand the scope, current trends, job prospects and career avenues in Botany.

PSO8: Share social and environmental consciousness with the fellow citizens and motivate them towards taking fundamental steps towards environmental conservation.

SEC: BOTANY FYBSC SEMESTER – I & II (Credits: 2)			
SEC – Skill Enhancement Techniques in Plant Sciences			
Paper Code	**Paper Name**	**Credits**	**Practicals/week**
	Skill Enhancement Techniques in Plant Sciences	02	04

SEC – Skill Enhancement Techniques in Plant Sciences (Practical)	Hr. 30
	Cr. 02
Learning Objectives: The course entitled **Skill Enhancement Techniques in Plant Sciences** would be offered in Semester – I and/or Semester – II. It will highlight the advanced skills and techniques in plant sciences and would provide insight into the field of plant preservation, antimicrobial activity, mushroom cultivation, floral decorations and indoor gardening.	

Course Outcomes:	
After completion of the course, learners would be able to:	
CO1: Get hands-on training in wet and dry preservation methods of plants.	
CO2: Acquire and perform the technique of screening antibacterial and antifungal activities of plant extracts.	
CO3: Identify and comment upon the stages of mushroom cultivation.	
CO4: Apply the technique of mushroom cultivation for small scale production of oyster mushrooms.	
CO5: Create flower arrangements, vegetable & fruit carvings, bio-jewellery by acquiring botanical decoration skills.	
CO6: Create indoor gardens like dish gardens and terrariums.	
CO7: Process the fruits and vegetables to prepare plant products by becoming proficient in food preservation technology.	
CO8: Formulate herbal cosmetics.	
CO9: Develop entrepreneurial skills by arranging exhibition cum sale of plant products, herbal cosmetics, bio-jewellery, etc.	

1	Study of preservation of plants by wet and dry preservation techniques.	
2	Study of dry preservation of plants using herbarium preservation technique.	

3	Study of antibacterial activity of plant extracts	
4	Study of antifungal activity of plant extracts.	
5	Identification of stages in mushroom cultivation.	
6	Small – scale cultivation of Oyster mushroom.	
7	Preparation of floral arrangements: Indian, Japanese and Western	
8	Preparation of Jams, Jellies, Pickle and Syrup.	
9	Preparation of herbal Products: Herbal Face Pack, Bath Oil, Herbal Shampoo, Herbal Lip Balm, Rose water, Floral Incense, and Kajal.	
10	Preparation of indoor gardens: Dish Garden, Bottle Garden and Terrarium.	
11	Preparation of Biojewellery (Resin art), and Bio-gifts.	
12	Preparation of Botanical decoration: Vegetable and Fruit carving.	

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SIES COLLEGE OF ARTS, SCIENCE AND COMMERCE (AUTONOMOUS)
SION (W), MUMBAI – 400 022

Open-Elective Courses Offered By Unaided Departments (2023-24)

SEMESTER - I

1. Course offered by Department of Biotechnology

Course Code	Title	Credits	Lectures
SIUBTOE111	**FOOD AND NUTRITION**	**4**	
Course Outcomes	On successful completion of the course, the student will be able to • Understand the concepts of human nutrition, basic and advanced concepts of complementary nutrition, nutrition for fitness and exercise and food psychology.		
Unit I	**Human nutrition** Carbohydrates: Overview of Classification, Functions Carbohydrate recommendations, Glycemic Index and Glycemic Load, Sugar substitutes-Nutritive and non - nutritive sweeteners Synthetic and Natural sweeteners Fats and Fatty acids: Overview of Classification, Functions RDAs of total dietary fat and fatty acid consumption Fatty acid ratios, SFA, MUFA & PUFAs in health & disease Proteins and Amino acids- Overview of Classification, Functions, Essential Amino acid requirements and AA imbalances, Vitamins and minerals: Overview of Classification, Functions	**1**	**15**
Unit II	**Complementary Nutrition- Basic and advanced aspects** Classification, Health benefits, Mechanism of action, sources & recommendations of Prebiotics, Probiotics and Synbiotics - Types, Sources of prebiotics and probiotics, Health benefits, Regulations Bioactive Dietary Components, Functional foods, Phytochemicals, Flavonoids, Phytoestrogens , Meal Replacers, - Classification, Health benefits, Mechanism of action, Recommendations & concerns, Functional foods, Organic foods, Convenience foods	**1**	**15**
Unit III	**Nutrition For Exercise & Fitness** Definition and domains of fitness-Physical, Mental, Social & Spiritual domains of fitness, Components of physical fitness Health oriented components -cardiovascular endurance, muscular strength, muscular endurance, flexibility, and body composition. Skill oriented components-agility, balance, coordination, power, reaction time, and speed -Factors influencing Physical fitness - Role of exercise and nutrition in Physical fitness, Psychological Fitness- stress-Causes, consequences & strategies of management Nutrition and Physical Fitness in sports persons Classification of sports activities	**1**	**15**

	Body Composition of Sports Persons		
	Energy metabolism during Exercise (aerobic and anaerobic)		
Unit IV	**Food Psychology** The psychology of food choices and eating behavior-Models of food choice, Influences on food choice Social and psychological models of food choice- Role of family and peers, Food and Culture, Mood, emotions and food choice,Food cravings and addiction, Food Rewards, Influences of Media on food choice, Role of stress in choosing foods, Alcohol and tobacco use and abuse Behavior modification strategies to influence food and nutrition choices in disease conditions- Obesity - Behavioral phenotype in obesity, mindful eating, Diabetes, Allergies Psychology of the food and nutrition consumer- The psychology of the food shopper Factors affecting food purchase Food quality and consumer expectations,Packaging and labeling based on the psychology of the consumer, Ethnic, religious and economic influences on food choice of the consumer, Consumer perception of processed foods, supplements, organic and genetically modified foods	**1**	**15**

2. Course offered by Department of Data Science

Course Code	Title	Credits	Lectures
SIUDSOE111	**DATA MANAGEMENT IN EXCEL**	**2(T) + 2(P)**	
Course Outcomes	**CO1**. Learning the use and utility of functions and formulas on excel. **CO2**. Manipulate data using data names and ranges, filters and sort, and validation lists **CO3**. Analyzing data using Pivot Tables and Pivot Chart.		
Unit I	**Introduction to Excel :**About Excel & Microsoft, Uses of Excel, Excel software, Spreadsheet window pane, Title Bar, Menu Bar, Standard Toolbar, Formatting Toolbar, the Ribbon, File Tab and Backstage View, Formula Bar, Workbook Window, Status Bar, TaskPane, Workbook & sheets. **Columns & Rows:** Selecting Columns & Rows, Changing Column Width & Row Height, Autofitting Columns & Rows, Hiding/Unhiding Columns & Rows, Inserting & Deleting Columns& Rows, Cell, Address of a cell, Components of a cell – Format, value, formula, Use of paste and paste special. **Functionality Using Ranges:** Using Ranges, Selecting Ranges, Entering Information Into a Range, Using AutoFill. **Performing Calculations on Data:** Naming Groups of Data , Creating Formulas to calculate values, Summarizing Data that meets specific conditions, Finding and Correcting Errors in Calculations.	**1**	**15**

	Focusing on Specific Data by using Filters: Limiting Data that appears on screen, Manipulating worksheet data, Selecting list rows at random, summarizing worksheets with hidden and filtered rows, finding unique values within data set, Defining valid sets of values for ranges of cells		
Unit II	**Reordering and Summarizing Data:** Sortingworksheet data, Organizing data into levels , Looking up information in a worksheet. **Analyzing Alternative Data Sets:** Defining an alternative Data Set , Defining Multiple alternative Data Set, Varying Data to Get a Desired Result by using Goal Seek , Finding Optimal Solutions by Using Solver , Analyzing Data by using Descriptive Statistics. **Creating Dynamic Worksheets by Using Pivot Tables:** Analyzing Data Dynamically by Using PivotTables, Filtering, Showing, and Hiding PivotTable Data, Editing PivotTables, Formatting PivotTables, Creating PivotTables from External Data. **Creating Charts and Graphics :** Creating Charts, Customizing the Appearance of Charts, Finding Trends in Data , Summarizing Data by Using Sparkline, Creating Dynamic Charts by Using PivotCharts, Creating Diagrams by Using SmartArt, Creating Shapes and Mathematical Equations. **Printing :** Adding Headers and Footers to Printed Pages, Preparing Worksheets for Printing, Printing Worksheets.	**1**	**15**

List of Practicals – 2 Credits

1	i. Enter data into a Spreadsheet ii. Use AutoFill with labels, data and formulas iii. Format Cell Borders and Contents iv. Calculate the total across the rows v. Calculate the total for each column

2	Create worksheet with following fields Empno, Ename, Basic Pay(BP), Travelling Allowance(TA), Dearness Allowance(DA), House Rent Allowance(HRA), Income Tax(IT), Provident Fund(PF), Net Pay(NP)
	      i. Given: DA= 30% of BP, HRA=20% of BP, TA=17.5% of BP, IT=15% of BP, PF=12.5% of BP
	    ii. Calculate the Net Pay by using the formulae
	   iii. Gross Pay= DA+TA+HRA+BP
	    iv. Deductions=IT+PF
	     v. Net Pay= Gross Pay-Deduction

3	Create an Excel Worksheet with fields as Roll no. , Name ,Marks of Fivesubjects.
	      i. Find the Total Number & Average in all Subjects in Each Student.
	    ii. Find Grade Using If Function - If Average Greater >15 then "A" Grade otherwise "B" Grade.
	   iii. How Many Students "A" and "B" Grade ?

	iv. How Many Students in any two subjects Number Grater Then > 20 and <15 ? v. Represent the Data by inserting the Pie Chart	
4	Create an Excel Worksheet to apply Text Function on Full Name of the person. i. Calculate First Name ii. Calculate Last Name iii. Calculate Email id	
5	Create an Excel Worksheet with fields Roll no, Name , Marks i. Use hlookup function to display student's name ii. Use vlookup function to find the computer score of the students	
6	Create an Excel Worksheet with fields ordered, product, category(fruit,vegetable), amount, date and county. i. Create Pivot Table using Data Separate Fruit and Vegetable. ii. How many Fruit and Vegetable Items in a List? iii. Total Apple and Banana amount.	
7	Create an Excel Worksheet to perform i. alphabetical sort ii. numerical sort iii. Date-Time iv. Specify the cell color v. Apply Icon to cell.	
8	Create an Excel Worksheet to perform i. Text filter ii. Number filter	
9	Create an Excel Worksheet to perform data validation i. Allow only numeric or text values in a cell. ii. Allow only numbers within a specified range. iii. Allow data entries of a specific. iv. Restrict dates and times outside a given time frame.	
10	Create an Excel Worksheet to perform data validation i. Restrict entries to a selection from a drop-down list. ii. Validate an entry based on another cell. iii. Show an input message when the user selects a cell. iv. Show a warning message when incorrect data has been entered	

3. Course offered by Department of Computer Science

Course:	Title	Lectures	Credits
SIUCSOE111	**Basic Web Designing**	**2 per week (60 min per lec)**	**2**

Objectives:

To provide insight into emerging technologies to design and develop state of - the art web applicationsusing client-side scripting, server-side scripting, and database connectivity.

Expected Learning Outcomes:

- **CO1:** To design valid, well-formed, scalable, and meaningful pages using emerging technologies.

- **CO2:** Understand the various platforms, devices, display resolutions, viewports, and browsers thatrender websites

- **CO3:** To develop and implement client-side and server-side scripting language programs.

Unit I	**HTML5:** Fundamental Elements of HTML, Formatting Text in HTML, Organizing Text in HTML, Links and URLs in HTML, Tables in HTML, Images on a Web Page, Image Formats, Image Maps, Colors, FORMs inHTML, Interactive Elements, Working with Multimedia - Audio and VideoFile Formats, HTML elements for inserting Audio / Video on a web page	15L
Unit II	**CSS:** Understanding the Syntax of CSS, CSS Selectors, Inserting CSSin an HTML Document, CSS properties to work with background of a Page, CSS properties to work with Fonts and Text Styles, CSS propertiesfor positioning an element **Bootstrap**: What is Bootstrap, containers-fixed container, fixed- width container, grid system, typography- display headings, Colors- text colors, background colours, tables,images, jumbotron, alerts, buttons.	15L

Course	Title	Lectures	Credits
SIUCSOE111	**Practicals of Web Designing**	**4 per week (45 min per lec)**	**2**

1	Design a web page which displays the map of India. Create a clickable region using an image map on the same image so that when we click on Maharashtra it opens another tab with information about Maharashtra. Create two more clickable regions forstates of your choice.

2	A. Design a web page which contains three hyperlinks (audio,video, and gif image).
	  I. When a user clicks on an audio link web page should open in the same tab withsome audio content.
	  II. When a user clicks on a video web page should open in the same tab with somevideo content.
	  III. When a user clicks on a gif image web-page should open in the same tab withsome gif content.

3	Design a webpage to display nested ordered and unordered lists.
4	Design a webpage to display the time table of your class.
5	Design a webpage to display student registration forms.
6	Design a webpage that makes use of Cascading Style Sheets with (Background,fonts, Text styles).
7	Create webpage to showcase bootstrap containers
8	Create webpage to showcase bootstrap table with buttons and images

4. Course offered by Department of Environment Science

COURSE CODE	TITLE	CREDITS	LECTURES
SIUESOE111	**ENVIRONMENT AND SOCIETY**		
Course Objective: To acquaint the students with concepts of societal movements for the environment. **Learning Outcome:** The students will be made aware of environmental issues at society level and also about the role of society in environment management.			
Unit-I: Environment andSocial Inequalities	• Social and cultural construction of 'environment'; • Environmental thought from historical and contemporary perspective. • Inequalities of race, class, gender, region, and nation-state in access to healthy and safe environments. • Concept of ecological and social justice; • Environmental ethics.	1	15
Unit II: Impact of anthropogenic activities on environment and society	Impact of following anthropogenic activitieson environment and society: • Pollution • Industrialization • Urbanization • Deforestation • Mining • Developmental projects • Reclamation • Tourism	1	15
Unit III: Man and Environment Management	• State, corporate, civil society, community, and individual-level initiatives to ensure sustainable development. • Case studies of environmental movements (Chipko Movement, Appiko Movement, Narmada Bachao Andolan). • Corporate responsibility movement. • Appropriate technology movement. • Environmental groups and movements, citizen groups	1	15

Unit IV: Environment-society relationship	• Environment-society relationship; Development-induced displacement, resettlement, and rehabilitation: problems, concerns, andcompensative mechanisms;discussion on Project Affected People (PAPs). • Impact of technology on environment; • Conflict between economic and environmental interests; • Community participation. • Environmental education and awareness.	1	15

5. Course offered by Department of Information Technology

COURSE CODE	TITLE	CREDITS 2(T) + 2(P)	LECTURES
SIUITOE111	**Data Presentation and Visualization in MS PowerPoint**		

Course Objective: To help presenter to communicate more effectively by creating visually compelling presentations,and also enable them to highlight important information that they can use to persuade audiences.

Learning Outcome: Upon completion of this course, student will be able to:

CO1: Create and manipulate simple slide shows with outlines and notes.

CO2: Create slide presentations that include text, graphics, animation, and transitions.

CO3: Use various visualization techniques in power point presentations

Unit-I:	Basics of Powerpoint, Editing Slides, Working in Outline View, Proofing thepresentations, Notes and Slide Show. Fonts and Text Formatting, Designing and animating the slides, Working withSlide Master	1	15
Unit II:	Inserting Pictures and Drawing on slides, Working with charts,Working withsmartArt, Adding sound and video to the slides, Tables,hyperlinks and Action Buttons, Collaborating in the cloud with Office 365, Exporting your presentations to other formats, Data visualizations for power point.	1	15

List of Practical: 2 credits

Any 10 practical with respect to the syllabus topics.

6. Course offered by Department of Mass Media

Course Code	Title	Credits	Lectures
SIUMMOE111	**INTRODUCTION TO MEDIA AND ENTERTAINMENT**	**4**	
Course Outcomes	On completion of this course, students will be able to: • explain the concepts of media and entertainment • classify the role and forms of media and entertainment in society • discuss the media and communication theories • examine the trends in media and entertainment industry		
Unit I	**Introduction to Mass Media** • Nature and importance of Mass Media • Mass Communication and Mass Media and Multimedia • Types of Mass Media • The role of mass media in entertainment	**1**	**15**
Unit II	**Media and Entertainment** • The role of media and entertainment in society • The positive effects of media and entertainment on society • Function of media entertainment and media audiences • Categories in Entertainment: music, games, comedy, plays - performance, literature, and sport • Other forms of entertainment [live performance, games, comedy, literature, comedy, performance, storytelling, Theatre, Cinema, Film making, Dance, Circus, Animals]	**1**	**15**
Unit III	**Media Entertainment theory** • Media and Communication • Lasswell's model of communication • Influence of Media and Uses and Gratification model • Cultivation Theory • Mood management theory • The 4Cs: content, conduit, convergence, consumption to reinvent strategies for emotional attachment with customers. • Types of audience engagement with entertainment	**1**	**15**
Unit IV	**New media and entertainment industry** • Top 10 media and entertainment companies India and abroad [Comcast, WD, AT&T, Paramount Global, Sony, Fox] • The growth in Global media and entertainment industry: share, economic trends • The future of media and entertainment industry in India • The Creative media and entertainment • Careers in Media and Entertainment Investigate current trends and emerging practices in media and entertainment. • Assess the impact of globalization on media and entertainment businesses.	**1**	**15**

| | • Examine the marketing and promotional strategies used in the industry. | | |
| | • Develop critical thinking and analytical skills to evaluate industry practices and trends. | | |

7. Course offered by Department of Management Studies

Course Code	Title	Credits	Lectures
SIUMSOE111	**FOUNDATION OF HUMAN SKILLS**	**4**	
Course Outcomes	On completion of this course, students will be able to: • To understand inter and intra difference among individuals • To give overview of group behavior organizational conflicts and resolutions • To understand the different theories of Motivation. • To understand the organizational change with respect to organizational development and work stress.		
Unit I	**Understanding of Human Nature** • Individual Behaviour: Concept of a man, individual differences, factors affecting individual differences, Influence of environment • Personality and attitude: Determinants of personality, Personality traits theory, Big five model, Personality traits important for organizational behaviour like authoritarianism, locus of control, Machiavellianism, introversion-extroversion achievement orientation , self – esteem, risk taking, self-monitoring and type A and B personalities, Concept of understanding self through JOHARI WINDOWS, Nature and components of attitude, Functions of attitude, Ways of changing attitude, Reading emotions • Thinking, learning and perceptions: Thinking skills, thinking styles and thinking hat, Managerial skills and development, Learning characteristics, theories of learning (classical conditioning, operantconditioning and social learning approaches), Intelligence, type (IQ, EQ, SQ, at work place), Perception features and factor influencing individual perception, Effects of perceptual error in managerial decision making at work place. (Errors such as Halo effect, stereotyping, prejudice attributional).	**1**	**15**
Unit II	**Introduction to Group Behaviour** • Introduction to Group Behaviour • Group Dynamics: Nature, types, group behaviour model (roles, norms, status, process, structures) • Team effectiveness: nature, types of teams, ways of forming an effective team. • Setting goals. • • Organizational processes and system.	**1**	**15**

	• Power and politics: nature, bases of power, politics nature, types, causes of organizational politics, political games. • Organizational conflicts and resolution: Conflict features, types, causes leading to organizational conflicts, levels of conflicts, ways to resolve conflicts through five conflicts resolution strategies with outcomes.		
Unit III	**Organizational Culture and Motivation at workplace** • Organizational Culture: • Characteristics of organizational culture. • Types, functions and barriers of organizational culture • Ways of creating and maintaining effective organization culture • Motivation at workplace: • Introduction, Incentives • Concept of motivation • Theories of motivation in an organisational set up. • Maslow Need Heirachy • F.Hertzberg Dual Factor • Mc.Gregor theory X and theory Y. • Waysofmotivating through carrot (positive reinforcement) and stick (negative reinforcement) at workplace.	1	15
Unit IV	**Organisational Change, Creativity and Development and Work Stress** • Organisational change and creativity: Concepts of organisational change, Factors leading/influencing organisational change, Kurt Lewins model of organisational change and development, Creativity and qualities of a creative person, Ways of enhancing creativity for effective decision making, Creative problem solving. • Organisational Development and work stress: Need for organisational development, OD Techniques, Stress, types of stress, Causes and consequences of job stress, Ways for coping up with job stress	1	15

SEMESTER – II

1. Course offered by Department of Biotechnology

Course Code	Title	Credits	Lectures
SIUBTOE121	**INTRODUCTION TO FORENSIC SCIENCE**	**4**	
Course Outcomes	On successful completion of the course, the student will understand the basic concepts of forensic science, forensic medicine, medical law and ethics, forensic psychology and acts, and emerging trends in forensic science.		
Unit I	**Fundamentals of Forensic Science** History, Development and Fundamentals of Forensic Science, Definition and Origin of term *"forensis"* Nature, need and scope**,** Principles and laws of forensic science. Domains in Forensic Science divisions- ballistics, voice, audio-video, automobiles engineering Questioned documents division- (stylistics, linguistics, counterfeit)**,** Cyber division**,** Fingerprint division (Prints and other impressions)**,** Psychology (Criminal profiling, polygraphy, narco analysis, brain mapping)	**1**	**15**
Unit II	**Essentials of Forensic Science** Crime scene investigation and reconstruction, forensic photography. Forensic medicine: Introduction and forensic medicine and legal procedure. Medical law and ethics Personal identification. Medico legal autopsy, Thanatology, death, and its causes Stages of death, Instrumentation Basics of Microscopy, Chromatography - Paper, TLC, HPTLC, GC, HPLC; Basic Spectroscopy, UV-Visible spectrophotometer	**1**	**15**
Unit III	**Forensic Psychology and Acts** Narco-analysis- Theory, procedure, admissibility in court, prospects, merits, and demerits of the technique, Brain Mapping- Theory, procedure, admissibility in court, prospects, merits, and demerits of the technique, Polygraph-Theory, procedure, admissibility in court, prospects, merits, and demerits of the technique. **Special Acts:** Narcotic Drugs and Psychotropic Substance Act , 1985 IT Act, 2005 Wildlife Protection Act 1972	**1**	**15**
Unit IV	**Emerging Trends in Forensic Science** Brain mapping, polygraph, PCR, DNA fingerprinting, Digital Forensics, Computer Crimes- Definition Types of computer crimes, Cyber Crimes - Definition, Types of cyber-crimes**,** Computer security, Online security, Data retrieval	**1**	**15**

2. Course offered by Department of Data Science

Course Code	Title	Credits	Lectures
SIUDSOE121	**DATA HANDLING USING MySQL**	**2(T) + 2 (P)**	
Course Outcomes	Upon completion of this course, student will be able to: **CO1:** Gain familiarity with the MySQL development environment **CO2:** Understand basic concepts of database development: SQL, Database design and Administration. **CO3:** Design and code a database solution		
Unit I	**Introduction:** Why is MySQL so Popular, Elements of MySQL and Its Environment , Installing MySQL : Installation Choices and Platforms , Using the command-line Interface , Using a Text Editor , Installing Under Windows. **Modeling and Designing Databases :** The database design process. **Basic SQL:** SELECT statement, INSERT statement , DELETE statement , UPDATE statement, Exploring Database and Tables with SHOW and mysqlshow. **Working with Database Structures:** Creating and using Database , Creating Tables, Altering Structures , Renaming Tables, Dropping Tables, Truncating Tables, Backing Up and Restoring databases.	**1**	**15**
Unit II	**Advanced Querying:** Aggregating Data ,Nested Queries , User Variables , Transactions and Locking , Table Types. **Functions** – String Functions (concat, instr, left, right, mid, length, lcase/lower,ucase/upper, replace, strcmp, trim, ltrim, rtrim), Math Functions (abs, ceil, floor, mod,pow, sqrt, round, truncate) Date Functions (adddate, datediff, day, month, year, hour,min, sec, now, reverse) **Joining Tables** – inner join, outer join (left outer, right outer, full outer) **Managing Users and Privileges:** Understanding Users and Privileges, Creating and using new users , GRANT OPTION privilege.	**1**	**15**

List of Practicals – 2 Credits

1	Perform the following:
	   i. Viewing all databases
	   ii. Creating a database
	   iii. Viewing all Tables in a database
	   iv. Creating Tables(With and Without Constraints)

2	Perform the following:
	   i. Inserting Records in a Table.
	   ii. Updating Records in a Table.
	   iii. Deleting Records in a Table.

3	Perform the following: i. Altering a Table

	ii.	Dropping/Truncating/Renaming Tables
	iii.	Backing up / Restoring a Database
4	Perform the following:	
	i.	Simple Queries
	ii.	Simple Queries with Aggregate functions
	iii.	Queries with Aggregate functions (group by and having clause)
5	Subqueries With IN clause	
6	Subqueries With EXISTS clause	
7	Write a Queries involving Date Functions.	
8	Write a Queries involving String Functions.	
9	Write a Queries involving Math Functions.	
10	Join Queries	
	i.	Inner Join
	ii.	Outer Join

3. Course offered by Department of Computer Science

Course	Title	Lectures	Credits
SIUCSOE121	Basics of R programming	2 per week (60 min per lec)	2

Objective:

The course covers data reading and its manipulation using R, which is widely used for data analysis internationally. The course also covers different control structures and design of user-defined functions.Loading, installing and building packages are covered.

Course Outcome:

- CO1: Develop an R script and execute it.

- CO2: Install, load and deploy the required packages, and build new packages for sharing and reusability.

- CO3: Extract data from different sources using API and use it for data analysis.

- CO4: Visualize and summarize the data.

- CO5: Design application with database connectivity for data analysis.

Unit I	**Introduction:** R interpreter, Introduction to major R data structures like vectors, matrices, arrays, list and data frames, Control Structures, vectorized if and multiple selection, functions. **Installing, loading and using packages:** Read/write data from/in files, extracting data from web-sites, Clean data, Transform data by sorting, adding/removing new/existing columns, centring, scaling and normalizing the data values, converting types of values, using string in-built functions.	15L
Unit II	**Statistical analysis of data -** for summarizing and understanding data, Visualizing data using scatter plot, line plot, bar chart, histogram and box plot.	15L

Course	Title	Lectures	Credits
SIUCSOE121	**Practicals of Basics of R Programming**	**4 per week** (45 min per lec)	**2**
1	Write a program to check whether a year (integer) entered by the user is a leap year ornot?		
2	Write an R program to find the sum of natural numbers without formula using theif–else statement and the while loop		
3	Write a program that prints the grades of the students according to the marks obtained.The grading of the marks should be as follows. <table><tr><td>Marks</td><td>Grades</td></tr><tr><td>800-1000</td><td>A+</td></tr><tr><td>700 – 800</td><td>A</td></tr><tr><td>500 – 700</td><td>B+</td></tr><tr><td>400-500</td><td>B</td></tr><tr><td>150 – 400</td><td>C</td></tr><tr><td>Less than 150</td><td>D</td></tr></table>		
4	Write a set of instructions to create the following matrix using vectors and rbind() function. Rename the rows to Lang1,Lang2 & Lang3 respectively and use the functionto access any one element using row names. 		
5	Write an R script to do the following: a) simulate a sample of 100 random data points from a normal distribution withmean 100 and standard deviation 5 and store the result in a vector. b) visualize the vector created above using different plots.		
6	In the library MASS is a dataset UScereal which contains information about popular breakfast cereals. Attach the data set and use different kinds of plots to investigate thefollowing relationships: a) relationship between manufacturer and shelf b) relationship between fat and vitamins c) relationship between fat and shelf d) relationship between carbohydrates and sugars e) relationship between fibre and manufacturer f) relationship between sodium and sugars		
7	Using the Algae data set from package DMwR to complete the following tasks. a) create a graph that you find adequate to show the distribution of the values ofalgae a6. b) show the distribution of the values of size 3.		

	c) check visually if oPO4 follows a normal distribution.
	d) produce a graph that allows you to understand how the values of NO3 are distributed across the sizes of rivers.
	e) using a graph check if the distribution of algae a1 varies with the speed of theriver.
	f) visualize the relationship between the frequencies of algae a1 and a6. Give the appropriate graph title, x-axis and y-axis title.
8	Let us use the built-in dataset air quality which has Daily air quality measurements inNew York, May to September 1973. Create a histogram by using appropriate arguments for the following statements. a) Assigning names, using the air quality data set. b) Change colors of the Histogram c) Remove Axis and Add labels to Histogram d) Change Axis limits of a Histogram e) Create a Histogram with density and Add Density curve to the histogram

4. Course offered by Department of Environment Science

COURSE CODE	TITLE	CREDITS	LECTURES
SIUESOE121	ECOTOURISM		
Course Objective: To introduce the learners to the concept of ecotourism and impart environmental importance to them as a tourist. **Learning Outcome:** The course will make the students aware about the rich heritage of our country and instill a sense of responsibility towards conserving the ancient ecology of such tourist places, besides introducing them to the concerned policies followed in our country.			
Unit-I: History, Nature and Scope of Ecotourism	• Definition and concept of Ecotourism; • History of ecotourism; • Nature of tourism; • Ecotourism and Ecotourists; • Natural resources and heritage sites; Conservation and Protected areas; • Significance and scope of ecotourism;	1	15
Unit II: Types and Importance of Ecotourism	• Types of ecotourism – self- guided tours, guided tours. • Social and ecological impacts of ecotourism; Role of ethics in ecotourism; Benefits of ecotourism – educational, promotional, economical; recreational; • Ecotourism and local communities.	1	15

Unit III: Potential and Challenges of Ecotourism	• Economics, marketing and management of ecotourism; • Ecotourism development; • Ecotourism programme planning; • Carrying capacity of ecotourism destinations; • Recreation Opportunity Spectrum (ROS); • Limits of Acceptable change (LAC); • Sustainable tourism development. • Case studies.	1	15
Unit IV: Ecotourism Policy of India and Major ecotourism destinations	• Planning and policy frameworks; National Strategy for Ecotourism drafted in 2022 under Incredible India. • Major Ecotourism destinations in India – Jim Corbett National Park (Uttarakhand), Kerala backwaters, Thenmala (Kerala), Coorg (Karnataka), Maredumilli (Andhra Pradesh), Sunderbans (West Bengal), Khangchendzonga (Sikkim), Namdapha (Arunachal Pradesh), Tsomoriri Wetland Conservation Reserve (Ladakh), Andaman Islands, Chilika lake (Odisha), Matheran • (Maharashtra), Malvan Marine Sanctuary (Maharashtra).	1	15

5. Course offered by Department of Information Technology

COURSE CODE	TITLE	CREDITS 2(T) + 2(P)	LECTURES
SIUITOE121	**Data Analysis in MS Excel**		
Course Objective: Help students to organize data in an easy-to-navigate way, turn piles of data into helpful graphics and charts and analyze data and make forecasting predictions. **Learning Outcome: Upon completion of this course, student will be able to:** CO1: Remember and apply the basics of excel such as formatting cells, sorting and filtering of the given large data set. CO2: Remember to design the various charts in excel. CO3: Apply powerful features like pivot table and chart to large data set in excel.			
Unit-I:	What is Excel? Cells, Rows, and Columns, Navigation, Formatting, Separating Text within a Cell, Sorting, Filters, Functions and Formulas **Excel New Features:** Chart Recommendations, Format Charts, Chart Design, Richer Data Labels, Leader Lines	1	15

	Fundamental Data Analysis: Instant Data Analysis, Sorting Data by Color,Slicers, Flash Fill			
Unit II:	**Powerful Data Analysis:** PivotTable and Pivot Chart, Data Model, PowerPivot, External Data Connection, Pivot Table Tools, Power View, Visualizations, Pie Charts, Format Reports, Handling Integers, Templates,Manage Passwords.	1		15

List of Practical: 2 credits

Any 10 practical with respect to the syllabus topics.

6. Course offered by Department of Mass Media

Course Code	Title	Credits	Lectures
SIUMMOE121	**UNDERSTANDING CINEMA**	**4**	
Course Outcomes	On completion of this course, students will be able to: • describe and relate with history of cinema from still pictures to moving images. • discuss and illustrate aspects of film appreciation. • examine major film movements and its impact. • compare and evaluate mainstream Indian cinema and parallel Indian cinema • discuss and demonstrate film production to film exhibition under stages of film making. • describe film institute, bodies, associations and relevance of film awards in India and abroad.		
Unit I	• Introduction to Cinema as a Medium, Language of Cinema, Cinema Narratives, Evolution of Cinema covering Hollywood as well as Indian Cinema from the early beginnings to its status today. • Popular Hindi commercial films (Bollywood): past to present, economic contribution of cinema, convergence of art and commercial, genre in present (romcom, thriller, biographic, action, musical etc.) • The contemporary era, from celluloid to digital (1990-1999), the digital explosion (2000 onwards), media convergence and film viewing culture.	**1**	**15**
Unit II	• Introduction to the genres, understanding diverse film genres, with a special mention to Italian neorealism, French new wave. • Introduction and basic discussion to cover a broad range of films: Documentaries, Commercial Ads, Corporate Films, Short Films, Newsreels, Public Service Ads and others.	**1**	**15**

Unit III	• Introduction to Film Institute, Film Bodies and Trade Associations such as FTII, NFAI, Films Division, the DFF, IFFI, CBFC, IFTDA, SGI, WICA, etc. • Film Festivals: What is Film Festival? Major Film Festivals in India and Abroad • Film Awards: Nature and Types of Film Awards. Major Film Awards in India and Abroad	1	15

Unit IV	• Basic Introduction to the TECHNOLOGY used in Cinema; Introduction to few important TECHNIQUES employed by different film makers; Introduction to the BUSINESS with prevailing practices in the production and marketing of films. The contribution and the role of Digital technologies in Modern Filmmaking process.
	• Filmmaking
	  o Film Production to Film Exhibition
	  o Aspects of Production Systems: Financial, Administrative and Creative.
	  o Stages of Filmmaking -1: Pre-Production
	  o Stages of Filmmaking -2: Actual Production
	  o Stages of Filmmaking -2: Post-Production
	  o Film and Censorship.
	  o ROI Systems in Film Industry (Distribution, Promotion, Marketing, Branding, Internet)
	• Trending in 2023;Streaming videos, social media and gaming, VR, AR Future of Entertainment (personalized, immersive)
		1	15

8. Course offered by Department of Management Studies

Course Code	Title	Credits	Lectures
SIUMSOE121	**FINANCIAL LITERACY AND INVESTING**	**4**	
Course Outcomes	• To make students aware about the practical aspects of money and money management • To highlight the importance of investments in achieving financial independence • To help students in recognizing the importance of financial prudence and impact of purchase decision on the personal finances • To understand how passive income can become secondary source of income		
Unit I	**Introduction to Budgeting** Concept of Income, Expenses and Savings- Types of Income and expenses, Different sources of Income- Difference between needs and wants- Concept of budgeting, Importance of budgeting, process of budgeting (steps in budgeting), The Budgeting Rule	1	15
Unit II	**Introduction to Invesment and Different Investment Avenues** Concept of Investment, difference between Investment and Savings- Investment Process- Criteria for Investment- Type of Investors- Factors Influencing selection of Investment-	1	15

	Different Investment Avenues- Short Term and Long Investment- Alternate (Modern) Investment Avenues like Cryptocurrencies, Non-Fungible Tokens and Digital Assets		
Unit III	**Purchase Decision, Opportunity cost and Concept of Gratification** Meaning of Purchase Decision, Types of Purchase Decision, Process of Decision Making, Concepts of Opportunity Cost and Scarcity, Concept of Instant Gratification, Delayed Gratification and Financial Minimalism	1	15
Unit IV	**Introduction to the Assets and Liabilities and Financial Planning** Meaning of Asset and Liability, Concept of Real asset and liability, Types of Asset and Liabilities- Concept of Financial Planning, Financial Goals- Steps in Financial Planning- Retirement Planning.	1	15

SIES College of Arts, Science and Commerce, Sion (W)
Autonomous College

RISE WITH EDUCATION

NAAC REACCREDITED -'A' GRADE
BEST COLLEGE AWARD - UNIVERSITY OF MUMBAI

Syllabus for
Program: First Year Bachelor of Science
(NEP) Course: Computer Science
Semester: I & II

With effect from
Academic Year 2023 -24

Preamble

Information and Communication Technology (ICT) has today become an integral part of all industry domains as well as fields of academics and research. The industry requirements and technologies have been steadily and rapidly advancing. Organizations are increasingly opting for open source systems. The students too these days are thinking beyond careers in the industry and aiming for research opportunities.

The B.Sc. Computer Science course structure therefore needed a fresh outlook and complete overhaul. A real genuine attempt has been made while designing the new syllabus for this 3 year graduate course. Not only does it prepare the students for a career in the Software industry, it also motivates them towards further studies and research opportunities.

The core philosophy of overall syllabus is to -

    a.   Form strong foundation of Computer science,

    b.   Introduce emerging trends to the students in gradual way,

    c.   Groom the students for the challenges of ICT industry

In the first year i.e. for semester I & II, the basic foundation of important skills required for software development is laid. The syllabus proposes to have 2 core subjects of Computer science and 2 core courses of Mathematics-Statistics. In Semester II the students would also be given industrial exposure via field projects/industrial visit. All core subjects are proposed to have theory as well as practical tracks. While the Computer Science courses will form fundamental skills for solving computational problems, the Mathematics & Statistics course will inculcate research oriented acumen.

The syllabus design for further semesters encompasses more advanced and specialized courses of Computer Science.

We sincerely believe that any student taking this course will get a very strong foundation and exposure to basics, advanced and emerging trends of the subject. We hope that the students' community and teachers' fraternity will appreciate the treatment given to the courses in the syllabus.

We wholeheartedly thank all experts who shared their valuable feedback and suggestions in order to improvise the contents, we have sincerely attempted to incorporate each of them. We further thank the Chairperson and members of the Board of Studies for their confidence in us. Special thanks to the Department of Computer Science and colleagues from various colleges, who volunteered or have indirectly helped design certain specialized courses and the syllabus as a whole.

Program Outcomes and Program Specific Outcomes

B.Sc. Computer Science

SR.NO	Details
PO 1	Recall and explain acquired scientific knowledge in a comprehensive manner and apply the skills acquired in their chosen discipline. Interpret scientific ideas and relate its interconnectedness to various fields in science.
PO 2	Evaluate scientific ideas critically, analyse problems, explore options for practical demonstrations, illustrate work plans and execute them, organize data and draw inferences.
PO 3	Explore and evaluate digital information and use it for knowledge upgradation. Apply relevant information so gathered for analysis and communication using appropriate digital tools.
PO 4	Ask relevant questions, understand scientific relevance, hypothesize a scientific problem, construct and execute a project plan and analyze results.
PO 5	Take complex challenges; work responsibly and independently, as well as in cohesion with a team for completion of a task. Communicate effectively, convincingly and in an articulate manner.
PO 6	Apply scientific information with sensitivity to values of different cultural groups. Disseminate scientific knowledge effectively for upliftment of the society.
PO 7	Follow ethical practices at the workplace and be unbiased and critical in interpretation of scientific data. Understand the environmental issues and explore sustainable solutions for it.
PO 8	Keep abreast with current scientific developments in the specific discipline and adapt to technological advancements for better application of scientific knowledge as a lifelong learner.

SR.NO	Details
PSO 1	Apply knowledge of computational mathematics, statistics and programming acquired in the field of Computer Science.
PSO 2	Identify, analyze complex problems in the real world and formulate innovative solutions to those problems.
PSO 3	Compare and apply hardware and software technologies for implementing reliable optimized solutions catering to need and available resources.
PSO 4	Apply software development, managerial, Professional, and soft skills in industry
PSO 5	Understand the global needs and prepare themselves for the changing needs worldwide adapting an ability to engage in life-long learning.
PSO 6	Become a responsible, ethical citizen and explore environmental issues to develop sustainable solutions for it.

F.Y.B.Sc. Computer Science Open Elective Course Syllabus
Credit Based System and Grading System
Academic year 2023-2024

Semester – I						
Course Code	**Course Type**	**Course Title**	**Credits**	**Lectures/Week**		
				Theory	**Practical (2 lectures)**	**Total**
Generic/ Open Elective Courses (OE)						
SIUCSOE111	Open Elective	Basic Web Designing	2	2		2
SIUCSOE111	Open Elective Practical	Practical of SIUSCS15	2		2	2

Semester – II						
Course Code	**Course Type**	**Course Title**	**Credits**	**Lectures/Week**		
				Theory	**Practical (2 lectures)**	**Total**
Generic/ Open Elective Courses (OE)						
SIUCSOE121	Open Elective	Basics of R programming	2	2		2
SIUCSOE121	Open Elective Practical	Practical of SIUSCS25	2		2	2

Course:	Title	Lectures	Credits
SIUCSOE111	**Basic Web Designing**	**2 per week (60 min per lec)**	**2**

Objectives:

To provide insight into emerging technologies to design and develop state of - the art web applications using client-side scripting, server-side scripting, and database connectivity.

Expected Learning Outcomes:

- **CO1:** To design valid, well-formed, scalable, and meaningful pages using emerging technologies.

- **CO2:** Understand the various platforms, devices, display resolutions, viewports, and browsers that render websites

- **CO3:** To develop and implement client-side and server-side scripting language programs.

Unit I	**HTML5:** Fundamental Elements of HTML, Formatting Text in HTML, Organizing Text in HTML, Links and URLs in HTML, Tables in HTML, Images on a Web Page, Image Formats, Image Maps, Colors, FORMs in HTML, Interactive Elements, Working with Multimedia - Audio and Video File Formats, HTML elements for inserting Audio / Video on a web page	15L
Unit II	**CSS:** Understanding the Syntax of CSS, CSS Selectors, Inserting CSS in an HTML Document, CSS properties to work with background of a Page, CSS properties to work with Fonts and Text Styles, CSS properties for positioning an element **Bootstrap**: What is Bootstrap, containers-fixed container, fixed- width container, grid system, typography- display headings, Colors- text colors, background colours, tables,images, jumbotron, alerts, buttons.	15L

Text book:

1. HTML 5 Black Book, Covers CSS 3, JavaScript, XML, XHTML, AJAX, PHP and jQuery, 2ed, Dreamtech Press

2. Web Programming and Interactive Technologies, scriptDemics, StarEdu Solutions India. 3) PHP: A Beginners Guide, Vikram Vaswani, TMH

Additional References:

1. HTML, XHTML, and CSS Bible Fifth Edition, Steven M. Schafer, WILEY

2. Learn to Master HTML 5, scriptDemics, StarEdu Solutions Pvt Ltd.

Course	Title	Lectures	Credits
SIUCSOE111	**Practicals of Web Designing**	**4 per week (45 min per lec)**	**2**
1	Design a web page which displays the map of India. Create a clickable region using an image map on the same image so that when we click on Maharashtra it opens another tab with information about Maharashtra. Create two more clickable regions for states of your choice.		
2	A. Design a web page which contains three hyperlinks (audio,video, and gif image). I. When a user clicks on an audio link web page should open in the same tab with some audio content. II. When a user clicks on a video web page should open in the same tab with some video content. III. When a user clicks on a gif image web-page should open in the same tab with some gif content.		
3	Design a webpage to display nested ordered and unordered lists.		
4	Design a webpage to display the time table of your class.		
5	Design a webpage to display student registration forms.		
6	Design a webpage that makes use of Cascading Style Sheets with (Background, fonts, Text styles).		
7	Create webpage to showcase bootstrap containers		
8	Create webpage to showcase bootstrap table with buttons and images		

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Course	Title	Lectures	Credits
SIUCSOE121	**Basics of R programming**	**2 per week (60 min per lec)**	**2**

Objective:
The course covers data reading and its manipulation using R, which is widely used for data analysis internationally. The course also covers different control structures and design of user-defined functions. Loading, installing and building packages are covered.

Course Outcome:

- CO1: Develop an R script and execute it.

- CO2: Install, load and deploy the required packages, and build new packages for sharing and reusability.

- CO3: Extract data from different sources using API and use it for data analysis.

- CO4: Visualize and summarize the data.

- CO5: Design application with database connectivity for data analysis.

Unit I	**Introduction:** R interpreter, Introduction to major R data structures like vectors, matrices, arrays, list and data frames, Control Structures, vectorized if and multiple selection, functions. **Installing, loading and using packages:** Read/write data from/in files, extracting data from web-sites, Clean data, Transform data by sorting, adding/removing new/existing columns, centring, scaling and normalizing the data values, converting types of values, using string in-built functions.	15L
Unit II	**Statistical analysis of data -** for summarizing and understanding data, Visualizing data using scatter plot, line plot, bar chart, histogram and box plot.	15L

Textbook:

1. Cotton, R., Learning R: a step by step function guide to data analysis. 1st edition. O'reilly Media Inc

Additional References:

1. Gardener, M.(2017). Beginning R: The statistical programming language, WILEY Lawrence, M., & Verzani, J. (2016).

2. Programming Graphical User Interfaces in R. CRC press. (ebook)

Course	Title	Lectures	Credits
SIUCSOE121	**Practicals of Basics of R Programming**	**4 per week** (45 min per lec)	**2**

1	Write a program to check whether a year (integer) entered by the user is a leap year or not?
2	Write an R program to find the sum of natural numbers without formula using the if–else statement and the while loop
3	Write a program that prints the grades of the students according to the marks obtained. The grading of the marks should be as follows. | Marks	Grades
800-1000	A+
700 – 800	A
500 – 700	B+
400-500	B
150 – 400	C
Less than 150	D	
4	Write a set of instructions to create the following matrix using vectors and rbind() function. Rename the rows to Lang1,Lang2 & Lang3 respectively and use the function to access any one element using row names.
5	Write an R script to do the following: a) simulate a sample of 100 random data points from a normal distribution with mean 100 and standard deviation 5 and store the result in a vector. b) visualize the vector created above using different plots.
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7	Using the Algae data set from package DMwR to complete the following tasks. a) create a graph that you find adequate to show the distribution of the values of algae a6. b) show the distribution of the values of size 3.

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8	Let us use the built-in dataset air quality which has Daily air quality measurements in New York, May to September 1973. Create a histogram by using appropriate arguments for the following statements. a) Assigning names, using the air quality data set. b) Change colors of the Histogram c) Remove Axis and Add labels to Histogram d) Change Axis limits of a Histogram e) Create a Histogram with density and Add Density curve to the histogram

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Program: First Year Bachelor of Science
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   b.   Introduce emerging trends to the students in gradual way,
   c.   Groom the students for the challenges of ICT industry

In the first year i.e. for semester I & II, the basic foundation of important skills required for software development is laid. The syllabus proposes to have 2 core subjects of Computer science and 2 core courses of Mathematics-Statistics. In Semester II the students would also be given industrial exposure via field projects/industrial visit. All core subjects are proposed to have theory as well as practical tracks. While the Computer Science courses will form fundamental skills for solving computational problems, the Mathematics & Statistics course will inculcate research oriented acumen.

The syllabus design for further semesters encompasses more advanced and specialized courses of Computer Science.

We sincerely believe that any student taking this course will get a very strong foundation and exposure to basics, advanced and emerging trends of the subject. We hope that the students' community and teachers' fraternity will appreciate the treatment given to the courses in the syllabus.

We wholeheartedly thank all experts who shared their valuable feedback and suggestions in order to improvise the contents, we have sincerely attempted to incorporate each of them. We further thank the Chairperson and members of the Board of Studies for their confidence in us. Special thanks to the Department of Computer Science and colleagues from various colleges, who volunteered or have indirectly helped design certain specialized courses and the syllabus as a whole.

Program Outcomes and Program Specific Outcomes

B.Sc. Computer Science

SR.NO	Details
PO 1	Recall and explain acquired scientific knowledge in a comprehensive manner and apply the skills acquired in their chosen discipline. Interpret scientific ideas and relate its interconnectedness to various fields in science.
PO 2	Evaluate scientific ideas critically, analyse problems, explore options for practical demonstrations, illustrate work plans and execute them, organize data and draw inferences.
PO 3	Explore and evaluate digital information and use it for knowledge upgradation. Apply relevant information so gathered for analysis and communication using appropriate digital tools.
PO 4	Ask relevant questions, understand scientific relevance, hypothesize a scientific problem, construct and execute a project plan and analyze results.
PO 5	Take complex challenges; work responsibly and independently, as well as in cohesion with a team for completion of a task. Communicate effectively, convincingly and in an articulate manner.
PO 6	Apply scientific information with sensitivity to values of different cultural groups. Disseminate scientific knowledge effectively for upliftment of the society.
PO 7	Follow ethical practices at the workplace and be unbiased and critical in interpretation of scientific data. Understand the environmental issues and explore sustainable solutions for it.
PO 8	Keep abreast with current scientific developments in the specific discipline and adapt to technological advancements for better application of scientific knowledge as a lifelong learner.

SR.NO	Details
PSO 1	Apply knowledge of computational mathematics, statistics and programming acquired in the field of Computer Science.
PSO 2	Identify, analyze complex problems in the real world and formulate innovative solutions to those problems.
PSO 3	Compare and apply hardware and software technologies for implementing reliable optimized solutions catering to need and available resources.
PSO 4	Apply software development, managerial, Professional, and soft skills in industry
PSO 5	Understand the global needs and prepare themselves for the changing needs worldwide adapting an ability to engage in life-long learning.
PSO 6	Become a responsible, ethical citizen and explore environmental issues to develop sustainable solutions for it.

F.Y.B.Sc. Computer Science Skill Enhancement Course Syllabus
Credit Based System and Grading System
Academic year 2023-2024

Semester – I						
Course Code	**Course Type**	**Course Title**	**Credits**	**Lectures/Week**		
				Theory	**Practical (2 lectures)**	**Total**
Skill Enhancement Course						
SIUCSSE111	Skill Enhancement Course (SEC)	Beginning MySQL	1	1		1
SIUCSSE111	Skill Enhancement Course (SEC)	Practical of SIUSCSP14	1		1	1

Semester – II						
Course Code	**Course Type**	**Course Title**	**Credits**	**Lectures/Week**		
				Theory	**Practical (2 lectures)**	**Total**
Skill Enhancement Course						
SIUCSSE121	Skill Enhancement Course (SEC)	Digital Electronics	1	1		1
SIUCSSE121	Skill Enhancement Course (SEC)	Practical of SIUSCS24	1		1	1

Semester I – Theory

Course	Title	Lectures	Credits
SIUCSSE111	Beginning MySQL	1 per week (60 min per lec)	1

Objectives:

The objective of this course is to introduce the concept of the DBMS with respect to the relational model, to specify the functional and data requirements for a typical database application and to understand creation, manipulation and querying of data in databases .

Expected Learning Outcomes

- **CO1:** Gain familiarity with the MySQL development environment

- **CO2**: Understand basic concepts of database development:

- **CO3:** SQL, Database design, Administration, and Security

- **CO4:** Design and code a database solution

Unit I	**Introduction to DBMS –** Database, DBMS –Definition, Overview of DBMS, Advantages of DBMS, Levels of abstraction, Data independence, DBMS Architecture **DDL Statements** - Creating Databases, Using Databases, data types Creating Tables (with integrity constraints – primary key, default, check, not null), Altering Tables, Renaming Tables, Dropping Tables, Truncating Tables, Backing Up and Restoring databases **DML Statements** – Viewing the structure of a table insert, update, delete, Select all columns, specific columns, unique records, conditional select, in clause, between clause, limit, aggregate function (count, min, max, avg, sum), group by clause, having clause **Functions** – String Functions (concat, instr, left, right, mid, length, lcase/lower, ucase/upper, replace, strcmp, trim, ltrim, rtrim), Math Functions (abs, ceil, floor, mod, pow, sqrt, round, truncate) Date Functions (adddate, datediff, day, month, year, hour, min, sec, now, reverse) **Joining Tables** – inner join, outer join (left outer, right outer, full outer) **Subqueries** – subqueries with IN, EXISTS, subqueries restrictions, Nested subqueries, ANY/ALL clause, correlated subqueries **Views** (creating, altering dropping, renaming and manipulating views) **DCL Statements** (creating/dropping users, privileges introduction, granting/revoking privileges, viewing privileges)	15L

Text books:

1. Ramez Elmasri & Shamkant B.Navathe, Fundamentals of Database Systems, Pearson Education, Sixth Edition, 2010
2. Ramakrishnam, Gehrke, Database Management Systems, McGraw‑Hill, 2007
3. Joel Murach,Murach's MySQL, Murach, 2012

Additional References:

1. Robert Sheldon, Geoff Moes, Begning MySQL, Wrox Press, 2005.

Course	Title	Lectures	Credits
SIUCSSE111	**Practicals on Beginning MySQL**	**2 per week (60 min per lec)**	**1**
1	For given scenario Perform the following: - Viewing all databases - Creating a Database - Viewing all Tables in a Database - Creating Tables (With and Without Constraints) - Inserting/Updating/Deleting Records in a Table - Saving (Commit) and Undoing (rollback)		
2	For given scenario Perform the following: - Altering a Table - Dropping/Truncating/Renaming Tables - Backing up / Restoring a Database Perform the following: - Simple Queries - Simple Queries with Aggregate functions - Queries with Aggregate functions (group by and having clause)		
3	For given scenario Queries involving - Date Functions - String Functions - Math Functions		
4	For given scenario Join Queries - Inner Join - Outer Join Subqueries - With IN clause - With EXISTS clause		
5	For given scenario Views - Creating Views (with and without check option) - Dropping views - Selecting from a view DCL statements - Granting and revoking permissions		

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Course	Title	Lectures	Credits
SIUCSSE121	**Digital Electronics**	**1 per week (60 min per lec)**	**1**

Objectives:
The objective of this course is to provide a comprehensive study of the C programming language, stressing strengths of C, which provide the students with the means of writing modular, efficient, and portable code.

Course Outcomes:

- **CO1**: Apply concepts of Digital Binary System and implementation of Gates.

- **CO2**: Analyze and design of Combinational logic circuits.

- **CO3**: Analyze and design of Sequential logic circuits with their applications.

- **CO4**: Implement the Design procedure of Synchronous & Asynchronous Sequential Circuits.

- **CO5**: Apply the concept of Digital Logic Families with circuit implementation.

Unit I	**Computer Abstractions and Technology**: Basic structure and operation of a computer, functional units and their interaction. **Number Systems:** Binary, Decimal, Octal and Hexadecimal. **Logic circuits and functions:** Combinational circuits and functions: Basic logic gates and functions, truth tables; logic circuits and functions. Minimization with Karnaugh maps. Synthesis of logic functions with and-or-not gates, nand gates, nor gates. Fan-in and fan-out requirements; tristate buffers. Half adder, full adder, ripple carry adder. (Flip flops) Gated S-R and D latches, edge-triggered D latch. Shift registers and registers. Decoders, multiplexers. Sequential circuits and functions: State diagram and state table **Instruction set architectures:** Memory organization, addressing and operations; word size, big-endian and little endian arrangements. Instructions, sequencing. Instruction sets for RISC and CISC (examples Altera NIOS II and Freescale ColdFire). Operand addressing modes; pointers; indexing for arrays. Machine language, assembly language, assembler directives. Function calls, processor runtime stack, stack frame. **Types of machine instructions:** arithmetic, logic, shift, etc. Instruction sets, RISC and CISC examples. **Basic Processor Unit:** Main components of a processor: registers and register files, ALU, control unit, instruction fetch unit, interfaces to instruction and data memories. Datapath. Instruction fetch and execute;	15L

executing arithmetic/logic, memory access and branch instructions; hardwired and microprogrammed control for RISC and CISC.

Basic I/O: Accessing I/O devices, data transfers between processor and I/O devices. Interrupts and exceptions: interrupt requests and processing.

Text book:

1. Carl Hamacher et al., Computer Organization and Embedded Systems, 6 ed., McGraw-Hill 2012

Additional References:

1. Patterson and Hennessy, Computer Organization and Design, Morgan Kaufmann, ARM Edition, 2011

2. R P Jain, Modern Digital Electronics, Tata McGraw Hill Education Pvt. Ltd. , 4th Edition, 2010

Course	Title	Lectures	Credits
SIUCSSE121	**Practical on Digital Electronics**	**2 per week (60 min per lec)**	**1**
1	Study and verify the truth table of various logic gates (NOT, AND, OR, NAND, NOR, EX-OR, and EX-NOR).		
2	Simplify given Boolean expression and realize it		
3	Design and verify a half/full adder		
4	Design and verify half/full subtractor		
5	Verify the operation of a UP and DOWN Counter.		
6	Verify the operation of a 4 bit shift register		
7	Design and verify the operation of flip-flops (SR, D and T) using logic gates.		
8	Using SPIM, write and test an adding machine program that repeatedly reads in integers and adds them into a running sum. The program should stop when it gets an input that is 0, printing out the sum at that point		
9	Using SPIM, write and test a program that reads in a number from the user and prints if it is prime or not prime		

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SIES College of Arts, Science and Commerce, Sion (W)
Autonomous College

NAAC REACCREDITED - 'A' GRADE
BEST COLLEGE AWARD - UNIVERSITY OF MUMBAI

Syllabus for
Program: First Year Bachelor of Science (NEP) Course: Computer Science
Semester: I & II

With effect from
Academic Year 2023 -24

Preamble

Information and Communication Technology (ICT) has today become an integral part of all industry domains as well as fields of academics and research. The industry requirements and technologies have been steadily and rapidly advancing. Organizations are increasingly opting for open source systems. The students too these days are thinking beyond careers in the industry and aiming for research opportunities.

The B.Sc. Computer Science course structure therefore needed a fresh outlook and complete overhaul. A real genuine attempt has been made while designing the new syllabus for this 3 year graduate course. Not only does it prepare the students for a career in the Software industry, it also motivates them towards further studies and research opportunities.

The core philosophy of overall syllabus is to -
- a.   Form strong foundation of Computer science,
- b.   Introduce emerging trends to the students in gradual way,
- c.   Groom the students for the challenges of ICT industry

In the first year i.e. for semester I & II, the basic foundation of important skills required for software development is laid. The syllabus proposes to have 2 core subjects of Computer science and 2 core courses of Mathematics-Statistics. In Semester II the students would also be given industrial exposure via field projects/industrial visit. All core subjects are proposed to have theory as well as practical tracks. While the Computer Science courses will form fundamental skills for solving computational problems, the Mathematics & Statistics course will inculcate research oriented acumen.

The syllabus design for further semesters encompasses more advanced and specialized courses of Computer Science.

We sincerely believe that any student taking this course will get a very strong foundation and exposure to basics, advanced and emerging trends of the subject. We hope that the students' community and teachers' fraternity will appreciate the treatment given to the courses in the syllabus.

We wholeheartedly thank all experts who shared their valuable feedback and suggestions in order to improvise the contents, we have sincerely attempted to incorporate each of them. We further thank the Chairperson and members of the Board of Studies for their confidence in us. Special thanks to the Department of Computer Science and colleagues from various colleges, who volunteered or have indirectly helped design certain specialized courses and the syllabus as a whole.

Program Outcomes and Program Specific Outcomes

B.Sc. Computer Science

SR.NO	Details
PO 1	Recall and explain acquired scientific knowledge in a comprehensive manner and apply the skills acquired in their chosen discipline. Interpret scientific ideas and relate its interconnectedness to various fields in science.
PO 2	Evaluate scientific ideas critically, analyse problems, explore options for practical demonstrations, illustrate work plans and execute them, organize data and draw inferences.
PO 3	Explore and evaluate digital information and use it for knowledge upgradation. Apply relevant information so gathered for analysis and communication using appropriate digital tools.
PO 4	Ask relevant questions, understand scientific relevance, hypothesize a scientific problem, construct and execute a project plan and analyze results.
PO 5	Take complex challenges; work responsibly and independently, as well as in cohesion with a team for completion of a task. Communicate effectively, convincingly and in an articulate manner.
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SR.NO	Details
PSO 1	Apply knowledge of computational mathematics, statistics and programming acquired in the field of Computer Science.
PSO 2	Identify, analyze complex problems in the real world and formulate innovative solutions to those problems.
PSO 3	Compare and apply hardware and software technologies for implementing reliable optimized solutions catering to need and available resources.
PSO 4	Apply software development, managerial, Professional, and soft skills in industry
PSO 5	Understand the global needs and prepare themselves for the changing needs worldwide adapting an ability to engage in life-long learning.
PSO 6	Become a responsible, ethical citizen and explore environmental issues to develop sustainable solutions for it.

F.Y.B.Sc. Computer Science Vocational Skill Courses Syllabus
Credit Based System and Grading System
Academic year 2023-2024

Semester – I						
Course Code	Course Type	Course Title	Credits	Lectures/Week		
				Theory	Practical (2 lectures)	Total
Vocational Skill Courses						
SIUCSVS111	Vocational Skill Course (VSC)	Basic Web Programming	1	1		1
SIUCSVS111	Vocational Skill Course practical	Practical of SIUSCS13	1		1	1

Semester – II						
Course Code	Course Type	Course Title	Credits	Lectures/Week		
				Theory	Practical (2 lectures)	Total
Vocational Skill Courses						
SIUCSVS121	Vocational Skill Course (VSC)	Programming with C	1	1		1
SIUCSVS121	Vocational Skill Course practical	Practical of SIUSCS23	1		1	1

Course	Title	Lectures	Credits
SIUCSVS111	**Basic Web Programming**	**1 per week (60 min per lec)**	**1**

Objectives:
The course has been designed to provide the basic knowledge for developing of the web pages using HTML,CSS and JavaScript programming language.

Expected Learning Outcomes:
- **CO1:** Learn the fundamental technology used to define the structure of a webpage.
- **CO2:** Understand the various platforms, devices, display resolutions, viewports, and browsers that render websites
- **CO3:** To develop and implement client-side and server-side scripting language programs

Unit I	**HTML5:** Fundamental Elements of HTML, Formatting Text in HTML, Organizing Text in HTML, Links and URLs in HTML, Tables in HTML, Images on a Web Page, Image Formats, Image Maps, Colors, FORMs in HTML, Interactive Elements, Working with Multimedia - Audio and Video File Formats, HTML elements for inserting Audio / Video on a web page **CSS:** Understanding the Syntax of CSS, CSS Selectors, Inserting CSS in an HTML Document, CSS properties to work with background of a Page, CSS properties to work with Fonts and Text Styles, CSS properties for positioning an element **JavaScript:** Using JavaScript in an HTML Document, Programming Fundamentals of JavaScript – Variables, Operators, Control Flow Statements, Popup Boxes, Functions – Defining and Invoking a Function, Defining Function arguments, Defining a Return Statement, Calling Functions with Timer, JavaScript Objects - String, RegExp, Math, Date, Browser Objects - Window, Navigator, History, Location, Document, Cookies, Document Object Model, Form Validation using JavaScript	15L

Text Book(s):

1) HTML 5 Black Book, Covers CSS 3, JavaScript, XML, XHTML, AJAX, PHP and jQuery, 2ed, Dreamtech Press
2) Web Programming and Interactive Technologies, scriptDemics, StarEdu Solutions India. 3) PHP: A Beginners Guide, Vikram Vaswani, TMH

Additional Reference(s):

1) HTML, XHTML, and CSS Bible Fifth Edition, Steven M. Schafer, WILEY

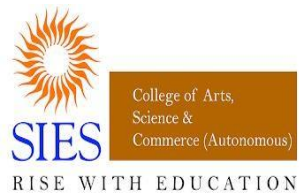2) Learn to Master HTML 5, scriptDemics, StarEdu Solutions Pvt Ltd.

Course	Title	Lectures	Credits
SIUCSVS111	**Practicals on Basic Web Programming**	**2 per week (60 min per lec)**	**1**
1	A. Design a web page which displays data in a table B. Design a registration form web page		
2	Design a web page which contains three hyperlinks (audio,video, and gif image). ● When a user clicks on an audio link, the web-page should open in the same tab with some audio content. ● When a user clicks on a video web page should open in the same tab with some video content. ● When a user clicks on a gif image web-page should open in the same tab with some gif content. ● Every hyperlink web page should contain hyperlink (home). So that when user click on home it go back to home page(main page)		
3	Design a webpage that makes use of Cascading Style Sheets with (Background, fonts, Text styles).		
4	A. Create a web page which takes a number from the user through the input box. onclick of button it should display the factorial of that number. B. Create a web page which takes series length from the user through the input box Onclick of button it should display Fibonacci series of that length. C. Create a web page which takes a number from the user through input box Onclick of button it should display the reverse of that number.		
5	Write a javascript program which contain following buttons i) browser window size (height and width), ii) current page details(hostname, protocol and port of the page), iii) browser details like(appversion, appname, language) . iv) Back v) Forward On click of first three buttons it should display the information.And onclick of back and forward button it should load the previous and next URL respectively.		
6	Write a javascript program to take firstname, last name ,age , contact-no, address for registration. Validate all the fields using Regular expression (RegExp object) such that i) firstname should contain only characters ii) lastname should contain only characters iii) age should contain only number iv) contact-no should contain only number v) address should not contain $ sign		

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Course	Title	Lectures	Credits
SIUCSVS121	**Programming with C**	**1 per week (60 min per lec)**	**1**

Objectives:
The objective of this course is to provide a comprehensive study of the C programming language, stressing strengths of C, which provide the students with the means of writing modular, efficient, and portable code.

Course Outcome:

- **CO1**: Students should be able to write, compile and debug programs in C language.

- **CO2:** Students should be able to use different data types in a computer program.

- **CO3**: Students should be able to design programs involving decision structures, loops and functions.

- **CO4**: Students should be able to explain the difference between call by value and call by reference.

- **CO5**: Students should be able to understand the dynamics of memory by the use of pointers.

Unit I	**Structure of C program**: Header and body, Use of comments. Interpreters vs compilers, Python vs C. Compilation of a program. Formatted I/O: printf(), scanf(). **Data**: Variables, Constants, data types like: int, float char, double and void, short and long size qualifiers, signed and unsigned qualifiers. **Variables**: Declaring variables, scope of the variables according to block, hierarchy of data types. **Iterations**: Control statements for decision making: (i) **Branching**: if statement, else.. if statement, switch statement. (ii) **Looping**: while loop, do.. while, for loop. (iii) **Jump statements**: break, continue and goto. **Arrays**: (One and two dimensional), declaring array variables, initialization of arrays, accessing array elements. **Functions**: Function declaration, function definition, Global and local variables, return statement, Calling a function by passing values. **Recursion**: Definition, Recursive functions. **Pointer**: Fundamentals, Pointer variables, Referencing and dereferencing, Pointer Arithmetic, Using Pointers with Arrays, Using	15L

	Pointers with Strings, Array of Pointers, Pointers as function arguments, Functions returning pointers.	
	Dynamic Memory Allocation: malloc(), calloc(), realloc(), free() and sizeof operator.	
	Structure: Declaration of structure, reading and assignment of structure variables, Array of structures, arrays within structures, structures within structures. Compare C structures with Python tuples.	

Text books:

1. Programming in ANSI C (Third Edition) : E Balagurusamy, TMH

Additional References:

1. Pradip Dey, Manas Ghosh, "Programming in C", second edition, Oxford University Press

2. Yashavant P. Kanetkar. " Let Us C", BPB Publications

Course	Title	Lectures	Credits
SIUCSVS121	**Practicals Of Programming with C**	**2 per week (60 min per week)**	**1**
1	**Basic Programs(Variables, Operators):** A. Write a program to find the addition, subtraction, multiplication and division of two numbers. B. Write a program to find the area of rectangle, square and circle. C. Write a program to find the volume of a cube, sphere, and cylinder.		
2	A. Programs to demonstrate data input and output functions B. Programs to manipulate strings		
3	**Conditional statements and loops** A. Write a program to check whether the number is even or odd. B. Write a program to check whether the number is positive, negative or zero. C. Write a program to find the sum of squares of digits of a number. D. Write a program to reverse the digits of an integer.		
4	Programs on Functions.		
5	**Recursive functions** 1. Write a program to find the factorial of a number using a recursive function. 2. Write a program to find the sum of natural numbers using a recursive function.		
6	**Arrays** A. Write a program to find the largest value that is stored in the array. B. Write a program using pointers to compute the sum of all elements stored in an array. C. Write a program to arrange the 'n' numbers stored in the array in ascending and descending order.		
7	**Pointers** A. Write a program to demonstrate the use of pointers. B. Write a program to perform addition and subtraction of two pointer variables.		
8	Programs on structures.		
9	Programs on unions.		
10	**Programs on File Handling** A. Write a program to Create a File, Write in it, And Close the File. B. Write a program to Open a File, Read from it, And Close the File C. Write a program to read the name and marks of 'n' number of students and store them in a file.		

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College of Arts,
Science &
Commerce (Autonomous)

SIES
RISE WITH EDUCATION

Indian Institute
of Environment
Management

SIES
RISE WITH EDUCATION

Syllabus

Faculty: Science

Program: B.Sc.

Subject: ENVIRONMENTAL SCIENCE

Academic Year: 2023-2024

FYBSc Class

**Choice based Credit system Semester and
Grading Syllabus to be brought into effect
from 2023- 2024 as per NEP pattern**

PREAMBLE

Environmental Sustainability is one of the dominant issues and challenges of the 21st century, as the over growing needs of the galloping global population increasingly pressing up against the limits of the earth's resources and ecosystems. At the same time, policy makers increasingly believe that an environmentally literate workforce is critical to the long-term success and profitability, with better environmental practices and improved efficiencies impacting positively on the bottom line while helping to better position the country and conserve the natural resources for the future. A key component of an environmentally sustainable country is a highly educated work force, with thorough knowledge of theoretical and practical aspects of environmental sciences.

B.Sc. in Environmental Science is an undergraduate, interdisciplinary course wherein learning is imparted to eligible candidates in concepts such as sustainable resource development, environmental pollution control and, management among others. This 4- year course is divided into eight semesters, with each semester lasting for a period of six months. The students opting for four years will graduate with Bachelor's Degree (in Research) as per the new NEP pattern with effect from 2023-24.

The course combines aspects of Biology, Ecology, Geography, Chemistry, Natural Resource Management, Environment Management etc. Students are taught to develop scientific knowledge and techniques needed to understand environmental patterns and processes to investigate ecosystems and address local and global environmental issues, besides investigating how Environmental Science is directly related to the human society.

Structure of FYBSc Environmental Science program under NEP from 2023-24

Semester-I

Subject					
Subject 1 Mandatory (Ecosystem, Ecology and Biodiversity) SIUESMJ111	Unit I (1 credit) Ecosystem	Unit II (1 credit) Ecology	Unit III (1 credit) Biodiversity And Conservation	Practicals (1 credit) [Ecology, Ecosystem and Biodiversity]	**(3+1) credits**
Subject 2 (Basic Chemistry-I) SIUESMN111	Unit I (1 credit) Nomenclature, Classification & Solutions, Buffers	Unit II (1 credit) Chemical bonding	Unit III (1 credit) Stereochemistry	Practicals (1 credit) [Basic Chemistry-I]	**(3+1) credits**
OE (Environment & Society) SIUESOE111	Unit I (1 credit) Environment and Social inequalities	Unit II (1 credit) Impact of Anthropogenic activities on environment and society	Unit III (1 credit) Man and Environment Management	Unit IV (1 credit) Environment – Society Relationship	**4 credits**
VSC (Fundamentals of Computers) SIUESVS111	Unit I (1 credit) Fundamentals of Computers	Tutorial (1 credit) Fundamentals of Computers	-	-	**(1 + 1) Credits**
SEC (Introduction to good laboratory practices) SIUESSE111	Unit I (1 credit) Good laboratory practices	Tutorial (1 credit) Good laboratory practices	-	-	**(1 + 1) Credits**

Semester-II

Subject 1 Mandatory (Meteorology and Global Environmental Issues) SIUESMJ121	Unit I (1 credit) Meteorology	Unit II (1 credit) Pollution and Environmental Degradation	Unit III (1 credit) Global Environmental Issues	Practicals (1 credit) Meteorology and Global Environmental Issues)	(3+1) credits
Subject 2 (Basic Life Science-I) SIUESMN121	Unit I (1 credit) Plant diversity	Unit II (1 credit) Animal diversity	Unit III (1 Credit) Cell Biology and Microscopy	Practicals (1 credit) [Basic Life Science-I]	(3+1) credits
OE (Ecotourism) SIUESOE121	Unit I (1 credit) History, nature and scope of ecotourism	Unit II (1 credit) Types and importance of ecotourism	Unit III (1 credit) Potential and challenges of Ecotourism	Unit IV (1 credit) Ecotourism policy of India and major ecotourism destinations	**4 credits**
VSC (Sustainable tourism) SIUESVS121	Unit I (1 credit) Sustainable Tourism	Tutorial (1 credit) Sustainable Tourism	-	-	**(1 + 1) Credits**
SEC (Indian Geography and Map studies) SIUESSE121	Unit I (1 credit) Study of Indian Geography with maps	Tutorial (1 credit) Study of Indian Geography with maps	-	-	**(1 + 1) Credits**

Detailed Syllabus of FYBSc Environmental Science

SEMESTER – I; Subject 1 Mandatory: <u>Ecosystem, Ecology and Biodiversity</u>

COURSE CODE	TITLE	CREDITS	LECTURES
SIUESMJ111	**Ecosystem, Ecology and Biodiversity**		
Course Objective: To acquaint the students with basic concepts of ecology of ecosystems and their biodiversity. **Learning Outcome:** The learners will attain systematic and updated knowledge about the different components of the ecosystem along with their functioning and gain insight into the biodiversity of India and the world with respect to the threats faced by it and their conservation aspects.			
Unit-I: Ecosystem	• Components of ecosystem • Food chain • Food web • Ecological pyramids • Productivity and decomposition • Functions of ecosystem, energy flow models • Biogeochemical cycles • Types of ecosystems • Biomes and their types	1	15
Unit II: Ecology	• Introduction to Ecology: Definition, Scope, Relation to Other Disciplines, Subdivisions, Modern Branches of Ecology, Applications and Significance to Human Beings. Evolution and succession. • Ecological adaptations: Adaptations in plants- Hydrophytes, Mesophytes, Xerophytes, Epiphytes, Halophytes; Adaptations in Aquatic and Desert Animals, Adaptations in animals for Flying and Burrowing. • Population Interactions and their types.	1	15
Unit III: Fundamentals of	• **Biodiversity:** Definition, Types and Levels of Biodiversity, Importance of Biodiversity,	1	15

Biodiversity and Conservation	Status of Biodiversity (Global and National), Speciation and Extinction, Threats to Biodiversity, IUCN categories of threats to Biodiversity, Endemism; Endemic species and Endangered Species, Exotic species, 'Hotspots' of Biodiversity. • **Biodiversity Conservation:** *'In-Situ'* Conservation, *'Ex-Situ'* Conservation.		

Practical– <u>Ecosystem, Ecology and Biodiversity</u> - 1 Credit

COURSE CODE	TITLE	CREDITS	HOURS
SIUESMJ111	<u>**Ecosystem, Ecology and Biodiversity**</u>	1	30
1. Identification of ecological adaptations in plants and animals across different habitats. 2. Identification of different types of population interactions. 3. Determination of primary productivity of terrestrial ecosystem by chlorophyll method. 4. Determination of primary productivity of aquatic ecosystem by light and dark bottle method. 5. Present biogeographic regions of India on map. 6. Prepare a map of Maharashtra showing Protected Area Network (PAN). 7. Identification of global environmental problems.			

References:

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. Mishra, D. D., 2008. Fundamental Concepts of Environmental Studies, S. Chand Publishers, N. Delhi, 271.
3. Eugene P. Odum and Gary W. Barrett (1953), Fundamentals of Ecology (5th edn), brooks/cole, US
4. Charles Krebs (2013), Ecology: Pearson New International Edition (6th Edin).
5. Krishnan, M. S. 1982. *Geology of India and Burma*. CBS Publishers & Distributors.
6. Singh K.P. and J.S. Singh (1992). Tropical Ecosystems: Ecology and Management. Wiley Eastern Limited, Lucknow, India.
7. Singh, J.S. (ed.) 1993. Restoration of Degraded Land: Concepts and Strategies. Rastogi Publications, Meerut.
8. Smith, R.L. (1996). Ecology and Field Biology, Harper Collins, New York.
9. Botkin, D.B. and Keller, E.A. 2000. Environment Science: Earth as a living planet. Third Edition. John Wiley and Sons Inc.
10. E. P. Odum (1996) Fundamentals of Ecology, Nataraj Publisher, Dehra Dun.

11. K.M.M. Dakshini (1999) Principle and Practices in Plant Ecology, CRC, Boston.
12. M.C. Dash (1994) Fundamentals of Ecology, Tata McGraw Hill, New Delhi.

SEMESTER – I; Subject 2: BASIC CHEMISTRY-I

COURSE CODE	TITLE	CREDITS	LECTURES
SIUESMN111	BASIC CHEMISTRY - I		
Course Objective: To acquaint the students with basic concepts of chemistry viz., nomenclature chemical bonding and stereochemistry. **Learning Outcome:** The students will learn elaborate concepts of nomenclature of solutions, classification and buffers. They will also be able to elaborate the chemical bonding types in different compounds along with gaining insight into stereochemistry.			
Unit-I: Nomenclature, Classification and Solutions, Buffers	**Nomenclature and Classification of:** 1. **Inorganic Compounds:** Oxides, Salts, Acids, Bases, Ionic, Molecular and Coordination Compounds 2. **Organic Compounds:** Alkanes, Alkenes, Alkynes, Cyclic Hydrocarbons, Aromatic Compounds, Alcohols and Ethers, Aldehydes and Ketones, Carboxylic Acids and its derivatives, Amines, Amides, Alkyl Halides and Heterocyclic Compounds **Solutions:** Normality, Molarity, Mole fraction, ppb, ppm, millimoles, milliequivalents (Numericals expected). **Buffer:** Concept of Buffers, Types of Buffers, Derivation of Henderson equation for Acidic and Basic buffers, Buffer action, Buffer capacity (Numericals expected) pH of Buffer Solution.	1	15
Unit II: Chemical Bonding	• Bond length, Bond order Ionic Bond-Nature of Ionic Bond, Structure of NaCl, KCl and CsCl, Factors influencing the formation of ionic bond. • Covalent Bond- Nature of covalent bond, Structure of CH_4, NH_3, H_2O, Shapes of $BeCl_2$, BF_3. • Coordinate Bond- Nature of Coordinate Bond.	1	15

	• Non-Covalent Bonds: Van De Waal's forces: dipole - dipole, dipole – induced dipole, Hydrogen Bond.		
Unit III: Stereochemistry	**Stereochemistry:** Isomerism, Racemic mixtures Cis-Trans, Threo, Erythro and Meso isomers. Conformation: Conformations of Ethane, Difference between Configuration and Conformation. • Configuration: Asymmetric Carbon Atom, Stereogenic/ Chiral Centers, Chirality • Projection formulae – Fischer, Newman and Sawhorse, The Interconversion of the Formulae	1	15

Practical – Minor – BASIC CHEMISTRY-I – 1 Credit

COURSE CODE	TITLE	CREDITS	HOURS
SIUESMN111	**BASIC CHEMISTRY-I**	**1**	**30**
1. Spot test for compounds belonging to Carboxylic Acid, Phenol, Aldehyde/Ketone, Ester, Alcohol, Amine, Nitro Compounds, Haloalkane, Haloarene. 2. To prepare 0.1 N succinic acid and standardize sodium hydroxide of two different concentrations. 3. Study of neutralization reaction by titration. 4. Estimation of Alcohol by Dichromate method. 5. Preparation of buffers.			

References:

- Ahluwalia, V. K., 2010 TEXTBOOK OF ORGANIC CHEMISTRY, VOL.III, S. Chand Publishers, Ane Books Pvt. Ltd.
- Arun Bahl and B. S. Bahl: Advanced Organic Chemistry, S. Chand
- Atkins P.W. and Paula J.de, Atkin's Physical Chemistry, 10th Ed., Oxford University 12 Press (2014).
- Ball D.W., Physical Chemistry, Thomson Press, India (2007).
- Castellan G.W., Physical Chemistry, 4th Ed., Narosa (2004).
- Mortimer R.G., Physical Chemistry, 3rd Ed., Elsevier: NOIDA, UP (2009).
- Kalsi, P. S. Stereochemistry Conformation and Mechanism, New Age International, 2005
- Garland C. W., Nibler J.W. and Shoemaker D.P., Experiments in Physical Chemistry, 8th Ed., McGraw-Hill, New York (2003).

- Halpern A.M. and McBane G.C., Experimental Physical Chemistry, 3rd Ed., W.H. Freeman and Co., New York (2003).

SEMESTER I: OE– ENVIRONMENT AND SOCIETY

COURSE CODE	TITLE	CREDITS	LECTURES
SIUESOE111	**ENVIRONMENT AND SOCIETY**		
Course Objective: To acquaint the students with concepts of societal movements for the environment. **Learning Outcome:** The students will be made aware of environmental issues at society level and also about the role of society in environment management.			
Unit-I: Environment and Social Inequalities	• Social and cultural construction of 'environment'; • Environmental thought from historical and contemporary perspective. • Inequalities of race, class, gender, region, and nation-state in access to healthy and safe environments. • Concept of ecological and social justice; • Environmental ethics.	1	15
Unit II: Impact of anthropogenic activities on environment and society	Impact of following anthropogenic activities on environment and society: • Pollution • Industrialization • Urbanization • Deforestation • Mining • Developmental projects • Reclamation • Tourism	1	15
Unit III: Man and Environment Management	• State, corporate, civil society, community, and individual-level initiatives to ensure sustainable development. • Case studies of environmental movements (Chipko Movement, Appiko Movement, Narmada Bachao Andolan). • Corporate responsibility movement. • Appropriate technology movement. • Environmental groups and movements, citizen groups	1	15

Unit IV: Environment-society relationship	• Environment-society relationship; Development-induced displacement, resettlement, and rehabilitation: problems, concerns, and compensative mechanisms; discussion on Project Affected People (PAPs). • Impact of technology on environment; • Conflict between economic and environmental interests; • Community participation. • Environmental education and awareness.	1	15

References:

• Chokkan, K.B., Pandya, H. & Raghunathan, H. (eds). 2004. Understanding Environment. Sagar Publication India Pvt. Ltd., New Delhi.
• Pandit, M.K. 2013. Chipko: Failure of a Successful Conservation Movement. In: Sodhi, N.S., Gibson, L. & Raven, P.H. Conservation Biology: Voices from the Tropics. pp. 126-127. Wiley Blackwell, Oxford, UK.

SEMESTER I: VSC

COURSE CODE	TITLE	CREDITS	LECTURES
SIUESVS111	**Fundamentals of Computers**		
Course objective: To acquaint the students with Microsoft office and its various tools. **Learning outcomes**: Students will learn the basics of computers and to use various toolbars in Microsoft Word, Microsoft Excel and Microsoft PowerPoint.			
Unit I: Fundamentals of Computers	● **Microsoft Word** – Creating new document; Page Layout; Styles and Themes; Columns and Ordering; Working with Text; Format Text; Text boxes; Listing of Text; Use of various shapes; Use of Tables; SmartArt Graphics; Saving documents. ● **Microsoft Excel –** Starting a workbook; Modifying columns,	1	15

	rows and cells; Formatting cells; Creating formulas; Formatting Tables; Aligning Texts; Working with Worksheets; Freezing worksheet panes; Use of Charts; Conditional Formatting. ● **Microsoft PowerPoint** – Uses of PowerPoint presentations; Basics of Presentation slides; Text Basics; Themes and Background styles; Pictures and Clip Art; Viewing and Printing slides; Animating Texts and Objects; Use of Slide Transitions; Slide Show options.		
Tutorials	**Tutorials based on Fundamentals of Computers**	1	15

References:

1. Maluth, J. (2016). Basic Computer Knowledge. (n.p.): Amazon Digital Services LLC - Kdp.
2. Wempen, F. (2014). Computing Fundamentals: Introduction to Computers. Germany: Wiley.
3. Thareja, R. (2019). Fundamentals of Computers. India: Oxford University Press.
4. Foulkes, L. (2020). Learn Microsoft Office 2019: A Comprehensive Guide to Getting Started with Word, PowerPoint, Excel, Access, and Outlook. United Kingdom: Packt Publishing.
5. Habraken, J. (2022). Microsoft Office Inside Out (Office 2021 and Microsoft 365). United States: Microsoft Press.

SEMESTER I: SEC

COURSE CODE	TITLE	CREDITS	LECTURES
SIUESSE111	**Introduction to good laboratory practices**		

Course objective: to acquaint the students with basic rules, etiquettes and handling of chemicals in laboratory.
Learning outcomes: Students will be able to work in the laboratory with confidence and professional diligence required at the industrial level.

Unit I: Good Laboratory Practices	• Basic rules and etiquettes to be followed in a laboratory. • Types of glasswares used. • Storage and labelling of chemicals. • Handling of chemicals. • Transfer of chemicals; Use of pipettes. • Disposal of chemicals and housekeeping practices. • Measures to follow in case of accidents and injuries.	1	15
Tutorials	**Tutorials based on Good laboratory practices**	1	15

References:

1. Seiler, J. P. (2012). Good Laboratory Practice: The Why and the How. Germany: Springer Berlin Heidelberg.
2. Good Laboratory Practice Regulations, Revised and Expanded. (2002). United States: CRC Press.
3. Good Laboratory Practice Regulations. (1989). Switzerland: M. Dekker.
4. Anderson, M. A. (2002). GLP Essentials: A Concise Guide to Good Laboratory Practice. United Kingdom: Interpharm Press.

SEMESTER – II; Subject 1: Meteorology and Global Environmental Issues

COURSE CODE	TITLE	CREDITS	LECTURES
SIUESMJ121	**Meteorology and Global Environmental Issues**		
Course Objective: This paper will enable the students to gain in-depth knowledge of rising environmental issues at global level in the context of meteorological concepts.			
Learning Outcome: The learners will become aware about the detailed reasons behind environmental issues globally and contribute to their resolving by putting use of the knowledge of meteorology.			
Unit I: Meteorology	• Basic knowledge of climatological parameters for environmental study; • Weather and climate; • Classification of Climate;	1	15

	• Concept of heat transfer - conduction, convection; • Fundamentals of temperature, pressure, relative humidity, rainfall and wind speed; • Concept of atmospheric stability; • Environmental lapse rate, Temperature inversion, Mixing height.		
Unit II: Pollution and Environmental Degradation	• Environmental pollution: Sources and Effects of Air, Water, Soil/Land, Noise, Light pollution. • Environmental degradation • Deforestation • Soil erosion • Desertification.	1	15
Unit III: Global Environmental Issues	• Climate change • Global warming • Ozone hole • Loss of Biodiversity • Water crisis • Natural resource depletion • Diseases in humans	1	15

Practical – Subject 1– Meteorology and Global Environmental Issues – 1 Credit:

COURSE CODE	TITLE	CREDITS	HOURS
SIUESMJ121	**Meteorology and Global Environmental Issues**	1	30
1. Estimation of air-borne particulate matter in different areas with personalized air sampler. 2. Determination of relative humidity of air by whirling psychrometer. 3. Measurement of light intensity using lux meter. 4. Identification of meteorological instruments. 5. Survey and report on environmental awareness- Questionnaire method. 6. Identification of global environmental problems.			

References:

1. Mishra, D. D., 2008. Fundamental Concepts of Environmental Studies, S. Chand Publishers, N. Delhi, 271.
2. Krishnan, M. S. 1982. *Geology of India and Burma*. CBS Publishers & Distributors.

SEMESTER – II; Subject 2: BASIC LIFE SCIENCES – I

COURSE CODE	TITLE	CREDITS	LECTURES
SIUESMN121	BASIC LIFE SCIENCES - I		
Course Objective: The students will get acquainted with the plant and animal world with respect to their evolution and diversity along with ultrastructure of living cell and their studies through microscopy techniques. **Learning Outcome:** The learners will be able to observe and appreciate the diversity of plants and animals. They will also be able to understand the ultrastructure of prokaryotic and eukaryotic cells by different types of microscopy techniques.			
Unit-I: Plant Diversity	• **Introduction to Plant Diversity:** General Characteristic Features with Examples and Ecological significance of - Algae, Bryophyta, Pteridophyta, Gymnosperms and Angiosperms (Dicotyledons and Monocotyledons). • Structure and Ecological significance of **Fungi and Lichens**.	1	15
Unit II: Animal Diversity	• **Introduction to Animal Diversity:** General Characteristic Features with Examples of different groups of animals under Non-Chordates and Chordates. • **Ecological roles of various animals.**	1	15
Unit II: Cell Biology and Microscopy	• **Ultrastructure of Prokaryotic Cell**: Bacterial cell and Cyanobacterial cell. • **Ultrastructure of Eukaryotic Cell** – Plant cell and Animal cell. • **Comparison of Prokaryotic and Eukaryotic Cells**.	1	15

	• **Microscope**: Simple and Compound – Principle, Parts and types, Aberration, Functions and Applications; Dark Field, Phase Contrast.		

Practical – Subject 2– Basic Life Sciences-I – 1 Credit

COURSE CODE	TITLE	CREDITS	HOURS
SIUESMN121	**Basic Life Sciences-I**	1	30

1. Observation of *Nostoc* under compound microscope.
2. Identification and classification of plant species into respective groups with the help of specimens / photographs / slides.
3. Identification and classification of animal species into respective groups with the help of specimens / photographs / slides.
4. Study of lichens with the help of specimens / photographs.
5. Study of *Rhizopus* with the help of fresh / preserved material and / or photomicrographs.
6. Identification of parts of cell and cell organelles with the help of photomicrographs.
7. Components and working of simple, compound, dark field and phase contrast microscope.

References:

• Gangulee, Das and Dutta, 2015. College Botany Volume I and II latest edition. Central Education enterprises.
• Sharma, OP, 2002. Textbook of Thallophytes, Tata McGraw Hill Publishing Co. New Delhi
• Sharma, PD, 2005. Fungi and Allied Organisms, Narosa Publishing House, New Delhi.
• G M Smith Cryptogamic Botany Volume I and II by McGraw Hill.
• Campbell, N.A. and Reece, J. B. (2008) Biology 8th edition, Pearson Benjamin Cummings, San Francisco.
• Raven, P.H et al (2006) Biology 7th edition Tata McGraw Hill Publications, New Delhi
• Dubey and Maheshwari, General Microbiology, S. Chand, New Delhi.
• Modi HA, Handbook of Elementary Microbiology, Shanti Prakashan
• Pelczar et al., Microbiology, Tata Mc Graw Hill Publishing Co.
• Stanier et al., General Microbiology, Printice Hall of India Pvt. Ltd., New Delhi

SEMESTER II: OE– Ecotourism

COURSE CODE	TITLE	CREDITS	LECTURES
SIUESOE121	ECOTOURISM		
Course Objective: To introduce the learners to the concept of ecotourism and impart environmental importance to them as a tourist. **Learning Outcome:** The course will make the students aware about the rich heritage of our country and instill a sense of responsibility towards conserving the ancient ecology of such tourist places, besides introducing them to the concerned policies followed in our country.			
Unit-I: History, Nature and Scope of Ecotourism	• Definition and concept of Ecotourism; • History of ecotourism; • Nature of tourism; • Ecotourism and Ecotourists; • Natural resources and heritage sites; Conservation and Protected areas; • Significance and scope of ecotourism;	1	15
Unit II: Types and Importance of Ecotourism	• Types of ecotourism – self-guided tours, guided tours. • Social and ecological impacts of ecotourism; Role of ethics in ecotourism; Benefits of ecotourism – educational, promotional, economical; recreational; • Ecotourism and local communities.	1	15
Unit III: Potential and Challenges of Ecotourism	• Economics, marketing and management of ecotourism; • Ecotourism development; • Ecotourism programme planning; • Carrying capacity of ecotourism destinations; • Recreation Opportunity Spectrum (ROS); • Limits of Acceptable change (LAC); • Sustainable tourism development. • Case studies.	1	15

| Unit IV: Ecotourism Policy of India and Major ecotourism destinations | • Planning and policy frameworks; National Strategy for Ecotourism drafted in 2022 under Incredible India.
• Major Ecotourism destinations in India – Jim Corbett National Park (Uttarakhand), Kerala backwaters, Thenmala (Kerala), Coorg (Karnataka), Maredumilli (Andhra Pradesh), Sunderbans (West Bengal), Khangchendzonga (Sikkim), Namdapha (Arunachal Pradesh), Tsomoriri Wetland Conservation Reserve (Ladakh), Andaman Islands, Chilika lake (Odisha), Matheran (Maharashtra), Malvan Marine Sanctuary (Maharashtra). | 1 | 15 |

References:

1. Fennell, D. A. (2004). Ecotourism: An Introduction. United Kingdom: Taylor & Francis.
2. Buckley, R. (2009). Ecotourism: Principles and Practices. United Kingdom: CABI.
3. Wearing, S., Neil, J. (2009). Ecotourism: Impacts, Potentials and Possibilities. Netherlands: Routledge.
4. Routledge Handbook of Ecotourism. (2021). United Kingdom: Taylor & Francis.
5. Liyakhat, S., Bhatt, S. (2008). Ecotourism Development in India: Communities, Capital, and Conservation. India: Cambridge University Press.

SEMESTER II: VSC

COURSE CODE	TITLE	CREDITS	LECTURES
SIUESVS121	**Sustainable Tourism**		
Course objectives: To introduce the students to the concept of sustainable tourism and impart the importance of sustainable tourism for conservation of environment.			
Learning outcomes: Students will be aware about the various sectors involved in tourism and impacting environment and how sustainable tourism helps to conserve the environment.			
Unit I: Sustainable Tourism	• Introduction and Emergence of sustainable tourism • Dimensions of sustainable tourism – environmental, social, economic	1	15

	• Importance of sustainable tourism • Components/subsets of sustainable tourism- Ecotourism, geotourism, responsible tourism and cultural tourism • Principles of sustainable tourism management		
Tutorials	**Tutorials based on Sustainable Tourism**	1	15

References:

1. Cooper, C., Fennell, D. A. (2020). Sustainable Tourism: Principles, Contexts and Practices. United Kingdom: Channel View Publications.
2. Sustainable Tourism Development: Futuristic Approaches. (2019). United States: Apple Academic Press.
3. Edgell Sr, D. L. (2019). Managing Sustainable Tourism: A Legacy for the Future. United Kingdom: Taylor & Francis.
4. Reframing Sustainable Tourism. (2015). Netherlands: Springer Netherlands.
5. Swarbrooke, J. (1999). Sustainable tourism management. United Kingdom: CABI Pub.

SEMESTER II: SEC

COURSE CODE	TITLE	CREDITS	LECTURES
SIUESSE121	**Indian Geography and Map studies**		
Course objectives: To acquaint the students with the Indian geography with the help of maps. **Learning outcomes**: The knowledge of student will be upgraded in the area of physical, political divisions of India and its natural wealth.			
Unit I: Study of Indian Geography with Maps	• Political divisions of India – States and Union territories • Variations in climate across different regions of India • Physical features of India – rivers, mountain ranges, forests, deserts across India • Other natural wealth of India • Indian Heritage sites	1	15
Tutorials	**Tutorials based on Study of Indian Geography with Maps**	1	15

References:

1. Geography Of India. (2012). India: McGraw-Hill Education (India) Pvt Limited.
2. Karuṇākaran, S. K. (2012). The Ailing Forests of India. India: National Book Trust, India.
3. The Indian Rivers: Scientific and Socio-economic Aspects. (2017). Singapore: Springer Nature Singapore.
4. Bhatt, S. C. (2005). Land and people of Indian states and union territories: (in 36 volumes). India: Kalpaz Publications.
5. Kapur, A. (2019). Mapping Place Names of India. United Kingdom: Taylor & Francis.
6. Gupta, A. (2019). India - Map Practice Book: Set of 150 Blank Outlined Map. (n.p.): Independently Published.

Course codes and Evaluation pattern:

Course Code	Total Credits	Exam Conduction Type	Continous Evaluation Passing Cut Off	Continous Evaluation Marks Out Off	External Passing Cut Off	External Marks Out Off	Practical Passing Cut Off	Practical Marks Out Off
SIUESMJ111	4 (3L + 1P)	INTERNAL, EXTERNAL, PRACTICAL	10	25	20	50	10	25
SIUESMN111	4 (3L + 1P)	INTERNAL, EXTERNAL, PRACTICAL	10	25	20	50	10	25
SIUESOE111	4(4L)	INTERNAL, EXTERNAL,	16	40	24	60	NA	NA
SIUESVS111	2 (1L + 1T)	INTERNAL, TUTORIAL	10	25	NA	NA	10	25
SIUESSE111	2 (1L + 1T)	INTERNAL, TUTORIAL	10	25	NA	NA	10	25
SIUESMJ121	4 (3L + 1P)	INTERNAL, EXTERNAL, PRACTICAL	10	25	20	50	10	25
SIUESMN121	4 (3L + 1P)	INTERNAL, EXTERNAL, PRACTICAL	10	25	20	50	10	25
SIUESOE121	4(4L)	INTERNAL, EXTERNAL,	16	40	24	60	NA	NA
SIUESVS121	2 (1L + 1T)	INTERNAL, TUTORIAL	10	25	NA	NA	10	25
SIUESSE121	2 (1L + 1T)	INTERNAL, TUTORIAL	10	25	NA	NA	10	25

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SIES College of Arts, Science and Commerce (Autonomous) Sion (West), Mumbai – 400022.

Department of Biochemistry-Food Technology and Nutraceuticals

PROPOSED SYLLABUS FOR

Master of Science (MSc)-

Food Technology & Nutraceuticals

To be implemented from June 2023

For the academic year 2023-24

(NEP-2020 implementation)

Content

PREAMBLE

PREAMBLE

CREDIT STRUCTURE FOR MSc PART I

Semester	Major		Research Methodology	On Job training of field project	Research project	Credit /Semester	Degree/Cumulative credit
	Mandatory	Electives					
I	7 + 7= 14 C	4 C	4 C	-	-	22 C	PG Diploma 44
II	7 + 7= 14 C	4 C	-	4 C	-	22 C	
Total (I+II)	28 C	8 C	4 C	4 C	-	44 C	

Summary of courses offered by the department.

Sr. no	Course	Title	MARKS		
			Theory	**Practical**	**Total marks**
Semester 1					
1	Core 1	Food Science	60 + 40 (4 Credits)	50 (2 Credits)	150
2	Core 2	Biochemistry & HumanPhysiology	60 + 40 (4 Credits)	50 (2 Credits)	150
3	Core 3	Food Quality	50 (2 Credits)		50
5	DSE	Food Safety Hygiene & Sanitation	75 (3 Credits)	25 (1 Credit)	100
4	RM	Research Methodology	75 (3 Credits)	**Research proposal – 25 M**(1 Credit)	150
		Total	**17 credits**	**5 credits**	**600**
Semester 2					
1	Core 1	Food Technology	60 + 40 (4 Credits)	50 (2 Credits)	150
2	Core 2	Functional Foods andNutraceuticals	60 + 40 (4 Credits)	50 (2 Credits)	150
3	Core 3	Food Standards and QualityControl	50 (2 Credits)		150
4	DSE	Food Analysis; Entrepreneurship	60 + 40 (3 Credits)	**25** **(1 Credits) Dissertation**	150
5	RM	OJT/INTERNSHIP (mandatory incase of exit after one year)	**04 credits**		
		Total	**17 credits**	**5 credits**	**600**

Summary of Course-wise Units

SEMESTER I

COURSE CODE	UNIT	TOPICS	CREDITS	L/ WEEK
		FOOD SCIENCE		
	I	Food Science I		
SIPSFTN11	II	Food Science II	04	04
	III	Food Science III		
	IV	Class Assignment and Presentation		
		BIOCHEMISTRY AND HUMAN PHYSIOLOGY		
	I	Nutritionally important biomolecules I		
SIPSFTN12	II	Nutritionally important biomolecules-II	04	04
	III	Human Physiology-I		
	IV	Human Physiology-II		
		FOOD QUALITY		
	I	Introduction to Food quality		
SIPSFTN13	II	Defects and texture affecting quality	02	
	III	Quality of raw materials		
		FOOD SAFETY, HYGIENE & SANITATION		
	I	Introduction to Food Microbes		
SIPSFTN1-DSE	II	Microbial spoilage	03	03
	III	Basic Sanitation		
	IV	Effluent Treatment		
		RESEARCH METHODOLOGY		
	I	Research Method, design and ethics		
	II	Sampling techniques	03	03
	III	Statistics in Research		
	IV	Statistical tests and computer applications indata analysis		
Practicals				
SIPSFTNP11		**Food Science Practical**	02	04
SIPSFTNP12		**Food Biochemistry Practical**	02	04
SIPSFTNP1-DSE		**Food safety, hygiene & Sanitation**	01	01
		Research methodology (NPD proposal)	01	01

SEMESTER II

COURSECODE	UNIT	TOPICS	CREDITS	L/ WEEK
SIPSFTN21		**FOOD TECHNOLOGY**	04	04
	I	Food processing & preservation I		
	II	Food processing & preservation II		
	III	Processing of miscellaneous food		
	IV	Fortification and Enrichment		
SIPSFTN22		**FUNCTIONAL FOODS & NUTRACEUTICALS**	04	04
	I	Functional foods & Nutraceuticals-I		
	II	Functional foods & Nutraceuticals-II		
	III	Functional foods and Nutraceuticals inhealth management:		
	IV	Extraction and Isolation of naturalbioactive compounds		
SIPSFTN23		**FOOD STANDARDS & QUALITY CONTROL**	02	
	I	Food laws and standards-Global/International bodies		
	II	Food regulations in India.		
	III	Quality Management		
SIPSFTN2-DSE		**FOOD ANALYSIS AND ENTREPRENEURSHIP**	03	03
	I	Food Analysis-I		
	II	Food Analysis-II		
	III	Entrepreneurial Skills		
Practicals				
SIPSFTNP21		**Food Technology practical**	02	04
SIPSFTNP22		**Functional foods & nutraceuticals**	02	04
SIPSFTNP2-DSE		**Food Analysis**	01	01

MSc. Theory Syllabus

Course	**Core Paper I - Food science**	Lectures:60
	Course Outcome: On completing the course, the learner should be able to	

Course Outcome: *On completing the course, the learner should be able to*

1. *Learn the structure, composition, and functional properties of each individual component of food system.*
2. *Understand the importance of other food elements such as spices and plantation crops.*
3. *Recognize the various processed foods and beverages along with the awareness of food adulteration.*
4. *Explore the role and function of different food additives used in processing of food.*

Food Science I

1.1 Cereals: Structure & Composition; Flours, cooking cereals, breakfast cereals; Gluten, classes of batters and doughs, leaveningprocess

1.2 Pulses: Structure and composition, anti-nutritional factors in pulses; Texturized vegetable proteins, soy isolates, beverages. Fruits & Vegetables: Structure & Composition; Physiochemical changes during harvesting, post harvesting, ripening, cooking, storage; Organically grown fruits & vegetables

Unit 1   **15**

1.3 Milk & Milk products: Structure & Composition; Milk components as Food ingredients (Lipid phase, protein micelles, milk salt system, whey proteins, lactose); Use of milk in formulatedfoods; Effect on food processing on nutrients

1.4 Fats & Oils: Structure & composition; Functional properties of fat; Fat substitutes/ mimetics

Food Science II

2.1 Meat, fish, and poultry: Structure and functions of muscles; Conversion of muscle to meat (Rigor mortis, ageing, tenderizing); Natural and Induced post-mortem biochemical changes (cold shortening, thaw rigor, electrical stimulation); Fish – composition, spoilage; Eggs- structure and composition, cooking changes, effectof added ingredients on coagulation

Unit 2   **15**

2.2 Sugars, Sweeteners and Confections: Role of sugars in food systems; Types of sugars and sugar syrups; Sugar based and cocoa-based confections.

2.3 Functional Properties of Food: Maillard reaction, dextrinization, Gelatinization, Caramelization, retrogradation, denaturation, coagulation, gluten formation.

Food Science-III

Unit 3	**3.1** Spices Production and processing scenario of spice, flavor & plantation crops, and its scope and manufacture of value-added products, specific examples of pepper, cardamom, ginger, turmeric, vanilla, garlic, Dill seed Fern seed nutmeg mint marjoram, Rosemary, saffron, sage. **3.2** Soft Drinks-Types, Specification for beverage water, Alkalinity reduction, filtration of water, water softening. Sweeteners used in soft drinks and their properties, non-nutritive sweeteners, Natural colorants used in soft drinks, Synthetic colorants used in soft drink Acidulants used in soft drink. Clouding agents for soft drinks, Flavoring agents used in soft drink, Carbon dioxide and carbonation for soft drink. **3.3** Food adulteration **3.4** Food additives: Types, General principles, and regulation in their use. Additives: emulsifiers, firming agents, humectants and propellants, Anti browning and anticaking agents, antioxidants, raising and glazing agents, stabilizers, thickening and gelling agents, foaming and antifoaming agents.	15
Unit 4	Class Assignment / Tutorials / Quiz 1. Examples of Food additives 2. Antinutritional factors in Soybean & overcoming it; Texturized vegetable proteins, soy isolates & beverages. 3. Value added products in markets using spices	15

Course I Practicals

Course	Food Science	Credits

Course Outcome: On completing the course, the learner should be able to

1. comprehend the methods used to convert metric values and estimate the nutritional value of dietary components.

2. Understand and recall the science involved in the preparation of food. Appreciate the use of substances such as starch, gluten, sugar, fats, and oils in food.

3. Understand how the addition of various acidulants affects the chemistry of milk protein coagulation.

1. Nutritive value
2. Metric Conversions
3. Determination of gluten
4. Ice crystallization (Ice-cream)
5. Sugar Cookery
6. Gelatinization of starch
7. Starches as thickening agents
8. Emulsions
9. Smoke point, Effect of temperature on fat, coating, binding, texture, flavor, mouthfeel
10. Effect of acids (citric acid, lactic acid, and acetic acid)on coagulation of milk proteins

2

MSc. Theory Syllabus

Course	**Core Paper II - Biochemistry & Human Physiology**	Lectures:60

Course Outcome: *On completing the course, the learner should be able to*
1. Know the macro- and micronutrients the human body needs for development and growth.
2. Grasp the principles of nutrition and solve numericals based on these concepts.
3. Understand and recall human physiology in normal and disease condition.

Nutritionally significant biomolecules I:

1.1 Biochemical constituents of food – Digestion and Absorption of carbohydrates, proteins, lipids.
Nutritional significance of Vitamins and water.

1.2 Basic concepts of nutrition: Basics of energy balance - Basal Metabolic Rate (BMR), Body Mass Index (BMI) and Specific Dynamic Action (SDA/ thermic effect)

Unit 1 Recommended dietary allowance, acceptable dietary intake, Nutrient reference values (NRVs), Nitrogen balance, protein efficiency ratio,net protein utilization, PDCASS.   **15**

1.3 Carbohydrates: Classification, Structure and Properties of monosaccharides and disaccharides (maltose, lactose, sucrose); Properties and significance of Polysaccharides- Starch, Cellulose, Glycogen, Dextrin, Chitin, Pectin, agar, Hyaluronic acid, Chondroitin sulphate

Unit 2   **Nutritionally significant biomolecules-II**

2.1 Proteins: classification of amino acids and their properties (isoelectric pH, solubility profile); Peptides; classification of proteins; structure (primary, secondary, tertiary, and quaternary);Denaturation of proteins.

2.2 Lipids: Classification- Simple, compound, and Derived; Propertiesof Fatty acids, Triacylglycerols, Cholesterol.

2.3 Enzymes: General properties of enzymes, Classification of enzymes- IUB/EC classification (up to I digit), Active site of enzyme, mechanism of action: lock and key, induced fit, transition state theory. Cofactors, Coenzymes (role of vitamins), Prosthetic groups, Apoenzyme and Holoenzyme, Enzyme kinetics Factors affecting enzyme-catalyzed reactions. Derivation of Michaelis-Menten equation, Km, Lineweaver Burk plot, Catalytic efficiency-turn overnumber, Enzyme activity: Katal, IU Specific activity of enzyme. Enzyme inhibition: Competitive (allopurinol and Sulphonamides, Methotrexate) and Noncompetitive (Iodoacetate and Diisopropyl fluorophosphate).   **15**

Human Physiology I

3.1 Basic human tissues. Introduction to human skeleton. Structure ofbone and cartilage.

3.2 Heart Its structure and circulation of blood. Cardiac cycle Information about hypertension & ischemic heart disease.

3.3 Respiratory system Respiratory organs-nose, sinuses, larynx, trachea, bronchi lung brief structure and functions. Mechanism of respiration, factors affecting efficacy of respiration. Various lung volumes and capacities.

Unit 3

Common diseases- TB, asthma, bronchitis, cough, pneumonia sinusitis.

15

3.4 Gastro - intestinal system Oral cavity, tonsils, pharynx, esophagus, stomach small and large intestine - brief structure and functions. Liver, gall bladder, pancreas structure and functions.

Common disorders- Dental caries, vomiting. diarrhea, constipation.Hyperacidity, diabetes.

Human Physiology II

4.1 Excretory system: Structure and function of organs of urinary system (in brief). Mechanism of urine formation Common diseases-urinary tract infection and renal stones.

4.2 Structure and function of Skin; Regulation of body temperature

Unit 4

Common disorders – acne, dandruff, and burns.

15

4.3 Nervous system: Classification of nervous system Structure and functions of different parts of brain, spinal cord, and reflex action.

Eye - Structure and mechanism of vision
Common problems - conjunctivitis, cataract.

Ear - Structure and mechanism of hearing
Common problems -deafness, vertigo, motion sickness

Core Paper II Practicals

Course	Core Paper II - Biochemistry & Human Physiology	Credits
	Course Outcome: On completing the course, the learner should be able to 1. Determine the amount of ash in a food sample. 2. Acquire skills in food sampling 3. Determine the amount of carbohydrates and protein are present in food samples. 4. Check the Sol-gel characteristics. 5. Identify micrographs of organ sections.	
	1. Concepts of food sampling 2. Determination of ash content 3. Determination of Mineral content (Ca, P and Fe) 4. Qualitative analysis of proteins (Biuret, precipitation) 5. Qualitative analysis carbohydrates (Molish, Benedict's/Fehling's, Seliwanoff,Osazone) 6. lipids: solvent extraction and weight determination 7. Determination of moisture content by Hot air method/Karl Fischer method. 8. Quantitative estimation of reducing sugars by DNSA method. 9. Quantification of proteins by Folin Ciocalteau method. 10. Lipid Analysis (Acid value, saponification and peroxide). 11. Study of Sol-gel properties of different starch samples. 12. Study of organs in different sections	2

MSc. Theory Syllabus

Course	**Core Paper III - Food Quality**	**Lectures:30**

Course Outcome: On completing the course, the learner should be able to

1.Comprehend the significance of food quality and the factors affecting it.

2. *Inter – relate various parameters describing the quality of food such as color, shape, size, texture, consistency, and flavor.*
3. *Apply the knowledge of analytical techniques and instruments in food quality detection.*
4. *Discern the processes involved in ensuring and recording the quality of food at industry level.*

Unit 1	**Introduction to Food quality:** its role in industry definition of quality, quality control, factors affecting quality control. Quality attributes, dominant attributes, hidden attributes. Color-role of color in quality spectra, different types of color measuring instruments. Viscosity- types of fluids, different viscometers to measure viscosity. Consistency- Methods used to measure consistency of product Difference between viscosity and consistency. Size and shape- Its role, method to find shape and size of food and food products	12
Unit 2	**Defects:** classification, genetic- physiological defects-structural, off color, character, Entomological defects: holes, scars, lesions, off coloring, curled leaves, Pathological defectsMechanical defects, Extraneous or foreign material defects. Measurement of defects: Improving visibility by dilution, whitebackground, color differences, standardization of conditions, reference standards, counts and measures, isolation of defects by floatation, elution, electronic sorting, Internal defects. Texture- Classification, definition, and role of firmness, yielding quality, juiciness, chewiness, fibrousness, grittiness,mealiness, stickiness.	10
Unit 3	**Quality of raw materials**: Physical, Chemical, and microbialquality. Quality of products during processing & after processing color, taste, texture, flavor, appearance. Factors influencing the Food qualities: Soil, field practices, harvestingpractices, procedures, packaging, transportation, storage, conditions, processing conditions, packaging, and storage conditions of finished products. Recording and reporting of quality.	8

MSc. Theory Syllabus (DSE)

Course	Core Paper IV - Food Safety, Hygiene & Sanitation	Lectures: 45
	Course Outcome: On completing the course, the learner should be able to 1. Categorize different kinds of microbes into subcategories and connecting them to food. 2. Recognize the obvious food product spoilages. 3. Implement the fundamental sanitation practices to sustain cleanliness in the food processing industry.	
Unit 1	**Introduction to Food Microbes** **1.1** Study of microorganisms in food: *Lactobacillus, S. aureus, Bacillus subtilis, E. coli, Salmonella, shigella, Clostridium*, Molds: Aspergillus niger, Penicillium, Rhizopus, Yeast and Candida **1.2** Microbial sources, microbial growth analysis, factors affecting growth of microorganisms: Intrinsic, Extrinsic	15
Unit 2	**Microbial spoilage** **2.1** Microbial spoilage and its effect on food; Spoilage of different kinds of food- cereals, pulses, fruits and vegetables, meat, fish, egg, poultry and their processed products, milk and milk products, canned foods, and beverages. **2.2** Food borne diseases, intoxication, infection, and microbial toxins. **2.3** Class I & Class II Preservatives **2.4** Hurdle Technology	15
Unit 3	**Basic Sanitation** **3.1** Principles of Food Hygiene, hygiene in urban and rural areas with respect to food preparations. Food handling habits and personal hygiene. Water supply systems and water purification,chlorination. **3.2** Types of Soil (Food residues on equipment surfaces) and its properties. Cleaning procedures, types of cleaning agents and their properties. Acid and alkaline cleaners. Physical sanitizing agents' example Hot water, Steamand UV light. Sanitation facilities and procedures in food plantoperations. CIP system. Cleaning premises and surroundings. **3.3** Common Pests in food services rodents, insects, birds, house flies, cockroaches, ants, and their control. Sanitation regulations, phytosanitary requirements. Hygiene and sanitation of preparation, storage, and retail shops. Plant and equipment design, requirements for ease in maintenance of hygiene and sanitation Study of food sanitation check lists	15

Unit 4

Effluent Treatment

Kinds of filters Disinfection methods Water softening methods Treatment of domestic water supplies and industrial effluent treatment.

15

Practicals

Course	DSE - Food Safety, Hygiene & Sanitation	Credits

Course Outcome: *On completing the course, the learner should be able to*

1. Understand the basics of microbiological analysis, which include culture media preparation, microorganism separation, preservation of culture media, and spoilage detection.
2. Assess the effectiveness of disinfectants and sanitizers.
3. Evaluate the BOD, COD, and microbiological content of industrial effluents for quality and safety.
4. Assess the milk and water's microbiological safety in terms of the presence of coliforms and live organisms.

1. Preparation of culture media for cultivation of bacteria molds and yeasts.
2. Different methods of maintenance and preservation of cultures of microorganisms.
3. Different methods of isolation of microorganisms.
4. Bacteriological analysis of foods, yeast, and mold count in food samples
5. Study the factors affecting food spoilage – pH, sugar, temperature, moisture.
6. Microbial load of palm/ fingers, nose secretions of workers TPC/E.coli / vibrio- continue.
7. Testing of sanitizers, disinfectants for antimicrobial activity
8. BOD & COD of water
9. Study of microorganisms from effluent.
10. Microbial analysis of water and milk-Total count, Viable count, MPN   Coliform and MBRT.
11. Biochemical tests for characterization of bacteria (IMVIC)

2

MSc. Theory Syllabus

Course	Research Methodology	Lectures:45

Course Outcome: On completing the course, the learner should be able to

1. Compare and contrast the various sampling techniques and realize their importance in research.

2. Employ statistical methods for analysis and interpretation of biological data.

3. Analyze and interpret the demographic & diagnostic data using statistical tools and tests.

Unit 1	**Research Method, design and ethics** **1.1** An introduction to research methodology: -Definition, Objectives of research **1.2** Types of research a) Descriptive vs. Analytical b) Applied vs. Fundamental c) Quantitative vs. qualitative d) Conceptual vs. Empirical Other types: a) Cross sectional vs. longitudinal b) Field setting or laboratory c) Clinical or diagnostic d) Exploratory Research e) Historical research. **1.3** Research approach: Quantitative and qualitative approach Ethics in research; Literature review; Formulation of hypothesis **1.4** Research designs: a) Need for a research design, features of a good design b) Types of research designs- Explorative/ descriptive/ experimental/ Survey/ Case Study	09
Unit 2	**Sampling techniques** **2.1** Sampling techniques a) Sample Design-Criteria of selecting a sampling procedure b) Characteristics of a good sampling design. c) Types of sample designs: non-probability sampling, Probability sampling. **2.2** Determination of sample size for different types of research **2.3** Measurement and scaling techniques	06
Unit 3	**Role of statistics in research** a) Measures of central tendency: Mean, Median, Mode b) Measures of dispersion: Range, Interquartile range, Variance and Standard Deviation c) Normal distribution and normal curve d) Testing of Statistical Hypothesis e) Type I and Type II errors f) Guidelines for selecting an appropriate test.	15
Unit 4	**Statistical tests and Computer Applications in data analysis-** Parametric test of difference- T-test, ANOVA b) Parametric tests of association- Pearson's correlation coefficient c) Nonparametric tests of difference- Chi-square d) Regression Analysis Computer applications in data analysis: Introduction to SPSS	15

-RM: Course VI: Research Methodology Practical; 1 Credit: 15 hours

New Product Development: Research Proposal writing and presentation.

MSc. Syllabus Theory – Semester II

Course	**Core Paper I: Food Technology**	Lectures: 60

*Course Outcome***:** *On completing the course, the learner should be able to*

1. Understand the steps involved in various high and low temperature processing techniques.

2. Familiarize with intricate technologies of spice processing and mechanism of flavor and aroma perception.

3. Differentiate among food fortification, food enrichment and food supplements.

	Food Processing & Preservation I	
	1.1 Techniques of food preservation: High Temperature - Evaporation, Drying & dehydration, Pasteurization, Canning and bottling, Retort processing and Smoking. Low temperature - Refrigeration, Chilling, Freezing. Non-thermal methods - radiations, controlled atmosphere storage, enzymes and bacteriocins.	
	1.2 Food processing techniques: Baking, Frying, Roasting, Blanching	
Unit 1	**1.3** Processing of Foods of plant origin: Processing of Cereals and pulses - Different types of processing methods used in case of cereals and pulses-conventional and modern methods, Processing operations such as milling, pearling, par boiling. Extruded, puffed and fermented cereal-based products, Indian traditional products. Malting.	15
	1.4 Processing of fruits and vegetables: Post harvest handling, storage, control of ripening, Introduction to fruit and vegetable products, different types of products, dehydration techniques, canning, processed fruits and vegetables - pulps, jams, jellies, marmalades and other products like fruit juice and fruit bars.	
	1.5 Bakery - Different types of bakery products, manufacturing process of bread, biscuits, and others	

Food Processing & Preservation II

2.1 Fermentation process in traditional food, commonly available fermented foods: sauerkraut, yoghurt, cheese, miso, tempeh, idli, dosa.

2.2 Dairy technology: Milk processing by filtration, clarification, standardization, homogenization and pasteurization, cream separating techniques and chilling techniques. Types of milk and milk products- cream, butter, spray dried powder, casein, lactose, whey, ice cream, fermented dairy products, technology and applications with examples of Yoghurt, Acidophilous milk and value-added products (baby foods, weaning foods, therapeutic foods)

2.3 Poultry, meat and fish processing - sources, process and products. (Chicken Sausages, Salami, Smoked Meat, Fish Fingers)

Unit 2 ... 15

Processing of miscellaneous food (oil, sugar & confectionary, beverages, spices)

3.1 Sugar and Confectioneries - Types of sugars and different products of sugar industry, sugar processing - chocolate and confectionary manufacturing.

3.2 Beverages and spices technology - Chemistry and production technology of coffee, tea and cocoa cultivation, harvesting, management and manufacture, value added products: Spice industry - cultivation, processing, and manufacture of value-added products, specific examples of pepper, cardamom, ginger, turmeric, vanilla, garlic.

3.3 Flavours a) Molecular mechanism of flavour perception (sweet, bitter, salty, sour, umami, kokumi, pungent, cooling and astringent) b) Flavours from vegetables, fruits, spices, fats and oils, milk, and meat products

Pigments a) Pigments in Animal and Plant tissues (Haeme compounds, Chlorophyll, Carotenoids, Anthocyanins, Betalins) b) Synthetic Food Colours (toxicity and regulatory aspects)

Unit 3 ... 15

| Unit 4 | **4.1 Fortification and enrichment**: Definition, criteria of foodselection, methods of fortification, Indian and International scenario
4.2 Processing of some specific foods
4.2.1 Processing of fruit juices, butter, margarine, cheese, marmalades, jams, value added products, processed meat, egg products, fish meal, etc.
4.2.2. Processing of barley, oats, rye, soybean, and its products | 15 |

Practicals

Course	**Core Paper I - Food Technology**	**Credits**

Course Outcome: *On completing the course, the learner should be able to*
1. Prepare various fruit products with added value, such as juices, sauces, jams, ketchups, jellies, and marmalades.
2. Process a variety of dairy products, including fermented drinks, cheese, butter, and paneer.
3. Produce baked goods, cookies, and crackers made from processed cereal.
4. Comprehend sugar cooking procedures through the production of candy.

1. Wine preparation.
2. Preparation of syrups, squashes, jams, jellies, fruit bars, ketchups, and sauces.
3. Lab scale preparation of fermented milk products (yogurt, cheese)
4. Manufacture of margarine & butter.
5. Preparation of cookies & biscuits.
6. Preparation of Chocolates and candies.

2

*Visits to Food industry is recommended

MSc. Syllabus Theory - Semester II

Course

	Core Paper II - Functional Foods & Nutraceuticals	Lectures: 60

Course Outcome: On completing the course, the learner should be able to

1. Describe the various origins of nutraceuticals and functional foods.

2. Go over the advantages of health and resources for general wellbeing.

3. Analyze the manner in which ingredients in nutraceuticals are extracted.

	Functional foods & Nutraceuticals-I	
Unit 1	**1.1** Introduction; Nutraceutical Industry: Scope of the industry, Indian and global scenario. Classification of nutraceuticals based on source and chemical nature. **1.2** Nutraceuticals of plant origin: Plant secondary metabolites- Terpenoids, Phenolics, Alkaloids, phytoestrogens, Pigments, Organo Sulphur compounds. **1.3** Sources and health benefits of nutraceuticals: Glucans, ascorbic acid, quercetin, kaempferol, rutin, β-carotene, allicin, lycopene, limonene, α-tocopherol, zeaxanthin, caffeine, Olive oil, green tea **1.4** Minerals – Ca, P, Cu, I, Zn, Se, F, Mg, Mn	15
Unit 2	**Functional foods and Nutraceuticals-II** **2.1** Nutraceuticals of animal origin: collagen chitin, chitosan, glucosamine, chondroitin sulphate, conjugated linoleic acid, eicosapentenoic acid, docosahexaenoic acid, choline, lecithin. **2.2** Microbial and algal nutraceuticals: Concept of prebiotics, probiotics and Synbiotics. Prebiotics: Non-digestible carbohydrates- Dietary fibers, functional oligosaccharides, Resistant starch, and gums. Probiotic microorganisms- Features and health benefits. Probiotics in various foods: Dairy-based, fermented, and non-fermented foods. Quality assurance of probiotics and safety Algae as source of omega-3 fatty acids, antioxidants, and minerals. kelp and spirulina	15

3.1 Functional foods and Nutraceuticals in health management:
Diabetes, management of Cancer, Cognitive decline, Liver & kidney
disorders, Osteoporosis, Pediatrics, Geriatrics, Sports, Pregnancy and
Lactation

Unit 3	**3.2** Concept of antioxidants - use of antioxidants as dietary supplements in prevention and treatment of cancer, obesity, and stress. **3.3** Concepts of standardization- Pharmacopeial standards. screening of phytochemicals	15
Unit 4	**Extraction and isolation of natural bioactive compounds** **2.1** Plant secondary metabolites: Properties of Alkaloids, phenols, Terpenoids, Glycosides. **2.2** Extraction and purification: Pre-extraction preparation, Isolation and purification: Traditional methods- maceration, Soxhlet extraction, decoction, infusion, percolation, sonication.	15

2.3 Modern methods: Microwave-assisted, ultrasound assisted, supercritical fluid extraction, accelerated solvent extraction.

Class Assignments

1. Collagen, gelatin, and Bioactive peptides
2. Polyunsaturated fatty acids
3. Health benefits of bioactive compounds/nutraceutical ingredients
4. Effect of food processing technology on bioactive components of nutraceuticals and functional foods

Practicals

Course	Core Paper II - Functional Foods & Nutraceuticals	Credits
	Course Outcome: On completing the course, the learner should be able to	
	1. Extract different plant constituents	
	2. Employ various methods and techniques for extraction of natural products from their sources	
	3. Apply the knowledge of analytical techniques in estimation of natural compounds	
	4. Conduct market research for several nutraceuticals and functional food products.	
	5. Create certificate of analysis for a food product	
	1. Chemical profiling of plant samples and extracts.	
	2. Extraction and characterization (UV/VIS, chromatography) of phytoconstituents:	
	3. Extraction and characterization of alkaloids (Caffeine/Catechins).	**2**
	4. Extraction of Pigments (Lycopene, Curcumin, Carotenoids).	
	5. Determination of caffeine and tannin content in coffee and tea.	
	6. Study of functional foods and nutraceuticals already in market	
	7. Preparation of certificate of analysis of nutraceutical raw material – turmeric and curcumin	

MSc. Syllabus Theory - Semester II

Lectures:30

Course	Core Paper III - Food Standards & Quality Control	
	Course Outcome: On completing the course, the learner should be able to 1.*Demonstrate awareness of Indian & International Food laws and regulatory authorities.* 2.*Understand Indian Food Safety Standards linked with each individual food product and special categories.* 3.*Analyze the various tools employed in the quality management system (QMS) of food industry.* 4.*Prepare a HACCP work plan for a food processing unit with significance to identifying the critical control point (CCP), fixing critical control limits (CCLs) and monitoring procedure.*	
Unit 1	**Food laws and standards- Global/International bodies** **1.1** Understanding the food regulatory cycle. Introduction to Global regulatory authorities for the food Industry **1.2** Codex Alimentarius Commission (CAC): Introduction, standards, codex of practice, guidelines, and recommendations, applying codex standards, Codex India, core functions of National Codex Contact Point, National Codex Committee of India.	9
Unit 2	**Food Regulations in India**: **2**.1 History of food regulations in India.Legislations- Prevention of Food Adulteration act 1954, Food product order (1955), Meat Food Products Order (1973), Vegetable Oil Products Order, 1998, Milk & Milk Product Amendment Regulations – 2009. **2.2** FSSAI – Role of FSSAI - Food Safety and Standards Act, 2006 (FSS) and Regulations: Food Safety and Standards (Food ProductsStandards and Food Additives) Regulation, 2011. Food Safety andStandards (Packaging and Labelling) Regulation, 2011. **2.3** Food Safety and Standards (Health Supplements, Nutraceuticals, Food for Special Dietary Use, Food for Special Medical Purpose, Functional Food and Novel Food) Regulations, 2016. Food Safetyand Standards (Organic Food) Regulation, 2017. Food Safety andStandards (Fortification of Food) Regulation, 2018. Food Safety and Standards (Packaging) Regulation, 2018. Standard weights and measures – legal metrology **2.4** Voluntary National Standards: BIS and AGMARK **Quality Management** **3.1** Quality inspection, quality control, quality management and quality assurance. Total quality management **3.2** Good manufacturing practices; Good agricultural practices Good laboratory practices ; Quality management systems (QMS) Quality Circles, SQC., ISO System. **3.3** Quality Management in the Food Industry: Concept of Total Quality Management–Quality Management Systems	12

Unit 3   (QMS):ISO9001Food Safety Management Systems (FSMS): ISO 22000; General Principles of -GHP and GMP. Other food safety practices: Good Agriculture Practices, Good Retail Practices, Good Transport Practices, GDP and Nutrition Labelling, Traceability studies.

3.5 Hazard Analysis Critical Control Point (HACCP): History, structure, pre- requites and principles, HACCP applications, HACCP based SOPs. Risk analysis: Introduction to risk analysis, Risk management, assessment and communication

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MSc. Syllabus Theory - Semester II

Course	DSE - Food analysis and Entrepreneurship	Lectures:45

*Course Outcome***:** *On completing the course, the learner should be able to*

1. Understand the principle of working of various separation and analytical techniques. Apply this knowledge in separation, purification, identification and analysing food samples for quality and safety.

2. Create a strategy for determining the shelf life of a food product.

3. Comprehend diverse approaches for sensory evaluation. Analyse, evaluate and document the sensory characteristics of food samples.

4. Develop marketing and entrepreneurial skills.

Unit 1	**Food Analysis-I** **1.1** Principle and applications of electrophoresis, Capillary andzone electrophoresis, PAGE, SDS-PAGE, Agarose. **1.2** Basic concepts, principles, and applications: paper chromatography, thin layer chromatography, ion exchange chromatography, affinity chromatography and gel exclusionchromatography. High pressure liquid chromatography, gasliquid chromatography - principle, instrumentation, and applications. Column chromatography as a separation technique. **1.3** Modern methods: Microwave-assisted, ultrasound assisted, supercritical fluid extraction, accelerated solvent extraction.	15
Unit 2	**Food Analysis-II** **2.1 Study of Rheological properties and Principles ofinstruments used.** Viscosity - Brookfield Viscometer, Texture Analyzer and Universal Testing Machine. Study of pH and its Importance in Food Technology. Study of Water Activity and its measurement.Polarimetry and measurement of color. **2.2 Shelf-life study (ASLT)** - Stability and Shelf-Life Studies- Definitions -Designing a shelf-life study, selecting characteristicsto be studied in shelf-life studies -Types of Shelf-Life Studies- Simple, Comparative, accelerated shelf-life studies, Spiking of samples -Shelf-life study of a developed product. **2.3 Sensory Evaluation** Importance of Sensory Evaluation, Physiological Bases of SensoryEvaluation, Sensory Characteristics of Food, Sensory Panels, Environment for Sensory Evaluation, Sensory Evaluation methodsfor quality of products. Correlation of sensory and instrumental analysis. Score cards & rating scales.	15

Unit 3	**Entrepreneurial Skill -**Definition and meaning of entrepreneurship -Types, Classification,and trends of Entrepreneurial ventures in foods and nutrition - Qualities and skills of an entrepreneur -Resources required for a business - Project formulation, Government and non-government opportunities for funds and resources. − Franchising opportunities **Marketing skills-** Concepts of marketing -Channels of distribution -Market Researchand Marketing strategies -Market segmentation, targeting and positioning -Novel and innovative product /service development - Brand development and promotion	15

Practicals

Course	DSE – Food Analysis & Entrepreneurship	Credit

*Course Outcome***:** *On completing the course, the learner should be able to*
1. Gain practical experience with chromatographic methods such thin layer, paper, and liquid chromatography. Apply this knowledge in separation, purification, identification and analysing food samples for quality and safety.
2. Capable of carrying out analytical tasks utilizing spectrophotometric methods.
3. Demonstrate awareness of the accelerated shelf life (ASLM) study methodology used to compare various processed items.
4. Comprehend and use diverse approaches for sensory evaluation. Analyse, evaluate and document the sensory characteristics of food samples.

1. Sensory Evaluation
2. Shelf-Life Study
3. The identification of sugars in fruit juice using TLC   **1**
4. Separation of amino acids by two-dimensional paper chromatography
5. Molecular weight determination using sephadox-gel.
6. Estimation of phytic acid using spectrophotometer
7. Instrumentation Workshop / Visit

Course V: OJT/Internship: 4 Credits

Recommended Reference Books

Sr.no.	Book Tittles / Research Papers
1	Vaclavik, V. A., Christian, E. W., & Campbell, T. (2008). Essentials of food science(Vol. 42). New York: Springer.
2	Smith, J., & Hong-Shum, L. (2011). Food additives data book. John Wiley & Sons
3	Kothari, C. R. (2004). Research methodology: Methods and techniques. New Age International.
4	Subbulakshmi, G., & Udipi, S. A. (2017). Food processing and preservation. NewAge International
5	Potter, N. N., & Hotchkiss, J. H. (2012). Food science. Springer Science & BusinessMedia
6	Srilakshmi, B. (2003). Food science. New Age International.
7	Introduction to Biochemistry – Rafi M.D
8	Introduction to Functional foods & Nutraceuticals – Rekha Sharma
9	Fundamental of Water Supply & Sanitary Engineering – Rangwala S.C
10	Guide to Improving food Hygiene – Ed Gaston & Tiffney
11	Functional foods & Nutraceuticals – Chukwuebuka Egbuna, Genevieve Dable – Tupas
12	Food Hygiene & Sanitation – S. Roday
13	Food Microbiology – W.C Frazier & D.C Westhoff
14	Safety of Foods – H.D. Graham
15	Quality Control for Food Industry – Krammer & Twigg
16	Quality Control in Food Industry - S.N Herchodgrfer
17	Advances in Food Research – Academic Press. Vol I
18	Practical Food Microbiology – Harry H. Weiser, J. Mountney & W.W Gord (Technical) 2nd Edition
19	Sylvia Escott-Stump, Janice L. Raymond, Marie V. Krause (2012) Nutrition in Pregnancy and Lactation, Infancy, Nutrition in Adolescence, Adult Years, Aging
20	Eschleman, M. M. (1984). Introductory nutrition and diet therapy. Lippincott.
21	The Psychology of Food Choice (2006). United Kingdom: CABI.
22	Stanbury, Whitaker & Hall (2017) Principles of Fermentation Technology
23	Sylvia Escott-Stump, Janice L. Raymond, Marie V. Krause (2012) Nutrition in Pregnancy and Lactation, Infancy, Nutrition in Adolescence, Adult Years, Aging
24	Eschleman, M. M. (1984). Introductory nutrition and diet therapy. Lippincott.
25	Keith Wilson & John Walker (2010) Principles and Techniques of Biochemistry and Molecular Biology
26	Nielsen, S. S. (2017). Food analysis laboratory manual. Springer.
27	Shelf-Life Evaluation of Foods. (2012). United Kingdom: Springer US.
28	Food Packaging and Shelf Life: A Practical Guide. (2009). Ukraine: Taylor &Francis.
29	Taxmann Entrepreneurship Development
30	https://pubmed.ncbi.nlm.nih.gov/12671662/ DOI: 10.1038/nrg1047
31	https://www.hindawi.com/journals/jnme/2014/202759/ DOI: https://doi.org/10.1155/2014/202759
32	https://pubmed.ncbi.nlm.nih.gov/19248861/ DOI: 10.1016/j.jada.2008.11.02410.
33	https://pubmed.ncbi.nlm.nih.gov/27286972/ DOI: 10.1159/00044634712.
34	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3191675/ DOI: 10.5001/omj.2011.21

35   FAO Food Database https://www.fao.org/faostat/en/

36   WHO food database https://www.who.int/teams/nutrition-and-food-safety/databases

37   USDA food database https://fdc.nal.usda.gov/

38   Food Informatics and Its Challenges and Opportunities – A Review
https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3042148

39   https://www.mdpi.com/2304-8158/10/11/2889 https://doi.org/10.3390/foods10112889

40   https://www.sciencedirect.com/science/article/pii/S102194981830173X
https://doi.org/10.1016/j.jfda.2018.12.002

41   https://www.iso.org/iso-9001-quality-management.html

42   https://www.fssc.com/

43   https://www.fooddocs.com/post/food-safety-audit

44   https://pubmed.ncbi.nlm.nih.gov/21625170/ DOI: 10.1159/000327772

45   https://pubmed.ncbi.nlm.nih.gov/16195369/ DOI: 10.1096/fj.05-3911rev

46   Essentials of Food & Nutrition – M.S. Swaminathan

PATTERN OF EXAMINATION: Semester Pattern

SCHEME OF EXAMINATION

A) THEORY
B) PRACTICAL

EVALUATION SYSTEM

1.   **Standard of passing**

To pass each paper students are required to obtain a minimum of 40% marks in each internal (40 marks) and Semester end exam (60 marks).

2. Assessment of Project / Industrial visit /study tour /Internship/Workshop
Report
- The Industrial visit/study tour/on-job training/workshop report must be submitted by the prescribed date.
- The Industrial visit/study tour/ on-job training report and its presentation shall be evaluated by the coordinator of the course and concerned faculty**.**

3   Grade point for Theory/Practical/ Experiential learning

Table –I: for 100/50 Marks Theory or Practical

Letter Grades and their equivalent Grade point			
Percentage of marks	**Grade Point**	**Grade**	**Performance**
80.00 and above	10	O	Outstanding
70-79.99	9	A$^+$	Excellent
60-69.99	8	A	Very Good
55-59.99	7	B$^+$	Good
50-54.99	6	B	Above Average
45-49.99	5	C	Average
40-44.99	4	D	Pass
Less than 40	0	F	Fail

Calculation of GPA and CGPA

1. Grade Point Average (GPA) = $\underline{\Sigma \text{ (course credits in passed courses X earned grade points)}}$

    Σ (Course credits in registered courses)

2. Cumulative Grade Point Average = $\underline{\Sigma \text{ (course credits in passed courses X earned grade points) of all Sem.}}$

    (CGPA) Σ (Course credits in registered courses) of all Semesters

<u>GPA and overall Grade</u>

Grade Point	**Grade**	**Description of Performance**
0-3.99	F	Fail
4.0 to 4.99	D	Unsatisfactory
5.0 to 5.99	C	Fair
6.0 to 6.99	B	Satisfactory
7.0 to 7.99	B+	Good
8.0 to 8.99	A	Very Good
9.0 to 9.99	A+	Excellent
10.00	O	Outstanding

- Ist Class with distinction: GPA > 7.0 and above [Text Wrapping Break]Ist Class: GPA > 6.0 and < 7.0
- IInd Class: GPA > 5.0 and < 6.0
- Pass Class: GPA > 4.0 and < 5.0
- Fail: GPA < 4.0

Ordinances for grace marks and condonation:

General Ordinances prescribed by the University of Mumbai (Item No. 4.101, dated 25/05/2011) and which are concurrent with the rules and guidelines of professional statutory bodies at the All-India level such AICTE, MCI, Bar Council, CCIM, CCIH, NCTE, UGC etc. are adopted.

Table II: Symbols in the marksheet

Symbols in the marksheet	Description
F	Head of failure
---	Not applicable
Ab	Absent
@	0.5043
#	0.229
$	Carried forward grade of the Head

SIES College of Arts, Science and Commerce (Autonomous) ,

Sion (W), Mumbai – 400022

Faculty: Arts

Programme: B.A.

Subject : Hindi (VSC)

हिंदी पटकथा एवं संवाद लेखन

Academic Year : 2023-24

FYBA SEM 1(Credit based Semester and Grading System syllabi approved by the Board of Studies in Hindi to be brought into effect from June 2023-24 under NEP)

SEMESTER 1

Title of paper – हिंदी पटकथा एवं संवाद लेखन
Number of credits – 02
Total no. of Lectures = 30

शिक्षण उद्देश्य

- ❖ विद्यार्थियों को हिन्दी पटकथा एवं संवाद लेखन के महत्त्व से परिचित कराना ।

- ❖ विद्यार्थियों में पटकथा एवं संवाद लेखन कौशल का विकास करना ।

- ❖ विद्यार्थियों को पटकथा लेखन कौशल से परिचित कराना ।

- ❖ विद्यार्थियों को संवाद लेखन कौशल से परिचित कराना ।

- ❖ विद्यार्थियों में पटकथा एवं संवाद लेखन संबंधी रुचि का विकास करना ।

- ❖ विद्यार्थियों में पटकथा एवं संवाद लेखन कौशल का विकास करना ।

- ❖ विद्यार्थियों के मन में हिन्दी भाषा ,साहित्य व पटकथा लेखकों के प्रति सम्मान व प्रेम का निर्माण करना ।

अधिगम निष्पत्ति

- ❖ विद्यार्थी हिन्दी पटकथा एवं संवाद लेखन के महत्त्व से परिचित होंगे ।

- ❖ विद्यार्थियों में पटकथा एवं संवाद लेखन कौशल का विकास होगा ।

- ❖ विद्यार्थियों में हिन्दी पटकथा लेखन संबंधी रुचि का विकास होगा ।

- ❖ विद्यार्थियों में हिंदी संवाद लेखन संबंधी रुचि का विकास होगा

- ❖ विद्यार्थी पटकथा एवं संवाद लेखन कर सकेंगे ।

- ❖ विद्यार्थियों के मन में हिन्दी भाषा ,साहित्य व पटकथा लेखकों के प्रति सम्मान व प्रेम का निर्माण होगा ।

❖

Module – 1- व्याख्यान – 15

पटकथा , अवधारणा , परिभाषा एवं स्वरूप

पटकथा लेखन के तत्त्व

पटकथा लेखन के लिए आवश्यक कौशल

फीचर फिल्म एवं डॉक्यूमेंट्री पटकथा लेखन

धारावाहिक की पटकथा लेखन

Module – 2- व्याख्यान – 15

संवाद की परिभाषा एवं संवाद लेखन की प्रक्रिया

दृश्य श्रव्य माध्यम के लिए संवाद लेखन की विशेषताएँ

 प्रसंग आधारित संवाद लेखन

फीचर फ़िल्म एवं डॉक्यूमेंट्री के लिए संवाद लेखन

हिंदी पटकथा एवं संवाद लेखन   के प्रश्न पत्र का प्रारूप एवं अंक विभाजन का विवरण
(30 -20)

 सत्रांत परीक्षा – कुल अंक – 30
प्रश्न -1- प्रथम मॉड्यूल से आंतरिक विकल्प सहित एक प्रश्न – अंक -15
प्रश्न -2 -द्वितीय मॉड्यूल से आंतरिक विकल्प सहित एक प्रश्न – अंक -15

आंतरिक मूल्यांकन
कुल अंक – 20
1 -प्रकल्प -20
क-पटकथा/ संवाद लेखकों के जीवन एवं पटकथा / संवाद लेखन का समीक्षात्मक अध्ययन
ख – फिल्म / डाक्यूमेंट्री / धारावाहिक से संबंधित पटकथा/ संवाद का लेखन
ग – उपलब्ध पटकथा / संवाद लेखकों का साक्षात्कार

* लिखित प्रस्तुतीकरण -10
* मौखिकी -10

संदर्भ ग्रंथ-सूची :

1-पटकथा लेखन; एक परिचय , मनोहर श्याम जोशी, राजकमल प्रकाशन,प्रकाशन,वर्ष 2002, नई दिल्ली।

2-फिल्मों में कथा, पटकथा लेखन,रतन प्रकाश, प्रभात प्रकाशन, प्रकाशन वर्ष 2020

3-हिंदी में पटकथा लेखन, जाकिर आली रजनीश,उत्तर प्रदेश हिंदी संस्थानप्रकाशन वर्ष 2014

4कथा- पटकथा, मन्नू भंडारी-वाणी प्रकाशन,नई दिल्ली प्रकाशन वर्ष 2014

5-रेडियो लेखन , मधुकर गंगाधर, बिहार हिंदी ग्रंथ अकादमी, संस्करण 2016

6टेलीविजन लेखन,असगर वजाहत, प्रभात रंजन, राधा कृष्ण प्रकाशन, नई दिल्ली,प्रकाशन वर्ष2022

SIES COLLEGE OF ARTS, SCIENCE AND COMMERCE
(Autonomous)

Affiliated to
UNIVERSITY OF MUMBAI

Syllabus under NEP effective from June 2023
Department of Physics & Mathematics

Programme: B.A. & B.Com
Sem: I and II
Class: FYBA & FYBCom

Skill Enhancement Course
Courses: 1. Basic Spreadsheet and Word Processing Techniques,
2. Basic Presentation and Designing Techniques

Choice Based Credit System (CBCS) with effect from the academic year 2023–2024

SIES COLLEGE OF ARTS, SCIENCE AND COMMERCE(AUTONOMOUS), SION WEST

Skill Enhancement Course
Class: FYBA/FYBCom

	SEMESTER I			
Course Code	**Title**	**Total Marks**	**Credits**	**Practicals/ week**
SIUPYSE112	**Basic Spreadsheet and Word Processing Techniques**	**50**	**02**	**02**
	SEMESTER II			
Course Code	**Title**	**Total Marks**	**Credits**	**Practicals/ week**
SIUPYSE122	**Basic Presentation and Designing Techniques**	**50**	**02**	**02**

SIES COLLEGE OF ARTS, SCIENCE AND COMMERCE(AUTONOMOUS), SION WEST

Course Code: SIUPYSE112
Course Name: **Basic Spreadsheet and Word Processing Techniques**

Learning Objective

To provide computer knowledge to students and equip them with computational skills using ICT.

Course Outcomes

On completion of this course, students will be able to

1. Store and manipulate Data using Excel and Google Sheets.
2. Design an online questionnaire to collect data and analyse the data.
3. Design a quiz.
4. Perform word processing using MS Word and Google Docs which will include creating a resume and writing letters and other basic office skills.

The following contents will be covered in **30 Practical sessions** of **60 hours** per batch in a semester

Pre-requisites:	Own Google Account.
Unit 1 a)	**Basic spreadsheet and Google Sheets:**
	● Concept of Workbook, Worksheet, Cell, Google Sheets. ● Types of data, Entering, Editing, Deleting data, Fill command, Series command, Custom list. ● Selecting, Inserting, Deleting cells, Rows, Columns, Ranges, Cell formatting. ● References: Mixed, Relative, Absolute. ● Formulae and Library Functions. ● Hiding/ unhiding Rows, Columns; Background of sheet. ● Data Validation, Conditional formatting, sorting, filter with customized condition ● Chart Wizard: Bar, Pie, Line, Scatter plot.
Unit 1 b)	**Google Forms:**
	● Set up a new form/quiz ● Edit and format a form ● Publish a form
Unit 1 c)	**Word Processing(Using MS Word/Google Doc):**
	● Text basics: Alignment and editing ● Text formatting and saving a file ● Working with objects ● Tables, Headers and Footers ● Sharing, printing a document

SIES COLLEGE OF ARTS, SCIENCE AND COMMERCE(AUTONOMOUS), SION WEST

Practical	Topic
01	Creating a table and manipulating the data in spreadsheet
02	Data validation and graphical representation of data in spreadsheet
03	Formulae and Library functions in spreadsheet
04	Creating an online questionnaire in Google form
05	Creating a quiz in Google form
06	Analysing Form data in Google form
07	Typing an article from a sample in MS Word
08	Writing application letters and creating a CV in MS Word

Criterion for journal certification: Minimum six practicals required to be attended and completed.

Optional Project Work:
Students may opt to take up a project. One project (optional) is equivalent to 2 practicals. Project topic will be decided by the teacher incharge. Project report should be submitted to the teacher in-charge along with the journal.

Main Reference Books:
1. Office 2010 the missing manual – Nancy Conner and Matthew MacDonald.
2. Excel 2010 All-In-One for Dummies – Greg Harvey.

Additional Reference Books:
1. Microsoft Office 97 – Gini Courter and Annette Marquis.
2. Microsoft Office 2016 – Joan Lambert and Curtis Frye.

References:

1 a)	MS Excel: Excel 2010 All-In-One for Dummies – Greg Harvey Google Sheets: The Ultimate Guide to Google Sheets
1 b)	Google Forms: How to use Google Forms - Computer - Google Docs Editors Help
1 c)	Google Docs: Google Docs training and help - Google Workspace Learning Center

Scheme of examination

There will be continuous evaluation for the course throughout the semester.

Sr No.	Particulars	Marks
1.	Active participation and certified journal	20
2.	Practical examination	20
3.	Viva	10
	Total	50

SEMESTER II

Course Code: SIUPYSE112 Course Name: **Basic Presentation and Designing Techniques**	

Learning Objective
Students will be able to independently create professional-looking presentations and designing techniques.

Course Outcomes
On completion of this course, students will be able to
1. Set up and perform presentations required as an employee of any organisation.
2. Design brochures, pamphlets, posters, booklets.
3. Design animated presentations.
4. Design and publish their own websites.

The following contents will be covered in **30 Practical sessions** of **60 hours** per batch in a semester

Pre-requisites:	Own Google Account.
Unit 1 a)	**Basic PowerPoint and Google Slides:**
	- Setting up a presentation - Creating slides and applying themes - Text Basics - Working with objects, smart arts, etc - Transitions and Animations - Presenting slide show - Inserting Charts
Unit 1 b)	**Canva and Powtoon**
	- Canva Menus, Creating a team, using and customising templates, using search and personalising editor, using and elements, fonts and text, uploading and using media, sharing and collaborating on designs, saving and organising documents - Knowing Powtoon Workspace, creating and presenting animated presentations using Powtoon
Unit 1 c)	**Google Sites**
	- Creating your own website - Adding contents to the site(this includes adding everything learned in this course upto last section) - Publishing and Sharing the site

Practical	Topic
01	Setting up and presentation using MS PowerPoint
02	Setting up and presentation using Google Slides
03	Setting up a professional presentation using charts and other features
04	Creating a brochure/pamphlet/poster using Canva from
05	Animated Presentation using Powtoon
06	Creating and organising data in Google Drive
07	Creating a simple website and publishing it
08	Using Google slides and Canva in Google sites

Criterion for journal certification: Minimum six practicals required to be attended and completed.

Optional Project Work:

Students may opt to take up a project. One project (optional) is equivalent to 2 practicals. Project topic will be decided by the teacher incharge. Project report should be submitted to the teacher in-charge along with the journal.

Main Reference Books:
1. Office 2010 the missing manual – Nancy Conner and Matthew MacDonald.

Additional Reference Books:
1. Microsoft Office 97 – Gini Courter and Annette Marquis.
2. Microsoft Office 2016 – Joan Lambert and Curtis Frye.

References:

1 a)	MS PowerPoint: Microsoft PowerPoint 2019 Fundamentals Workshop Google Slides: https://edu.gcfglobal.org/en/googleslides/#
1 b)	Canva: A beginner's guide to using Canva Powtoon: Tutorials | Powtoon Also, POWTOON
1 c)	Google Sites: How to use Google Sites - Sites Help

Scheme of examination

There will be continuous evaluation for the course throughout the semester.

Sr No.	Particulars	Marks
1.	Active participation and certified journal	20
2.	Practical examination	20
3.	Viva	10
	Total	50

College of Arts,
Science &
Commerce (Autonomous)

SIES

RISE WITH EDUCATION

NAAC REACCREDITED - 'A' GRADE

SIES College of Arts, Science and Commerce, (Autonomous)

Affiliated to University of Mumbai

Syllabus under NEP effective from June 2023

Department of Mathematics

Programme: B.Sc.

Sem: I and II

Class: FYBSc

Skill Enhancement Course

Course Name
1. Techniques of solving differential equations and applications
2. Linear Algebra for Machine Learning (ML)

Choice Based Credit System (CBCS)

with effect from the academic year 2023-24

SIES COLLEGE OF ARTS, SCIENCE AND COMMERCE(AUTONOMOUS), SION WEST

Skill Enhancement Course

This course is offered to students of BSc in semester I or II, who have chosen Mathematics as a Major/ Minor subject. Any one of the two options may be offered.

Name of Programme: Bachelor of Science   **Name of Department:** Mathematics
Type of course: Skill Enhancement Course – Practical Course
Evaluation Pattern: Continuous Internal Evaluation

Option	Course Name	Course Code	Credits	L/P (per week)	Marks
SEC option1	Techniques of solving differential equations and applications	SIUMTSE111/ SIUMTSE121	2	2 P	50
SEC option2	Linear Algebra for Machine Learning (ML)	SIUMTSE111/ SIUMTSE121	2	2 P	50
1P (Practical) = 2 Hours per week					

Skill Enhancement Course - option1

Course Name: Techniques of solving differential equations and applications
Credits**: 2**   Type**: Practical Course**

Expected Course Outcomes

On completion of this course, students will be able to:

1) Solve first-order linear differential equations using various methods, finding integrating factors, for non-exact equations.

2) Apply differential equations to model and solve real-world problems, such as population growth, radioactive decay, orthogonal trajectories including identifying families of curves that are orthogonal to a given family.

3) Analyse and interpret solutions of first-order linear differential equations, including equilibrium solutions, growth and decay behaviour, and the effect of initial conditions.

4) Recognize the limitations and challenges in solving ODEs analytically and the need for numerical methods.

5) Demonstrate proficiency in using numerical methods, such as Euler's method, the improved Euler method, and the Runge-Kutta methods, to approximate solutions of first-order ODEs

The following contents will be covered in Practical sessions.

Duration: 30 Practical Sessions of 2 hours per batch, of not more than 30 students.	
Pre-requisites:	Fundamental concepts of first-order linear differential equations, including variables, functions, derivatives, order and degree of a differential equation. Formation of DE and solution by separation of variables.

a)	**First Order Differential Equations**	
	- Solutions of Homogeneous and non-homogeneous differential equations of first order and first degree - Notion of partial derivative, exact equations and condition of exactness - Rules for finding integrating factors[without proof] for non-exact equations. - Solving linear and Bernoulli DE.	
b)	**Applications and Mathematical Modelling of DE**	
	- Formulation and solving DE related to Orthogonal trajectories - Solving differential equations related to population growth and decay and Half life period - Solving differential equations related to electrical circuits	
c)	**Numerical solutions of Ordinary differential equations**	
	- Euler's method - Euler's modified method - Picard's method - Runge-Kutta method	

Practical Sessions	
Practical	Topic
01	Solving homogeneous and non-homogeneous differential equations of first order and first degree,linear and Bernoulli
02	Solving problems on exact differential equations and finding integrating factors
03	Solving linear and Bernoulli differential equations
04	Solving differential equations related to Orthogonal trajectories

05	Formation and solving differential equations related to electric circuits-RL and RC
06	Formation and solution of differential equations related to exponential growth, decay and half life period.
07	Numerical solutions of ODE using Euler's method and Euler's modified methods.
08	Numerical solutions of ODE using Picard's method and Runge- Kutta methods.

References:

1) Ordinary and Partial Differential Equations; S. Chand.

2) G.F. Simmons; Differential Equations with Applications and Historical Notes; Taylor's and Francis

3) K. Atkinson, W.Han and D Stewart, Numerical Solution of Ordinary Differential Equations, Wiley.

4) Kendall E. and Atkinson; An Introduction to Numerical Analysis; Wiley.

5) M. K. Jain, S. R. K. Iyengar and R. K. Jain; Numerical Methods for Scientific and Engineering Computation; New Age International Publications.

6) S. Sastry; Introductory methods of Numerical Analysis; PHI Learning.

Scheme of Evaluation:

There will be continuous internal assessment throughout the semester.
A practical examination will be conducted at the end of the semester.
Students will have to submit the certified journal at the time of practical examination.

1.	Written Assignment / Project and Viva	10
2.	Journal	15
3.	Attendance and participation	05
4.	Practical Examination	20
	Total Marks	50

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SIES COLLEGE OF ARTS, SCIENCE AND COMMERCE(AUTONOMOUS), SION WEST

Skill Enhancement Course option 2

Course Name: **Linear Algebra for Machine Learning(ML)** Credits**: 2 Type: Practical Course**

Expected Course Outcomes
On completion of this course, students will be able to: 1) Understand the fundamental concepts of matrices, including matrix notation, dimensions, and operations such as addition, subtraction, and scalar multiplication. 2) Apply matrix operations to solve basic problems, such as matrix multiplication and finding inverse, transpose. 3) Comprehend the properties of matrices, including commutativity, associativity, and distributivity, and their implications in matrix operations. 4) Gain proficiency in solving systems of linear equations using various methods, such as substitution, elimination, and matrix inversion.

The following contents will be covered in Practical sessions. **Duration: 30 Practical Sessions of 2 hours per batch, of not more than 30 students.**

Prerequisites:	Vectors in R^2, R^3, Dot product, norm.
a)	**Systems of Linear equations and matrices**
	- Introduction to Machine Learning - Parametric equation of lines and planes - System of homogeneous and non-homogeneous linear equations - The solution of homogeneous system of m linear equations in n unknowns by elimination and their geometrical interpretation for (n, m) = (1, 2), (1, 3), (2, 2), (2, 3), (3, 3) - Definition of n−tuples of real numbers, sum of two n−tuples and scalar multiple of an n−tuple.
b)	**Matrices with real entries**
	Addition, scalar multiplication, multiplication of matrices and transpose

	• Types of matrices: zero matrix, identity matrix, scalar matrices, diagonal matrices, orthogonal matrices,upper triangular matrices, lower triangular matrices, symmetric matrices, skew-symmetric matrices, Invertible matrices. • Identities such as $(AB)^t = (B^t)(A^t)$, $(AB)^{-1} = (B^{-1})(A^{-1})$
c)	**System of linear equations in matrix form**
	• Elementary row operations, row echelon matrix, • Gaussian elimination method

Practical Sessions	
Practical	Topic
01	Finding equation of line and plane
02	Drawing appropriate figures for (n, m) = (1, 2), (1, 3), (2, 2), (2, 3), (3, 3) And possible interpretation of their solutions geometrically
03	Solving homogeneous systems by elimination and back substitution
04	Problems on handling different types of matrices
05	Finding inverse of a matrix using elementary row transformations.
06	Checking for consistency
07	Solving the system for unique / infinitely many solutions using Gaussian elimination.
08	Solving system to find value of unknown k

References:
1) Howard Anton, Chris Rorres, Elementary Linear Algebra, Wiley Student Edition. 2) S Kumaresan, Linear Algebra - A Geometric Approach, PHI Learning. 3) Serge Lang, Introduction to Linear Algebra, Springer. 4) K. Hoffman and R. Kunze : Linear Algebra, Tata McGraw-Hill, New Delhi.

Scheme of Evaluation:

There will be continuous internal assessment throughout the semester.
A practical examination will be conducted at the end of the semester.
Students will have to submit the certified journal at the time of practical examination.

1.	Written Assignment / Project and Viva	10
2.	Journal	15
3.	Attendance and participation	05
4.	Practical Examination	20
	Total Marks	50

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College of Arts,
Science &
Commerce (Autonomous)

SIES

R I S E   W I T H   E D U C A T I O N

NAAC REACCREDITED - 'A' GRADE

SIES College of Arts, Science and Commerce   (Autonomous)

Affiliated to University of Mumbai

Syllabus under NEP effective from June 2023

Department of Mathematics

Programme: B.Sc.

Semesters: I and II

Class: FYBSc

Vocational Skill Course

Course Name

Option1. Basic Spreadsheet and Word Processing Techniques
Option2. Basic Presentation and Designing Techniques

Choice Based Credit System (CBCS)
with effect from the academic year 2023-24

SIES COLLEGE OF ARTS, SCIENCE AND COMMERCE, AUTONOMOUS, SION WEST

This course is offered to students of BSc in semester I or II, who have chosen Mathematics as Major/ Minor subject. Any one of the two options may be offered.

Name of Program: Bachelor of Science   **Name of Department:** Mathematics
Type of course: Vocational Skill Course – Practical Course
Evaluation Pattern: Continuous Internal Evaluation

Option	Course Name	Course Code	Credits	L/P (per week)	Marks
VSC option1	Basic Spreadsheet and Word Processing Techniques	SIUMTVS111/ SIUMTVS121	2	2 P	50
VSC option2	Basic Presentation and Designing Techniques	SIUMTVS111/ SIUMTVS121	2	2 P	50

1P (Practical) = 2 Hours per week

Vocational Skill Course: Option 1

Course Name: **Basic Spreadsheet and Word Processing Techniques**
Credits**: 2**   Type: **Practical Course**

Expected Course Outcomes

On completion of this course, students will be able to

1. Store and manipulate Data using Excel and Google Sheets
2. Design an online questionnaire to collect data and analyse the data
3. Design a quiz
4. Perform word processing using MS Word and Google Docs which will include creating a resume and writing letters and other basic office skills

The following contents will be covered in Practical sessions.

Duration: 30 Practical Sessions of 2 hours per batch, of not more than 30 students.

Prerequisites:	Use of Google Drive
a)	**Basic Excel and Google Sheets:**
	● Concept of Workbook, Worksheet, Cell, Google Sheets

	- Types of data, Entering, Editing, Deleting data, Fill command, Series command, Custom list - Selecting, Inserting, Deleting cells, Rows, Columns, Ranges, Cell formatting - References: Mixed, Relative, Absolute - Formulae and Library Functions - Hiding/ unhiding Rows, Columns; Background of sheet - Data Validation, Conditional formatting, sorting, filter with customized condition - Chart Wizard: Bar, Pie, Line, Scatter plot.
b)	**Google Forms:(3 L)**
	- Set up a new form or quiz - Edit and format a form or quiz - Publish a form or quiz
c)	**Word Processing(Using MS Word/Google Doc): (6 L)**
	- Text basics: Alignment and editing - Text formatting and saving a file - Working with objects - Tables, Headers and Footers - Sharing, printing a document

Practical Sessions	
Practical	Topic
01	Creating a table and manipulating the data
02	Data validation and graphical representation of data
03	Formulae and Library functions
04	Creating an online questionnaire
05	Creating a quiz
06	Analysing Form data
07	Typing an article from a sample
08	Writing application letters and creating a CV

References and Online Resources:

1) Greg Harvey, *Excel 2010 All-In-One for Dummies*;

2) For Google Sheets: online resource

   The Zapier Team, *The ultimate guide to google sheets 2016*, Zapier Learning

3) For Google Forms: online resource

   https://support.google.com/docs/answer/6281888?hl=en&co=GENIE.Platform%3DDesktop

4) For Google Docs: online resource *https://support.google.com/a/users/answer/9282664?hl=en*

Scheme of Evaluation:

There will be continuous internal assessment throughout the semester.
A practical examination will be conducted at the end of the semester.
Students will have to submit the certified journal at the time of practical examination.

1. Project and Viva	20
2. Journal	05
3. Attendance and participation	05
4. Practical Examination	20
Total Marks	50

Vocational Skill Course: Option 2

Course Name: **Basic Presentation and Designing Techniques**
Credits: 2   **Type: Practical Course**

Expected Course Outcomes
On completion of this course, students will be able to

1. Set up and perform presentations required as an employee of any organisation

2. Design brochures, pamphlets, posters, booklets

3. Design animated presentations

4. Design and publish their own websites

The following contents will be covered in Practical sessions.
Duration: 30 Practical Sessions of 2 hours per batch, of not more than 30 students.

Prerequisites:	Use of Google Drive

a)	**Basic Powerpoint and Google Slides**
	- Setting up a presentation - Creating slides and applying themes - Text Basics - Working with objects, smart arts, etc - Transitions and Animations - Presenting slide show - Inserting Charts from Google sheets into Google Slides
b)	**Canva and Powtoon**
	- Canva Menus, Creating a team, using and customising templates, using search and personalising editor, using and elements, fonts and text, uploading and using media, sharing and collaborating on designs, saving and organising documents - Knowing Powtoon Workspace, creating and presenting animated presentations using Powtoon
c)	**Google Sites**
	- Creating your own website - Adding contents to the site (this includes adding everything learned in this course upto last section) - Publishing and Sharing the site

Practical Sessions	
Practical	Topic
01	Setting up and presentation using MS PowerPoint
02	Setting up and presentation using Google Slides
03	Setting up a professional presentation using charts and other features
04	Creating a brochure/pamphlet/poster using Canva from
05	Animated Presentation using Powtoon
06	Creating and organising data in Google Drive

| 07 | Creating a simple website and publishing it |
| 08 | Using Google slides and Canva in Google sites |

References and Online resources:

1) MS PowerPoint:
https://www.technology.pitt.edu/sites/default/files/Microsoft%20PowerPoint%202019%20Fundamentals.pdf
2) Google Slides:
 https://edu.gcfglobal.org/en/googleslides/#

3) Canva:
https://www.canva.com/learn/how-to-canva-beginners-guide/

4) Powtoon:: Tutorials | Powtoon. Also, POWTOON

5) Google Sites:
 How to use Google Sites - Sites Help

Scheme of Evaluation:

There will be continuous internal assessment throughout the semester.
A practical examination will be conducted at the end of the semester.
Students will have to submit the certified journal at the time of practical examination.

5. Project and Viva	20
6. Journal	05
7. Attendance and participation	05
8. Practical Examination	20
Total Marks	50

****

AC / 27.06.2023 / RS1

SIES COLLEGE OF ARTS, SCIENCE ANDCOMMERCE

(Autonomous)

Affiliated to

UNIVERSITY OF MUMBAI

Syllabus for SEM I and SEM II (Under NEP)

Program Name: BSc

Class: FYBSc

Course: FYBSc Vocational Skill Enhancement Course (VSC)

Offered By: Department of Physics

(Choice Based Credit System (CBSC) with effect from the academic year 2023–2024 under NEP)

Syllabus for F.Y.B.Sc. Vocational Skill Enhancement Course

As per credit-based system

First Year B.Sc. 2023–2024

The syllabus of Vocational Skill Enhancement Course in Physics as per credit-based system for the First Year BSc. The course will be implemented from the academic year 2023–2024.

Preamble:

The systematic and planned curricula from this course shall motivate and encourage learners to develop the basic knowledge and skill of electronic instrumentation.

Course code	Title	Credits
SIUPYVS111	**Basic instrumentation 1**	**2**

Scheme of examination For Vocational Skill Enhancement Course:

Only internal examination of this course will be conducted as per the following scheme:

Sr. No.	Particulars of VSC Examination	Marks
1.	**Continuous Evaluation:** Continuous evaluation based on attendance/following lab ethics/completion of lab work in the allotted time duration	**10**
2.	**Internal Examination:**	
	Laboratory Work	25
	Course File	10
	Viva	05
	Total	**50**

The candidate should submit a certified Course file of Vocational Skill Enhancement Course with the certificate from the Head of the Department at the time of examination to obtain the Course file marks.

PSO No.	DETAILS
PSO1	Understand the basic concepts and the fundamentals of mechanics, properties of matter, current electricity, and electrodynamics
PSO2	Understand the basics of quantum mechanics, relativistic physics, nuclear physics, optics, Atomic Physics, solid state physics, statistical physics and thermodynamics, mathematical physics & biophysics
PSO3	Understand and apply the concepts of electronics in the designing of different analog & digital circuits and in instrumentation
PSO4	Understand the basics of computer programming, assembly language & numerical analysis
PSO5	Apply and verify theoretical concepts through laboratory experiment
PSO6	Applications of theoretical concepts
PSO7	To familiarize with current and recent scientific and technological developments
PSO8	To enrich knowledge through problem-solving, hands-on activities, study visits & projects.

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome; Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Semester I

Course Code	Credits	Lectures/week	Course Name	
SIUPYVS111	2	2	Basic Instrumentation-1	

CO. No.	DETAILS	Cognitive Level	Affinity with PO/ PSO
CO1	Use of CRO and DMM as measuring instruments	U, Ap	PSO5, PSO6
CO2	Various applications of logic gates.	U, Ap	PSO5, PSO6
CO3	Use of transformers and semiconductor devices like diodes	U, Ap	PSO5, PSO6

List of experiments:

1. Introduction to circuit components; resistors, capacitors, inductors.

2. Use of oscilloscope.

3. Circuit tracing.

4. Step-up and step-down transformers.

5. Diode characteristics.

6. Applications of Logic gates 1.

7. Applications of Logic gates-2.

8. P.O. Box/ Wheatstone's bridge.

9. Use of DMM.

A minimum of 8 experiments from the list should be completed in the semester. All these experiments are to be reported in the course file to be eligible for internal examination.

References:

1. Electrical Circuits, K.A. Smith and R.E. Alley, 2014, Cambridge University Press
2. A text book in Electrical Technology - B L Theraja - S Chand & Co.
3. Performance and design of AC machines - M G Say ELBS Edn.
4. Electronic Devices and Circuits, A. Mottershead,1998, PHI Learning Pvt. Ltd.
5. Network, Lines and Fields, John D. Ryder, Pearson Ed. II, 2015.
6. Electrical Circuit Analysis, K. Mahadevan and C. Chitran, 2nd Edition, 2018, PHI learning Pvt. Ltd

College of Arts,
Science &
Commerce (Autonomous)

SIES

RISE WITH EDUCATION

NAAC REACCREDITED - 'A' GRADE

Faculty: Arts

Programme: B.A.

Subject: Philosophy

Academic Year: 2023-2024

FYBA
Choice Based Credit System and
Learning Outcome Based System
as
Multidisciplinary Undergraduate
Program
with DSC in Philosophy
under NEP 2020

Revised Syllabi approved
by Board of Studies in Philosophy
w.e.f. June 2023

॥ कल्पयतु, विश्वासं कुरु, साधयतु ॥

"कल्पना करो, विश्वास करो, हासिल करो।
Imagine, Believe, Achieve!

With the implementation of National Education Policy (NEP 2020) and in continuation with academic autonomy engaging the undergraduates in Philosophy has continued to be more meaningful and purposeful. As per the NEP First Year Course Structure, the FYBA Courses are revised and designed to promote critical thinking, ethical reasoning, and philosophical inquiry among the students. In a rapidly changing world with evolving technologies and global challenges, ethical reasoning is vital for addressing moral dilemmas. It enables individuals to consider the implications of their actions on others, weigh competing values and interests, with a commitment to fulfil one's own professional duties and responsibilities.

Philosophy is one of the oldest disciplines in the world and its origin can be traced back in all the historical civilizations. Moreover, it is the academic exploration of life's big questions. Its multidisciplinary approach can be applied to any field, and it helps to develop critical thinking skills. Today, the bedrock of ethical practice in demand in any professional settings is competence, and an attitudinal skill to uphold principles of justice, fairness, and integrity.

Through a collective effort of the members of Board of Studies in Philosophy at SIES College, Sion (West) both within and from outside the institution we have collectively kept the national interest while framing the syllabus. Their expertise was very valuable in conceptualizing the syllabus as per NEP 2020 guidelines and based on OBE. This syllabus shall help learners to sustain their interest in the subject, that could be a beginning in the career of some willing to do their Major in Philosophy, and it shall further enable them to engage in self-directed thought.

F. Y. B. A. Philosophy Course Structure (NEP 2020)
and credit distribution for
3 / 4 Year Multidisciplinary Undergraduate Program
opting for Discipline Specific Courses (DSC)-Philosophy as Major

		Faculty of Arts		Faculty of Arts/Commerce			Inter-Intra Faculty	
		Subject 1		Subject 2	Subject 3	Subject 4	Subject 5	Subject 6	Credits
		Major		Minor	GEC/OE	VSC/ SEC (VSEC)	AEC/VEC/ IKS	OJT/FP/CE P/CC/RP	
Level	Sem	Core	DSE						
4.5	I	C 1 Fundamentals of Ethics (4) SIUPHCA 111	---	Fundamentals of Ethics SIUPHCB 111	---	VSC Professional Ethics (2) SIUPHVS 111	---	---	**4+2 =06**
	II	C 2 Introduction to Logic (4) SIUPHCA 121	---	Introduction to Logic SIUPHCB 121	---	VSC Critical Thinking (2) SIUPHVS 121	---	---	**4+2 =06**
Semesters I & II		**08**	---	---	---	**04**	---		**8+4 =12**
Exit option with Certificate in Major with completion of course minimum of 40-44 credits, 4 Exit Skill Credits OR Continue with Major and Minor									

F. Y. B. A. Philosophy Syllabus (NEP 2020) Semester I
(Choice Based Credit System and Learning Outcome Based System
with DSC in Philosophy under NEP 2020
with effect from academic year 2023-2024)

Class	Semester	Course Code	Course Name	No. of hours	Credits	Marks
FYBA	I	**SIUPHCA 111 & SIUPHCB 111**	**Subject 1&2 Fundamentals of Ethics**	**60**	**4**	**40+60=100**

Learning Objectives -
- Familiarise learners to the foundational knowledge of ethics and human value as rooted in philosophy.
- Develop an ability to apply ethical principles in decision making.

Learning Outcomes -
1. Identify ethical terms and issues along with its area of specific application.
2. Discuss the significance of duty, virtue, character and moral obligations as an integrated phenomenon in diverse cultures.
3. Examine the need for moral decision making and corrective measures for responsible behavior through theories and discussions.

Module I: Introduction to Moral Philosophy   [15 hours]
(a) Definition, nature, scope of ethics, values and types
(b) Moral/immoral/amoral, absolutism/relativism
(c) Applied ethics- Corporate, Bio-medical & Social Media

Module II: Indian & Western ethics   [15 hours]
(a) Vedic & Upanishadic ethical concepts -
    Rta, Rna, Purusharthas, Shreyas and Preyas
(b) Virtue ethics- Socrates, Plato & Aristotle
(c) Gita Ethics and Kantian ethics

Module III: Conditions for moral responsibility   [15 hours]
(a) Freewill verses Determinism- Necessitarianism, Libertarianism &
    Compatibilism
(b) Teleology- Utilitarianism of Jeremy Bentham and John Stuart Mill
(c) Theories of Punishment- Deterrent, Reformative and Retributive,
    Capital Punishment-debates

Module IV: Morality of Self-Interest and Altruism   [15 hours]
(a) Charvaka Hedonistic ethics-Sukhavada
(b) David Hume's ethics of Altruism
(c) Ayn Rand's Selfishness as virtue

Suggested References:

- Acton, H. B. (ed.), *The Philosophy of Punishment* (Macmillan, 1969)
- Bowie, Norman & Werhane, Patricia. *Management Ethics* (Blackwell Publishing, 2005)
- Fieser, James and Lillegard, Norman. *Philosophical Questions: Reading and Interactive Guides* (New York/Oxford: OUP, 2005)
- Honderich, Ted. *Punishment: The Supposed Justifications* (Penguin Books, 1969)
- Lawhead, William. *The Philosophical Journey: An Interactive Approach* (Mayfield Publishing Company, 2000)
- Levy, Neil. *Sartre* (One world Publications, 2007)
- Norman, Richard. *The Moral Philosophers: An Introduction to Ethics* (Oxford: Clarendon Press, 1983)
- Olen, Jeffery & Barry, Vincent. *Applying Ethics* (Wadsworth, 1998)
- Rand, Ayn. *The Virtue of Selfishness* [Introduction, chpts. 1 and 3] (New York: Signet Book, 1964)
- Sartre, Jean Paul. "Existentialism is a Humanism" in Walter Kaufman (ed.), *Existentialism from Dostoyevsky to Sartre* (New American Library -Meridian Book, 1975)
- Shankar, Uma Maheshwari. & Pai, Vatsala. *Moral Philosophy*, (Sheth Publishers, Mumbai. 2014)

Class	Semester	Course Code	Course Name	No. of hours	Credits	Marks
FYBA	I	SIUPHVS 111	VSC 1- Professional Ethics	30	2	20+30=50

Learning Objectives:
- Familiarize with concepts central to the philosophical study of professional ethics.
- Foster morally responsible citizens.

Learning Outcomes:
1. Explain the historical, social, or cultural contexts of the professions, codes of professional ethics, and the relations between the professions and other institutions.
2. Apply moral theories to professional or workplace moral issues using the case-study method.
3. Write an argument that analyzes, evaluates, or defends a solution to a specific problem in professional ethics.

Course Content-

Module I: Human Values, Rights and Responsibility   **[10 Hours]**

(a) Morals, Values and Ethics – Integrity-Academic integrity-Work Ethics.
(b) Civic Virtue – Respect for others- Living peacefully- Caring and Sharing- Honesty-courage-Cooperation – Commitment – Empathy-Self Confidence -Social Expectations.
I Peer assessment – Managing conflict- Collective bargaining- Confidentiality -Conflicts of interest- Occupational crime- Professional rights Employee right- IPR.

Module II: Code of conduct   **[10 Hours]**

(a) Teacher and Students
(b) Doctor and Patients
© Lawyer and Clients

Module III: Case Study Analysis (Practical)   **[10 Hours]**

(a) Business Ethics
(b) Media Ethics
© Ethics of Artificial Intelligence

Suggested References:
1. Chadwick, Ruth. Professional Ethics. In E. Craig (Ed.), Routledge *Encyclopedia of Philosophy*. (London: Routledge. 1998)
2. Frey, R.G. and Wellman, Christopher Heath (ed.) : *A Companion to Applied Ethics*, (John Wiley & Sons, New York, 2008)
3. Fullerton, G.S. *Introduction to Philosophy*, (Andrews UK Limited, Luton, 2012)
4. Joshi, H.M. *Traditional and Contemporary Ethics: Western and Indian*. (Bharatiya Vidya Prakashan, Delhi, 2002)
5. Lillie, William. *An Introduction to Ethics*. (Methuen, London, 1966)
6. Singer, Peter. Practical Ethics, Cambridge University Press, Cambridge, UK, 1990.
7. Sinha, Jadunath. Manual of Ethics, New Central Book Agency (P) Limited, Calcutta, 1998
8. Naagarazan. R.S. Professional Ethics and Human Values. New Age International (P) Limited, Publishers, New Delhi, 2006
9. Tandon, Nirmala. Contemporary Indian Ethics, English Edition Publishers, Mumbai, 2003
10. Titus, Harold. Ethics Today, Eurasia Publishing house Pvt. Ltd., New Delhi, 1966.

F. Y. B. A. Philosophy Syllabus (Autonomous) Semester II
(Choice Based Credit System and Learning Outcome Based System with DSC in Philosophy under NEP 2020 with effect from academic year 2023-2024)

Class	Semester	Course Code	Course Name	No. of hours	Credits	Marks
FYBA	II	SIUPHCA 121 & SIUPHCB 121	Subject 1 & 2 Introduction to Logic	60	4	40+60=100

Learning Objectives:
- Acquaint learners with fundamental concepts in logic and reasoning.
- Enable learners to engage in rational communication with argumentative and analytical skills.

Learning Outcomes:
1. Describe basic concepts in logic.
2. Distinguish between Propositions and Inferences, Logic and Language.
3. Determine with the logical rules, decision procedure methods the truth of propositions, validity of inferences and fallacies in an argument.

Module I: Basic Concepts in Logic   [15 hours]
 (a) **Introduction-** definition, nature and scope of logic.
 (b) **Inference**- definition, nature, validity, types, exercise.
(c) **Application areas:** Scientific reasoning, Procedural reasoning and Practical reasoning

Module II: Propositions and Inferences   [15 hours]
(a) **Proposition/Sentence/Judgement**-definition, nature & types
(b) **Classification of Proposition**-Traditional & Modern, Relational proposition, exercise.
(c) **Decision Procedure**- Truth-Table & Truth-Tree, exercise.

Module III: Logic and Language   [15 hours]
(a) **Role of Logic in Language**-Functions of language and exercise.
(b) **Kinds of Agreement and Disagreement** and exercise.
(c) **Definitions**- definiendum & definiens, nature, types, exercise.

Module IV: Fallacies   [15 hours]
(a) **Fallacy**- definition, nature, classification- formal & non-formal, purpose of study.
(b) **Formal fallacies –** reasons for occurrence, types & exercise
(c) **Non-formal fallacies –** reasons for occurrence, classification, types & exercise

Suggested References:
- Basantani, K.T., *Elementary Logic in LL.B*. Sheth Publishers, Mumbai.
- Copi, Cohen, Rodych, *Introduction to Logic*. 15th edition, (Routledge, U.S.A.2019)
- Dave, Ramesh., Sardesai, Rohini & Srinivas, Kamala. *Logic*. Sheth Publishers, Mumbai.
- Firma, R.D, *Logic of truth-functions- An Introduction to Symbolic Logic.*, (K.L. Mukhopadhyay, Calcutta, 1964)
- Hughes, G.E., Londey, D.G., Mansukhani, G.N. *The Elements of Formal Logic.* B.I Publications, Bombay,1965

- Hunter, G. *Metalogic: An – Introduction to the Metatheroy of Standard First order Logic,* University of California Press, Rev. Ed.1996
- Hurley, Patrick J. & Watson, Lori. *A Concise Introduction to Logic*. (Cengage Learning India Pvt. Ltd. 2019)
- Jetli P & Prabhakar, M. *Logic* (Pearson: Delhi, Chennai and Chandigarh 2012)
- Robert Lata and Alexander Macbeath, *The Elements of Logic*. (Macmillan & Co. Ltd.)

FYBA COURSE
SEMESTER I : Fundamentals of Ethics (Subject 1 & 2) SIUPHCA 111 & CB 111
SEMESTER II : Introduction to Logic (Subject 1 & 2) SIUPHCA 121 & CB 121

The following question paper pattern for FYBA Subject I & II titled Fundamentals of Ethics and Introduction to Logic to be brought into effect from the academic year (2023-2024)

Internal Assessment [40 marks – 20 marks class test + 15 marks individual/group presentation + 5 marks for active participation in the class]

1. ONLINE CLASS TEST (Multiple Choice) – [**20 marks**]

Any **One** of the above first two units

2. INDIVIDUAL/GROUP **-** Participation in lecture and seminar, webinar**/**Project work/ Written Test / Panel Discussion / Power Point Presentation/ Field Visit Report Writing/ Paper Presentation- [**20 marks**]

Semester End Exam Evaluation [60 marks]

1. There shall be four compulsory questions
2. The four questions shall correspond to the four units (with internal choice)
3. Each question shall carry a maximum of 15 marks

Q.1. Module I – a or b	**15**
Q.2. Module II – a or b	**15**
Q.3. Module III – a or b	**15**
Q.4. Module IV – a or b	**15**

OR

Q.1. Module I – a & b	**7 + 9 = 15**
Q.2. Module II – a or b	**15**
Q.3. Module III – a & b	**7 + 9 = 15**
Q.4. Module IV – a or b	**15**

Class	Semester	Course Code	Course Name	No. of hours	Credits	Marks
FYBA	II	SIUPHVS 121	VSC 2 - Critical Thinking	30	2	20+30=50

Learning Objectives:
- Familiarize with preconceived assumptions, illogical reasons, biases and change them to build effective thinking skill.
- Empower learners with knowledge of reasoning and arguments to make applicable decisions in work environments.

Learning Outcomes:
1. Distinguish between thinking, reasoning and cognition.
2. Understand the role of bias on critical thinking.
3. Apply and assess decision making based on facts, assumptions, arguments to arrive at practical solutions.

Module I: Thinking, Reasoning and Cognition [10 hours]
(a) What are the types of thinking?
(b) What is critical thinking?
(c) Importance of critical thinking

Module II: Cognitive Bias [10 hours]

(a) What is Cognitive Bias?
(b) How does it impact Critical Thinking?
(c) Strategies to overcome biases

Module III: Critical Thinking and Its application [10 hours]
- Case Studies and Story Telling
- Understanding the practical application of Critical Thinking
- Developing a powerful logic-based positive mindset
- Applying the tools and theories to improve Critical Thinking

Suggested References:
Dauer, Francis Watanabe. *Critical Thinking: An Introduction to Reasoning*, (Oxford University Press. 1989)
Dowden. Bradley H., *Logical Reasoning*. Philosophy. (Department, California State University Sacramento, CA 95819 USA. 2012)
Fisher, Alec and Scriven, Michael. *Critical Thinking: Its Definition and Assessment*, (Center for Research in Critical Thinking (UK) / Edgepress (US). 1997)
Moore, Brooke Noel and Parker, Richard. *Critical Thinking*. 10th ed. (Published by McGraw-Hill. 2012)
Paul, Richard. *Critical Thinking: How to Prepare Students for a Rapidly Changing World*. 4th ed. (Foundation for Critical Thinking. 1995)
Paul, Richard and Elder, Linda. *Critical Thinking Tools for Taking Charge of Your Learning and Your Life*, (New Jersey: Prentice Hall Publishing. 2006)
van den Brink-Budgen, Roy. *Critical Thinking for Students*, (How To Books Publisher. (4th Ed.). 2011)

Evaluation Pattern
These courses will follow the 'Do-Review-Learn-Apply' model

SEMESTER I: VSC 1- Professional Ethics
SEMESTER II: VSC 2- Critical Thinking

The following question paper pattern for FYBA titled Professional Ethics and Critical Thinking as Vocational Skill Course (Semester I & II) to be brought into effect from the academic year (2023-2024)

Internal Assessment [20 marks – 10 marks class test + 10 marks individual/group presentation, includes marks to be considered for active participation in the class]

Any **One** of the above first two units

1. ONLINE TEST (Multiple Choice) - **10 marks class test**

2. INDIVIDUAL/GROUP **-** Participation in Lectures and Seminars, Webinars/Project work/
Book review/ Symposium/ Written Test / Panel Discussion /
Power Point Presentation/ Field Visit Report Writing/
Paper Presentation - **10 marks**

Semester End Exam Evaluation [30 marks]
1. There shall be Three compulsory questions
2. Questions shall correspond to the three units (with internal choice)

Q.1. Module I – a or b	**10**
Q.2. Module II – a or b	**10**
Q.3. Write Short notes – any one from all 3 modules	**10**

College of Arts, Science & Commerce

R I S E   W I T H   E D U C A T I O N

SIES COLLEGE OF ARTS, SCIENCE AND COMMERCE
(Autonomous)

Affiliated to
UNIVERSITY OF MUMBAI

Syllabus for

SEM I & II

Program: F.Y. B.Sc.

Course: Physics

(Credit Based Semester and Grading System with effect from the academic year 2021–2022)

Syllabus for B.Sc. Physics(Theory&Practical)

As per credit based system

Program Specific Outcome

PSO1. **Understand the basic concepts of and the fundamentals of mechanics, properties of matter, current electricity and electrodynamics**

PSO2.Understand the basic of quantum mechanics, relativistic physics, nuclear physics, optics, Atomic Physics , solid state physics, statistical physics and thermodynamics, mathematical physics & biophysics

PSO3. Understand and apply the concepts of electronics in the designing of different analog & digital circuits and in instrumentation

PSO4. Understand the basics of computer programming, assembly language & numerical analysis

PSO5. Apply and verify theoretical concepts through laboratory experiments

PSO6. Applications of theoretical concepts

PSO7. To familiarize with current and recent scientific and technological developments

PSO8. To enrich knowledge through problem solving, hands on activities, study visits & projects

First Year B.Sc. 2021–2022.

The revised syllabus in Physics as per credit based system for the First Year BSc .Course will be implemented from the academic year 2021–2022.

Preamble:

The systematic and planned curricula from these courses shall motivate and encourage learners to understand basic concepts of Physics.

Course code	Title	Credits
	Semester I	
SIUSPHY11	**Mechanics & Properties of matter**	2
SIUSPHY12	**Electricity & Electronics**	2
SIUSPHYP1	**Practical I**	2
		Total = 06
	Semester II	
SIUSPHY21	**Optics, Modern Physics & Medical Physics**	2
SIUSPHY22	**Vector algebra, Electrostatics & Megnetostatics**	2
SIUSPHYP2	**Practical II**	2
		Total = 06

Scheme Of Examination:
(i) Theory:
   (A) **Internal Examination: 40 marks**

No.	Particulars	Marks
1.	One Class Test /online examination to be conducted in the given semester.	20
2.	Assignments/project/ viva based on the curriculum to be assessed by the teacher concerned and active participation.	20

   (B) **Semester End Examination: 60 marks**
   Each theory paper shall be of two hour duration. Each paper shall consist of FOUR questions. All questions are compulsory and will have internal option.

   Q – 1 is from Unit - I

   Q – 2 is from Unit - II

   Q – 3 is from Unit - III

   Q - 4 will consist of questions from all the THREE units with equal weightage of marks allotted to each unit.

There will not be any internal examination for practical. The SEMESTER END examination per practical course will be conducted as per the following scheme:

No	Particulars	Marks
1.	Laboratory Work	80
2.	Journal	10
3.	Viva	10
	TOTAL	100

A candidate will be allowed to appear for the practical examination only if the candidate submits a certified journal of FYBSc Physics or a certificate from the Head of the Department to the effect that the candidate has completed the practical course of F Y BSc Physics as per the minimum requirements.

SEMESTER-I

Paper -1

CourseCode	Title	Credits
SIUSPHY11	**Mechanics & Properties of matter**	2

Course Outcome:

CO1. Apply the basic concepts of Newtonian mechanics

CO2. Define central force and its characteristics, and study gravitational force from the point of view of central force

CO3. Apply basic ideas of pendulum to compound pendulum

CO4. Study superposition of harmonic oscillation with necessary derivations.

CO5. To Derive relation between elastic constants, torque per unit twist.
Study bending of beams with relevant derivations.

CO6. Derive equation of continuity, state and prove Bernoullie's theorem and derive Poiseullie's equation.

UNIT -I   Mechanics   **15 Lectures**

1. Newton's notion of space, Newton's laws of motion, Limitations of Newton's laws of motion, Components of velocity and acceleration in Cartesian Coordinate system, Newtonian principle of relativity

2. Central force, its characteristics; Newton's law of gravitation, Gravitational field, Gravitational potential, Gravitational field and Gravitational potential due to a spherical shell and solid sphere , Gravitational self energy of a body, Gravitational self energy of galaxy.

UNIT -II   Compound pendulum & superposition of oscillations   15 Lectures

1. S H M & Simple pendulum (review), Compound Pendulum: Expression for period, maximum and minimum time period, centres of suspension and oscillation, reversible compound pendulum. Bessel's formula, Kater's reversible pendulum,   compound pendulum and simple pendulum- a comparative study.

2. Superposition of Collinear Harmonic oscillations: (review)
   Superposition of two perpendicular Harmonic Oscillations: Graphical and Analytical Methods. Lissajous Figures with equal an unequal frequency and their uses.

UNIT -III   Elasticity & Fluid Mechanics   **15 Lectures**

1. Elastic constants, Relation between elastic constants, Twisting torque on a cylinder or wire, limiting values of Poisson's constant,   Bending of beams : Bending Moment, Cantilever and beam supported at two ends and loaded at the centre.

2. Kinematics of moving fluids, Equation of continuity, Bernoulli's theorem and its application, streamline and turbulent flow, Poiseuille's equation.

Note: A good number of numerical examples are expected to be covered during the prescribed lectures.

Reference:
   1. C.L Arora and Dr P.S. Hemne, Physics for degree students S.Chand Publications
   2. Hans and Puri, Mechanics, 2nd Ed. Tata McGraw Hill

   3. Halliday, Resnick and Walker, Fundamental of Physics (extended) – (6th Ed.), John Wiley and Sons.
   4. H. C. Verma, Concepts of Physics – (Part–I), 2002 Ed. Bharati Bhavan Publishers.

Additional References:

   1. Thornton and Marion, Classical Dynamics – (5th Ed)
   2. D S Mathur, Element of Properties of Matter, S Chand & Co.

Paper -2

Course Code	Title	Credits
SIUSPHY12	**Electricity & Electronics**	2

Course outcome:

CO1. Discuss and derive growth and decay of current in LR, CR and LCR circuit

CO2. Discuss the basic circuit laws and examine simple circuits using network theorems, application of maximum power theorem to dc circuits

CO3. Describe AC bridge concept with examples.

CO4. Understand working, sensitivity and damping of ballistic galvanometer

CO5. Categorize the digital and analog circuits. Convert from one number system to another. Understand logic gates with help of truth tables. Apply boolean laws to logic expression.

CO6. Investigate binary arithmetic with the help of logic circuits

CO7. Discuss the concept of rectification, able to calculate ripple factor and efficiency, understand voltage regulation.

UNIT I   DC circuits   15 Lectures

1. Transient response: LR growth and decay of current, CR charging and discharging, LCR growth and decay of current.

2. Ideal   Constant-voltage   and   Constant-current   Sources.   Potential   &   current divider rule

3. Network Theorems: Thevenin's theorem, Norton's theorem, Superposition theorem, Reciprocity theorem, Maximum Power Transfer theorem. Applications to dc circuits.

UNIT II: AC Circuits & B.G   15 lectures

1. AC Circuits: Kirchhoff's laws for AC circuits, Complex reactance and impedance, Series LCR Circuit: Resonance, Power dissipation, Quality Factor and Band width. Parallel LCR Circuit.

2. AC Bridges: General AC bridge, Maxwell inductance bridge and LC bridge, de-Sauty's bridge, Wien Bridge, Hay Bridge.

3. Ballistic Galvanometer: Torque on a current loop, Ballistic Galvanometer: Current and Charge Sensitivity, Electromagnetic damping. Logarithmic damping decrement.

UNIT III: Basic Electronics   15 lectures

1. Digital Circuits: Difference between Analog and Digital circuits. Binary numbers. Decimal to Binary and Binary to Decimal conversion. Hexadecimal numbers. NAND and NOR Gates as Universal Gates. XOR and XNOR Gates and application as Parity checker.

2. Boolean algebra: De Morgan's Theorems. Boolean Laws. Simplification of Logic Circuit using Boolean Algebra.

3. Arithmetic Circuits: Binary Addition, Binary Subtraction using 2's Complement. Half and Full Adders.

4. Full-wave Bridge rectifiers, Calculation of Ripple factor and Rectification efficiency, Capacitor-filter, Zener Diode and Voltage Regulation.

Note: A good number of numerical examples are expected to be covered during the prescribed lectures.

References:

1. D. Chattopadhyay, P C Rakshit , Electricity and Magnetism 7th Ed. New Central Book agency.
2. B.L. Theraja and A.K. Theraja , A Textbook of Electrical Technology Vol. I , S. Chand Publication
3. Boylestad and Nashelsky, Electronic devices and Circuit Theory: 7th edition, Prentice Hall of India.
4. V K Mehta and R Mehta Electronics Principals, Multicoloured Revised 11th Ed. reprint in 2012 ,S Chand.

Additional references:
1. A B Bhattacharya, Electronics Principlesand Applications, Central publisher.
2. A P Malvino, Digital Principles and Applications: Tata McGraw Hill
3. Tokhiem, Digital electronics, 4thed, McGraw Hill International Edition.

SEMESTER-I

Course Code	Title	Credits
SIUSPHYP1	**Practical I**	**2**

Course Outcome:
 CO 1: To demonstrate practical skills.
 CO 2: To understand and practice the skills while doing physics practicals.
 CO 3: Use of apparatus and their use without fear.
 CO 4: Correlate their physics theory concepts through practicals.
 CO 5: Concepts of errors and their estimation.

A. **Regular experiments:**

Paper -I

1. Y by vibrations: To determine Young's Modulus of a material by method of vibrations
2. Torsional Oscillation: To determine modulus of rigidity η of material of wire by torsional oscillations
3. Frequency of AC mains
4. To study Thermistor characteristic Resistance vs Temperature
5. To determine 'g' by Bar pendulum
6. Constant volume air thermometer
7. **Y and η** by Flat Spiral Spring

Paper - II

1. LR Circuit: To determine the value of given inductance and phase angle
2. Verification of Thevenin's Theorem.
3. CR Circuit: To determine value of given capacitor and Phase angle
4. LCR Series Resonance
5. NAND & NOR Gates As Universal Building Block
6. De Morgan's Theorems
7. Load regulation of a Bridge Rectifier
8 Zener Diode As Voltage Regulator
9 Verification of Maximum power transfer theorem

B. **Skill/Demo Experiments :**

1. Use of Vernier calipers, Micrometer Screw Gauge, Travelling Microscope
2. Graph Plotting : Exponential, Straight Line with intercept, Resonance Curve etc.
3. Use of DMM
4. Absolute and relative errors calculation.

Minimum 8 experiments from the list (**4 experiments each from Group A and Group B)** should be completed in the second semester. All four skill/demo experiments are to be reported in the journal.

The scheme of examination for the revised course in Physics at the First Year B.Sc. Semester end examination will be as follows.

Semester End Practical Examination:
There will be no internal assessment for practical.
The duration of the practical examination will be two hours per experiment. There will be two experiments through which the candidate will be examined in practical. The questions on slips for the same should be framed in such a way that candidate will be able to complete the task and should be evaluated for his/her skill and understanding of physics.

Paper -1

Course Code	Title	Credits
SIUSPHY21	**Optics, Modern Physics & Medical Physics**	**2**

Course Outcome :

CO1. Derive lens equation and study different types of magnification

CO 2. Derive equivalent focal length and hence study the construction of different types of

   eye -piece

CO 3. Examine different types of inherent defects in lens

CO 4. Describe the phenomenon of interference

CO 5. Outline the origin of quantum theory

CO 6. Describe the production of X-rays and X-ray spectra

CO 7. Outline basic biophysical terminology of human body

CO 8. To understand physics of human physiology

UNIT-I   Ray optics & Interference   15 Lectures

1. Lens Maker's Formula (Review), Newton's lens equation, magnification-lateral, longitudinal and angular.
2. Equivalent focal length of two thin lenses, thick lenses, cardinal points of a thick lens, Ramsden and Huygens eyepiece.
3. Aberration, Spherical Aberration, Reduction of Spherical Aberration, Chromatic aberration and condition for achromatic aberration.
4. Interference (Review), Interference in thin films, Fringes in Wedge shaped films, Newton's Rings (Reflective).

UNIT -II   Modern Physics   15 Lectures

1. Origin of Quantum theory, Black body (definition), Wien's displacement law, Matter waves, wave particle duality, Heisenberg's uncertainty principle. G.P Thomson experiment.
2. X-Ray production and properties. Continuous and characteristic X-Ray spectra, X-Ray Diffraction, Bragg's Law, Applications of X-Rays.
3. Compton Effect, Pair production, Photons and Gravity, Gravitational Red Shift.

UNIT-III   Bio-Mechanics   15 Lecture

1. Basic Anatomical Terminology: Standard anatomical position, planes. Familiarity with terms like-Superior, Inferior, Anterior, Posterior, Medial, Lateral, Proximal and Distal.
2. Mechanics of the body: Skeleton, forces, and body stability. Muscles and dynamics of body movement. Physics of locomotors systems: joints and movements, Stability and Equilibrium.
3. Energy house hold of the body: Energy balance in the body, Energy consumption of the body

Note: A good number of numerical examples are expected to be covered during the prescribed lectures.

Reference :
1. Optics By Brijlal & Subramanyum.
2. Concept of Modern Physics by Arthur Beiser.
3. Medical Physics, J.R. Cameron and J.G.Skofronick, Wiley (1978).
4. Physics of the human body, Irving P. Herman, Springer (2007).

SEMESTER-II

Paper -2

Course Code	Title	Credits
SIUSPHY22	**Vector algebra and Vector derivatives, Electrostatics & Magnetostatics**	**2**

Course Outcome :

CO1. To identify basic components of Vector Algebra.

CO2 . To explain types of vector products and their applications.

CO3. To explain del operator and to illustrate its different applications.

CO4. To explain del operator and to illustrate its different applications.

CO5. To explain Gauss's law and its applications to determine electric fields

CO6. To discuss and determine the electrostatic potential and PE in different systems.

CO7. To discuss and determine the magnetic field in different systems.

CO8. To study the curl and div of magnetic field in systems and compare with electric fields

UNIT-I   Vector Algebra and Vector Calculus (derivatives)   15 Lectures

1.   Review of Vector Algebra: Vectors, Scalars, Vector algebra, Laws of Vector algebra, Unit vector, Rectangular unit vectors, Components of a vector, Scalar fields, Vector fields.
2. Dot or Scalar product, Cross or Vector product, Commutative and Distributive Laws, Scalar Triple product, Vector Triple product (Omit proofs). Problems and applications based on Dot, Cross and Triple products.
3.   Gradient, divergence and curl: The ∇ operator, Definitions and physical significance of Gradient, Divergence and Curl; Distributive Laws for Gradient, Divergence and Curl (Omit proofs); Problems based on Gradient, Divergence and Curl.

UNIT-II   Electrostatics   15 Lectures

1. Review: Introduction, Coulomb's Law, The Electric Field, Continuous charge Distribution, Electric flux, Gauss' theorem and its applications, screening of electric field by a conductor. Electric field due to a dipole. Differential form of Gauss' law.

2. Electric field is conservative. Work done in electric field is path independent. Electric potential and potential difference. Electric potential due to a point charge, electric potential due to continuous charge distribution, electric field as potential gradient, electrostatic energy stored in a medium, method of images (plane surface)

UNIT-III   Magnetostatics   15 Lectures

1. Biot Savart's law, Applications of Biot Savart's law – Magnetic field on the axis of a circular coil. Helmholtz coil. Biot Savart's law and Coulomb's law (Compare and contrast).
2. Ampere's law, its application to determine B inside a solenoid and toroid and due to a straight current carrying conductor .
3. Current density, **div B** = 0. Differential form of Ampere's law, Significance of **div B** and **curl B.** Comparison between electric field and magnetic field.

Note: A good number of numerical examples are expected to be covered during the prescribed lectures.

 Reference:

1. Schaum's outline of Theory and problems of Vector Analysis: Murray R Spiegel, Asian Student Edition
2. Physics for degree students C.L Arora and Dr P.S. Hemne, S.Chand publication.
3. Electricity and Magnetism : D. Chattopadhyay, P C Rakshit ,   7th Ed. New Central Book agency.
4. Introduction to Electrodynamics: A. Z. Capria and P. V. Panat. Narosa Publishing House.
5. Introduction to Electrodynamics: David J. Griffiths (3rd Ed) Prentice Hall of India.
6. Electricity and Magnetism: NavinaWadhwani (PHI – 2010).

Course Code	Title	Credits
SIUSPHYP2	**Practical II**	2

Course Outcome:

CO 1. To understand and practice the skills while doing physics practical.
CO 2. To understand the use of apparatus and their use without fear.
CO 3. To correlate their physics theory concepts through practical.
CO 4. Understand the concepts of errors and their estimation.

A. Regular experiments:

Paper - I

1. Spectrometer: Determination of Angle of Prism

2. Spectrometer : R. I. prism

3. Combination of Lenses

4. Newton's Ring Experiment: Determination of radius of curvature of lens

5. Wedge Shaped Film

6. Newton's Ring Experiment: Determination of Refractive Index of liquid (Newton's ring)

Paper-II

1. Characteristics of LDR

2. Maxwell's L- bridge

3. Computer based experiment: Graph plotting using excel

4. Computer based experiment: Data analysis

5. Planck's constant using LED

6. Determination of B of a solenoid and its variation with distance

7   Charging and discharging of Capacitor

8   Correction of Myopia (short sightedness) using a combination of lenses on an optical bench/breadboard.

B. **Skill/Demo Experiments (Any Four):**

1. Laser Beam Divergence.

2. Spectrometer: Optical levelling.

3. Understanding the working of a manual mercury Blood Pressure monitor and measure the Blood Pressure.

4. Use of CRO and Lissajous figures

5. Phase shift measurement of AC circuit

6. Moving coil Galvanometer

Minimum 8 experiments from the list (**4 experiments each from Group A and Group B)** should be completed in the second semester. Any four skill/demo experiments are to be reported in the journal.

The scheme of examination for the revised course in Physics at the First Year B.Sc. Semester end examination will be as follows.

Semester End Practical Examination:

There will be no internal assessment for practical.

The duration of the practical examination will be two hours per experiment. There will be two experiments through which the candidate will be examined in practical. The questions on slips for the same should be framed in such a way that candidate will be able to complete the task and should be evaluated for his/her skill and understanding of physics.

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AC /27.06.2023 / RS(1)

College of Arts,
Science &
Commerce (Autonomous)

SIES

RISE WITH EDUCATION

NAAC REACCREDITED - 'A' GRADE

SIES COLLEGE OF ARTS, SCIENCE ANDCOMMERCE

(Autonomous)

Affiliated to

UNIVERSITY OF MUMBAI

Syllabus for SEM I

Program Name: BA & BCOM

Class: FYBA & FYBCOM

Course: Open Elective 1 - Logical Reasoning and Mental Ability

Offered By: Department of Physics

(Choice Based Credit System (CBSC) with effect from the academic year 2023–2024 under NEP)

SEMESTER-I

<u>Open Elective – I</u>

Course Overview:

The Basic Astronomy course provides a fundamental understanding of the principles and concepts of astronomy, exploring the wonders of the universe and our place within it. This course covers a wide range of topics, including celestial objects, the solar system, stars and galaxies, the history of astronomy, expansion of the universe and recent astronomical discoveries. Through lectures, discussions, and practical exercises, students will develop observational skills and gain insights into the scientific methods used in astronomy. Reference materials from reputable sources will be utilized to enhance the learning experience.

Scheme of examination:

(i) Tutorials: Internal (Continuous evaluation): 50 marks

Sr. No.	Particulars	Marks
1.	6 of 8 tutorial assignment/ based on the curriculum to be assessed by the teacher concerned and active participation in routine class instructional deliveries.	30
2.	One Class Test to be conducted in the given semester.	20

(ii) Theory: Semester End Examination: 50 marks

Each theory paper shall be of two hour duration. Each unit will have 25 marks weightage. All questions are compulsory and will have internal options.

A candidate will be allowed to appear for the examination only if the candidate attends at least 75% of lectures and tutorials and submits at least 6 tutorials.

Open Elective Course – 1

Course Code	Title	Credits
SIUPYOE111	**Logical Reasoning and Mental ability**	4

Course outcome:

CO1. Understand logical reasoning using Venn diagram, symbolism and pattern

CO2. Understand the concept of arithmetic and logical deduction reasoning.

CO3. Understand the concept of data interpretation

UNIT I: Data interpretation skill and reasoning   15 hours

1. Venn diagram, Blood relation, Symbolism, Pattern, Seating arrangement, odd man out and series.

2. Data interpretation – Percentage, Pie, line chart etc…

UNIT II: Mental ability and Arithmetic skills   15 hours

1. Average, Problem of ages, Profit and loss, Simple interest, Compound interest, Ratio and proportion, Partnership.

2. Time, work and distance, Problems on train, Probability, Logical deduction.

Note: A good number of numerical examples are expected to be covered during the prescribed lectures.

References:
1. R.S. Aggarwal, A Modern Approach to Verbal & Non-Verbal Reasoning, S. Chand publications
2. R.S. Aggarwal, Quantitative Aptitude, S. Chand publications

Additional references:
1. Trishna Knowledge Systems, Data interpretation and logical reasoning for CAT, Pearson
2. Sinha & Nishit, Data Interpretation and Logical Reasoning
3. Vijay, S. Quantitative Aptitude: For Officers / Office Assistant Exams in IBPS, SBI, RBI, LIC, GICs....

4. Sharma, Arun,How to prepare for Quantitative Aptitude for the CAT: 5th ed

Tutorial based on paper **Logical Reasoning and Mental ability (SIUPYOE111) (2 credits / 30hrs)**

1. Venn diagram
2. Deciphering jumbled up description and relation puzzles
3. number series, alpha numeric series, pattern series
4. symbolism and pattern
5. data interpretation using pie and line chart
6. Finding percentage, simple and compound interest
7. Averages, profit and loss
8. Time work and distance
9. logical deduction
10. Probability

AC / 27.06.2023 / RS (1)

College of Arts,
Science &
Commerce (Autonomous)

RISE WITH EDUCATION

NAAC REACCREDITED - 'A' GRADE

SIES COLLEGE OF ARTS, SCIENCE AND COMMERCE

(Autonomous)

Affiliated to

UNIVERSITY OF MUMBAI

Syllabus for SEM II

Program Name: BA & BCOM

Class: FYBA & FYBCOM

Course: Open Elective 2 - Basic Astronomy

Offered By: Department of Physics

(Choice Based Credit System (CBSC) with effect from the academic year 2023–2024 under NEP)

SEMESTER-II

<u>Open Elective - II</u>

Course Overview:

The Basic Astronomy course provides a fundamental understanding of the principles and concepts of astronomy, exploring the wonders of the universe and our place within it. This course covers a wide range of topics, including celestial objects, the solar system, stars and galaxies, the history of astronomy, expansion of the universe and recent astronomical discoveries. Through lectures, discussions, and practical exercises, students will develop observational skills and gain insights into the scientific methods used in astronomy. Reference materials from reputable sources will be utilized to enhance the learning experience.

Scheme of examination:

(i) Tutorials: Internal (Continuous evaluation): 50 marks

Sr. No.	Particulars	Marks
1.	6 of 8 tutorial assignment/ based on the curriculum to be assessed by the teacher concerned and active participation in routine class instructional deliveries.	30
2.	One Class Test to be conducted in the given semester.	20

(ii) Theory: Semester End Examination: 50 marks

Each theory paper shall be of two hour duration. Each unit will have 25 marks weightage. All questions are compulsory and will have internal options.

A candidate will be allowed to appear for the examination only if the candidate attends at least 75% of lectures and tutorials and submits at least 6 tutorials.

Open Elective Course – II

Course Code	Title	Credits
SIUPYOE121	**Basic Astronomy**	4

Course outcome:
CO1. Introduce participants to the fundamental concepts and principles of astronomy.
CO2. Familiarize participants with the night sky and teach them how to observe celestial objects.
CO3. Provide an understanding of our solar system, including the planets, moons, and other objects.
CO4. Explore the life cycle of stars, galaxies, and the universe as a whole.
CO5. Develop practical skills in stargazing and using telescopes.
CO6. Encourage curiosity and a deeper appreciation for the wonders of the cosmos.

Unit I

1. Brief history of astronomy and its significance, Introduction to the scientific method in astronomy, Discussion on the scale of the universe and celestial objects. Distance measurement.
2. Observing the sky: Basics of naked-eye observations (Day and night sky), True and apparent Magnitude. Understanding constellations, stars, and planets (How do we know the earth is spinning?), Size of the earth, Introduction to sky maps and star charts (Coordinates of heaven), Tips for stargazing and observing celestial events.
3. The moon and its phases: Exploration of Earth's natural satellite, the Moon, Understanding lunar phases, tides and eclipses, Notable lunar features and missions

Unit II

1. The Solar System: Structure and formation of the Solar System, Exploration of planets, moons, and other objects, Discussion on the Sun, asteroids, comets, and meteoroids, Overview of the planets in our Solar System, Characteristics, atmospheres, and notable features of each planet,
2. Stars and stellar evolution: Characteristics of stars and their classification, binary stars, The life cycle of stars and stellar evolution, Stellar phenomena such as supernovae and black holes.
3. Milky way and other galaxies: Overview of the Milky Way galaxy,   Types   and properties of galaxies, Introduction to cosmology and the study of the universe, The Big Bang theory and the origin of the universe, Expansion of the universe and Hubble's Law, Dark matter and dark energy
4. Introduction to telescope: Types of telescopes and their functions, Understanding telescope components and terminology, Tips for choosing and using a telescope

References:

1.   "Astronomy: A Beginner's Guide to the Universe" by Eric Chaisson and Steve McMillan.
2.   "The Backyard Astronomer's Guide" by Terence Dickinson and Alan Dyer.
3.   "NightWatch: A Practical Guide to Viewing the Universe" by Terence Dickinson.
4.   "Astronomy Beginner's guide" by William H. Waller
5.   "Astronomy Demystified" By Stan Gibilisco

Tutorial/workshop/experiment/(problem solving sessions) based on Basic Astronomy (2 credits / 30hrs)

1. Use of homemade sextant for measuring the height of a structure, angles of the star. Estimation of latitude and time and tilt of earth using elevation of pole star. (multiple experiments)

2. Measurement of distance using various methods.

3. Plotting graph of various properties of planets with distance. (multiple experiments)

4. Tracking the star to measure the rate of rotation of the earth.

5. Study the globe.

6. Measurement of time using the position of the star.

7. Measuring the temperature of a light source from the intensity and known distance. (using Stefan's law/Wein's displacement law)

8. Experiment (demonstration) on tidal forces.

9. Experiment (demonstration) on doppler effect

10. Experiment (demonstration) on lens system.

11. Understanding Foucault Pendulum.

12. Mapping intensity distribution in a room using an LDR or the variation of intensity throughout a day.

13. To learn how to use a sky map, learn to locate constellations, stars and planets at any time of year.

14. Scaling the positions of the planets, place the sun at the centre of the paper, and use the concentric circles as the orbits.

 Demonstrations including Audio visual demonstration can be carried out, followed by a problem-solving session. Minimum 6 tutorials from the above list should be submitted in a semester.
Report on one industrial visit/star gazing session being equivalent to 2 tutorials sessions.

Faculty: Arts Programme: B.A.

Course: Vocational Skill Course (VSC)

Academic Year: 2023-2024

FYBA

Choice Based Credit System and

Learning Outcome Based System under

NEP 2020

Syllabus approved

by Board of Studies in Politics to be

brought in effect from June 2023

Name of Program: Bachelor of Arts			Name of Department: Politics			
Class	Semester	Course Code	Course Name	No. of lectures/ per week	Credits	Marks
FYBA	I	SIUPOVS111	Legal Awareness	2 per week	2	50

Course Outcomes:

CO1: Understand the development of Constitutional Law and the role of Judiciary.

CO2: Analyse the evolution of constitutional rights and freedoms through certain contemporary legislations and laws.

CO3: Develop awareness about various forms of legal aids, institutions and instruments.

Module 1: Understanding Law and its functions

1.1 Understanding the relationship between state, citizens and laws

1.2 Environmental Laws with reference to Environment Protection Act, 1986

1.3 Cyber Laws with reference to Information Technology Act, 2000

Module 2: Laws for access to justice

2.1 Right to Information (RTI)

2.2 Public Interest Litigation (PIL)

Practical sessions/application

Practical sessions on drafting of legal documents based on the following:

- Civil and Criminal Court documents

  Plaints, Written Statements, Interlocutory Application, Private Complaint.

- Petitions

  Drafting of Public Interest Litigation (PIL), writ petition, Petition Under Right to Information Act.

Assignments

Assignments would be based on prominent case studies and the application of Environmental laws and cyber laws with respect to access points provided by Right to Information (RTI) and Public Interest Litigation (PIL).

Reference documents

- Supreme Court of India, Compilation of Guidelines to be followed for entertaining petitions received as Public Interest Litigation: https://main.sci.gov.in/pdf/Guidelines/pilguidelines.pdf
- Note on Preparing a PIL petition:https://egyankosh.ac.in/bitstream/123456789/39100/1/Unit-4.pdf
- Information Handbook on Right to Information Act, 2005.
- Filing RTI offline https://www.cvc.gov.in/sites/default/files/rti.pdf
- Filing RTI online https://services.india.gov.in/service/detail/file-your-rti-application-online

Suggested Readings:

- Basu, Durga.Das, *Introduction to the Indian Constitution*, Lexis Nexis, 2015.
- Divan, Shyam, and Armin Rosencranz. *Environmental Law and Policy in India: Cases and Materials*. Oxford University Press, 2022.
- Duggal, Pavan. "Textbook on Cyber Law." *Universal Law Publication an imprint of Lexis Nexis,* 2016.
- Ghosh, Shibani, ed. *Indian environmental law: Key concepts and principles*. Orient Blackswan, 2019.
- Leelakrishnan, P. Environmental Law in India. Lexis Nexus Buttersworth India. 2016.
- Mann, Jeet Singh. *Comparative Legal Aid Systems and India*. Taylor & Francis, 2022.
- Sankaran, Kamala and Ujjawal Singh (Ed.), *Creating Legal Awareness*, (Delhi: OUP, 2007).
- South Asia Human Rights Documentation Centre. *Human Rights and Humanitarian Law: Developments in Indian and International Law*. Oxford University Press, 2008.
- Ujjwal Kumar Singh (ed.,) *Towards Legal Literacy: An Introduction to Law in India*, Oxford University Press, 2015.
- Wadehra, Basant Lal. *Public Interest Litigation: A Handbook, with Model PIL Formats*. Universal Law Publishing, 2009.

Name of Program: Bachelor of Arts			Name of Department: Politics		Program code:	
Class	Semester	Course Code	Course Name	No. Of lectures/ per week	Credits	Marks
FYBA	II	VSC II	Urban Local Governance	2	2	50

Course Objectives:

CO1: Understand the working and classification of urban local government.

CO2: Identify the roles and responsibilities of urban local government officials.

CO3: Evaluate the management of urban local government services.

CO4: Analyze citizen participation in urban local government.

Module 1: Introduction to Urban Local Government

1.1 Definition & Types of Urban Local Government

1.2 Urban local bodies (Urban Corporation, Municipal Council and Municipal Committees)

1.3 Financial and Human Resource Management

Module 2: Recent Trends in Urban Governance

2.1 Civil Society Participation

2.2 Urban Development and Renewal Policies (Smart Cities Mission and Atal Mission for Rejuvenation and Urban Transformation [AMRUT])

2.3 Urban Transport, Health & Sanitation, Education, and Housing

Suggested Readings:

- Aijaz, Rumi, and Kristian Hoelscher. "India's smart cities mission: an assessment." *ORF Issue Brief* 124.1 (2015): 1-12.

- Ahluwalia, Isher Judge. "Urban governance in India." *Journal of Urban Affairs* 41.1 (2019): 83-102.

- Anand, Ashwathy, Ajai Sreevatsan, and Persis Taraporevala. "An overview of the smart cities mission in India." *Centre for Policy Research, New Delhi* (2018): 1-17.

- Banerjee-Guha, Swapna, ed. *Accumulation by dispossession: Transformative cities in the new global order*. SAGE Publications India, 2010.

- Brooks Christopher, *Rethinking the City*, The Organisation of Economic Cooperation and Development Observer, No. 178 Paris: Organisation for Economic Cooperation and Development 1992.

- C. Nagaraja Rao, *Urban Governance in India*, Gyan Books, 2016.

- I.S.A Baud & J. De. Wit, *New Forms of Urban Governance in India*, Sage:2009.

- Kumar, Nallapaneni Manoj, Sonali Goel, and Pradeep Kumar Mallick. Smart cities in India: Features, policies, current status, and challenges. *2018 Technologies for Smart-City Energy Security and Power (ICSESP)* (2018): 1-4.

Assessment and Evaluation Criteria

VSC I & II- 50 marks

- Test- 20 marks
- Project – 30 marks

AC/27.06.2023/RS1

College of Arts,
Science &
Commerce (Autonomous)

SIES

RISE WITH EDUCATION

NAAC REACCREDITED - 'A' GRADE

SIES College of Arts, Science and Commerce
(Autonomous)
Affiliated to University of Mumbai

Syllabus revised in June 2023

Program: T.Y. B.Sc.
Course: APPLIED COMPONENT

Computer Programming and Applications

Choice Based Credit System (CBCS)
with effect from the academic year 2023-24

CONTENTS

1. Preamble
2. Learning Objectives
3. Course structure with minimum credits and Lectures/ Week
4. Consolidated Syllabus for semester V & VI with Course Outcomes
5. Scheme of Evaluation

1. Preamble

This undergraduate course is designed to provide students specializing in mathematics and statistics with a strong foundation in programming using Java, Python, SQL, and PL-SQL. The course aims to equip students with the essential programming skills necessary to effectively analyse and manipulate data, develop algorithms, and implement computational solutions in their field of study. Through a combination of theoretical concepts, hands-on programming exercises, and real-world applications, students will develop a solid understanding of programming principles and gain practical experience in utilising programming languages for mathematical and statistical analysis.

2. Learning Objectives:

➔ Understand programming fundamentals
➔ Apply SQL for database management
➔ Utilise PL-SQL for advanced data processing
➔ Integrate programming for mathematical and statistical applications
➔ Develop problem-solving skills
➔ Collaborate and communicate effectively

3. Course structure with credits and Lectures/Week

SEMESTER V				
THEORY				
Course Code	UNIT	TOPICS	Credits	L or P/Week
SIUSCPA51	I	**Introduction to Java Programming**	2	4L
	II	**Inheritance, Exception Handling**		
	III	**Relational Database Management System**		
	IV	**Introduction to PL/SQL**		
PRACTICALS				
SIUSCPAP5	Practicals based on **SIUSCPA51**		2	2P (1P=2L) per batch*
***Number of students per batch for the regular practical should not exceed 20.**				

SEMESTER VI				
THEORY				
Course Code	UNIT	TOPICS	Credits	L or P /Week
SIUSCPA61	I	**Introduction to Python 3x**	2	4L
	II	**Loops and functions**		
	III	**NumPy, SymPy, SciPy**		
	IV	**Pandas and Matplotlib**		
PRACTICALS				
SIUSCPAP6	Practicals based on **SIUSCPA61**		2	2P (1P=2L) per batch
***Number of students per batch for the regular practical should not exceed 20.**				

4. Consolidated Syllabus for semesters V & VI with Course Outcomes

Semester V

Course: Computer Programming and Applications
Course Code: SIUSCPA51

Course Outcomes:
On successful completion of this course students should be able to:
- Write programs in java with and without instance variables and methods
- Understand the concept of arrays, constructors and Overloading methods
- Understand error handling using exceptions and inheritance by creating suitable classes
- Create database tables with and without constraints
- Update and alter table structures
- Retrieve data from single or multiple tables
- Process data with date, string and aggregate functions
- Write simple PL/SQL block codes with and without loops.

Unit 1	**Introduction to Java Programming (15 L)**
	A. **Object-Oriented approach**: Features of object-orientations, Abstraction, Inheritance, Encapsulation and Polymorphism. B. **Introduction**: History of Java, Java features, Differentiate Java with other conventional languages. Java Virtual Machine. C. **Java Basics**: Variables and data types, declaring variables, literals: numeric, Boolean, character and string literals, keywords, type conversion and casting. Standard default values. Java Operators, Loops and Controls D. **Classes**: Defining a class, creating instance and class members: creating object of a class; accessing instance variables of a class; creating method; naming method of a class; accessing method of a class; overloading method; 'this' keyword, constructor and Finalizer: Basic Constructor; parameterized constructor; calling another constructor; finalize () method; overloading constructor. E. **Arrays:** one and two-dimensional array, declaring array variables, creating array objects, accessing array elements.
Unit II	**Inheritance, Exception Handling (15 L)**
	A. **Access control**: public access, friendly access, protected access, private access. B. **Inheritance**: Various types of inheritance, super and subclasses, keywords-extends'; 'super', overriding method, final and abstract class: final variables and methods; final classes, abstract methods and classes. Concept of interface.

	C. **Exception Handling and Packages:** Need for Exception Handling, Exception Handling techniques: try and catch; multiple catch statements; finally block; usage of throw and throws. Concept of packages. Inter class method: parseInt().
Unit III	**Relational Database Management System (15L)**
	A. **Introduction to Database Concepts**, Database systems vs file systems, view of data, data models, data abstraction, data in-dependence, three level architecture, database design, database languages - data definition language(DDL), data manipulation language(DML). B. **E - R Model**, Basic concepts, keys, E-R diagram, design of E-R diagram schema (simple example). Relational structure C. **Tables** (relations), rows (tuples), domains, attributes, candidate keys, primary key, entity integrity constraints, referential integrity constraints, query languages. D. **SQL Commands and Functions**, Handling data, selecting data using SELECT statement. FROM clause, WHERE clause, HAVING clause, ORDER BY, GROUP BY, DISTINCT and ALL predicates. Adding data with INSERT statement. Changing data with UPDATE statement. Removing data with DELETE statement. Joining Tables, Inner joins, outer joins, cross joins, union. Functions E. **Aggregate functions:** -- AVG, SUM, MIN, MAX and COUNT. Date functions - ADD_MONTHS (), CURRENT_DATE (), LAST_DAY (),MONTHS_BETWEEN (), NEXT_DAY (). String functions - LOWER (), UPPER (), TRIM (), RTRIM (), INSTR (), PATINDEX (), REPLICATE (), SUBSTR (), REVERSE (), RIGHT (), LEFT (). Numeric functions:-ABS(),EXP(),LOG(),SQRT(),POWER(),ROUND(). F. **Creating and altering tables**:-CREATE statement, ALTER statement, and DROP statement. G. **Constraints:-** Types of constraints, KEY constraints, CHECK constraints, DEFAULT constraints, disabling constraints.Indexes,Understanding indexes, creating and dropping indexes, maintaining indexes.
Unit IV	**Introduction to PL/SQL (15L)**
	A. **Fundamentals of PL/SQL**: Defining variables and constants, PL/SQL expressions and comparisons: Logical Operators, Boolean Expressions, CASE Expressions Handling, Null Values in Comparisons and Conditional Statements. B. **PL/SQL Data types**: Number Types, Character Types, Boolean Type. Datetime and Interval Types. C. **Overview of PL/SQL Control Structures**: Conditional Control: IF and CASE Statements, IF-THEN Statement, IF-THEN-ELSE Statement, IF-THEN-ELSIF Statement, CASE Statement. D. **Iterative Control**: LOOP and EXIT Statements, WHILE-LOOP, FOR-LOOP, Sequential Control: GOTO and NULL Statements.

Coure: CPA Practicals
Course Code: SIUSCPAP5

No.	Topics for Practical
0	Java programs that illustrate the concept of selection statements, loops, nested loops, breaking out of loop.
1	Java programs that illustrate the concept of arrays (one and two dimensional).
2	Programs to create a Java class (i) with instance variables and methods (ii) with instance variables and without methods (iii) without instance variables and with methods Create an object of this class that will invoke the instance variables and methods accordingly.
3	Programs to illustrate the concept of Java class that includes constructor with and without parameters.
4	Programs to illustrate the concept of Java class that includes overloading methods and inheritance.
5	Creating, altering and updating a single table with/ without constraints and executing queries.
6	Joining tables and processing queries. Queries containing aggregate, string and date functions fired on a single table.
7	Writing PL/SQL Blocks with basic programming constructs
8	Writing PL/SQL blocks with control structures

References:
(a) E. Balagurusamy(2009), *Programming with Java: A Primer 4th Edition* by Tata McGraw Hill.
(b)Herbert Schildt,(2013)*Java The Complete Reference, 8th Edition*, Tata McGraw Hill
(c)George Koch and Kevin Loney(2002),*ORACLE ―The Complete Reference‖*, Tata McGraw Hill,New Delhi.
(d)Ivan Bayross, (2012) ―*SQL, PL/SQL -The Programming language of Oracle‖*, B.P.B.Publications, 3rd Revised Edition.
(e) Ramakrishnam, Gehrke, (2003) *Database Management Systems*, McGraw-Hill.

Semester VI

Course: Computer Programming and Applications
Course Code: SIUSCPA61

Course Outcomes:

On successful completion of this course students should be able to:

- Write python programs using different constructs and data type
- Master the fundamentals of writing Python scripts
- Learn core Python scripting elements such as variables and flow control structures
- Integrate Mathematical and Statistical concepts in python programs

Unit I	PYTHON 3.x (15 L)
	A. **Introduction:** The Python Programming Language, History, features, Installing Python. Running code in the Interactive Shell, IDLE. Input, Processing and Output, Editing, Saving and Running a Script, Debugging: Syntax Errors, Runtime Errors, Semantic Errors. Experimental Debugging. B. **Data types and expressions**: Variables and the assignment statement, Program Comments and Docstrings, Data types:- Numeric integers and Floating point numbers, Boolean, string. Mathematical operators +,-,*,**,%.PEMDAS. Arithmetic expressions, Mixed-Mode Arithmetic and type Conversion, type(),input(),print(),program comments.id(),int(),str(),float(). C. **Strings,Lists,Tuple,Dictionary** : Assessing characters, indexing, slicing, replacing. Concatenation (+), Repetition (*).Searching a substring with the 'in' operator, Traversing string using while and for. String methods:- find, join,split,lower, upper, len() D. Math module:sin(),cos(),exp(),sqrt(),constants-pi,e.
Unit II	**Loops and functions**
	A. **Loops and selection statements**:- If statements, while construct, for statements, the range function, break, continue, else clause B. **Design with Functions:** Defining Simple Functions-parameters and arguments, the return statement,tuple as return value.Boolean functions.Defining a main function.Defining and tracing recursive functions C. **Exception Handling:**Try-except. Calculating the factors of an Integer,Generating Multiplication tables,converting units of measurement,finding the roots of a quadratic equation.
Unit III	**NumPy, SymPy, SciPy**
	A. **Numpy arrays:** Creating arrays creating n-dimensional arrays using np.array and array operations (indexing and slicing, transpose, mathematical operations)

		B. **Algebra and Symbolic Math with SymPy**: Symbolic math using the SymPy library.Defining Symbols and Symbolic operations,factoring and expanding expressions,substituting in values,converting strings to mathematical expressions.Solving equations,solving quadratic equations,solving for one variable in terms of others,solving a system of linear equations,plotting using SymPy,Plotting expressions input by the user,plotting multiple functions. C. **SciPy:**constants, optimizers,sparse data, graphs,spatial data,matlab arrays.
Unit IV	**Pandas and Matplotlib**	
		A. **Pandas dataframes:** Creating series and dataframes and Operations on series and dataframes. Reading and writing data: From and to Excel and CSV files, Text data operations: len, upper, lower, slice, replace, contains, Frequency Tables B. **Plotting:** using "matplotlib" (Histograms, Box plots, Scatter plot, Bar plot, Line plot), Descriptive Statistics: mean, median, mode, min, max, quantile, standard deviation, variance, skewness, kurtosis, correlation.

Coure: CPA Practicals
Course Code: SIUSCPAP5

No.	Topics for Practical
1	Basic Python programs based on data types and expressions
2	Python programs using strings, lists, tuples, dictionary, math modules
3	Python programs using loops and functions
4	Exception Handling
5	NumPy, SymPy
6	SciPy
7	Pandas
8	Matplotlib

References:

(a) E. Balagurusamy(2017), Introduction to computing and *Problem Solving using Python* by Tata McGraw Hill.

(b) Herbert Schildt,(2013)*Java The Complete Reference, 8th Edition*, Tata McGraw Hill

(c) Ivan Bayross,(2006),*Web Enabled Commercial Applications Development Using Java 2,*BPB Publications, Revised Edition

(d) Kenneth A Lambert chapters 1,2 and 3,4,5 .(2018)*Fundamentals of Python First Programs 2nd edition*

(e) Doing Math with Python by Amit Saha(internet source) chapter 1,4

(f) **Software: http://continuum.io/downloads.Anaconda 3.x**

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5. Scheme of Evaluation

Internal Assessment of Theory Course of each semester
(Total 40 marks)

(a) One Assignment/Project ..... 10 Marks.

(b) One Class Test: ……20 Marks.

(c) Active participation in class and attendance . ..…10 Marks.

Semester End Theory Examination (Total 60 marks)

Theory: At the end of the semester, examinations of two and half hours duration and60 marks based on the four units shall be held for each theory course.

Pattern of Theory question paper at the end of the semester for each course: There shall be Four compulsory Questions of 15 marks each with an internal option. Question1 based on Unit I, Question 2 based on Unit II, Question 3 based on Unit III and Question 4 based on Unit IV

Semester End Practical Examination (Total 100 marks)

Semester V and Semester VI: Total evaluation is as follows:-

1) Semester end Practical exam on computer- 80 marks
2) Viva 10 marks
3) Certified Journal 10 marks

Pattern of Practical Examination:-

1. There shall be four compulsory questions of twenty marks each for the semester end practical examination on computer.
2. The questions to be asked in the practical examination shall be from the list of practical experiments mentioned in the practical topics. A few simple modifications may be expected during the examination.
3. The semester end practical examination on the machine will be of THREE hours.
4. Students should carry a certified journal with a minimum of 06 practicals (mentioned in the practical topics) at the time of examination.
5. **Number of students per batch for the regular practical should not exceed 20. Not more than two students are allowed to do practical experiments on one computer at a time.**

College of Arts, Science & Commerce (Autonomous)

SIES

RISE WITH EDUCATION

NAAC REACCREDITED - 'A' GRADE

(*Affiliated to University of Mumbai*)

Faculty: Science

Program: F.Y.B.Sc

Subject: ZOOLOGY

Academic Year: 2023 – 2024

**Revised Syllabus in Zoology under
Choice Based Credit System (CBCS)
Approved by the Board of Studies in Zoology
Effective from academic year 2023-24 under the aegis of
National Education Policy (NEP)**

Preamble
"Where the mind is without fear and the head is held high ...."
— *A poem written by Nobel Laureate Rabindranath Tagore (Nobel Prize in Literature in 1913), the poem represents Tagore's vision of a new and awakened India (it is quoted in this preamble in the context of India's National Education Policy – New Education Policy).*

The implementation of India's National Education Policy 2020 (NEP) in this academic year, has significant relevance, especially in the context of our institution, since, this year, our institution has been bestowed with 'Empowered Autonomous Status'. Universal high-quality education is fundamental for achieving full human potential, besides developing an equitable and just society, and promoting national development. It is the best way forward for developing and maximizing our country's rich talents and resources which eventually will determine the future of our country. Although, under the aegis of academic autonomy, our institution has the privilege of 'academic freedom', however, we are also aware of the fact that 'freedom' comes with 'responsibility' and moreover, it needs to be justified with 'academic excellence'. Therefore, one of the ways to achieve this, is through restructuring and refining the curriculum, which is pivotal in shaping the educational outcomes of an academic institution. Thus, a modest attempt has been made to design an effective syllabus that will preserve the essence of the subject, besides inculcating critical thinking and developing analytical reasoning amongst the students.

At the undergraduate level this syllabus will enable students to have a sound foundation of the Major subject - Zoology, besides encouraging an interdisciplinary approach by integration and inclusion of a few courses under Vocational Skill Course (VSC), Skill Enhancement Course (SEC), Generic/Open Electives (GE/OE), a course related to Indian Knowledge System (IKS), Ability Enhancement Course (AEC), Value Education Course (VEC), and Co-Curricular Courses (CC). Some of the key features of this revised syllabus are as follows:-

✓ *Mandatory/Core Course* – A course which is aimed at understanding the fundamental concepts of Zoology by inclusion of topics such as Life Processes - vital processes that make life possible through an understanding of the adaptations animals have evolved that best suit the milieu in which they thrive; Ecology - to understand the relation between organisms and their environment through the study of "life at home"; Biodiversity - which will sensitize students about the bio wealth nature has bestowed on humans, and to treat the natural resources with humane and responsible attitude in this era of global warming Animal Biotechnology - so as to acknowledge the emerging field of Biotechnology that blends the technological advancements and the natural wealth – the living organisms, for improving human life.

✓ *Vocation Skill Course* – A course, which is aimed at providing hands-on training, competencies, proficiency to students to enhance their skills & employability. For example: Bioinstrumentation – to give students a hands-on experience of instrumentation used in laboratory facility which will enable them to operate instruments independently.

✓ *Skill Enhancement Course* – A course, which is aimed at imparting practical skills, nurturing soft skills etc., to enhance the employability of students. For example: Animal Systematics – to introduce the students to the diversity of animal life to understand that part of the world around us comprising of various life forms, besides gaining an insight into field biology which will enable them to be equipped with the skills of understanding taxonomy of animal kingdom.

✓ *Generic or Open Elective* – An elective course generally chosen from an unrelated subject / discipline with the intention to seek multidisciplinary exposure. For example, any one of the following elective courses such as: Understanding the History of Mumbai (Course offered by Department of History) or Basics of Banking and Finance (Course offered by Department of Economics) or Stress Management (Course offered by Department of Psychology) or Fundamentals of Advertising (Course offered by Department of Commerce).

✓ *Indian Knowledge System* – A course which will make students aware of the vast repositories of ancient traditional knowledge in India in fields such as Literature, Culture, Indian traditional systems of medicine, Astronomy, Yoga, Arthashastra, etc.

✓ *Ability Enhancement Course* – A course which is aimed at enabling the students to acquire & demonstrate the core linguistic skills, achieve competency in Modern Indian Language (such as Marathi / Hindi among others) and in English Language.

✓ *Value Education Course* – A course which is based upon the content that leads to knowledge enhancement through various areas of study such as Understanding India, Constitution of India, Environment studies, Sustainable Development.

✓ *Co-Curricular Courses* – A course which will provide student's a sense of identity & belonging, as well as appreciation of other cultures & identities; For example: courses such as National Cadet Corps (NCC), National Service Scheme (NSS), Yoga education, Health & Wellness, Sports, Cultural activities, courses related to Fine / Applied / Performing Arts etc.

This syllabus is a collective and constructive effort of the faculty, experts from research institutions, alumni and the board members whose valuable suggestions and expertise were instrumental in materializing this syllabus. The comments and recommendations of the contributors and reviewers have been carefully considered and implemented wherever feasible.

For effective teaching-learning, teachers are advised not to follow the syllabus too rigidly, but to exercise their professional discretion and judgement in implementing it. After all teaching is about creating a conducive environment for learners to sustain enthusiasm about the subject. We sincerely hope that all stakeholders from faculty to learners exploring this course will appreciate the importance of a well-designed curricular framework in shaping educational outcomes.

In conclusion, we hope this syllabus will encourage and maximize learning among students to develop open, inquiring minds for holistic development, thereby justifying the essence and spirit of National Education Policy.

Dr. Satish Sarfare
Chairman, Board of Studies in the subject of Zoology
Email: satishs@sies.edu.in

Members of the Board of Studies in the subject of Zoology

- ✓ *Professor (Dr.) Manisha Kulkarni – Professor, Department of Zoology, Institute of Science, Mumbai (Vice Chancellor's Nominee)*

- ✓ *Professor (Dr.) Manoj Mahimkar – Principal Investigator, Cancer Research Institute, ACTREC, Kharghar, Navi Mumbai; (Subject expert from outside the Parent University to be nominated by the Academic Council)*

- ✓ *Dr. Sasikumar Menon – Director, Institute for Advanced Training & Research in Interdisciplinary Sciences (IATRIS), (Therapeutic Drug Monitoring Lab), Sion, Mumbai; Faculty, Pharma Analytical Sciences, Ruia College, Mumbai (Subject Expert from outside college/Industry expert)*

- ✓ *Mr. Kedar Gore – Director, The Corbett Foundation (Non-profit Organization), Mumbai, (Subject expert from outside college / Representative from Corporate sector / Allied area)*

- ✓ *Ms. Uma Bandekar – Clinical Team Manager with ICON plc (Postgraduate Meritorious Alumnus)*

- ✓ *Dr. Satish Sarfare – Head and Faculty, Department of Zoology, SIES College, Mumbai*

- ✓ *Mr. Pushparaj Shetty – Faculty, Department of Zoology, SIES College, Mumbai*

- ✓ *Dr. Rupali Vaity – Faculty, Department of Zoology, SIES College, Mumbai*

- ✓ *Dr. Madhavan Gopalan – Faculty, Department of Zoology, SIES College, Mumbai*

- ✓ *Dr. Aditya Akerkar – Faculty, Department of Zoology, SIES College, Mumbai*

Syllabus Committee

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- ✓ *Mr. Pushparaj Shetty – Faculty, Department of Zoology, SIES College, Mumbai*

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- ✓ *Ms. Shraddha Patil – Faculty, Department of Zoology, SIES College, Mumbai*

- ✓ *Mr. Prathamesh Kulkarni – Faculty, Department of Zoology, SIES College, Mumbai*

- ✓ *Ms. Rutuja Nighot – Faculty, Department of Zoology, SIES College, Mumbai*

- ✓ *Dr. Sharvari Kudtarkar– Faculty, Department of Zoology, SIES College, Mumbai*

F.Y.B.Sc – Zoology – Semester I (Syllabus Grid)

Course name and code	Unit	Topic Headings	Credits
		SEMESTER – I	
		Major / Subject	
		Mandatory/Core Paper: Life Processes – I, Ecology and Animal Biotechnology – I	
SIUZOCC111 Theory	1	Life Processes - I	3
	2	Ecology	
	3	Animal Biotechnology	
Practical	1	Practicals based on Mandatory paper	1
		Vocational Skill Course (VSC): Bioinstrumentation (Semester I/II)	
SIUZOVS111 Theory	1	Principle, working and application of Microscope, Colorimeter, pH meter, Centrifuge, Electrophoresis and Chromatography	1
Practical	1	Practicals based on Vocational Skill Course	1
		Skill Enhancement Course (SEC): Animal Systematics (Semester I/II)	
SIUZOSE111 Practical	1	Conceptual understanding of systematics, taxonomy, phylogeny to inculcate and develop skills for practical's based on Skill Enhancement Course	2
		Generic or Open Elective (GE or OE) (Semester I/II)	
Theory and Tutorial	1	An elective course generally chosen from an unrelated subject / discipline with the intention to seek multidisciplinary exposure. For example, any one of the following elective courses such as: Understanding the History of Mumbai (Course offered by Department of History) or Basics of Banking and Finance (Course offered by Department of Economics) or Stress Management (Course offered by Department of Psychology) or Fundamentals of Advertising (Course offered by Department of Commerce)	4
		Indian Knowledge System (IKS) (Semester I/II)	
Theory	1	Course which will make students aware of the vast repositories of ancient traditional knowledge in India in fields such as Literature, Culture, Indian traditional systems of medicine, Astronomy, Yoga, Arthashastra, etc.	2
		Ability Enhancement Course (AEC) (Semester I/II)	
Theory	1	Course which is aimed at enabling the students to acquire & demonstrate the core linguistic skills, achieve competency in Modern Indian Language (such as Marathi / Hindi among others) and in English Language	2
		Value Education Course (VEC) (Semester I/II)	
Theory	1	Course which is based upon the content that leads to knowledge enhancement through various areas of study such as Understanding India, Constitution of India, Environment studies, Sustainable Development	2
		Co-Curricular Course (CC) (Semester I/II)	
Tutorial / Participation	1	Course which will provide students a sense of identity & belonging, as well as appreciation of other cultures & identities; Example: courses such as National Cadet Corps (NCC), National Service Scheme (NSS), Yoga education, Health & Wellness, Sports, Cultural activities, Fine/Applied/Visual/Performing Arts	2

F.Y.B.Sc – Zoology – Semester II (Syllabus Grid)

Course name and code	Unit	Topic Headings	Credits
SEMESTER – II			
Major / Subject			
Mandatory/Core Paper: Life Processes – II, Biodiversity and Animal Biotechnology – II			
SIUZOCC121 Theory	1	Life Processes - II	3
	2	Biodiversity	
	3	Animal Biotechnology	
Practical	1	Practicals based on Mandatory paper	1
Vocational Skill Course (VSC): Bioinstrumentation (Semester I/II)			
SIUZOVS111 Theory	1	Principle, working and application of Microscope, Colorimeter, pH meter, Centrifuge, Electrophoresis and Chromatography	1
Practical	2	Practicals based on Vocational Skill Course	1
Skill Enhancement Course (SEC): Animal Systematics (Semester I/II)			
SIUZOSE111 Practical	1	Conceptual understanding of systematics, taxonomy, phylogeny to inculcate and develop skills for practical's based on Skill Enhancement Course	2
Generic or Open Elective (GE or OE) (Semester I/II)			
Theory and Tutorial	1	An elective course generally chosen from an unrelated subject / discipline with the intention to seek multidisciplinary exposure. For example, any one of the following elective courses such as: An overview of cultural aspects of Maharashtra (Course offered by Department of History) or Credit and Insurance market (Course offered by Department of Economics) or Consumer Psychology (Course offered by Department of Psychology) or Introduction to e-commerce (Course offered by Department of Commerce)	4
Indian Knowledge System (IKS) (Semester I/II)			
Theory	1	Course which will make students aware of the vast repositories of ancient traditional knowledge in India in fields such as Literature, Culture, Indian traditional systems of medicine, Astronomy, Yoga, Arthashastra, etc.	2
Ability Enhancement Course (AEC) (Semester I/II)			
Theory	1	Course which is aimed at enabling the students to acquire & demonstrate the core linguistic skills, achieve competency in Modern Indian Language (such as Marathi / Hindi among others) and in English Language	2
Value Education Course (VEC) (Semester I/II)			
Theory	1	Course which is based upon the content that leads to knowledge enhancement through various areas of study such as Understanding India, Constitution of India, Environment studies, Sustainable Development	2
Co-Curricular Course (CC) (Semester I/II)			
Tutorial / Participation	1	Course which will provide students a sense of identity & belonging, as well as appreciation of other cultures & identities; Example: courses such as National Cadet Corps (NCC), National Service Scheme (NSS), Yoga education, Health & Wellness, Sports, Cultural activities, Fine/Applied/Visual/Performing Arts	2

Programme: Bachelor of Science, B.Sc. – Zoology

The characteristic graduate attributes comprising of Programme Outcomes, Programme Specific Outcomes and Course Outcomes for a science graduate in the subject of Zoology are as follows:

Note the list of abbreviations:
PO: Programme Outcome, PSO: Programme Specific Outcome, CO: Course Outcome
Cognitive Levels:- R: Remember, U: Understand, Ap: Apply, An: Analyze, E: Evaluate, C: Create

Serial Number	Details of Programme Outcomes (POs)
PO1 *(Skill Level)*	Problem Solving Ability *(U, Ap)* • Apply the knowledge of various courses learned under a program to break down complex problems into simple components. • Adopt and assimilate problem-based learning models and apply one's learning tosolve real life problem situations.
PO2 *(Skill Level)*	Critical Thinking *(U, An, E)* • Develop critical thinking based on a rationale to identify assumptions, verifyingthe accuracy and validity of assumptions, and making informed decisions. • Inculcate the ability of logical reasoning to question the rationale behindconcepts, ideas, and perspectives.
PO3 *(Skill Level)*	Effective Communication Skills *(Ap, C)* • Improve written and oral communication skills so as to express thoughts andideas effectively. • Demonstrate the ability to listen carefully and imbibe soft skills to convey andreceive instructions clearly. • Develop presentation skills to present complex information in a clear, lucid andconcise manner.
PO4 *(Skill Level)*	Proficiency with Information and Communication Technology *(U, An, E)* • Demonstrate ability to access, evaluate and use a variety of relevant information resources inclusive of internet and electronic media for the purpose of collating and analysing data. • Understand the scope and limitations of tools or software's used in Information and Communication Technology.
PO5 *(Skill Level)*	Leadership Skills and Team Work *(U, Ap, An, C)* • Demonstrate leadership skills formulating an inspiring vision, thereby building ateam, motivating and inspiring team members to engage and achieve that vision. • Develop management skills to guide people in taking tasks to their logicalconclusion. • Inculcate the ability to facilitate coordinated effort as a group or team in the interests of common cause and recognise the contribution of team members.
PO6 *(Attitude Level)*	Self-directed and Lifelong Learning *(U, Ap, An)* • Demonstrate the ability to work independently and take responsibility for one's actions. • Acquire the ability to explore and evolve by becoming self-sufficient and self-reliant. • Adapt lifelong learning approaches to broaden one's horizons for personal growth and development.

PO7 *(Attitude Level)*	Ethical Values and Environmental Concerns *(U, Ap, E)* • Embrace moral or ethical values in conducting one's life and implement ethical practices in all aspects of life. • Create awareness and concern for environmental and sustainability issues. • Understand and realize the significance and relevance of co-habitation and co-evolution in attaining the needs of sustainable development.
PO8 *(Attitude Level)*	Gender Sensitization and Community Service *(U, Ap, An)* • Respect gender sensitivity, gender equity and gender justice. • Encourage mutual understanding and express empathetic social concern towards different value systems and different strata of society. • Engage in community service through Institutional Social Responsibility.

Serial Number	Details of Programme Specific Outcomes (PSOs)
PSO1	Conceptual Understanding and Emerging Applications *(R, U, Ap, An)* • Inculcate conceptual and coherent understanding of zoology, and demonstrate a broad understanding of animal diversity, including fundamental and systematic knowledge of the scientific classification, taxonomy and evolutionary relationships of major groups of animals. • Understand the nature and basic concepts of cell biology, biochemistry, animal physiology, molecular biology, ecology among other topics, so as to recognize the relationships between structure and functions at different levels of biological organization for the major groups of animals. • Demonstrate interest in different areas of zoology so as to analyse the scope of emerging applications of biological sciences in medicine, genetics, wildlife, etc and apply appropriate methodologies with cutting edge tools/techniques in biological sciences to seek solutions to emerging problems faced by mankind. • Demonstrate the relevance of the procedural subject knowledge that creates different types of professionals related to the disciplinary/subject area of zoology, including professionals engaged in research and development, teaching and government/public service.
PSO2	Analytical reasoning and Scientific Inquiry *(U, An, E)* • Inculcate a sense of inquiry and capability for asking relevant or appropriate questions, articulating problems or concepts or questions. • Encourage the ability to analyse, interpret and draw conclusions from qualitative/quantitative data and critically evaluate ideas, experiences, theories and concepts by following scientific approach to knowledge development froman open minded and reasoned perspective. • Develop analytical skills involving paying attention to detail and imbibe the ability to construct logical arguments using correct technical language related to the relevant subject. • Analyse and interpret data/information collected or related to experiments or investigations, using appropriate methods involving Biostatistics, Bioinformatics among others and report accurately the findings of the experiment/investigations while relating the conclusions/ findings to relevant theories of zoology.
PSO3	Laboratory Skills and Fieldwork *(R, U, E, C)* • Understand and apply standard operating procedures as per Good Laboratory Practices so as to develop laboratory skills and qualities required for successful career in teaching, research, industry, etc. • Demonstrate awareness regarding animal ethics, human ethics, conservation of flora and fauna, so as to promote safe environment and ecosystem, in the pursuit of disciplinary knowledge. • Develop instrumentation handling skills and laboratory techniques relevant to academia and industry, integrate knowledge, skills with technical competency, so as to create solutions for issues and problems related to biological sciences. • Demonstrate leadership qualities, command trust and respect, thereby, motivating and inspiring team members to work effectively in diverse teams during excursions or study tours. Realise the relevance of participation in field studies in the context of teamwork as well as life on the outdoors.

PSO4	Research Aptitude and Interdisciplinary Approach *(Ap, An, E, C)*
	- Inculcate and adapt to research aptitude and culture, integrate research-based knowledge in an interdisciplinary framework, and realise the relevance of choosing research as an alternative career option. - Demonstrate the awareness regarding compliance with research ethics, awareness about conflicts of interests and Intellectual Property Rights, and avoiding unethical behaviour such as fabricating, falsifying or misrepresenting data or to committing plagiarism. - Inculcate the ability to recognise cause and effect relationships, formulate hypothesis, reporting the results of an experiment or investigation, and application of research tools for analysis and interpretation of data. - Inculcate an interdisciplinary approach, to understand and consolidate fundamental concepts through inquiry based curriculum, develop critical thinking and problem solving ability required to solve different types of biology related problems with well-defined solutions, and tackle open-ended problems that may cross disciplinary-area boundaries.

PSO4

At the root of all (science) education (Core Learning Outcome):

"The imaginative and original mind need not be overawed by the imposing body of present knowledge or by the complex and costly paraphernalia which today surround much of scientific activity. The great shortage in science now is not opportunity, manpower, money, or laboratory space. What is really needed is more of that healthy skepticism which generates the key idea – the liberating concept."   *– P.H. Abelson*

Purity of mind leads to clarity in thought and action for creation of an original archaic work.
As well, to consciously attempt the basic pursuit of understanding human existence.

Semester I – Theory

Course Code: SIUZOCC111
Course Name: Mandatory/Core Paper: Life Processes – I, Ecology and Animal Biotechnology
The study of this course will accomplish the following outcomes:

Unit	Course Outcome (CO)	Cognitive Level	Affinity with PO/ PSO
Life Processes - I	**CO CC111.1:** Elucidate the interplay between structure and function in animal biology which has survival value. Facilitate clarity on the working of human machine through analysis of animal physiology (physiological processes – inner working of animals). Account for the bodily processes as movement and locomotion, nutrition, respiration and circulation.	*R, U*	*PO1, PO2, PO6* *PSO1, PSO2*
Ecology	**CO CC111.2:** Outline concepts of ecology – a study of where (place) and how (interaction) organisms live on earth, and realise that any imbalances in the delicate ecological networking of organisms could lead to problems of global environmental concern. Recognise that living things transform energy.	*R, U*	*PO1, PO2, PO6, PO7, PO8* *PSO1, PSO3, PSO4*
Animal Biotechnology	**CO CC111.3:** Introduction to biotechnology – a field of endeavour and a frontier open for invention by application of technological advancements to biological systems for human benefit. Insight into transgenesis, animal cloning, gene therapy for benefit of mankind, and application.	*R, U, An*	*PO2, PO6, PO7, PO8* *PSO1, PSO2, PSO3, PSO4*

PRACTICAL

"*Study nature not books.*" – An old dictum.
The practical course in Zoology is designed for first hand study of animal life through observation of preserved specimens, *in situ* organ systems, microscopic examination of permanent slides, etc. as well as to perform experiments to strengthen the concept base.
It is an effort to invigorate a thought process that can analyse and reason for the sake of awareness, hence to reach a valid answer.

Semester I – Practical

Course Code: SIUZOCCP111 (Mandatory/Core)
Course Name: Practical based on SIUZOCC111

Course Outcome CO CCP111	Details	Cognitive Level	Affinity with PO/ PSO
	1. Explain essential life processes as digestion, excretion-osmoregulation and movement-locomotion by microscopic examination of one-celled animalcule, *Paramoecium*. 2. Account for functional morphology in animals by examining (preserved/ fresh, wherever applicable) nutritional apparatus, respiratory structures, hearts and blood smears of selected animals. 3. Emphasize the role of factors like pH and temperature for enzyme functioning by testing amylase activity, under physiology of digestion. 4. Examine a beating heart under light microscope and determine its rate by using crustacean arthropod *Daphnia*. 5. Explain coexistence and coevolution of animal forms through animal interaction study. 6. Insight into the chemistry of biomolecules – proteins and carbohydrates by their qualitative detection.	*R, U, Ap, An, E*	*PO1, PO2, PO6, PO7* *PSO1, PSO2, PSO3, PSO4*

Semester II – Theory

Course Code: SIUZOCC121
Course Name: Mandatory/Core Paper: Life Processes – II, Biodiversity and Animal Biotechnology – II
The study of this course will accomplish the following outcomes:

Unit	Course Outcome (CO)	Cognitive Level	Affinity with PO/ PSO
Life Processes - II	**CO CC121.1:** Elucidate the interplay between structure and function in animal biology which has survival value. Facilitate clarity on the working of human machine through analysis of animal physiology (physiological processes – inner working of animals). Account for the bodily processes as excretion andosmoregulation, control and coordination, and reproduction.	*R, U*	*PO1, PO2, PO6* *PSO1, PSO2*
Biodiversity	**CO CC121.2:** Insight into the wealth of living forms on earth for wise and sustainable usage of these natural resources for man's livelihood as well as recreational activity.	*R, U, An*	*PO2, PO6, PO7, PO8*

			PSO1, PSO2, PSO4
Animal Biotechnology	**CO CC121.3:** Introduction to biotechnology – a field of endeavour and a frontier open for invention by application of technological advancements to biological systems for human benefit. Insight on applications in food and enzyme technology and environmental biotechnology	R, U, Ap	PO1, PO2, PO6, PO7, PO8 PSO1, PSO2, PSO4

Semester II – Practical

Course Code: SIUZOCCP121 (Mandatory/Core)
Course Name: Practical based on SIUZOCC121

Course Outcome CO CCP121	Details	Cognitive Level	Affinity with PO/ PSO

	1. Observe under light microscope the structure of an excretory organ – septal nephridium present in an invertebrate – earthworm 2. Analyse the Urine and detect normal and abnormal composition 3. Extraction/ detection of another biomolecule – nucleic acids (DNA and RNA) and confirm their presence by specific bio-chemical tests. 4. Differentiate between the two broad categories of bacteria using Gram staining, a method that can serve as preliminary diagnostic test for bacterial infection disease 5. Discuss and perform a simple method to evaluate the quality of milk sample by checking its bacterial load, which has a direct impact on fitness of milk for human consumption and hence on commercial value of milk. Understand the International Organization for Standardization (ISO) criteria for milk quality. 6. Immobilize Amylase and detect its optimum activity 7. Explain fermentation, an age-old process known to mankind and meat tenderization, both with applications in food industry for consumer satisfaction.	*R, U, AP, An*	*PO1, PO2, PO6, PO7, PO8* *POS1, POS2, PSO3, PSO4*

Vocational Skill Course (VSC)			
Course Code: SIUZOVS111 **Course Name: Bioinstrumentation**			
Unit	**Course Outcome** **CO VS111**	**Cognitive Level**	**Affinity with PO/ PSO**
Bioinstrumentation	• Understand the Principle, working and application of Microscope, Colorimeter, centrifuge, electrophoresis and basic chromatography	*R, U, Ap, An*	*PO1, PO2, PO6, PO7* *PSO1, PSO2, PSO3 PSO 4*
Practicals based on Bioinstrumentation	• Analyze the importance of laboratory safety practices and safety symbols, for awareness regarding conduct as a science student. • Describe the handling and use/ function of basic laboratory equipments/ instruments	*R, U, Ap, An*	*PO1, PO2, PO6, PO7* *PSO1, PSO2, PSO3 PSO 4*

	in an undergraduate course laboratory. • Apply the knowledge of working of electrophoresis and basic chromatography		

Skill Enhancement Course (SEC)			
Course Code: SIUZOSE111 **Course Name: Animal Systematics**			
Course Outcome CO SE111		**Cognitive Level**	**Affinity with PO/ PSO**
	• Discuss levels of organization in animal kingdom on which animal body plans are made. • Elaborate on animal diversity (Protozoa to Arthropoda) and inquire into the relatedness of taxa in animal kingdom by direct observation preserved specimens/ permanent slides of chosen representatives from each phylum. • Identify, describe and classify animal representatives of different phyla (Mollusca to Chordata) as well as analyse the evolutionary connect between them. • Discuss vital life processes – digestion, excretion, nervous control and reproduction, through observation of structures/ organs in different animal specimens (preserved or fresh) and permanent slides, and clarify their possession by these animals	*R, U, Ap, An*	*PO1, PO2, PO6, PO7* *PSO1, PSO2, PSO3 PSO 4*

Semester – I Theory
Mandatory/Core Paper SIUZOCC111
Life Processes – I, Ecology and Animal Biotechnology - I

Learning Objectives
• To attempt an inquiry into the vital processes that make life possible through an understanding of the adaptations animals have evolved that best suit the milieu in which they thrive.
• To understand the relation between organisms and their environment through Ecology i.e., the study of "life at home".
• To acknowledge the emerging field of Biotechnology that blends the technological advancements and the natural wealth – the living organisms, for improving human life.

Expected Outcomes
✓ Students will be equipped knowledge of functionality of life, diversity of animals and manipulating genomes for economic and social wellbeing.
✓ Students will be able to apply the knowledge gained for appearing competitive examinations in future.
✓ Enhanced knowledge of physiology can be excellent skill set for students pursuing career in biological sciences.

Unit 1: Life Processes – I   **15 Lectures**
1.1 Movement and Locomotion
1.1.1: Amoeboid movement
1.1.2: Ultrastructure of cilia and ciliary movements
1.1.3: Action of muscles (Role of muscles in movement)

1.2 Nutrition
1.2.1: Types of nutrition: Autotrophic and heterotrophic
1.2.2: Apparatus for nutrition:

a. Food vacuole: Animals without alimentary canal, ex. *Amoeba*
b. Animals with incomplete alimentary canal, ex. *Hydra*
c. Animals with complete alimentary canal, ex. Bird
1.2.3: Physiology of digestion in vertebrates and symbiotic digestion in ruminants

1.3 Respiration
1.3.1: Types of respiratory surfaces:
a. General body surface: Cell membrane, ex. *Amoeba*; Skin - ex. Earthworm and Frog
b. Specialized respiratory structures: trachea and spiracles, gills of fish, lungs of frog and human, air sacs of bird
1.3.2: External respiration and cellular respiration with reference to human

1.4 Circulation
1.4.1: Types of circulating fluids: water, coelomic fluid, lymph and blood
1.4.2: Types of circulation: Protoplasmic streaming, open and closed circulation, single and double circulation
1.4.3: Hearts: Heart in *Daphnia,* cockroach and chordates (one, two, three and four-chambered hearts)
1.4.4: Structure of cardiac muscle

Unit 2: Ecology   15 Lectures
2.1: Concept of Ecosystem

2.2: Concepts of energy flow, food chain and food web

2.3: Biogeochemical cycles

2.3.1: Carbon cycle, oxygen cycle, nitrogen cycle, phosphorus cycle and water cycle

2.3.2: Human activities affecting biogeochemical cycles

2.4: Animal interactions: Symbiosis - mutualism, commensalism, parasitism, predation and antibiosis

Unit 3: Animal Biotechnology – I   15 Lectures
3.1 Biotechnology and Gene therapy
3.1.1: Recombinant DNA technology in production of insulin, alpha-1-antitrypsin, tissue plasminogen activator (tPA) and Human growth hormone (hGH).
3.1.2 : Gene therapy: *Ex vivo* and *In vitro* approach; Gene therapy for Severe Combined Immunodeficiency (SCID) and Cystic fibrosis
3.1.3: Ethical issues with reference to gene therapy

3.2 Transgenic Animals and Animal Cloning
3.2.1: Transgenic animals
3.2.2: DNA Micro injection, Retro-viral method of gene transfer
3.2.3: Nuclear transfer technology
3.2.4: Animal cloning experiments for "Dolly"

Semester – I Practical

Course Code: SIUZOCCP111 (Mandatory/Core)
Course Name: Practical based on SIUZOCC111

1. Study of *Paramoecium* culture to observe cyclosis, food vacuole, contractile vacuole and ciliary movement and irritability in *Paramoecium* by demonstration of release of trichocysts
2. Study of effect of pH and temperature on the activity of enzyme amylase/ trypsin
3. Rate of oxygen consumption by cockroach (demonstration only)
4. Determination of rate of heartbeat in Daphnia
5. Study of Animal interactions: -
a. Mutualism: Termite and *Trichonympha*

b. Antibiosis: Effect of antibiotics on bacterial growth in a petriplate

c. Parasitism: 1. Ectoparasite – Head louse and bed bug; 2. Endoparasite – *Trichinella spiralis*

d. Predation: Praying mantis and spider

6. Qualitative tests for Carbohydrates proteins and Lipids

Semester – II Theory
Mandatory/Core Paper SIUZOCC121
Life Processes - II, Biodiversity and Animal Biotechnology – II

Learning Objectives

- To attempt an inquiry into the vital processes that make life possible through an understanding of the adaptations animals have evolved that best suit the milieu in which they thrive.
- To acknowledge the importance of the natural treasure – the biodiversity around us, and to be judicious in the utilization of this natural economy.
- To acknowledge the emerging field of Biotechnology that blends the technological advancements and the natural wealth – the living organisms, for improving human life.

Expected Outcomes

- ✓ Students will be equipped knowledge of functionality of life, diversity of animals and manipulating genomes for economic and social wellbeing.
- ✓ Students will be able to apply the knowledge gained for appearing competitive examinations in future.
- ✓ Enhanced knowledge of physiology can be excellent skill set for students pursuing career in biological science.

Unit 1: Life Processes – II   **15 Lectures**

1.1 Excretion and Osmoregulation

1.1.1: Concepts of excretion and osmoregulation

1.1.2: Categorization of animals on the basis of principal nitrogenous excretory products

1.1.3: Ornithine cycle, formation of urea; deamination and detoxification

1.2 Control and Coordination

1.2.1: Irritability

1.2.2: Structure of neuron; sense organs – human eye and ear

1.2.3: Conduction of nerve impulse: Resting potential, action potential and refractory period: Synaptic transmission

1.2.4: Endocrine regulation: Hormones as chemical messengers; feedback mechanisms

1.3 Reproduction

1.3.1: Gametogenesis; structure of egg and sperm of mammal 2.3.2: Fertilization in animals; *In vitro* fertilization

1.3.3: Oviparity, viviparity and ovoviviparity

Unit 2: Biodiversity and its Conservation   **15 Lectures**

2.1: Introduction to Biodiversity - Definition, Concepts, Scope and Significance

2.2: Levels of Biodiversity - Introduction to Genetic, Species and Ecosystem Biodiversity

2.3: Introduction of Biodiversity Hotspots- (Western Ghats and IndoBurma Border)

2.4: Values of biodiversity - Direct and Indirect use value

2.5: Threats to Biodiversity - Habitat loss and Man-Wildlife conflict

2.6: Biodiversity conservation and management

2.6.1: Conservation strategies: in situ, ex-situ, National parks, Sanctuaries and Biosphere reserves.

2.6.2: Introduction to International efforts: International Union for Conservation of Nature and Natural Resources (IUCN).

2.6.3: Introduction to National conservation efforts: Project Tiger, Project Rhinoceros (IVR2020)

2.6.4: Introduction to Indian Wildlife (Protection) Act, 1972

Unit 3: Animal Biotechnology – II   15 Lectures

3.1 Food Biotechnology
3.1.1: Applications of biotechnology in making bread, beer, wine, yogurt and cheese

3.2 Enzyme Technology
3.2.1: Enzymes as meat tenderizers
3.2.2: Biodetergents
3.2.3: Concept of enzyme immobilization

3.3 Environmental Biotechnology
3.3.1: Bioremediation: Concepts and applications
3.3.2: *Ex* situ and *In* situ Bioremediation
3.3.3: Case studies related to Bioremediation

Semester – II Practical

Course Code: SIUZOCCP121 (Mandatory/Core)
Course Name: Practical based on SIUZOCC121

1. Mounting of septal nephridium of earthworm (from preserved specimen)
2. Urine analysis for detection of normal and abnormal constituents; Detection of uric acid from excreta of bird or cockroach
3. Extraction and qualitative detection of nucleic acids: DNA (SDS-NaCl extraction) and
 RNA (Phenol extraction)
4. Study of bacteria using Gram stain
5. To evaluate the quality of milk by Methylene Blue Reduction Test (MBRT)
6. Preparation and assay of of immobilization of enzyme amylase/ yeast cells in beads of calcium alginate (visual observation for comparing the colour intensity in test tubes)
7. To demonstrate fermentation of grape juice/ sugar cane juice or any fruit juice (Detection of alcohol generated during fermentation by benzoic acid)
8. Effect of Papain (raw papaya extract) as a meat tenderizer.

Semester I / II – Vocational Skill Course (VSC)
Course Code: SIUZOVS111
Bioinstrumentation

Learning Objectives
• To give students a hands-on experience of instrumentation used in laboratory facility.
• To expose students to concept in biological sciences by experiment-based learning.

Expected Outcomes
✓ Students will be able to operate instruments in laboratory facility independently.
✓ Students will be equipped with principle and working of instruments used in laboratory.
✓ Students will be gaining analytical skills based on experimental learning.

Unit 1: Bioinstrumentation   15 Lectures

1.1 Principle, working and application of Microscope: Simple and Compound
1.2 Principle, working and application of Centrifuge: High speed Centrifuge
1.3 Principle, working and application of Colorimeter, pH meter

1.4 Principle, working and application of Electrophoresis: Agarose Gel Electrophoresis (AGE) and Poly Acrylamide Gel Electrophoresis (PAGE)

1.5 Principle, working and application of Chromatography: Paper and Thin Layer Chromatography (TLC)

Practicals Based on Bioinstrumentation

1. Introduction to basic laboratory safety: safety rules, safety symbols and precautions; safety practices with respect to accidents which may occur while working in a laboratory (chemical spillage, burns, etc.); principle, working and use of fire extinguishers.

2. Handling of common laboratory equipment's/ instruments: Burner, microscope, centrifuge, colorimeter, balance, homogenizer; Handling of glassware

3. Separation of amino acids by ascending paper chromatography

4. Thin layer chromatography of lipids using silica gel coated aluminium-backed TLC sheets and silica gel coated glass plates

5. Adsorption chromatography using chalk to separate plant pigments or other pigments/ dyes (Food colours)

6. Demonstrate agarose gel electrophoresis for the separation of egg white proteins and compare with a protein ladder or standard protein sample

Semester I / II – Skill Enhancement Course (SEC)
Course Code: SIUZOSE111
Animal Systematics

Learning Objectives
• To do an introductory survey of the diversity of animal life to understand that part of the world around us comprising of various life forms. Also, to gain an insight into field biology.

Expected Outcomes
✓ Students will be equipped with the skill of understanding taxonomy of animal kingdom.
✓ Students will be able to gain and apply the practical knowledge in field studies in future.
✓ Enhanced knowledge of classification can be an excellent skillset for students pursuing career in field biology.

Practicals based on Animal Systematics - I

1. Levels of Organization in Animal Kingdom
a. Symmetry:
1. Asymmetric organization: *Amoeba*
2. Radial symmetry: Sea anemone, *Aurelia*
3. Bilateral symmetry: *Planaria*/ liver fluke
b. Coelom condition:
1. Acoelomate: T.S. of *Planaria*/ liver fluke
2. Pseudocoelomate: T.S. of *Ascaris*
3. Coelomate: T.S. of earthworm
c. Metamerism: Ametamerism, Psuedometamerism and Eumetamerism
d. Specialization of body parts for division of labour: Insect – Head, thorax and abdomen
e. Cephalization:
1. Cockroach – Head
2. Prawn/ crab – Cephalothorax
2. Animal Diversity
a. Phylum Protozoa: *Amoeba, Paramoecium, Euglena, Plasmodium*
b. Phylum Porifera: *Leucosolenia*, Bath sponge
c. Phylum Cnidaria / Coelenterata: *Hydra, Obelia colony, Aurelia,* Sea anemone, any one coral

d. Phylum Platyhelminthes: *Planaria*, liver fluke and tapeworm

e. Phylum Nemathelminthes: *Ascaris* (male and female)

f. Phylum Annelida: *Nereis*, earthworm and leech

g. Phylum Arthropoda: Crab, lobster, *Lepisma*, beetle, dragonfly, butterfly, moth, spider, centipede, millipede

h. Phylum Mollusca: *Chiton, Dentalium, Pila,* bivalve, Sepia and *Nautilus*

i. Phylum Echinodermata: Starfish, brittle star, sea urchin, sea cucumber, feather star

3. Field visit to Zoo / Aquarium / Museum / Natural habitats

Practicals based on Animal Systematics - II

1. Animal Diversity

a. Phylum Hemichordata: *Balanoglossus*

b. Subphylum Urochordata: *Herdmania*

c. Subphylum Cephalochordata: *Amphioxus*

d. Division Agnatha: Class Cyclostomata: *Petromyzon*/ *Myxine*

e. Class Pisces: Subclass Chondrichthyes: Shark, skates, sting ray/ electric ray Subclass Osteichthyes: *Sciaena*, flying fish

f. Class Amphibia: Frog, toad, caecilian, salamander

g. Class Reptilia: Chameleon, *Calotes,* turtle/ tortoise, snake, alligator/ crocodile

h. Class Aves: Kite, kingfisher, duck

i. Class Mammalia: Shrew, hedgehog, guinea pig, bat

2. Study of wheel organ of *Amphioxus,* scroll valve of shark, digestive system of pigeon, ruminant stomach

3. Observation of sagittal section of mammalian kidney, Bowman's capsule (under high power)

4. Observation of hen's egg with developing embryo at any stage of development

5. Study of mammalian brain (entire and sagittal section with the help of specimen/ model); observation of T.S. of mammalian spinal cord.

6. Geographical Mapping of National Parks and Sanctuaries

7. Field visit to Zoo / Aquarium / Museum / Natural habitats

References

- Biology – A Global Approach; Tenth Edition (Global Edition); Campbell, Reece, Urry, Cain, Wasserman, Minorsky & Jackson; Pearson Education Ltd., England; 2015
- Biology; Seventh Edition; Neil A. Campbell & Jane B. Reece; Pearson Education, Inc.; 2005
- Biology; Student Edition; Kenneth R. Miller & Joseph S. Levine; Prentice Hall; 2007
- Biology: Eleventh Revised Edition; Sylvia S. Mader & Michael Windelspecht; McGraw- Hill Education; 2012
- Biology – Concepts & Applications; Sixth Edition; Cecie Starr; Brooks/ Cole; 2005
- Biological science, 3rd edition – D.J. Taylor, N. P. O. Green, G. W. Stout. Cambridge University press, Low priced edition
- Zoology – S. A. Miller and J. B. Harley, Tata McGraw Hill
- Principles of Ecology – Odum
- Ecology – Principle and application – J. L. Chapman and M. J. Reiss, Cambridge University press
- Animal behaviour – David McFarland
- An introduction to animal behaviour, 4th edition - Aubrey Manning and M. S. Dawkins. Cambridge University press, Low priced edition
- Animal behaviour – Mohan Arora. Himalaya publication
- Genetics – Winchester Oxford IBH publication
- Principle of Genetics - W. Sinnott, L.C. Dunn and Theodosius Dobzhansky, McGraw Hill publication
- Basic human genetics – E. J. mange and A. P. Mange, Rastogi publications

- Biology – Investigating life on earth, Vernon Avila, Book mark publications
- Biology of Cell – An evolutionary approach – Dewitt, Saunders publications
- The Cell, Alberts, Panima Publications
- Essentials of human genetics – S. M. Bhatnagar, M.L. Kothari, L.A. Mehta, Orient Longman publications
- Essentials of Ecology, 3rd edition – G. Tyler and Miller Jr. Thompson Books
- Biodiversity: S.V.S. Rana, Prentice Hall Publications
- Evolution: Strickberger, C.B.S. Publication

Additional reading:
- World Encyclopaedia of Animals; English language edition; Elena Marcon & Manuel Mongini; Orbis Publishing Limited; 1984
- National Geographic Vol. 193 (3) March 1998: Rise of life on Earth p. 54-81
- Scientific American Oct. 1994: Origin of life on Earth p. 53-61

Documentaries:
- ✓ Planet Earth; Planet Earth II – Sir David Attenborough
- ✓ Life on our Planet; A Perfect Planet – Sir David Attenborough