## SEMESTER I

## ENVIRONMENTAL STUDIES

### 1. Course Description

**Program:** BSC
**Course Code:** U24/EVS/AECC/101
**Course Type:** AECC
**No. of credits:** 2

**Max. Hours:** 30
**Hours per week:** 2
**Max. Marks:** 50

### 2. Course Objectives:

- To Understand the principles of ecology and environmental issues
- To acquire the skills needed and develop a sense of responsibility to actively participate in its protection and improvement

### 3. Course Outcomes:

On completion of the course the student will be able to:

CO 1: Gain knowledge and develop in-depth understanding of the basics of ecological principles, conservation of biodiversity, renewable energy resources and water conservation

CO 2: Enhanced analytical capability to undertake and participate in finding solutions for various environmental issues and concerns of national and global importance to achieve environmental protection and sustainable development



CHAIR PERSON B.O.S. in Environmental Science University College of Science Osmania University Hyderabad-500 007.

Head Dept.of Environmental Studies St.Francis College for Women (Autonomous) Begumpet,Hyderabad-16

## 4. COURSE CONTENT

### UNIT - I: Ecosystem, Biodiversity & Natural Resources (15 hrs.)

1. Definition, Scope & Importance of Environmental Studies
2. Structure of Ecosystem – Abiotic & Biotic Components, Ecological Pyramids
3. Definition of Biodiversity, Genetic, Species & Ecosystem Diversity, IUCN Red list, Hotspots of Biodiversity, Threats and Conservation of Biodiversity (*Insitu & Exsitu*)
4. Renewable Energy Resources – Solar, Wind and Biomass
5. Water Conservation, Water Footprint, Rain Water Harvesting
6. Environmental Ethics

### UNIT – II: Environmental Pollution, Global Issues & Legislation (15 hrs.)

1. Causes, Effects and Control Measures of Air and Water Pollution
2. Solid and Plastic Waste Management, Zero Waste Management
3. Global Warming & Ozone Layer Depletion, Carbon Footprint
4. Environmental Laws and Acts-Wildlife Protection Act, Forest Act, Air Act, Water Act
5. People's Participation in Environmental Protection- Silent Valley, Bishnois of Rajasthan
6. Disaster Management-Flood, Earthquake and Cyclones
7. Environmental Management
8. Role of Information Technology in Environmental Protection and Health

**Field visit:**

1. Visit to Solar Plant in your Locality/City
2. A Glimpse of Biodiversity in Hyderabad/ Visit to National Parks and a Walk-Through Campus
3. Visit to a Nearby Lake



CHAIRPERSON B.O.S. in Environmental Science University College of Science Osmania University Hyderabad-500 007.

Head Dept.of Environmental Studies St.Francis College for Women (Autonomous) Begumpet,Hyderabad-16

## 5. REFERENCES:

**Books:**


- Text book of Environmental Studies for undergraduate courses (second edition) by Erach Bharucha
- Environmental Studies by Dr. J.P. Sharma
- Perspectives in Environmental Studies – Anubha Kaushik & C.P. Kaushik
- A text book of Environmental Studies by Dr. D. K. Asthana and Dr. Meera Asthana
- Environmental Science by Dr. Syeda Azeem Unnisa


**Magazines:**


- **Terra Green (a monthly digital magazine on environmental issues)**
- Down to Earth, Centre for Science &
- Environment Survey of the Environment published by The Hindu


**E-Resources:**


- https://www.cseindia.org/
- https://www.ugc.gov.in/oldpdf/modelcurriculum/env.pdf

## 6. Syllabus Focus

**a)** Relevance to Local, Regional, National and Global Development Needs

| Local /Regional/ National /Global Development Needs | Relevance |
|---|---|
| Local needs | Develop a critical understanding of Environmental issues and concerns. Inculcate the environmental ethics and work for sustainable future<br><br>Utilise the potential application of Methods of Solid Waste Management in the Waste management concerns<br><br>Involve in community development through extension and organising programs. |
| Regional needs | Creates awareness on pollution and threats to biodiversity in the Ecosystem |
| National needs | Have an over view of mitigation measures of disaster management. Explain major conservation strategies taken in India. Apply the Knowledge of role of information technology in protection of the environment. |
| Global needs | Environmental studies is globally relevant to monitor environmental issues and for the sustainable development. It deals with issues and challenges of environment management in the changing climate scenario. |

**b) Components on Skill Development/Entrepreneurship Development/Employability**

| SD/ED/EMP | Syllabus Content | Description of Activity |
|---|---|---|
| Skill Development, Entrepreneurship Development, Employability | Unit II<br><br>Solid Waste Management | Demonstration of Composting, Vermicomposting and the preparation of Bio-Enzymes. Awareness on scope of green entrepreneurship and employability related to Solid waste management |

**7. Pedagogy**

| S. No | Student Centric Methods Adopted | Type / Description of Activity |
|---|---|---|
| 1. | Experiential learning | Field trips, Documentary watching, Demonstrations, Student volunteering days, Plantation drives, Clean up drives |
| 2. | Participative Learning | Seminars, Workshops, Guest lectures, Group Discussion, Library reference, Presentations and Competitions, Demonstrations by students |
| 3. | Problem Solving | Case Studies, Projects |

**8. Course Assessment Plan**

**a) Weightage of Marks in Internal Assessments and End Semester Examination**

| CO | Internal Assessments IA -40% | End Semester Examination-60% |
|---|---|---|
| CO1 | Field Visit report/Case Study/ Poster making/ Presentations/Eco Friendly product making/Model making | Written Exam |
| CO2 | | |



CHAIR PERSON B.O.S. in Environmental Science University College of Science Osmania University Hyderabad-500 007.

Head Dept.of Environmental Studies St.Francis College for Women (Autonomous) Begumpet,Hyderabad-16

**b) Model Question Paper- End Semester Exam**

**ENVIRONMENTAL STUIDES**

**Course Code: U24/EVS/AECC/101**

**Time: 1 Hour** **Max. Marks: 30**

**Answer any five of the following:** **5X6=30**

1. Define environmental studies and mention the importance of environmental studies.
2. "Biomass is an important source of energy", Discuss.
3. Explain the rooftop rainwater harvesting system with the help of a diagram.
4. Identify the reasons for water pollution in your region and suggest measures to reduce the water pollution.
5. Discover the initiatives taken by swachh cities in solid waste management.
6. Comment on "Silent Valley- A people's movement that saved a forest."
7. List out the changes you would make in your lifestyle to reduce your carbon footprint.

**c) Question Paper Blueprint**

| Modules | Hours Allotted in the Syllabus | COs Addressed | Section A (No. of Questions) | Total Marks |
|---|---|---|---|---|
| I | 15 | CO 1 | 3 | 6 |
| II | 15 | CO 2 | 4 | 6 |

| Prepared by | Checked & Verified by | Approved by |
|---|---|---|
| G. Dhanalakshmi<br>Head, Dept. of Environmental Studies | G. Dhanalakshmi,<br>Head, Dept. of Environmental Studies | Dr. Uma Joseph<br>Principal |



CHAIR PERSON B.O.S. in Environmental Science University College of Science Osmania University Hyderabad-500 007.

Head Dept.of Environmental Studies St.Francis College for Women (Autonomous) Begumpet,Hyderabad-16

## SEMESTER II

## ENVIRONMENTAL STUDIES

### 6. Course Description

**Program:** BA, BMS & BCOM
**Course Code:** U24/EVS/AECC/201
**Course Type:** AECC
**No. of credits:** 2

**Max. Hours:** 30
**Hours per week:** 2
**Max. Marks:** 50

### 7. Course Objectives:

- To Understand the principles of ecology and environmental issues
- To acquire the skills needed and develop a sense of responsibility to actively participate in its protection and improvement

### 8. Course Outcomes:

On completion of the course the student will be able to:

CO 1: Gain knowledge and develop in-depth understanding of the basics of ecological principles, conservation of biodiversity, renewable energy resources and water conservation

CO 2: Enhanced analytical capability to undertake and participate in finding solutions for various environmental issues and concerns of national and global importance to achieve environmental protection and sustainable development

## 9. COURSE CONTENT

### UNIT - I: Ecosystem, Biodiversity & Natural Resources (15 hrs.)

1. Definition, Scope & Importance of Environmental Studies
2. Structure of Ecosystem – Abiotic & Biotic Components, Ecological Pyramids
3. Definition of Biodiversity, Genetic, Species & Ecosystem Diversity, IUCN Red list, Hotspots of Biodiversity, Threats and Conservation of Biodiversity (*Insitu & Exsitu*)
4. Renewable Energy Resources – Solar, Wind and Biomass
5. Water Conservation, Water Footprint, Rain Water Harvesting
6. Environmental Ethics

### UNIT – II: Environmental Pollution, Global Issues & Legislation (15 hrs.)

1. Causes, Effects and Control Measures of Air and Water Pollution
2. Solid and Plastic Waste Management, Zero Waste Management
3. Global Warming & Ozone Layer Depletion, Carbon Footprint
4. Environmental Laws and Acts-Wildlife Protection Act, Forest Act, Air Act, Water Act
5. People's Participation in Environmental Protection- Silent Valley, Bishnois of Rajasthan
6. Disaster Management-Flood, Earthquake and Cyclones
7. Environmental Management
8. Role of Information Technology in Environmental Protection and Health

**Field visit:**

1. Visit to Solar Plant in your Locality/City
2. A Glimpse of Biodiversity in Hyderabad/ Visit to National Parks and a Walk-Through Campus
3. Visit to a Nearby Lake

## 10. REFERENCES:

**Books:**


- Text book of Environmental Studies for undergraduate courses (second edition) by Erach Bharucha
- Environmental Studies by Dr. J.P. Sharma
- Perspectives in Environmental Studies – Anubha Kaushik & C.P. Kaushik
- A text book of Environmental Studies by Dr. D. K. Asthana and Dr. Meera Asthana
- Environmental Science by Dr. Syeda Azeem Unnisa


**Magazines:**


- **Terra Green (a monthly digital magazine on environmental issues)**
- Down to Earth, Centre for Science &
- Environment Survey of the Environment published by The Hindu


**E-Resources:**


- https://www.cseindia.org/
- https://www.ugc.gov.in/oldpdf/modelcurriculum/env.pdf




CHAIR PERSON B.O.S. in Environmental Science University College of Science Osmania University Hyderabad-500 007.

Head Dept.of Environmental Studies St.Francis College for Women (Autonomous) Begumpet,Hyderabad-16

## 6. Syllabus Focus

**a)** Relevance to Local, Regional, National and Global Development Needs

| Local /Regional/ National /Global Development Needs | Relevance |
|---|---|
| Local needs | Develop a critical understanding of Environmental issues and concerns. Inculcate the environmental ethics and work for sustainable future<br><br>Utilise the potential application of Methods of Solid Waste Management in the Waste management concerns<br><br>Involve in community development through extension and organising programs. |
| Regional needs | Creates awareness on pollution and threats to biodiversity in the Ecosystem |
| National needs | Have an over view of mitigation measures of disaster management. Explain major conservation strategies taken in India. Apply the Knowledge of role of information technology in protection of the environment. |
| Global needs | Environmental studies is globally relevant to monitor environmental issues and for the sustainable development. It deals with issues and challenges of environment management in the changing climate scenario. |

**b) Components on Skill Development/Entrepreneurship Development/Employability**

| SD/ED/EMP | Syllabus Content | Description of Activity |
|---|---|---|
| Skill Development, Entrepreneurship Development, Employability | Unit II<br><br>Solid Waste Management | Demonstration of Composting, Vermicomposting and the preparation of Bio-Enzymes. Awareness on scope of green entrepreneurship and employability related to Solid waste management |

**7. Pedagogy**

| S. No | Student Centric Methods Adopted | Type / Description of Activity |
|---|---|---|
| 1. | Experiential learning | Field trips, Documentary watching, Demonstrations, Student volunteering days, Plantation drives, Clean up drives |
| 2. | Participative Learning | Seminars, Workshops, Guest lectures, Group Discussion, Library reference, Presentations and Competitions, Demonstrations by students |
| 3. | Problem Solving | Case Studies, Projects |

**8. Course Assessment Plan**

**a) Weightage of Marks in Internal Assessments and End Semester Examination**

| CO | Internal Assessments IA -40% | End Semester Examination-60% |
|---|---|---|
| CO1 | Field Visit report/Case Study/ Poster making/ Presentations/Eco Friendly product making/Model making | Written Exam |
| CO2 | | |

**b) Model Question Paper- End Semester Exam**

**ENVIRONMENTAL STUIDES**

**Course Code: U24/EVS/AECC/201**

**Time: 1 Hour** **Max. Marks: 30**

**Answer any five of the following:** **5X6=30**

1. Define environmental studies and mention the importance of environmental studies.
2. "Biomass is an important source of energy", Discuss.
3. Explain the rooftop rainwater harvesting system with the help of a diagram.
4. Identify the reasons for water pollution in your region and suggest measures to reduce the water pollution.
5. Discover the initiatives taken by swachh cities in solid waste management.
6. Comment on "Silent Valley- A people's movement that saved a forest."
7. List out the changes you would make in your lifestyle to reduce your carbon footprint.

**c) Question Paper Blueprint**

| Modules | Hours Allotted in the Syllabus | COs Addressed | Section A (No. of Questions) | Total Marks |
|---|---|---|---|---|
| I | 15 | CO 1 | 3 | 6 |
| II | 15 | CO 2 | 4 | 6 |

| Prepared by | Checked & Verified by | Approved by |
|---|---|---|
| G. Dhanalakshmi<br>Head, Dept. of Environmental Studies | G. Dhanalakshmi,<br>Head, Dept. of Environmental Studies | Dr. Uma Joseph<br>Principal |



CHAIR PERSON B.O.S. in Environmental Science
University College of Science
Osmania University
Hyderabad-500 007.

Head
Dept.of Environmental Studies
St.Francis College for Women
(Autonomous)
Begumpet,Hyderabad-16

## SEMESTER - II

## BIOLOGICAL CHEMISTRY & MICROBIOLOGY

**1. Course Description**

**Programme: B.Sc.**
**Course Code: U24/BIT/DSC/201**
**Course Type: DSC-2**
**No. of credits: 4**

**Max. Hours: 60**
**Hours per week: 4**
**Max. Marks: 100**

**2. Course Objectives**

- To provide students with a comprehensive understanding of the fundamental principles and intricacies of biochemistry, enabling them to comprehend the molecular basis of life processes.
- To learn about the principles of microbiology and acquire an understanding of fundamental microbiological concepts as well as several ways for isolating pure cultures

**3. Course Outcomes**

On completion of the course the student will be able to:

**CO1**: Recall, Identify, understand, and derive the basic structure, properties and biological importance of various biomolecules (**REMEMBER, UNDERSTAND, APPLY**)

**CO2:** Retrieve, interpret and analyse the different cellular and metabolic processes that lead to production and utilization of energy. (**REMEMBER, UNDERSTAND, ANALYZE**)

**CO3:** Recognize and summarize the contributions of scientists in the field of Microbiology, gain an insight into classification, characterization of microorganisms and apply skills in handling microscopes. **((REMEMBER, UNDERSTAND, APPLY)**

**CO4:** Outline, apply and evaluate microbiological practices like Sterilization techniques, isolation, and culturing of microorganisms to study the microbial cells. **(UNDERSTAND, APPLY, EVALUATE)**

**4. Course Content**

## MODULE I : BIOMOLECULES (15 HRS)

- Carbohydrates - importance, classification; structure and functions of monosaccharides (glucose & fructose), disaccharides (sucrose, lactose & maltose) and polysaccharides (starch, glycogen & inulin)
- Amino acids- importance, classification, structure, physical and chemical properties of amino acids; peptide bond formation
- Proteins- importance, structure of proteins- primary, secondary, tertiary and quaternary
- Lipids- importance, classification- simple lipids (triacyl glycerides & waxes), complex lipids (phospholipids & glycolipids), derived lipids (steroids, terpenes &carotenoids)
- Introduction to Nucleic acids, Structure of DNA.
- Enzymes- importance, classification, and nomenclature; Michaelis-Menton Equation, factors influencing the enzyme reactions; enzyme inhibition (competitive, uncompetitive & mixed), co-enzymes

## MODULE II– BIOENERGETICS (15 HRS)

- Glycolysis, Tricarboxylic Acid (TCA) Cycle
- Electron Transport, Oxidative Phosphorylation
- Gluconeogenesis and its significance
- Transamination and Oxidative deamination reactions of amino acids
- B-Oxidation of Fatty acids
- Glyoxalate cycle

## MODULE III: FUNDAMENTALS OF MICROBIOLOGY (15 Hrs)

- Historical development of Microbiology and contributors of microbiology (Edward Jenner, Antony Van Leeuwenhoek, Louis Pasteur, Robert Koch, Alexander Fleming)
- Microscopy: Bright field microscopy, Dark field microscopy, Phase contrast microscopy, fluorescent microscopy, Scanning and Transmission electron microscopy
- Outlines of classification of microorganisms.



Prof. SMITA C. PAWAR
Department of Genetics
Osmania University
Hyderabad-500 007. T.S.

- Structure and general characteristics of bacteria and virus
- Structure and general characteristics of micro-algae and fungi.

**MODULE IV : CULTURE AND IDENTIFICATION OF MICROORGANISMS**

**(15 Hrs)**

- Methods of sterilization- physical and chemical methods
- Bacterial nutrition, nutritional types of bacteria, essential macro, micronutrients, and growth factors
- Bacterial growth curve-batch and continuous cultures, synchronous cultures
- Measurement of bacterial growth-measurement of cell number and cell mass.
- Factors affecting bacterial growth.
- Culturing of anaerobic bacteria and viruses
- Pure cultures and its characteristics

**5. Reference Books:**

1. Tortora G.J., Funke B.R. and Case C.L. (2008). Microbiology: An Introduction. (IX. Edition): Pearson Education
2. Wiley J.M., Sherwood L.M. and Woolverton C.J. (2008). Prescott, Harley and Klein's Microbiology. McGraw Hill Higher Education
3. Pelczar M.J., Chan E.C.S and Krieg N.R. (1993). Microbiology. 5th edition: McGraw Hill Book Company.
4. Jain, J.L., S. Jain and Nitin Jain. (2008). Fundamentals of Biochemistry. New Delhi:S. Chand & Company Ltd.
5. Nelson, D.L. and Cox, M.M. (2008). Lehninger: Principles of Biochemistry. (V Edition). New York:W.H. Freeman and Company.
6. Satyanarayana U, Chakrapani U. (2008). Biochemistry: Books& Allied (P) Ltd.

## 6. Syllabus Focus

**a)** Relevance to Local , Regional , National and Global Development Needs

| Local /Regional/National /Global Development Needs | Relevance |
|---|---|
| National Development<br><br>(Module 1, 2 & 3) | Addressing Health, Agriculture, Environment, and industry challenges through Research Innovation with an interdisciplinary collaboration in Biochemistry and Microbiology. |
| Global development<br><br>(Module 4) | The course addresses global imperatives by fostering interdisciplinary scholarship, innovation, and sustainable solutions for pressing societal challenges. |

**b) Components on Skill Development/Entrepreneurship Development/Employability**

| **SD/ED/EMP** | **Syllabus Content** | **Description of Activity** |
|---|---|---|
| Skill Development | (Module 1 & 3) | Seminar presentations, Art projects, group discussions to understand and evaluate the basics of Biochemistry and Microbiology. |
| Employability | (Module 2 & 4) | Hands on training on different media preparations, biochemical estimate analysis, pure culture procedures and handling of varied microscopes are useful in enhancing employability across a range of diagnostic labs. |



Prof. SMITA C. PAWAR
Department of Genetics
Osmania University
Hyderabad-500 007. T.S.

**7. Pedagogy**

| S. No | Student Centric Methods Adopted | Type / Description of Activity |
|---|---|---|
| 1. | Participative Learning | Seminar |
| 2. | Experiential Learning | Quiz |
| 3. | Participative Learning | Group Discussion |
| 4. | Participative Learning | Presentation |
| 5. | Experiential Learning | Art projects |
| 6. | Problem Solving | Research projects |
| 7. | Experiential Learning | Science experiments |
| 8. | Experiential Learning | Internship opportunities |

**8. Course Assessment Plan**

**A) Weightage of Marks in Continuous Internal Assessments and End Semester Examination**

| CO | Continuous Internal Assessments- CIA (40%) | End Semester Examination - (60%) |
|---|---|---|
| CO1 | CIA-1 Written Exam | Written Exam |
| CO2 | CIA-2 Quiz/ Assignment/Seminar Presentation | |
| CO3 | CIA-1 Written Exam | |
| CO4 | CIA-2 Presentation/ Art projects/ Science experiments/ Case studies | |

**b) Model Question Paper- End Semester Exam**

## BIOLOGICAL CHEMISTRY & MICROBIOLOGY

**Course Code: U24/BIT/DSC/201** **Max. Marks: 60**

**Credits: 4** **Time: 2 Hrs**

### SECTION – A

**I. Answer the following** **4 x 10 = 40 M**

1. Classify the types of carbohydrates. Add a note on their nomenclature and biological significance.

OR

2. How do you apply Michaelis-Menton Equation in enzyme kinetics.

3. How would you describe the TCA cycle

OR

4. Illustrate the process of β-Oxidation of Fatty acids

5. How would you summarize the principle and working of Transmission Electron Microscopy

OR

6. Illustrate the salient features of bacterial cell structure with well labelled diagrams

7. Explain about Batch culture. Add a detailed note on bacterial growth curve.

OR

8. Define sterilization. Compare the different physical sterilization methods.

### SECTION – B

**II. Answer any <u>FOUR</u> of the following** **4 x 5 = 20 M**

9. How would you classify the types of Phospholipids
10. What are the features of Oxidative phosphorylation
11. Summarize the contributions of Louis Pasteur.
12. Describe the factors affecting bacterial growth
13. Report the chemical properties of Amino acids.
14. Compare the isolation of different pure culture techniques

## SEMESTER-END MODEL QUESTION PAPER

| SECTION A - INTERNAL CHOICE<br>4 Q X 10 M = 40 M | | | | |
|---|---|---|---|---|
| Question Number | **Question** | **Question** | **CO** | BTL(Blooms Taxonomy Level) |
| 1 | Module 1 | Classify the types of carbohydrates. Add a note on their nomenclature and biological significance. | CO 1 | II |
| 2 | Module 1 | How do you apply Michaelis-Menton Equation in Enzyme kinetics | CO 1 | III |
| 3 | Module 2 | How would you describe the TCA cycle | CO 2 | I |
| 4 | Module 2 | Illustrate the process of β-Oxidation of Fatty acids | CO 2 | II |
| 5 | Module 3 | How would you summarize the principle and working of Transmission Electron Microscopy | CO 3 | II |
| 6 | Module 3 | Illustrate the salient features of bacterial cell structure with well labelled diagrams | CO 3 | II |
| 7 | Module 4 | Explain about Batch culture. Add a detailed note on bacterial growth curve | CO 4 | V |
| 8 | Module 4 | Define sterilization. Compare the different physical sterilization methods | CO 4 | II |

| SECTION B - ANSWER ANY 4 OUT OF 6<br>4 Q X 5 M = 20 M<br>(To compulsorily have **ONE** question from **each** module) | | | | |
|---|---|---|---|---|
| 9 | Module 1 | How would you classify the types of Phospholipids | CO 1 | II |
| 10 | Module 2 | What are the features of Oxidative phosphorylation | CO 2 | IV |
| 11 | Module 3 | Summarize the contributions of Louis Pasteur | CO 3 | II |
| 12 | Module 4 | Describe the factors affecting bacterial growth | CO 4 | II |
| 13 | Any Module | Report the chemical properties of Amino acids | CO 1 | II |
| 14 | Any Module | Compare the isolation of different pure culture techniques | CO 4 | V |



Prof. SMITA C. PAWAR
Department of Genetics
T.S.

## SEMESTER-II
## BIOLOGICAL CHEMISTRY & MICROBIOLOGY- PRACTICAL

### 1. Course description

**Programme: B.Sc**
**Course Code: U24/BIT/DSC/201/P**
**Course Type: DSC-2**
**No. of credits: 1**

**Max. Hour: 30**
**Hours per week: 2**
**Max. Marks: 50**

### 2. Course objective:

- To provide students a practical exposure in biochemical techniques to develop proficiency in laboratories skills that prepares them for future research or professional endeavors.
- To aid students gain hands on experience in basic Microbiological techniques including aseptic handling, staining and culture methods and apply this knowledge in research or clinical findings.

### 3. Course Outcomes:

On completion of the course the student will be able to

**CO-1:** Recall, perform and evaluate biochemical tests of various biomolecules (**REMEMBER, EVALUATE**)

**CO-2:** Classify and apply skills to prepare and sterilize media for culturing of microorganisms. (**APPLY & ANALYSE**)

**CO-3:** Distinguish and analyze the isolated microorganisms by differential staining techniques. (**ANALYSE**)

## PRACTICAL SESSIONS

1. Estimation of reducing sugar by DNS reagent.
2. Estimation of proteins by Biuret method.
3. Estimation of cholesterol by Zak and Henly's method.
4. Paper chromatography- using Amino acids samples.
5. Preparation of media & Inoculation methods- pour, plate and streak.
6. Staining techniques- gram staining.
7. Special staining technique- Negative staining.
8. Antibiotic sensitivity test.

**Spotters:**

1. Osazone
2. Globular protein
3. Lock and Key model
4. Competitive inhibition
5. RUBISCO
6. ATP synthase
7. Autoclave
8. Laminar air flow
9. Tyndalization
10. Bacterial growth curve
11. Hot air oven
12. Serial dilution technique

## SEMESTER-II

## BIOLOGICAL CHEMISTRY & MICROBIOLOGY-PRACTICAL

**Course Code: U24/BIT/DSC/201/P** **Max. Marks: 50**

**Credits: 1** **Time: 2Hrs**

**I. MAJOR:** **(20M)**

Estimate the concentration of protein present in the given unknown sample using colorimetric estimation method. Write the principle and procedure of the experiment. Calculate and report the results.

**II. MINOR:** **(10M)**

Perform negative staining using the given sample and report the results. Write the principle and procedure for the same.

**III. IDENTIFY THE GIVEN SPOTTERS:** **(10M)**

**IV. VIVA** **(5M)**

**V. RECORD** **(5M)**

| Prepared by | Checked & verified by | Approved by |
|---|---|---|
| 4/3/24 (Ms. Shouni Nivedita) Name and Signature of the teaching faculty | 4/3/24 (Ms. Shouni Nivedita) Name and Signature of HoD | Name and Signature of Principal |



Prof. SMITA C. PAWAR
Department of Genetics
Osmania University
Hyderabad-500 007. T.S.

**St. FRANCIS COLLEGE FOR WOMEN, BEGUMPET HYDERABAD-500016 (An Autonomous College Affiliated to Osmania University)**

**DEPARTMENT OF CHEMISTRY**

**DISCIPLINE SPECIFIC CORE I**
**CHEMISTRY PAPER I**
**B.Sc. I - SEMESTER- II 60 Hrs**

**Module 1: Inorganic Chemistry**

p-block elements

Interhalogen Compounds

Chemistry of Zero group elements

Boranes and Carboranes

Metal carbonyls

**Module 2: Physical Chemistry**

Electrochemistry

**Module 3: Organic Chemistry**

Aromatic Hydrocarbons
Halogen compounds
Alcohols, Phenols, Ethers

**Module 4: General Chemistry**

Solutions
Symmetry of molecules
Stereochemistry of Carbon Compounds

## CHEMISTRY – II

### Course Description

Programme: **B.Sc.** Max. Hours: **60 Hrs**

Course Code: **U24/CHE/DSC/201** Hours per week: **4 Hrs**

Course Type: **DSC-2** Max. Marks: **100**

No. of credits: **4**

**Course Objectives**

- To study about the elements of p block and the properties of their compounds.
- To understand the behavior of electrolytes in solution and to know the applications of electrode

Chairperson
Board of Studies in Chemistry
Dept of Chemistry
Osmania University, Hyd-07.

process.

- To learn the methods of preparation and reactivity of hydrocarbons with mechanisms and to classify and identify organic molecules by their functional groups.

- To learn the structures of basic organic molecules, the types of reactions they undergo and their stereochemistry and to foster acquisition of knowledge on the concepts of solutions.

**Course Outcomes**

On completion of the course the student will be able to:

CO1: Acquire knowledge on p-block elements.

CO2: Understand the theory of electrical conductance, transformation of chemical energy into electrical energy in Galvanic cells.

CO3: Interpret the concept of aromaticity and familiarize with the various types of aliphatic and aromatic reactions. Recognize functional groups in organic molecules and predict their reactivity through mechanisms.

CO4: Application of the behaviour of solutions and acquire a fundamental understanding of the relationships between molecular structure and reaction mechanisms.

**Course Content**

**MODULE I: Inorganic Chemistry** **(15 Hrs)**

**p-block elements** **(10 Hrs)**

General Characteristics of p block elements.

Group – 13: Synthesis and structure of diborane and higher Boranes ($B_2H_6$ and $B_4H_{10}$) Preparation and structure of boron-nitrogen compounds ($B_3N_3H_6$ and BN), Lewis acid nature of the BX.

Group – 14: Classification (ionic, covalent, interstitial) and industrial applications of Carbides. Preparation, classification (straight chain, cyclic and cross-linked) and applications of silicones, Preparation and applications of graphitic compounds.

Group – 15: Preparation, structure and reactions of hydrazine, hydroxylamine, Phosphazenes
Group – 16: Classifications of oxides based on (i) Chemical behavior and (ii) Oxygen content. Normal: acid, basic, amphoteric and neutral, Mixed oxides, Sub oxides, Peroxides, Super oxides.

Oxyacids of N, P, S and Cl – structure, acidic nature and redox

properties

**Interhalogen Compounds**

Classification- general preparation- structures of AB, $AB_3$, $AB_5$ and $AB_7$ type and reactivity. Poly halides- definition and structure of $ICl_2^-$, $ICl_4^-$ and $I_3^-$.Comparison of Pseudo halogens with halogens.

**Chemistry of Zero group elements**

Chairperson
Board of Studies in Chemistry
Dept of Chemistry
Osmania University, Hyd-07.

General preparation, structure, bonding and reactivity of Xenon compounds – Oxides, Halides. Clathrate compounds.

**Boranes and Carboranes** **(2 Hrs)**

Definition of clusters. Structures of boranes and carboranes- Wade's rules, closo, nido, arachno Boranes and carboranes

**Metal carbonyls** **(3 Hrs)**

Preparation and properties of $Ni(CO)_4$. Structural features of $Ni(CO)_4$, $Fe(CO)_5$, $Fe_2(CO)_9$ and $Cr(CO)_6$-18 valence electron rule.

## MODULE II: Physical Chemistry (15 Hrs)

Electrochemistry

Electrical transport – conduction in metals & in electrolyte solutions, specific conductance & equivalent conductance and measurement of equivalent conductance, variation of specific and equivalent conductance with dilution. Migration of ions and Kholrausch's law. Arrhenius theory of electrolytic dissociation and its limitation, weak and strong electrolytes, Ostwald's dilution law, its uses and limitations. Debye- Huckel- Onsagar's equation for strong electrolytes (elementary treatment only). Transport number, definition and determination by Hittorf method for attackable and non-attackable electrodes. Applications of conductivity measurements. Determination of degree of dissociation, determination of $K_a$ of acids, determination of solubility product of sparingly soluble salt, conductometric titrations. Electrolytic and Galvanic cell – reversible and irreversible cells, conventional representation of electrochemical cell. EMF of a cell and its measurement. Computation of EMF. Types of reversible electrodes gas electrode, metal - metal ion, metal - insoluble salt and redox electrode. Electrode reactions, Nernst equation, cell EMF and single electrode potential, stanard Hydrogen electrode – reference electrodes (calomel electrode) – standard electrode potential, sign conventions, electrochemical series and its significance. Calculation of thermodynamic quantities of cell reaction – $\Delta G$, $\Delta H$ and $K$ .Determination of pH using Hydrogen electrode, Glass electrode, quinhydrone electrode, solubility product of AgCl. Potentiometric titrations.

## MODULE III: Organic Chemistry (15 Hrs)

**Aromatic Hydrocarbons** **(6 Hrs)**

Concept of aromaticity –definition, Huckel's rule – application to Benzenoids and Non – Benzenoids (cyclopropenyl cation, cyclopentadienyl anion and tropylium cation).
Preparations: From acetylene, phenols, benzene carboxylic acids and sulphonic acids
Reactions - General mechanism of electrophilic substitution, mechanism of nitration, sulphonation,and halogenation, Friedel Craft's alkylation and acylation. Orientation of aromatic substitution - Definition of ortho, para, and meta directing groups. Ring activating and deactivating groups with examples. Orientation – (i) activating groups: Amino, methoxy and alkyl groups. (ii) Deactivating groups - carboxyl, nitro, nitrile, carbonyl and sulphonic acid & halo groups.

Chairperson
Board of Studies in Chemistry
Dept of Chemistry
Osmania University, Hyd-07.

**Halogen compounds** **(4 Hrs)**

Nomenclature and classification: alkyl (primary, secondary, tertiary), aryl, aralkyl, allyl, vinyl, benzyl. Chemical reactivity - reduction, formation of RMgX, Nucleophilic substitution reactions – classification into $S_N1$ and $S_N2$. Mechanism and energy profile diagrams of $S_N1$ and $S_N2$ reactions. Stereochemistry of $S_N2$ (Walden Inversion) 2-Bromobutane, $S_N1$ (Racemisation) 1-Bromo-1-phenylpropane explanation of both by taking the example of optically active alkyl halide.Structure and reactivity – Ease of hydrolysis - comparison of alkyl, vinyl, allyl, aryl, and benzyl halides.

**Alcohols, Phenols, Ethers** **(5 Hrs)**

**Alcohols:** Preparation of 1°, 2° and 3° alcohols using Grignard reagent, Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acid and esters. Reactions: With sodium, HX (Lucas test), esterification (mechanism), oxidation (with PCC, alk. $KMnO_4$, acidic dichromate, conc. $HNO_3$). Oppenauer oxidation

**Diols:** oxidation of diols, Pinacol – Pinacolone rearrangement.

**Phenols:** Preparation: Cumene hydroperoxide method, from diazonium salts. Reactions: Electrophilic substitution: Nitration, Halogenation and sulphonation. Reimer- Tiemann Reaction (with mechanism), Gattermann Aldehyde Reaction, Houben–Hoesch Condensation, Schotten – Baumann Reaction, Azo coupling reactions

**Ethers** (aliphatic and aromatic): Preparation: Williamson synthesis, Reaction: Cleavage of ethers with HI.

**MODULE IV: General Chemistry** **(15 Hrs)**

**Solutions** **(6 Hrs)**

Liquid- liquid mixtures – ideal liquid mixtures, Raoult's and Henry's law. Non – ideal systems. Azeotropes: HCl-$H_2O$, ethanol – water systems. Fractional distillation. Partially miscible liquids – phenol – water, trimethyl amine – water system, Nicotine - water

Lower and upper consolute temperature. Effect of impurity on consolute temperature. Immiscible liquids and steam distillation.

**Symmetry of molecules (3 Hrs)**

Symmetry operations and symmetry elements in molecules. Definition of Axis of symmetry types of Cn, Plane of symmetry (σh, σv, σd) Center of symmetry and improper rotational axis of symmetry (Sn). Explanation with examples.

**Stereochemistry of Carbon Compounds (6 Hrs)**

Conformations with respect to ethane, butane and cyclohexane. Molecular representation: Wedge Formula, Newmann, Sawhorse and Fischer representations. Optical isomerism: optical activity, optical rotation and specific rotation, Concept of chirality. Examples: Glyceraldehyde, Lactic acid, Alanine. Molecules with similar chiral carbons (Tartaric acid), Enantiomers and Meso compounds. Molecules with dissimilar chiral carbons (2,3 – Dibromopentane). Diastereomerism. Configuration: Relative (D and L) and Absolute configuration, CIP Rules: R/S Racemic mixture racemization and resolution techniques (chemical method only) Geometrical isomerism with reference to alkenes and cycloalkanes: cis – trans and E/Z configuration.

Chairperson
Board of Studies in Chemistry
Dept of Chemistry
Osmania University, Hyd-07.

## SEMESTER – II
## MICROBIAL PHYSIOLOGY -THEORY

### 1. Course Description:

**Programme: B.Sc.**
**Course Code:U24/MIC/DSC/201**
**Course Type: DSC**
**No. of credits: 4**

**Max. Hours: 60**
**Hours per week: 4**
**Max. Marks: 100**

### 2. Course Objectives:

- This course will help the students gain knowledge about the Microbial physiology and metabolism by understanding microbial nutrition and growth characteristics.
- Differentiating concepts of aerobic and anaerobic respiration and how these are manifested in the form of different metabolic pathways in microorganisms.

### 3. Course Outcomes:

**CO 1:** Gain knowledge about nutrient transport and growth characteristics of the microorganisms and the mechanisms of energy generation for their survival. (L II), (L III)

**CO 2:** Understand central metabolic pathways, energy production and growth characteristics. (LII)

**CO 3:** Attain insight about aerobic respiration and Photosynthesis of Green, Purple bacteria and Cyanobacteria. (L IV), (L VI)

**CO 4:** Analyse the concepts of anaerobic respiration and fermentation through different metabolic pathways in microorganisms. (L IV)



Chairperson, BoS
Department of Microbiology
Osmania University, Hyd-07

HEAD
Department of Microbiology
Osmania University
Hyderabad-500 007.

4. **Course Content:**

**MODULE I - MICROBIAL NUTRITION:** **(15 Hrs)**

Nutritional requirements of microbes, nutrient uptake. Microbial growth in response to nutrition and energy – Autotroph/Phototroph, Heterotrophy, Chemolithoautotroph, Chemolithoheterotroph, Chemoheterotroph, Photolithoautotroph, Photoorganoheterotroph. Introduction to aerobic and anaerobic chemolithotrophy with an example each. Hydrogen oxidation (definition and reaction), methanogenesis (definition and reaction) and acetogens.

**MODULE II - MICROBIAL GROWTH AND METABOLISM:** **(15Hrs)**

Definitions of growth, Batch culture, Continuous culture, generation time and specific growth rate. Synchronous growth, diauxic growth curve. Measurement of microbial growth. Microbial growth in response to environment -Temperature (psychrophiles, mesophiles, thermophiles, extremophiles, thermodurics, psychrotrophs), pH (acidophiles, alkaliphiles), Solute and water activity (halophiles, xerophiles, osmophiles), Oxygen (aerobic, anaerobic, microaerophilic, facultative aerobe, facultative anaerobe), barophiles with examples.

**MODULE III- AEROBIC RESPIRATION & PHOTOTROPHISM:** **(15 Hrs)**

Sugar degradation pathways i.e. EMP, ED, Pentose phosphate pathway , TCA cycle, Electron transport chain. Introduction to phototrophic metabolism - groups of phototrophic microorganisms, anoxygenic vs. oxygenic photosynthesis with reference to phototrophism in Green bacteria, Purple bacteria, Cyanobacteria.

**MODULE IV- ANAEROBIC RESPIRATION & FERMENTATION:** **(15Hrs)**

Anaerobic respiration with special reference to dissimilatory nitrate reduction (Denitrification; nitrate /nitrite and nitrate/ammonia respiration; fermentative nitrate reduction Fermentation- Alcohol fermentation and Pasteur effect; Lactate fermentation (homofermentative and heterofermentative pathways), concept of linear and branched fermentation pathways.



Chairperson, BoS
Department of Microbiology
Osmania University, Hyd-07

HEAD
Department of Microbiology
Osmania University
Hyderabad-500 007.

**5.Resources:**

**Text Books:**

1. Joanne M. Willey, Linda M Sherwood, Christopher J Wooolverton (2011). Prescott's Microbiology. 8th edition,Mc.Graw Hill publishers.
2. Reddy SR and Reddy SM. (2005). Microbial Physiology. Scientific Publishers India.

**Reference Books:**

1. Madigan MT, and Martinko JM (2014). Brock Biology of Microorganisms. 14th edition. Prentice Hall International Inc.
2. Moat AG and Foster JW. (2002). Microbial Physiology.4th edition.John Wiley & Sons.
3. Stanier RY, Ingrahm JI, Wheelis ML and Painter PR. (1987). General Microbiology. 5th edition,McMillan Press.
4. Gopal Reddy *et al,* (2006), Laboratory experiments in Microbiology, Himalaya Publishers.
5. Prescott, Harley and Klein Wim.(2002), Microbiology , Mc.Graw Hill Publishers.
6. R.C Dubey, D.K Maheshwari, Practical Microbiology, S Chand and Company, New Delhi.
7. Cappucino J and Sherman N. (2010). Microbiology: A Laboratory Manual. 9th edition. Pearson Education Limited.

**Online Resources:**

1. https://microbiologynotes.org/introduction-to-the-microbial-nutrition
2. https://thebiologynotes.com/microbial-growth-and-nutritio
3. http://webbuild.knu.ac.kr/~appmic//introduction%20to%20microbiology/chap8-metabolism.pdf
4. https://bio.libretexts.org/Bookshelves/Microbiology/Microbiology_(OpenStax)/08%3A_Microbial_Metabolism
5. https://www.ncbi.nlm.nih.gov/books/NBK7919/
6. https://microbenotes.com/anaerobic-respiration/
7. https://www.khanacademy.org/science/ap-biology/cellular-respiration-ap/a/fermentation-and-anaerobic-respiration



Chairperson, BoS
Department of Microbiology
Osmania University, Hyd-07

HEAD
Department of Microbiology
Osmania University
Hyderabad-500 007.

**6. Syllabus Focus:**

**a) Relevance to Local, Regional, National and Global Development Needs**

| Local/Regional/National /Global Development Needs | Relevance |
|---|---|
| Global needs | Microorganisms play important role in environment as producers, consumers and decomposers.<br><br>It holds Global needs as Microbiologists play an important role in disease prevention, the development of agrochemicals, and even the preservation of the environment by closely analysing microorganisms. |

**a) Components on Skill Development/Entrepreneurship Development/Employability**

| SD/ED/EMP | Syllabus Content | Description of Activity |
|---|---|---|
| Skill Development | MODULE II | To facilitate the learning process, the students would be trained to cultivate bacteria in different environmental conditions to demonstrate as how it affects their growth and patterns. Problems based questions will be framed to calculate the generation time of bacteria.<br><br>This procedure aims at developing the skills necessary to analyze different (and perhaps more complex) metabolic processes. |



Chairperson, BoS
Department of Microbiology
Osmania University, Hyd-07

HEAD
Department of Microbiology
Osmania University
Hyderabad-500 007.

**7. Pedagogy:**

| S. No | Type/Description of Activity | Student Centric Methods Adopted |
|---|---|---|
| 1. | Interactive class session | Participative Learning |
| 2. | Quiz | Experiential Learning |
| 3. | Group Discussion | Participative Learning |

**8. Course Assessment Plan:**

**a) Weightage of Marks in Continuous Internal Assessments and End Semester Examination**

| Cos | Continuous Internal Assessments - CIA (40%) | End Semester Examination - (60%) |
|---|---|---|
| CO1 | CIA-1 | End Semester examination |
| CO2 | CIA-1 | |
| CO3 | CIA-2 Presentation, Quiz | |
| CO 4 | CIA-2 Assignment | |



Chairperson, BoS
Department of Microbiology
Osmania University, Hyd-07

HEAD
Department of Microbiology
Osmania University
Hyderabad-500 007.

**b) Question Paper Pattern:**

**MICROBIAL PHYSIOLOGY**
**MODEL QUESTION PAPER - THEORY**

**Course Code: U24/MIC/DSC/201** **Max Marks: 60**
**Credits: 4** **Time: 2 Hrs**

**SECTION –A**

**I. Answer the following** **4x10 =40 M**

1. Build in detail about the bacterial nutrition and nutrient uptake.
(OR)
2. How would you identify Chemolithotrophs and give a detail account of it?

3. How would you classify the different phases of bacterial growth curve with different types of microorganisms and environmental conditions.
(OR)
4. What can you write about the different methods involved in measurement of microbial growth?

5. How can you identify the various steps involved in EMP pathway?
(OR)
6. What is the original way to differentiate between Oxygenic and An-oxygenic photosynthesis with examples?

7. What conclusions can you draw between dissimilatory and assimilatory nitrate reduction?
(OR)
8. Compare and contrast between homo-lactic acid and Heterolactic acid fermentation.

**SECTION –B**

**II. Answer any FOUR** **4x5=20 M**

9. How would you organize and identify Phototrophs
10. What are Methanogens
11. Explain about Synchronous growth
12. Compare and contrast Halophiles
13. Construct the steps involved in ED pathway
14. Justify Pasteur effect

**SECTION A - INTERNAL CHOICE** **4Q X 10 M = 40 M**

| Question Number | Module | Question | CO | BTL (Blooms Taxonomy Level) |
|---|---|---|---|---|
| 1 | Module 1 | Build in detail about the bacterial nutrition and nutrient uptake. | CO 1 | Level II, III |
| 2 | Module 1 | How would you identify Chemolithotrophs and give a detail account of it. | CO 1 | Level II, III |
| 3 | Module 2 | How would you classify the different phases of bacterial growth curve with different types of microorganisms and environmental conditions. | CO 2 | Level II |
| 4 | Module 2 | What can you write about the different methods involved in measurement of microbial growth. | CO 2 | Level II |
| 5 | Module 3 | How can you identify the various steps involved in EMP pathway | CO 3 | Level IV, V1 |
| 6 | Module 3 | What is the original way to differentiate between Oxygenic and Anoxygenic photosynthesis with examples. | CO 3 | Level IV, V1 |
| 7 | Module 4 | What conclusions can you draw between dissimilatory and assimilatory nitrate reduction. | CO 4 | Level IV |
| 8 | Module 4 | Compare and contrast between homo-lactic acid and Hetero-lactic acid fermentation | CO 4 | Level IV |

**SECTION B - ANSWER ANY 4 OUT OF 6** **4 Q X 5M = 20M**
(To compulsorily have **ONE** question from **each** module)

| | | | | |
|---|---|---|---|---|
| 9 | Module 1 | How would you organize and identify Phototrophs | CO 1 | Level III |
| 10 | Module 1 | What are Methanogens | CO 1 | Level II |
| 11 | Module 2 | Explain about Synchronous growth | CO 2 | Level II |
| 12 | Module 2 | Compare and contrast Halophiles and Osmophiles | CO 2 | Level II |
| 13 | Module 3 | Construct the steps involved in ED pathway | CO 3 | Level III |
| 14 | Module 4 | Justify Pasteur effect | CO 4 | Level IV |



Chairperson, BoS
Department of Microbiology
Osmania University, Hyd-07

HEAD
Department of Microbiology
Osmania University
Hyderabad-500 007.

## SEMESTER II
## MICROBIAL PHYSIOLOGY –PRACTICAL

**1. Course Description:**

**Course Code: U24/MIC/DSC/201/P**

**Course Type: DSC**

**No. of credits: 1**

**Max. Hours: 30**

**Hours per week:2**

**Max. Marks: 50**

**2. Course Objectives:**

- To enable the students to understand the growth pattern and factors affecting bacterial growth by performing bacterial growth curve experiments.
- To equip and expose students to various culturing techniques for growth of specific microorganisms.

**3. Course Outcomes:**

**CO 1:** Measuring microbial growth, calculate growth kinetic parameters of steady state and continuous growth.

**CO 2:** Analyze the growth characteristics of the microorganisms capable of growing under different environmental conditions of temperature, oxygen, and solute and water activity.

### List of Practicals

1. Enrichment culturing and isolation of phototrophs.
2. Culturing and isolation of chemoautotrophs- nitrifiers.
3. Study and plot the growth curve of *E. coli* by turbidometric method.
4. Determination and study of growth curve by standard plate count methods .
5. Calculation of generation time and specific growth rate of bacteria from the graph plotted with the given data.
6. Determination of viable count of bacteria.
7. Effect of temperature, pH and salt on growth of *E. coli.*
8. Effect of carbon and nitrogen sources on growth of *E.coli.*
9. Demonstration of the thermal death time and decimal reduction time of *E. coli.*
10. Cultivation of Anaerobic bacteria from dental samples and acne.
12. Study the growth pattern of Thermophiles and Alkaliphiles.



Chairperson, BoS
Department of Microbiology
Osmania University, Hyd-07

HEAD
Department of Microbiology
Osmania University
Hyderabad-500 007.

## MODEL QUESTION PAPER – PRACTICAL

**Course Code: U24/MIC/DSC/201/P**
**Course Type: DSC**
**No. of credits: 1**

**Max. Hours: 30**
**Hours per week: 2**
**Max. Marks: 50**

**I. MAJOR** **20M**

1. *E.coli* culture inoculated into nutrient broth and incubated at different time intervals at 37°C , is provided to you. Measure the turbidity and plot the growth curve of the given culture. Calculate the generation time.

**II. MINOR** **10M**

2. An organism is subjected to different parameters. Note the O.D. Plot a graph and comment. pH / Temperature/Salt

(OR)

3. Observe the given culture plates which were exposed to different time intervals at 60°C and interpret the results based on the growth.

**III.** Identify the given spots (A-E) and write few significant points **5x2=10 M**

**IV.** Record **5M**

**V.** Viva **5M**

| Prepared by Faculty | Checked &Verified by HoD | Approved by the Principal |
|---|---|---|
| Dr. Arsheen Tabassum | Dr. P. Roselin | Dr. Uma Joseph |



Chairperson, BoS
Department of Microbiology
Osmania University, Hyd-07

HEAD
Department of Microbiology
Osmania University
Hyderabad-500 007.

**St. FRANCIS COLLEGE FOR WOMEN, BEGUMPET, HYDERABAD-500016**
**(An Autonomous College Affiliated To Osmania University)**
**FACULTY OF SCIENCE- DEPARTMENT OF CHEMISTRY**
**PRACTICAL SYLLABUS CBCS-2024**
**SEMESTER -II**
**QUANTITATIVE ANALYSIS II**
**(Volumetric Analysis)**

Program: B.Sc.
Course Code: U24/CHE/DSC/201/P
Course: DSC-2
No. of Credits: 1

Max. Hours: 20 Hrs
Max. Marks: 50
Hours per week: 2 Hrs

**Course Objectives**

- To develop analytical skills using the principles of quantitative analysis.

**Course Outcomes**

CO 1: Interpret and apply the principles of redox and complexometric titrations.

CO 2: Quantitative estimation of salts using gravimetric principles.

**Volumetric Analysis**

1. Estimation of Fe (II) ions by titrating it with $K_2Cr_2O_7$ using an internal indicator.
2. Estimation of Cu (II) ions using $Na_2S_2O_3$ with $K_2Cr_2O_7$ as primary standard.
3. Estimation of Iodine content in Iodized salt.
4. Estimation Nickel by back titration using $MgSO_4$.
5. Estimation of Zinc using EDTA.
6. Estimation of calcium or magnesium ions in milk.
7. Estimation of hardness of water.

**References:**

1. Vogel's Qualitative Inorganic Analysis, *Svehla, G.* Pearson Education, 2012.
2. J. Vogel's Quantitative Chemical Analysis, *Mendham,* Pearson, 2009.

Chairperson
Board of Studies in Chemistry
Dept of Chemistry
Osmania University, Hyd-07,

## 6. Syllabus Focus

### a. Relevance to Local, Regional, National and Global Development Needs

| Local /Regional/National /Global Development Needs | Relevance |
|---|---|
| **local** | In manufacturing processes, local energy production and storage techniques, production of solvents and other materials, drug formulation and dosage calculations. |
| **Regional** | Preparation of fertilizers impacting agriculture, metal refining process, food and pharmaceutical applications, useful for analytical techniques. |
| **National** | Optimizing the use of P - block elements, focus on electrochemical principles, preparation of polymers, phase transformations of various systems. |
| **Global** | Electronic industry, advancements in electrochemical technologies, sustainable industrial processes impacting the environment, formulation of solutions. |

### b. Components on Skill Development/Entrepreneurship Development/ Employability

| SD/ED/EMP | Syllabus Content | Description of Activity |
|---|---|---|
| **SD** | Module No. 1 | Encourage them to compare and discuss trends in reactivity and chemical behaviour |
| **EMP** | Module No. 2 | Engage students in electrochemical cell design and analysis |
| **ED** | Module No. 3 | Invite professionals or researchers who can share their insights from organic chemistry. |
| **EMP** | Module No. 4 | Divide students into groups and share some real time applications. |

Chairperson
Board of Studies in Chemi
Dept of Chemistry

## 7. Pedagogy

| S. No. | Student Centric Methods Adopted | Type / Description of Activity |
|---|---|---|
| 1. | Experiential Learning | Field trips |
| 2. | Participative Learning | Presentations |
| 3. | Problem solving | Case studies |

## 8. Course Assessment Plan

### a. Weightage of Marks in Continuous Internal Assessments and End Semester Examination

| CO | Continuous Internal Assessments CIA - 40% | End Semester Examination-60% |
|---|---|---|
| CO1 | CIA 1 written exam | Written Exam |
| CO2 | CIA 2 (Quiz/Assignment/3D model making) | |
| CO3 | CIA 1 written exam | |
| CO4 | CIA 2 (Crossword/Problem solving/Assignment) | |

Chairperson
Board of Studies in Chemistry
Dept of Chemistry
Osmania University, Hyd-07

**b. Model Question Paper - End Semester Exam**

**St. FRANCIS COLLEGE FOR WOMEN, BEGUMPET, HYDERABAD-500016**
**(An Autonomous College Affiliated to Osmania University)**
**Faculty of Science – Department of Chemistry**
**MODEL PAPER**
**B. Sc. I YEAR SEMESTER -II**

**TIME: 2 hrs** **Course Code: U24/CHE/DSC/201**
**Max. Marks: 60 M**

**SECTION –A (Essay Questions)**

**I. Answer the following** **4X10M=40 Marks**

1. a). Classify the oxides based on the oxygen content. (CO 1) **L1** 4M
   b). What are interhalogen compounds? Explain the structure of the AX5 type of molecule. (CO 1) **L1** 6M

**OR**

2. a). Discuss the structure of Diborane. (CO 1) **L2** 5M
   b). What are silicones? Classify them. (CO 1) **L1** 5M
3. a). Describe the Hittorf method for the determination of transport number (CO 2) **L2** 5M
   b) Explain Debye –Huckle's theory and the role of inter-ionic effect. (CO 2) **L2** 5M

**OR**

4. a) Explain the working and construction of S.H.E. (CO 2) **L2** 5M
   b) State Kohlrausch law of independent migration of ions and list out its applications. (CO 2) **L2** 5M
5. a) Give the mechanism of Nitration on Benzene. (CO3) **L1** 5M
   b) Write a note on directive influence of methyl group. (CO3) **L1** 5M

**OR**

6. Explain $S_N1$ and $S_N2$ reactions with their mechanism, stereochemistry, and energy profile diagram. (CO 3) **L2** 10M
7. a) What are azeotropes? Explain ethanol-water system. (CO 4) **L2** 5M
   b) State and explain Raoult's law with its limitations. (CO 4) **L2** 5M

**OR**

8. a) Justify that the chair form of cyclohexane is the most stable conformation. (CO4) **L4** 6M
   b) Define proper axis of symmetry. Illustrate with 2 examples. (CO4) **L1** 4M

**SECTION – B (Short Answer Questions)**

**II. Answer any four** **4x5=20 Marks**

9. Discuss the structure of $XeO_3$. (CO1) **L1**
10. Calculate the EMF of Cd, $Cd^{+2}//Cu^{+2}$, Cu $E^0$ ($Cu^{+2}$, Cu) = 0.34V.
    $E^0(Cd^{2+}, Cd)$ = -0.488 V. (CO 2) **L5**
11. How can you interpret aromatic character in a molecule? (CO3) **L5**
12. State and explain Henry's Law and its limitations. (CO 4) **L2**
13. Write a note on Williamson synthesis. (CO3) **L1**
14. What are carbides and give their classification. (CO1) **L1**

Chairperson
Board of Studies in Chem...
Dept of Chemistry
Osmania University, Hyd-07.

**b. Model Question Paper - End Semester Exam**

**St. FRANCIS COLLEGE FOR WOMEN, BEGUMPET, HYDERABAD-500016**
**(An Autonomous College Affiliated to Osmania University)**
**Faculty of Science – Department of Chemistry**
**B. Sc. I YEAR SEMESTER -II**

**Time: 2 Hrs** **Course Code: U24/CHE/DSC/201**
**Max. Marks: 60M** **Credits: 4**

| **SECTION A - INTERNAL CHOICE** | | | **4 Q X 10 M = 40M** | |
|---|---|---|---|---|
| **Question Number** | **Question** | | **CO** | **BTL** |
| **1** | **Module 1** | a)Classify the oxides based on the oxygen content. 4M<br>b) What are interhalogen compounds? Explain the structure of $AX_5$ type of molecule. 6M<br>**OR** | **CO 1** | **(Level II)** |
| **2** | **Module 1** | a) Discuss the structure of Diborane. 5M<br>b)What are silicones? Classify them 5M | **CO 1** | **(Level II)** |
| **3** | **Module 2** | a) Describe the Hittorf method for the determination of transport number 5M<br>b) Explain Debye –Huckle's theory and explain the role of inter-ionic effect. 5M<br>**OR** | **CO 2** | **(Level II)** |
| **4** | **Module 2** | a) Explain the working and construction of S.H.E. 5M<br>b) State Kohlrausch law of independent migration of ions and list out application 5M | **CO 2** | **(Level II)** |
| **5** | **Module 3** | a) Give the mechanism of Nitration on Benzene. 5M<br>b) Write a note on directive influence of methyl group. 5M<br>**OR** | **CO 3** | **(Level I)** |
| **6** | **Module 3** | Explain the hydrolysis of primary and tertiary alkyl halides with mechanism, stereochemistry and energy profile Diagram. 10M | **CO 3** | **(Level II)** |

Chairperson
Board of Studies in Chem...
Dept of Chemistry
Osmania University, Hyd-07.

| | | | | |
|---|---|---|---|---|
| 7 | **Module 4** | a) What are azeotropes? Explain ethanol-water system. 5M<br>b) State and explain Raoult's law with its limitations. 5M<br>**OR** | **CO 4** | **(Level II)** |
| 8 | **Module 4** | a) Justify that the chair form of cyclohexane is the most stable conformation. 6M<br>b) Define proper axis of symmetry. Illustrate with 2 examples. 4M | **CO 4** | **(Level IV)** |
| **SECTION B – (Short answer questions)**<br>**ANSWER ANY 4 OUT OF 6** **4 X 5M = 20 M** | | | | |
| 9 | **Module 1** | Discuss the structure of $XeO_3$ | **CO 1** | **(Level I)** |
| 10 | **Module 2** | Calculate the EMF of $Cd,Cd^{+2}//Cu^{+2},Cu$ $E^0(Cu^{+2},Cu) = 0.34V$. $E^0(Cd^{2+},Cd) = -0.488V$. | **CO 2** | **(Level V)** |
| 11 | **Module 3** | How can you interpret aromatic character in a molecule? | **CO 3** | **(Level V)** |
| 12 | **Module 4** | State and explain Henry's Law and its limitations. | **CO 4** | **(Level II)** |
| 13 | **Module 3** | Write a note on Williamson synthesis. | **CO 3** | **(Level I)** |
| 14 | **Module 1** | What are carbides and give their classification. | **CO 1** | **(Level I)** |

Chairperson
Board of Studies in Chemistry
Dept of Chemistry
Osmania University, Hyd-07.