

SEMESTER I

ENVIRONMENTAL STUDIES

1. Course Description

Program: BSC

Max. Hours: 30

Course Code: U24/EVS/AECC/101

Hours per week: 2

Course Type: AECC

Max. Marks: 50

No. of credits: 2

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

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DEPARTMENT OF ENVIRONMENTAL STUDIES
 CHAIR PERSON B.O.
 Environmental Science
 University College of Science
 Osmania University
 Hyderabad-500 007.

ST. FRANCIS COLLEGE FOR WOMEN, HYDERABAD

Johnalakshmi
 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

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	<p>Develop a critical understanding of Environmental issues and concerns. Inculcate the environmental ethics and work for sustainable future</p> <p>Utilise the potential application of Methods of Solid Waste Management in the Waste management concerns</p> <p>Involve in community development through extension and organising programs.</p>
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 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 STUDIES

Course Code: U24/EVS/AECC/101

Time: 1 Hour

Max. Marks: 30

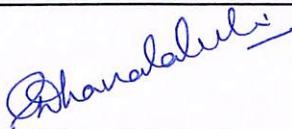
Answer any five of the following:

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 Head, Dept. of Environmental Studies	 G. Dhanalakshmi, Head, Dept. of Environmental Studies	 Dr. Uma Joseph Principal

SEMESTER II

ENVIRONMENTAL STUDIES

6. Course Description

Program: BA, BMS & BCOM

Max. Hours: 30

Course Code: U24/EVS/AECC/201

Hours per week: 2

Course Type: AECC

Max. Marks: 50

No. of credits: 2

7. Course Objectives:

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8. Course Outcomes:

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

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9. COURSE CONTENT

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

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6. Syllabus Focus

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Local /Regional/ National /Global Development Needs	Relevance
Local needs	<p>Develop a critical understanding of Environmental issues and concerns. Inculcate the environmental ethics and work for sustainable future</p> <p>Utilise the potential application of Methods of Solid Waste Management in the Waste management concerns</p> <p>Involve in community development through extension and organising programs.</p>
Regional needs	Creates awareness on pollution and threats to biodiversity in the Ecosystem
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SD/ED/EMP	Syllabus Content	Description of Activity
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7. Pedagogy

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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 STUDIES

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.
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II	15	CO 2	4	6

Prepared by	Checked & Verified by	Approved by
 G. Dhanalakshmi Head, Dept. of Environmental Studies	 G. Dhanalakshmi, Head, Dept. of Environmental Studies	 Dr. Uma Joseph Principal

SEMESTER - II

ANIMAL DIVERSITY - VERTEBRATES

1. Course Description

Programme: B.Sc**Max. Hours:** 60**Course Code:** U24/ ZOO/ DSC/201**Hours per week:** 4**Course Type:** DSC - II**Max. Marks:** 100**No. of credits:** 4

2. Course Objectives

- Identify the various vertebrate classes and cites the examples of individual species that belong to them
- Describes the diversity and evolutionary relationship of vertebrates by integrating knowledge in comparative anatomy and physiology
- Understands the geographical distribution of common vertebrates and basic structural & functional aspects of Animal diversity

3. Course Outcomes

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

CO1: To understand and appreciate the study of significance of animal biodiversity.

CO2: To remember general characteristics of vertebrates.

CO3: To analyze the various adaptations in vertebrates and their basic differences among Amphibians, Reptiles, Birds and Mammals.

CO4: To apply the gained knowledge in comprehending the structural organization in vertebrates.



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| DEPARTMENT OF ZOOLOGY, ST. FRANCIS COLLEGE FOR WOMEN, HYDERABAD

PROFESSOR & HEAD

Professor of Zoology, UGC

Board of Studies in Zoology, Osmania University, Hyd-07.

Osmania University, Hyd-07.

4. Course Content**Module I: Urochordata, Cephalochordata and Cyclostomata 15 HRS**

- 1.1 Salient features of Urochordata
- 1.2 Retrogressive metamorphosis and its significance in Urochordata
- 1.3 Salient features and affinities of Cephalochordata; General characters of Cyclostomata
- 1.4 Comparison of the Petromyzon and Myxine
- 1.5 General characters and classification of Chordata upto orders with examples.

Module II: Pisces & Amphibia 15 HRS

- 2.1 General characters of Fishes; Classification of fishes up to order level with examples
- 2.2 Scoliodon – Respiratory, Circulatory and Nervous system.
- 2.3 Types of Scales and types of Fins
- 2.4 General characters and Classification of Amphibians up to orders with examples.
- 2.5 Rana tigrina - Respiratory, Circulatory and Nervous system.
- 2.6 Parental care in amphibians; Neoteny and Paedogenesis.

Module III: Reptilia & Aves 15 HRS

- 3.1 General characters of Reptilia; Classification of Reptilia up to orders with examples
- 3.2 Calotes – Respiratory system, Circulatory and Nervous system
- 3.3 Temporal fosse in reptiles and its evolutionary importance;
- 3.4 General characters of Aves; Classification of Aves up to orders with examples.
- 3.5 Columba livia - Digestive system, Circulatory systems, Respiratory system and Nervous system.
- 3.6 Migration in Birds; Flight adaptation in Birds

Module IV: Mammalia 15 HRS

- 4.1 General characters of Mammalia
- 4.2 Classification of Mammalia up to orders with examples
- 4.3 Rabbit – Digestive system, Respiratory, Circulatory and Nervous system.
- 4.4 Dentition in mammals.
- 4.5 Aquatic adaptations in Mammals.
- 4.6 Flying adaptations in Mammals

5. References:

1. E.L.Jordan and P.S. Verma 'Chordate Zoology' - S. Chand Publications.
2. Mohan P.Arora. 'Chordata – I, Himalaya Publishing House Pvt.Ltd.
3. Marshal, Parker and Haswell 'Text book of Vertebrates'. ELBS and McMillan, England.
4. Alfred Sherwood Romer. Thomas S. Pearson 'The Vertebrate Body, Sixth edition, CBS college Publishing, Saunders College Publishing
5. J.W. Young, The Life of Vertebrates, 3rd ed, Oxford University press.
6. Harvey Pough F, Christine M. Janis, B. Heiser, Vertebrate Life, Pearson, 6th ed, Pearson Education Inc.2002.



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CHAIR MEN
Board of Studies in Zoology,
Osmania University, Hyd-07.

6.Syllabus Focus

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

Local /Regional/National /Global Development Needs	Relevance
National needs	Identifying priority areas for biodiversity is essential for directing conservation resources. Fundamentally, we must know where individual species live, which ones are vulnerable, where human actions threaten them, and their levels of protection.
Global development needs	To map global priority areas using the latest data on vertebrates. As conservation knowledge and threats change, it is essential it is reevaluate on global priorities.


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 Department of Zoology, UCS,
 Osmania University, Hyd-07.
CHAIR MEN
 Board of Studies in Zoology,
 Osmania University, Hyd-01.

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
Skill Development	Module II	Dissection techniques and structural organization in vertebrates
Entrepreneurship Development	Module III & IV	Adaptation and Conservation of Vertebrates

7. Pedagogy

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Experiential Learning	Field trips / Visit to Nehru Zoological Parks, Wild life sanctuaries.
2.	Participative learning	Presentation / Ppt presentation on general topics.
3.	Problem Solving learning	Awareness programmes / local activities of Conservation of Animals.

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 Test	Written Exam
CO2	CIA-1 Written Test	
CO3	CIA - 2 - Assignment	
CO4	CIA - 2 - Objective test	

b) Model Question Paper- End Semester Exam

ANIMAL DIVERSITY – VERTEBRATES
MODEL PAPER - THEORYCOURSE: DSC- II
SUBJECT CODE: U24/ZOO/DSC/201MAX MARKS: 60
TIME: 2HRS

ILLUSTRATE WITH DIAGRAMS WHEREVER NECESSARY

SECTION-A

I. Answer the following: -

4 X 10 = 40 M

1. Explain Retrogressive metamorphism and its significance in Urochordata
OR
2. Give characters of cyclostomata and discuss their phylogenetic status.
3. Describe the structure of Heart and course of blood circulation in Scoliodon.
OR
4. Discuss parental care in Amphibia with suitable examples.
5. Give an account of Heart , blood and course of circulation of Calotes
OR
6. Describe various modes of flight in birds.
7. Describe the structure and working of mammalian Heart. With a note
on its automaticity
OR
8. Explain dentition in Mammals and add a note on development of a tooth.

SECTION- B

II. Answer any four questions

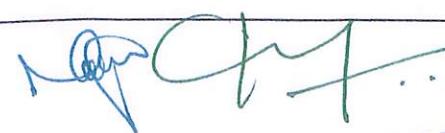
4 X 5 = 20 M

9. Salient features of Urochordata
10. Types of Scales
11. Neoteny
12. Temporal fossa in reptiles
13. Migration in Birds
14. Flying adaptations in Mammals

ANIMAL DIVERSITY - VERTEBRATES - MODEL PAPER THEORY

SECTION A - INTERNAL CHOICE			4 Q X 10 M = 40 M	
Question Number	Question	Question	CO	BTL (Bloom's Taxonomy Level)
1	Module 1	Explain Retrogressive metamorphism and its significance in Urochordata	CO 1	2
2	Module 1	Give characters of cyclostomata and discuss their phylogenetic status	CO 1	2
3	Module 2	Describe the structure of Heart and course of blood circulation in Scoliodon	CO 2	2
4	Module 2	Discuss parental care in Amphibia with suitable examples	CO 2	1
5	Module 3	Give an account of Heart , blood and course of circulation of Calotes	CO 3	2
6	Module 3	Describe various modes of flight in birds.	CO 3	1
7	Module 4	Describe the structure and working of mammalian Heart. With a note on its automaticity	CO 4	4
8	Module 4	Explain dentition in Mammals and add a note on development of a tooth.	CO 4	4

SECTION B - ANSWER ANY 4 OUT OF 6			4 Q X 5 M = 20 M	
9	Module 1	Salient features of Urochordata	CO 1	1
10	Module 2	Types of Scales	CO 2	1
11	Module 3	Neoteny	CO 3	3
12	Module 4	Temporal fosse in reptiles	CO 4	2
13	Module 3	Migration in Birds	CO 3	4
14	Module 4	Flying adaptations in Mammals	CO 4	4



CHAIRMAN
Board of Studies in Zoology,
Omanya University, Hyd-07.

PROFESSOR & HEAD
Department of Zoology, UGS
Omanya University, Hyd-07.

ANIMAL DIVERSITY- VERTEBRATES
PRACTICALS

Programme: B.Sc.

Max. Marks : 50

Type of course : DSC - II

Hours per week : 2

CourseCode: U24/ZOO/DSC/201/P

No. of credits : 1

Course Objective:

To understand the basic structural & functional aspects of Animal diversity – Vertebrates

Course Outcome:

To identify and remember the various vertebrate specimens under study.

To evaluate the techniques learnt during dissections.

Study of museum slides / specimens / models (Classification of animals up to orders)

1. Protochordata: *Amphioxus, Amphioxus* T.S. through pharynx
2. Cyclostomata: *Petromyzon, Myxine, Ammocoetes larva*
3. Pisces: *Sphyraena Pristis, Torpedo, Pleuronectes, Hippocampus, Exocoetus, Echeneis, Labeo, Catla, Clarias, Anguilla, Protopterus*
4. Amphibia: *Ichthyophis, Ambystoma, Siren, Hyla, Rachophous, Bufo, Rana, Axolotl* larva
5. Reptilia : *Draco, Chameleon, Gecko, Uromastyx, Vipera russelli, Naja, Bungarus, Enhydrina, Typhlops, Testudo, Trionyx, Crocodilus, Ptyas.*
6. Aves: *Archaeopteryx, Passer, Psittacula, Bubo, Alcedo, Columba, Corvus, Pavo*; Collection and study of different types of feathers: Quill, Contour, Filoplume, Down
7. Mammalia: *Ornithorhynchus, Tachyglossus, Pteropus, Funambulus, Manis, Loris, Hedgehog*

Osteology:

1. Rabbit – Axial skeleton system (bones of Skull and Vertebral Column)
2. Pigeon and Rabbit – Appendicular skeleton system (bones of limbs and girdles)

Dissections of *Labeo/Tilapia*: Brain, Weberian ossicles & V, VII, IX, X cranial nerves

An “Animal album” containing photographs, cut outs, with appropriate write up about the above mentioned taxa. Different taxa/ topics may be given to different sets of students for this purpose.

ANIMAL DIVERSITY- VERTEBRATES PRACTICALS – MODEL PAPER

Subject Code: U24/ZOO/DSC/201/P
No. of Credits:1

Max. Marks – 50
Time – 2 hour

I. Major Dissection

14 M

1. Dissect and display the Vth and VIIth Cranial Nerves of *Labeo* (OR)
2. Dissect and display the IXth and Xth Cranial Nerves of *Labeo*

II. Minor Dissection

6 M

3. Dissect and display the Brain of Labeo (OR)
4. Dissect and display the Weberian Ossicle of Labeo

III. Identify, classify, draw, label & write points of identification for the following spots (A-G). 7x2

$$7 \times 2 = 14 \text{ M}$$

- A. Protochordata: *Amphioxus*, *Amphioxus* T.S. through pharynx
- B. Cyclostomata: *Petromyzon*, *Myxine*, *Ammocoetus* larva
- C. Pisces: *Sphyrna*, *Pristis*, *Torpedo*, *Pleuronectes*, *Hippocampus*, *Exocoetus*, *Echieneis*, *Labeo*, *Catla*, *Clarius*, *Auguilla*, *Protopterus*
- D. Amphibia: *Ichthyophis*, *Amblystoma*, *Siren*, *Hyla*, *Rachophous*, *Bufo*, *Rana*, *Axolotl* larva
- E. Reptilia :*Draco*, *Chamaeleon*, *Gecko*, *Uromastix*, *Vipera russelli*, *Naja*, *Bungarus*, *Enhydrina*, *Typhlops*, *Testudo*, *Trionyx*, *Crocodilus*, *Ptyas*.
- F. Aves: *Archaeopteryx*, *Passer*, *Psittacula*, *Bubo*, *Alcedo*, *Columba*, *Corvus*, *Pavo*; Collection and study of different types of feathers: *Quill*, *Contour*, *Filoplume*, *Down*
- G. Mammalia: *Ornithorhynchus*, *Tachyglossus*, *Pteropus*, *Funambulus*, *Manis*, *Loris*, *Hedgehog*

III. OSTEOLOGY- IDENTIFICATION OF BONES (H-J)

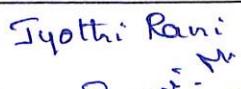
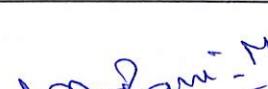
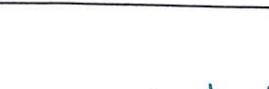
$$2 \times 2 = 4 \text{ M}$$

IV. ANIMAL ALBUM

5 M

V RECORD

5 M

Prepared by	Checked & Verified by	Approved by
<p>Dr. Jayothi Rani </p> <p>Name and Signature of the teaching faculty</p>	<p></p> <p>Name and Signature of HoD DR. JYOTHI RANI</p>	<p></p> <p>Name and Signature of Principal</p>

SEMESTER - II

ARCHEGONIATAE AND PALAEOBOTANY

1. Course Description

Program:	B. Sc	Max. Hours:	60
Course Code:	U24/ BOT/ DSC/201	Hours per week:	4
Type of Course:	DSC-2	Max. Marks:	60
No. of Credits:	4		

2. Course Objectives

1. Discuss the morphology, structure and importance of the lower plants.
2. Review the meaning of scientific terms.

3. Course Outcomes

After the successful completion of the course, the student will be able to:

- CO1: Assess the key characteristics, life cycles, structure, and reproduction of selected classes of bryophytes and trace the evolution of sporophyte.
- CO2: Classify pteridophytes according to their distinguishing characteristics, and trace their evolutionary history.
- CO3: Examine gymnosperm morphology, anatomy, and reproduction and discuss their economic significance.
- CO4: Describe the different types of fossils, the geological time scale, and discuss the relevance of fossil pteridophytes & gymnosperms.

4. Course content**Module I: Bryophytes 14 Hours**

- 1.1 General Account: Origin of bryophytes; Amphibian nature, Classification up to class with diagnostic characters and examples, Range of thallus.
- 1.2 Morphology and Life-cycles of the following: *Marchantia*, *Anthoceros*, *Polytrichum*.
- 1.3 Phylogeny: Origin of Alternation of Generations (Homologous and Antithetic theory) Evolution of Sporophytes (Progressive and Regressive concept).

Module II: Pteridophytes 18 Hours

- 2.1 General Account: Colonization and rise of early land plants.
- 2.2 Classification of vascular plants up to division with diagnostic characters and examples. Morphology and Life-cycles of the following: *Lycopodium*, *Equisetum* & *Marsilea*
- 2.3 Evolutionary trends – Heterospory and Origin of Seed habit. Stelar evolution. Telome concept and its significance in the origin of different groups of Pteridophytes.

Module III: Gymnosperms**14 Hours**

3.1 Classification of Gymnosperms: General characteristics, classification (up to family).

3.2 Morphology and Life-cycles of the following: *Pinus* and *Gnetum*

3.3 Ecological and economic importance.

Module IV: Palaeobotany**14 Hours**

4.1 Fossil formation and types of fossils, Importance of fossil study. Geological time scale with dominant plant groups through ages.

4.2 Fossil Pteridophytes: Structural features, Geological distribution and evolutionary significance of *Rhynia*.

4.3 General account of Bennettitales (Williamsoniaceae and Cycadeoidaceae).

Sushma

Mayabai
Kumari

A. Sarita Rani

CHAIRPERSON
B.O.S. IN BOTANY
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B. Barathi

Head of the Department
St. Francis College,
Begumpet,

5. Reference Books

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2. Pandey, B. P. 2006. *College Botany, Vol. II: Pteridophyta, Gymnosperms and Paleobotany*. S. Chand & Company Ltd, New Delhi.
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6. Syllabus Focus

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

Local /Regional/National /Global Development Needs	Relevance
Global Development Needs	<p>Archegoniates have wide range of ecological and economic value - for example</p> <ul style="list-style-type: none"> • Bryophytes - bioindicators of heavy metals in air pollution, material for seed beds, fuel, food, medicine, pesticides, nitrogen fixation, waste treatment etc • Pteridophytes - food, shelter, medicine, biofertilizers, horticulture value etc. • Gymnosperms - food, commercial wood, oil, medicine etc.

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
SD	Module I: Bryophytes	Identification of few bryophytes based on morphological and anatomical characters (by observing slides and specimens)
	Module II: Pteridophytes	Identification of few pteridophytes based on morphological and anatomical characters (by observing slides, specimens and by taking anatomical sections)
	Module III: Gymnosperms	Identification of few gymnosperms based on morphological and anatomical characters (by observing slides, specimens and by taking anatomical sections)

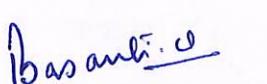
Pedagogy

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Participative Learning	Presentations and Group discussions
2.	Experiential Learning	Field Trips to research organizations / Botanical gardens
3.	Problem solving	Research Projects

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 2 – Test 1: MCQ's, Quiz test or subjective	
CO2		
CO3	CIA 1 - Subjective	Written Exam
CO4	CIA 2 – Test 2: MCQ's or Presentation	



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b) Model Question Paper – End Semester Exam Theory

ARCHEGONIATAE AND PALAEOBOTANY

Course Code: U24/ BOT/ DSC/201

MAX MARKS: 60

Credits: 4

TIME: 2 hours

Note: This question paper consists of Section A and B. The answer to Section A & B must be written in the answer book given.

SECTION – A (Long Essay Type)

Answer ALL questions:

Marks: 4 x 10 - 40

1. Describe the structure of the Sporophyte of *Marchantia*.
OR
2. Explain the process of evolution of Sporophyte in Bryophytes.
3. Describe the internal structure of an *Equisetum* stem.
OR
4. Explain the internal structure of *Marsilea* sporocarp.
5. Describe the morphology and anatomy of *Pinus* needle. Comment on its Xeric nature.
OR
6. Describe the primary structure and secondary growth in *Gnetum* stem.
7. What are fossils? Explain the types and process of fossil formation
OR
8. Outline the characteristic features of Bennettitales.

SECTION –B (Short Essay Type)

II. Write short notes on any **FOUR** of the following:

Marks: 4 x 5 - 20

9. Explain the internal structure of *Anthoceros* thallus.
10. Describe the Strobilus of *Lycopodium*
11. Describe *Pinus* female cone.
12. Explain the methods of Compressions and petrifications
13. Illustrate with examples on the Endangered gymnosperms.
14. Describe the Stelar Evolution.

Sathare *Megha* *Parmar*

A. Sabitha Rehman

SECTION A - INTERNAL CHOICE			4Q X 10 M = 40 M	
Question Number	Question	Question	CO	BTL (Blooms Taxonomy Level)
1	Module 1	Describe the structure of the Sporophyte of <i>Marchantia</i> .	CO 1	Level I
2	Module 1	Explain the process of evolution of Sporophyte in Bryophytes.	CO 1	Level II
3	Module 2	Describe the internal structure of an <i>Equisetum</i> stem.	CO 2	Level I
4	Module 2	Explain the internal structure of <i>Marsilea</i> sporocarp.	CO 2	Level II
5	Module 3	Describe the morphology and anatomy of <i>Pinus</i> needle. Comment on its Xeric nature.	CO 3	Level I
6	Module 3	Describe the primary structure and secondary growth in <i>Gnetum</i> stem.	CO 3	Level I
7	Module 4	What are fossils? Explain the types and process of fossil formation	CO 4	Level I , Level II
8	Module 4	Outline the characteristic features of Benettitales	CO 4	Level II

SECTION B - ANSWER ANY 4 OUT OF 6

4Q X 5 M = 20 M

(To compulsorily have ONE question from each module)

9	Module 1	Explain the internal structure of <i>Anthoceros</i> thallus.	CO 1	Level II
10	Module 2	Describe the Strobilus of <i>Lycopodium</i> .	CO 2	Level I
11	Module 3	Describe <i>Pinus</i> female cone.	CO 3	Level I
12	Module 4	Explain the methods of Compressions and petrifactions	CO 4	Level II
13	Module 3	Illustrate with examples on the Endangered gymnosperms.	CO 3	Level II
14	Module 2	Describe the Stelar Evolution.	CO 2	Level I

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c) Question Paper Blueprint

Modules	Hours Allotted in the Syllabus	COs Addressed	Section A (No. of Questions)	Total Marks	Section B (No. of Questions)	Total Marks
1	14	CO 1	2	10 each	1	5
2	18	CO 2	2	10	1	5
3	14	CO 3	2	10	1	5
4	14	CO 4	2	10	1	5

9. CO-PO Mapping

CO	PO	Cognitive Level	Classroom sessions (hrs)
1	1, 5	Evaluate	14
2	1, 2, 5	Analysing	18
3	1, 5, 7	Analysing	14
4	1, 2, 3, 5, 7, 8	Understanding	14



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ARCHEGONIATAE AND PALAEOBOTANY

Practical Syllabus

1. Course Description

Programme:	B. Sc	Max. Hours:	30
Course Code:	U24/ BOT/ DSC/201/P	Hours per week:	2
Type of Course:	DSC-2	Max. Marks:	50
No. of Credits:	1		

2. Course Objectives

1. To develop critical understanding of the morphology and anatomy of archegoniate.
2. To acquire knowledge on few fossil plants.

3. Course Outcomes

After the successful completion of the course, the student will be able to:

CO 1: Examine the morphology, anatomy, reproduction and life cycle of Bryophyte types mentioned in the syllabus

CO 2: Examine the morphology, anatomy, reproduction and life cycle of Pteridophyte types mentioned in the syllabus

CO 3: Examine the morphology, anatomy, reproduction and life cycle of Gymnosperm types mentioned in the syllabus

CO 4: Devise Techniques to Preserve and Study Plant Materials

4. Course Content

1. Study of Morphology (vegetative and reproductive structures) and anatomy of the following Bryophytes: *Marchantia*, *Anthoceros* & *Polytrichum*.
2. Study of Morphology (vegetative and reproductive structures) and anatomy of the following Pteridophytes: *Lycopodium*, *Equisetum* and *Marsilea*.
3. Study of Anatomical features of *Lycopodium* stem, *Equisetum* stem and *Marsilea* petiole & rhizome by preparing double-stained permanent mount.
4. Study of Morphology (vegetative and reproductive structures) of the following taxa: Gymnosperms: *Pinus* and *Gnetum*
5. Study of Anatomical features of *Pinus* needle and *Gnetum* stem by preparing double-stained permanent mount.
6. Fossil forms using permanent slides / photographs: *Rhynia* and *Cycadeoidea*.
7. Brief study of the fossil deposits in India, Important Indian Paleobotanical Institutes and Contributions of Indian Paleobotanists - Birbal Sahni.

5. Model Question Paper – End Semester Exam Practical

ARCHEGONIATAE AND PALAEOBOTANY

Course Code: U24/ BOT/ DSC/201/P

Time: 2 Hours

Maximum Marks: 50 Marks

QI. Prepare a single stain or double stain mount of the transverse section of the given material 'A'. Identify, classify, draw and describe the same.

Scheme for valuation: (slide preparation- 3; stains used-1; classification- 1; diagram-3; description -4
12 marks

QII. Identify the fossil 'B' and describe with the help of a diagram.

Scheme for valuation: (Identification-1; diagram-2; description-2) 5 marks

QIII. Identify, classify giving reasons with suitable diagrams of the given

Specimens and slides. **C, D, E, F, G, H** 6 x 3 – 18 marks

QIV. Seminar topic on study of the fossil deposits in India, Important Indian Paleobotanical Institutes and Contributions of Indian Paleobotanists-Birbal Sahni or Project. 10 marks

QV. Record. 5 marks

Prepared by	Checked & verified by	Approved by
<p><i>Basanti Ch</i> Dr. Basanti Chintapalli Teaching faculty</p>	<p><i>Basanti Ch</i> Dr. Basanti Chintapalli HoD</p>	 Dr. Uma Joseph Principal

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St. FRANCIS COLLEGE FOR WOMEN, BEGUMPET HYDERABAD-
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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

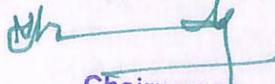
Course Code: U24/CHE/DSC/201 Hours per week: 4 Hrs

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


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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 (B₂H₆ and B₂H₁₀) Preparation and structure of boron-nitrogen compounds (B₂NH₃ and BN), Lewis acid nature of the BX₃.

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.

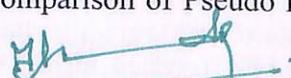
Group – 15: Preparation, structure and reactions of hydrazine, hydroxylamine, Phosphazenes
Group – 16: Classifications of oxides based on (i) Chemical behavior and (ii) Oxygen content. Normal: acid, basic, amphoteric and neutral, Mixed oxides, Sub oxides, Peroxides, Super oxides.

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

Interhalogen Compounds

Classification- general preparation- structures of AB, AB₂, AB₃ and AB₄ type and reactivity. Poly halides- definition and structure of ICl₄⁻, ICl₃⁻ and I₃⁻. Comparison of Pseudo halogens with halogens.

Chemistry of Zero group elements



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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 $\text{Ni}(\text{CO})_4$. Structural features of $\text{Ni}(\text{CO})_4$, $\text{Fe}(\text{CO})_5$, $\text{Fe}_2(\text{CO})_9$, $\text{Fe}_3(\text{CO})_{12}$ and $\text{Cr}(\text{CO})_6$.-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. 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, standard Hydrogen electrode – reference electrodes (calomel electrode) – standard electrode potential, sign conventions, electrochemical series and its significance. Calculation of thermodynamic quantities of cell reaction – ΔG , ΔH 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 tropyl 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.

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.1 and S.2. Mechanism and energy profile diagrams of S.1 and S.2 reactions. Stereochemistry of S.2 (Walden Inversion) 2-Bromobutane, S.1 (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: $\text{HCl}-\text{H}_2\text{O}$, 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 C_n , Plane of symmetry (σ_h , σ_v , σ_d) Center of symmetry and improper rotational axis of symmetry (S_n). 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.

St. FRANCIS COLLEGE FOR WOMEN, BEGUMPET, HYDERABAD-500016
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FACULTY OF SCIENCE- DEPARTMENT OF CHEMISTRY
PRACTICAL SYLLABUS CBCS-2024
SEMESTER -II
QUANTITATIVE ANALYSIS II
(Volumetric Analysis)

Program: B.Sc.	Max. Hours: 20 Hrs
Course Code: U24/CHE/DSC/201/P	Max. Marks: 50
Course: DSC-2	Hours per week: 2 Hrs
No. of Credits: 1	

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 K₂Cr₂O₇ using an internal indicator.
2. Estimation of Cu (II) ions using Na₂S₂O₃ with K₂Cr₂O₇ as primary standard.
3. Estimation of Iodine content in Iodized salt.
4. Estimation Nickel by back titration using MgSO₄.
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.


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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.



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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)	


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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 XeO₃. (CO1) **L1**

10. Calculate the EMF of Cd, Cd⁺²//Cu⁺², Cu E⁰ (Cu⁺², Cu) = 0.34V.
 E⁰(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**

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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

Max. Marks: 60M

Course Code: U24/CHE/DSC/201

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 b) What are interhalogen compounds? Explain the structure of AX_5 type of molecule. 6M OR	CO 1	(Level II)
2	Module 1	a) Discuss the structure of Diborane. 5M 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 b) Explain Debye – Huckle’s theory and explain the role of inter-ionic effect. 5M OR	CO 2	(Level II)
4	Module 2	a) Explain the working and construction of S.H.E. 5M 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 b) Write a note on directive influence of methyl group. 5M 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)

7	Module 4	a) What are azeotropes? Explain ethanol-water system. 5M b) State and explain Raoult's law with its limitations. 5M OR	CO 4	(Level II)
8	Module 4	a) Justify that the chair form of cyclohexane is the most stable conformation. 6M b) Define proper axis of symmetry. Illustrate with 2 examples. 4M	CO 4	(Level IV)

SECTION B – (Short answer questions)

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 $\text{Cd, Cd}^{+2}//\text{Cu}^{+2}, \text{Cu}$ E^0 ($\text{Cu}^{+2}, \text{Cu}$) = 0.34V. $E^0(\text{Cd}^{2+}, \text{Cd}) = -0.488\text{V}$.	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)


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