

**B.Sc. ZOOLOGY SYLLABUS UNDER CBCS**

**CURRICULUM FOR ZOOLOGY**

**IN UNDER GRADUATE DEGREE PROGRAMME CBCS SYLLABUS SCHEDULE 2016 – 2017**

**MAHATMA GANDHI UNIVERSITY**

Year	Semester	Paper	Code	Course Type*	Title of the Paper	No. of Credits	No. of hours per week	Exam Hrs.	Max. Marks								
									I.A	End Exam	Total						
I	I	I	BS105	DSC-2A Theory	Animal Diversity-Invertebrates	4	4	2	20	40	60						
				DSC-2A Practical	Animal Diversity-Invertebrates	1	2	2	-	40	40						
	II	II	BS205	DSC-2B Theory	Ecology, Zoogeography and Animal Behavior	4	4	2	20	40	60						
				DSC-2B Practical	Ecology, Zoogeography and Animal Behavior	1	2	2	-	40	40						
				BS301	SEC-1	SEC	2	2	2	10	40	50					
II	III	III	BS305	DSC-2C Theory	Animal Diversity-Vertebrates and Developmental Biology	4	4	2	20	40	60						
				DSC-2C Practical	Animal Diversity-Vertebrates and Developmental Biology	1	2	2	-	40	40						
				BS401	SEC-2	SEC	2	2	2	10	40	50					
	IV	IV	BS405	DSC-2D Theory	Cell Biology, Genetics and Evolution	4	4	2	20	40	60						
				DSC-2D Practical	Cell Biology, Genetics and Evolution	1	2	2	-	40	40						
III				BS501	SEC-3	SEC	2	2	2	10	40	50					
				BS502	GE-1 Theory	Generic Elective	2	2	2	20	40	60					
				V	BS504	DSC-2E Theory	Physiology and Biochemistry	3	3	2	20	40	60				
						DSC-2E Practical	Physiology and Biochemistry	1	2	2	-	40	40				
				VI	BS507	DSE-2E (A, B, C) Theory	Applied Zoology/ Entomology/Sericulture	3	3	2	20	40	60				
						DSE-2E (A, B, C) Practical	Applied Zoology/ Entomology/Sericulture	1	2	2	-	40	40				
				VII				BS601	SEC-4	SEC	2	2	2	10	40	50	
								BS602	GE-2 Theory	Generic Elective	2	2	2	20	40	60	
								VII	BS604	DSC-2F Theory	Immunology and Animal Biotechnology	3	3	2	20	40	60
										DSC-2F Practical	Immunology and Animal Biotechnology	1	2	2	-	40	40
								VIII	BS607	DSE-2F (A, B, C) Theory	Aquatic Biology/Public Health and Hygiene / Poultry Science	3	3	2	20	40	60
										DSE-2F (A, B, C) Practical	Aquatic Biology / Public Health and Hygiene / Poultry Science	1	2	2	-	40	40
														48	48		

\*DSC – Discipline Specific Course, DSE – Discipline Specific Elective, GE – Generic Elective, SEC – Skill Enhancement Course

**B.Sc. ZOOLOGY SYLLABUS UNDER CBCS**

**B.Sc. ZOOLOGY MODEL PAPER  
ZOOLOGY – CORE / ELECTIVE PAPER**

**Time: 3 hrs**

**Max. Marks: 40**

**Section- I (Marks: 8x2=16 Marks)  
Answer any TWO of the following  
Draw labeled diagrams wherever necessary**

1. ....

or

.....

2. ....

or

.....

**Section- II (Marks: 4x4=16)  
Answer any FOUR of the following  
(Minimum One from each Unit)**

3. ....

4. ....

5. ....

6. ....

7. ....

8. ....

**Section- III (Marks: 8x1=8)  
Answer EIGHT from the following  
(TWO from each Unit)**

9. ....

10. ....

11. ....

12. ....

13. ....

14. ....

15. ....

16. ....

17. ....

18. ....

19. ....

20. ....

**B.Sc. ZOOLOGY SYLLABUS UNDER CBCS**

**B.Sc. I Year  
I - SEMESTER**

**Discipline Specific Course, Paper – I  
[Code: BS105; Course Type DSC 2A]  
Animal Diversity – Invertebrates**

**Periods: 60**

**Max. Marks: 40**

**UNIT – I**

**(15 Periods)**

**1.1 Brief history of Invertebrates**

- 1.1.1 Kingdom Animalia
- 1.1.2 Brief history of Invertebrates

**1.2 Protozoa**

- 1.2.1 General characters
- 1.2.2 Classification up to classes with examples
- 1.2.3 Type study - *Elphidium*
- 1.2.4 Life cycle of *Plasmodium*.
- 1.2.5 Locomotion, Reproduction and Diseases

**1.3 Porifera**

- 1.3.1 General characters
- 1.3.2 Classification of Porifera up to classes with examples
- 1.3.3 Type study - *Sycon*
- 1.3.4 Canal system in sponges and Spicules.

**UNIT – II**

**(15 Periods)**

**2.1. Cnidaria**

- 2.1.1 General characters
- 2.1.2 Classification of Cnidaria up to classes with examples
- 2.1.3 Type study - *Obelia*
- 2.1.4 Polymorphism in hydrozoa
- 2.1.5 Corals and coral reef formation

**2.2 Platyhelminthes**

- 2.1.1 General characters
- 2.1.2 Classification of Platyhelminthes up to classes with examples
- 2.1.3 Type study- *Schistosoma*

**2.3 Nematelminthes**

- 2.3.1 General characters
- 2.3.2 Classification of Nematelminthes up to classes with examples
- 2.3.3 Type study - *Dracunculus*
- 2.3.4 Parasitic Adaptations in Helminthes

**UNIT – III**

**(15 Periods)**

**3.1 Annelida**

- 3.1.1 General characters
- 3.1.2 Classification of Annelida up to classes with examples
- 3.1.3 Type study - *Hirudinaria granulosa*.
- 3.1.4 Evolutionary significance of Coelome and Coelomducts and metamerism

**3.2 Arthropoda**

- 3.2.1 General characters
- 3.2.2 Classification of Arthropoda up to classes with examples
- 3.2.3 Type study - Prawn
- 3.2.4 Mouth parts of Insects
- 3.2.5 Insect metamorphosis
- 3.2.6 *Peripatus* - Structure and affinities

**UNIT – IV**

**(15 Periods)**

**4.1 Mollusca**

- 4.1.1 General characters
- 4.1.2 Classification of Mollusca up to classes with examples
- 4.1.3 Type study - *Pila*
- 4.1.4 Pearl formation
- 4.1.5 Torsion and detorsion in gastropods

**4.2 Echinodermata**

- 4.2.1 General characters
- 4.2.2 Classification of Echinodermata up to classes with examples
- 4.2.3 Water vascular system in star fish
- 4.2.4 Echinoderm larvae and their significance

**4.3 Hemichordata**

- 4.3.1 General characters
- 4.3.2 Classification of Hemichordata up to classes with examples
- 4.3.3 *Balanoglossus* - Structure and affinities

**Suggested Readings**

1. L.H. Hyman 'The Invertebrates' Vol I, II and V. – M.C. Graw Hill Company Ltd.
2. Kotpal, R.L. 1988 - 1992 Protozoa, Porifera, Coelenterata, Helminthes, Arthropoda, Mollusca, Echinodermata. Rastogi Publications, Meerut.
3. E.L. Jordan and P.S. Verma 'Invertebrate Zoology' S. Chand and Company.
4. R.D. Barnes 'Invertebrate Zoology' by: W.B. Saunders CO., 1986.
5. Barrington. E.J.W., 'Invertebrate structure and Function' by ELBS.
- 6 P.S. Dhami and J.K. Dhami. Invertebrate Zoology. S. Chand and Co. New Delhi.
7. Parker, T.J. and Haswell 'A text book of Zoology' by, W.A., Mac Millan Co. London.
8. Barnes, R.D. (1982). *Invertebrate Zoology, V Edition*

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS

B.Sc. I Year  
ZOOLOGY PRACTICAL SYLLABUS FOR I SEMESTER  
Discipline Specific Course, Paper – I  
[Code: BS105; Course Type DSC 2A]  
ANIMAL DIVERSITY - INVERTEBRATES

Periods: 30

Max. Marks: 40

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

- i. **Protozoa:** *Amoeba*, *Paramecium*, *Paramecium* Binary fission and Conjugation, *Vorticella*, *Entamoeba histolytica*, *Plasmodium vivax*
- ii. **Porifera:** *Sycon*, *Spongilla*, *Euspongia*, *Sycon* - T.S & L.S, Spicules, Gemmule
- iii. **Coelenterata:** *Obelia* – Colony & Medusa, *Aurelia*, *Physalia*, *Velella*, *Corallium*, *Gorgonia*, *Pennatula*
- iv. **Platyhelminthes:** *Planaria*, *Fasciola hepatica*, *Fasciola* larval forms – Miracidium, Redia, Cercaria, *Echinococcus granulosus*, *Taenia solium*, *Schistosoma haematobium*
- v. **Nemathelminthes:** *Ascaris*(Male & Female), *Dracunculus*, *Ancylostoma*, *Wuchereria*
- vi. **Annelida:** *Nereis*, *Aphrodite*, *Chaetopterus*, *Hirudinaria*, Trochophore larva
- vii. **Arthropoda:** *Cancer*, *Palaemon*, *Scorpion*, *Scolopendra*, *Sacculina*, *Limulus*, *Peripatus*, Larvae - Nauplius, Mysis, Zoea, Mouth parts of male & female *Anopheles* and *Culex*, Mouthparts of Housefly and Butterfly.
- viii. **Mollusca:** *Chiton*, *Pila*, *Unio*, *Pteredo*, *Murex*, *Sepia*, *Loligo*, *Octopus*, *Nautilus*, Glochidium larva
- ix. **Echinodermata:** *Asterias*, *Ophiothrix*, *Echinus*, *Clypeaster*, *Cucumaria*, *Antedon*, Bipinnaria larva
- x. **Hemichordata:** *Balanoglossus*, Tornaria larva

**2. Dissections:**

**Prawn:** Appendages, Digestive system, Nervous system, Mounting of Statocyst  
**Insect Mouth Parts**

**3. Laboratory Record work shall be submitted at the time of practical examination**

4. 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.

**5. Computer aided techniques should be adopted – show virtual dissections**

**Suggested manuals:**

1. Practical Zoology- Invertebrates S.S. Lal
2. Practical Zoology - Invertebrates P.S. Verma
3. Practical Zoology - Invertebrates K.P. Kurl

**B.Sc. ZOOLOGY SYLLABUS UNDER CBCS**

**B.Sc. I Year  
ZOOLOGY PRACTICAL SYLLABUS FOR I SEMESTER  
Discipline Specific Course, Paper – I  
[Code: BS105; Course Type DSC 2A]  
ANIMAL DIVERSITY - INVERTEBRATES**

**Time: 2 Hrs.**

**Max. Marks: 40**

1. Identification, labeled diagram and salient features of spots: (7 Museum specimens + 2 slides)	18
2. Dissection (one) (Diagram -02 + Dissection & Display-05)	07
3. Field Visit & Note Book	04
4. Project Work	03
5. Certified practical record	03
6. Animal Album	03
7. Viva voce	02

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**B.Sc. I Year**

**II - SEMESTER**

**Discipline Specific Course, Paper – II**

**[Code: BS205; Course Type DSC 2B]**

**Ecology, Zoogeography and Animal Behavior**

**Periods: 60**

**Max. Marks: 40**

**UNIT – I**

**(15Periods)**

**1.1 Ecology - I**

- 1.1.1 Ecosystem structure and functions.
- 1.1.2 Types of Ecosystems –Aquatic and Terrestrial.
- 1.1.3 Biogeochemical cycles - Nitrogen, Carbon, Phosphorus and Water.
- 1.1.4 Energy flow in ecosystem.
- 1.1.5 Food chain, food web and ecological pyramids.
- 1.1.6 Animal Associations - Mutualism, commensalism, parasitism, competition, predation.

**UNIT – II**

**(15 Periods)**

**2.1 Ecology – II**

- 2.1.1 Concept of Species, Population dynamics and Growth curves.
- 2.1.2 Community Structure and dynamics and Ecological Succession.
- 2.1.3 Ecological Adaptations.
- 2.1.4 Environmental Pollution – Sources, Effect and Control measures of Air, Water, Soil and Noise pollution,
- 2.1.5 Wildlife conservation - National parks and Sanctuaries of India, Endangered species.
- 2.1.6. Biodiversity and hotspots of Biodiversity in India.

**UNIT – III**

**(15 Periods)**

**3.1 Zoogeography**

- 3.1.1 Zoogeographical regions – Palaearctic, Nearctic, Neotropical, Oriental, Australian and Ethiopian regions - their Climatic and faunal peculiarities
- 3.1.2 Wallace line, Discontinuous distribution
- 3.1.3. Continental Drift

**UNIT – IV**

**(15 Periods)**

**4.1 Animal Behaviour**

- 4.1.1 Types of Behaviour- Innate and Acquired, Instinctive and Motivated behaviour
- 4.1.2 Taxes, Reflexes, Tropisms
- 4.1.3 Physiology and phylogeny of learning, trial and error learning, Imprinting, habituation, Classical conditioning, Instrumental conditioning
- 4.1.5 Social behavior, Communication, Pheromones

4.1.6 Biological rhythms, Biological clocks, Circadian rhythms

**Suggested Readings**

**M.P.Arora**, '*Ecology*' Himalaya Publishing company.

**P.D.Sharma**, '*Environmental Biology*'.

**P.R.Trivedi and Gurdeep Raj**. '*Environmental Ecology*'

**Buddhadev Sarma and Tej Kumar**, '*Indian Wildlife Threats and Preservation*

**Chapman J.L. and Reiss M.J**, '*Ecology Principles and Applications*', Second Ed., Cambridge University Press, London.

**Benny Joseph**, '*Environmental Studies*', TATA McGraw Hill Com., New Delhi.

**Eugene P. Odum**, '*Fundamentals of Ecology*' Third Ed., NataraJ Publishers, Dehradun.

**Veer Bala Rastogi**, "Ecology and Animal Distribution"

**P.K. Gupta**, "Text Book of Ecology and Environment"

**Bhatnagar and Bansal**, "Ecology and Wildlife biology"

**Dasmann**, "Wild life Biology"

**Reena Mathur**, "Animal Behaviour"

**Alocock**, "Animal Behaviour- an Evolutionary Approach"



**B.Sc. ZOOLOGY SYLLABUS UNDER CBCS**

**B.Sc. I Year**

**B.Sc. PRACTICAL SYLLABUS FOR II SEMESTER**

**Discipline Specific Course, Paper – II**

**[Code: BS205; Course Type DSC 2B]**

**Ecology, Zoogeography and Animal Behavior**

**Periods: 30**

**Max. Marks: 40**

1. Determination of pH of Soil and Water
2. Estimation of salinity (chlorides) of water in given samples.
3. Estimation of Carbonates and bicarbonates in the given water samples.
4. Estimation of dissolved oxygen of pond water, sewage water and effluents.
5. Identification of Zooplankton from a nearby water body.
6. Study of Pond Ecosystem / local polluted site - Report submission
7. Study of at least 3 endangered or threatened wild animals of India through photographs / specimens / models
8. Field visit to Zoo Park to study the management, behavior and enumeration of wild animals.
9. Identification of Zoogeographical realms from the Map and identify specific fauna of respective regions.
10. Observe the response of invertebrates in different lightening conditions

**Computer aided techniques should be adopted as per UGC guide lines.**

**Suggested manuals**

1. **Robert Desharnais, Jeffrey Bell**, 'Ecology Student Lab Manual, Biology Labs'
2. **Darrell S Vodopich**, 'Ecology Lab Manual'

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**B.Sc. I Year  
PRACTICAL MODEL PAPER FOR II SEMESTER  
Discipline Specific Course, Paper – II  
[Code: BS205; Course Type DSC 2B]  
Ecology, Zoogeography and Animal Behavior**

**Time: 2 Hrs.**

**Max. Marks: 40**

1. Identification, labeled diagram and salient features of Spots: (06 spots)	12
2. Estimation of dissolved oxygen of a pond,	09
3. Identify any <b>Five</b> Zooplankton in a given water samples	05
4. Field Visit & Note Book	04
5. Project Report	04
6. Certified practical record	04
7. Viva voce	02

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**B.Sc. II Year**

**III - SEMESTER**

**Discipline Specific Course, Paper – III**

**[Code: BS305; Course Type DSC 2C]**

**Animal Diversity- Vertebrates and Developmental Biology**

**Periods: 60**

**Max. Marks: 40**

**UNIT – I**

**(15 Periods)**

**1.1. Urochordata, Cephalochordata, Cyclostomata**

- 1.1.1. Salient features of Urochordata
- 1.1.2. Retrogressive metamorphosis and its significance in Urochordata
- 1.1.3. Salient features and affinities of Cephalochordata
- 1.1.4. General characters of Cyclostomata
- 1.1.5. Comparison of the *Petromyzon* and *Myxine*
- 1.1.6. General characters and classification of Chordata upto orders with examples.

**1.2. Pisces**

- 1.2.1. General characters of Fishes
- 1.2.2. Classification of fishes up to order level with examples
- 1.2.3. *Scoliodon* – Respiratory, Circulatory and Nervous system.
- 1.2.4. Types of Scales and types of Fins

**UNIT – II**

**(15 Periods)**

**2.1. Amphibia**

- 2.1.1. General characters of Amphibians
- 2.1.2. Classification of Amphibians up to orders with examples.
- 2.1.3. *Rana tigrina* - Respiratory, Circulatory and Nervous system.
- 2.1.4. Parental care in amphibian; neoteny and paedogenesis.

**2.2 Reptilia**

- 2.2.1. General characters of Reptilia
- 2.2.2. Classification of Reptilia up to orders with examples
- 2.2.3. *Calotes* – Respiratory system, Circulatory and Nervous system.
- 2.2.4. Temporal fosse in reptiles and its evolutionary importance
- 2.2.5. Distinguished characters of Poisonous and Non poisonous snakes.
- 2.2.6. Rhynchocephalia.

**UNIT – III**

**(15 Periods)**

**3.1. Aves**

- 3.1.1. General characters of Aves
- 3.1.2. Classification of Aves up to orders with examples.
- 3.1.3. *Columba livia* -, Digestive system, Circulatory systems, Respiratory system and

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Nervous system.

3.1.4. Migration in Birds

3.1.5. Flight adaptation in Birds

### 3.2. Mammalia

3.2.1. General characters of Mammalia

3.2.2. Classification of Mammalia up to orders with examples

3.2.3. Rabbit –Digestive, Respiratory, Circulatory and Nervous system.

3.2.4. Dentition in mammals.

3.2.5. Aquatic adaptations in Mammals.

## UNIT – IV

(15 Periods)

### 4.1 Developmental Biology and Embryology

4.1.1 Gametogenesis (Spermatogenesis and Oogenesis)

4.1.2 Fertilization

4.1.3 Types of eggs

4.1.4 Types of cleavages

4.1.5 Development of Frog up to formation of primary germ layers

4.1.6 Formation of Foetal membrane in chick embryo and their functions

4.1.7 Types and functions of Placenta in mammals

4.1.8 Regeneration in Turbellaria and Lizards

### Suggested Readings:

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. **George C. Kent, Robert K. Carr.** *Comparative Anatomy of the Vertebrates*, 9th ed. McGraw Hill.
6. **Kenneth Kardong** *Vertebrates: Comparative Anatomy, Function and Evolution*, 4th ed, 'McGraw Hill.
7. **J.W. Young**, *The Life of Vertebrates*, 3rd ed, Oxford University press.
8. **Harvey Pough F, Christine M. Janis, B. Heiser**, *Vertebrate Life*, Pearson, 6th ed, Pearson Education Inc.2002.

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**B.Sc. II Year**

**ZOOLOGY PRACTICAL SYLLABUS FOR III SEMESTER**

**Discipline Specific Course, Paper – III**

**[Code: BS305; Course Type DSC 2C]**

**Animal Diversity- Vertebrates and Developmental Biology**

**Periods: 30**

**Max. Marks: 40**

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

1. **Protochordata:** *Amphioxus*, *Amphioxus* T.S. through pharynx
2. **Cyclostomata:** *Petromyzon*, *Myxine*, *Ammocoetus larva*
3. **Pisces:** *Sphyrna Pristis*, *Torpedo*, *Channa*, *Pleuronectes*, *Hippocampus*, *Exocoetus*, *Echieneis*, *Labeo*, *Catla*, *Clarius*, *Auguilla*, *Protopterus*, Scales: Placoid, Cycloid, Ctenoid
4. **Amphibia:** *Ichthyophis*, *Amblystoma*, *Siren*, *Hyla*, *Rachophous*, *Bufo*, *Rana*, Axolotal larva
5. **Reptilia :** *Draco*, *Chamaeleon*, *Gecko*, *Uromastix*, *Vipera russelli*, *Naja*, *Bungarus*, *Enhydrina*, *Typhlops*, *Testudo*, *Trionyx*, *Crocodylus*, *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

**Histology:** T.S. of Liver, Pancreas, Kidney, Stomach, Intestine, Lungs Artery, Vein, Bone T.S., Spinal cord.

**Osteology :**

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

**Dissections of *Labeo/Tilapia*:**

1. Digestive system.
2. Brain, Weberian ossicles
3. V, VII, IX, X cranial nerves

**Embryology**

1. Study of T.S. of Testis and Ovary of a mammal
2. Study of different stages of cleavages (2, 4, 8, 16 cell stages); Morula, Blastula
3. Study of chick embryos of 18 hours, 24 hours, 33 hours and 48 hours of incubation

**Laboratory Record work shall be submitted at the time of practical examination**

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.

**Computer aided virtual dissections.**

**Suggested manuals**

1. **S.S.Lal**, Practical Zoology – Vertebrata
2. **P.S.Verma**, A manual of Practical Zoology – Chordata
3. **Freeman & Bracegirdle**, An atlas of embryology

**B.Sc. ZOOLOGY SYLLABUS UNDER CBCS**

**B.Sc. II Year**

**ZOOLOGY PRACTICAL SYLLABUS FOR III SEMESTER**

**Discipline Specific Course, Paper – III**

**[Code: BS305; Course Type DSC 2C]**

**Animal Diversity- Vertebrates and Developmental Biology**

**Time: 2 Hrs.**

**Max. Marks: 40**

1. Identification, labeled diagram and salient features of spots: (6 Museum specimens + 2 slides)	16
2. Osteology (02 Spots)	04
3. Dissection (one) (Diagram -02 + Dissection & Display-05)	07
4. Embryology (02 Spots)	04
5. Certified practical record	04
6. Animal Album	03
7. Viva voce	02

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**B.Sc. II Year  
IV - SEMESTER**

**Discipline Specific Course, Paper – IV  
[Code: BS405; Course Type DSC 2D]  
Cell Biology, Genetics & Evolution**

**Periods: 60**

**Max. Marks: 40**

**UNIT – I**

**(15 Periods)**

**1. Cell Biology**

- 1.1. Cell theory, Differences of Prokaryotic and Eukaryotic cells
- 1.2. Ultrastructure of animal cell
- 1.3. Structure and functions of plasma membrane proteins.
- 1.4. Structure and functions of cell organelles –  
Endoplasmic reticulum, Golgi body, Ribosomes, Lysosomes, centrosomes, Mitochondria and Nucleus
- 1.1.5 Chromosomes – Structure, types, giant chromosomes
- 1.1.6 Cell Division - Mitosis, Meiosis.
- 1.1.7. Cell cycle and its regulation.

**UNIT – II**

**(15 Periods)**

**2. Molecular Biology**

- 2.1 DNA (Deoxyribo Nucleic Acid) - Structure
- 2.2 RNA (Ribo Nucleic Acid) - Structure, types
- 2.3 DNA Replication
- 2.4 Protein Synthesis – Transcription and Translation
- 2.5 Gene Expression – Genetic Code; operon concept
- 2.6 Molecular Biology Techniques- Polymerase Chain Reaction, Electrophoresis

**UNIT – III**

**(15 Periods)**

**3. Genetics**

- 3.1 Mendals laws of Inheritance and Non-Medelian Inheritance
- 3.2 Linkage and Crossing over
- 3.3. Sex determination and sex-linked inheritance
- 3.4 Chromosomal Mutations- Deletion, Duplication, Inversion, Translocation, Aneuploidy and Polyploidy.
- 3.5. Gene mutations- Induced versus Spontaneous mutations.
- 3.6. Inborn errors of metabolism.
- 3.7. One gene one enzyme, one gene one polypeptide theory.

UNIT – IV

(15 Periods)

**4. Evolution**

- 4.1. Theories of evolution – Lamarckism and Neo-Lamarckism, Darwinism and Neo-Darwinism, Modern synthetic theory.
- 4.2. Evidences of Evolution and Hardy Weinberg Law.
- 4.3. Forces of Evolution – mutation, gene flow, genetic drift, and natural selection.
- 4.4. Isolation – Pre-mating and post mating isolating mechanisms
- 4.5. Speciation: Methods of speciation - Allopatric and sympatric
- 4.6. Causes and Role of Extinction in Evolution.

**Suggested readings**

1. **Lodish, Berk, Zipursky, Matsudaria, Baltimore, Darnell** '*Molecular Cell Biology*' W.H. Free man and company New York.
2. **Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008).** *Principles of Genetics*. VIII Edition. Wiley India.
3. **Snustad, D.P., Simmons, M.J. (2009).** *Principles of Genetics*. V Edition. John Wiley and Sons Inc.
4. **Klug, W.S., Cummings, M.R., Spencer, C.A. (2012).** *Concepts of Genetics*. X Edition. Benjamin Cummings.
5. **Russell, P. J. (2009).** *Genetics- A Molecular Approach*. III Edition. Benjamin Cummings.
6. **Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B.** *Introduction to Genetic Analysis*. IX Edition. W. H. Freeman and Co.
7. **Ridley, M. (2004).** *Evolution*. III Edition. Blackwell Publishing
8. **Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007).** *Evolution*. Cold Spring, Harbour Laboratory Press.
9. **Hall, B. K. and Hallgrimsson, B. (2008).** *Evolution*. IV Edition. Jones and Bartlett Publishers
10. **Campbell, N. A. and Reece J. B. (2011).** *Biology*. IX Edition, Pearson, Benjamin, Cummings.
11. **Douglas, J. Futuyma (1997).** *Evolutionary Biology*. Sinauer Associates.
12. **Minkoff, E. (1983).** *Evolutionary Biology*. Addison-Wesley.
13. **James D. Watson, Nancy H. Hopkins** '*Molecular Biology of the Gene*'
14. **Jan M. Savage.** *Evolution*, 2nd ed, Oxford and IBH Publishing Co., New Delhi.
15. **Gupta P.K.,** 'Genetics'



**B.Sc. ZOOLOGY SYLLABUS UNDER CBCS**

**B.Sc. II Year**

**ZOOLOGY PRACTICAL SYLLABUS FOR III SEMESTER**

**Discipline Specific Course, Paper – IV**

**[Code: BS405; Course Type DSC 2D]**

**Cell Biology, Genetics and Evolution**

**Periods: 30**

**Max. Marks: 40**

**I. Cytology**

1. Preparation and Identification of slides of Mitotic divisions with onion root tips
2. Preparation and Identification of different stages of Meiosis in Grasshopper Testes
3. Identification and study of the following slides
  - i). Different stages of Mitosis and Meiosis
  - ii) Lamp brush and Polytene chromosomes

**II. Genetics**

1. Problems on Genetics - Mendelian inheritance, Linkage and crossing over, Sex linked inheritance

**III. Evolution**

1. Museum Study of Fossil animals: *Peripatus*, *Coelacanth Fish*, *Dipnoi fishes*, *Sphenodon*, *Archeopteryx*.
2. Study of homology and analogy from suitable specimens and pictures
3. Problems on Hardy-Weinberg Law
4. Macroevolution using Darwin finches (pictures)

**Laboratory Record work shall be submitted at the time of practical examination**

An “**Album**” containing photographs, cut outs, with appropriate write-up about Genetics and Evolution.

**Computer aided techniques should be adopted as per UGC guide lines.**

**Suggested manuals**

Manual of laboratory experiments in cell biology Edward, G.

**B.Sc. ZOOLOGY SYLLABUS UNDER CBCS**

**B.Sc. II Year**

**B.Sc. PRACTICAL MODEL PAPER FOR IV SEMESTER**

**Discipline Specific Course, Paper – IV**

**[Code: BS405; Course Type DSC 2D]**

**Cell Biology, Genetics and Evolution**

**Time:2 Hrs.**

**Max. Marks: 40**

1. Identification, labeled diagram and salient features of spots: (06 spots)	12
2. Prepare and Identify Mitotic divisions with onion root tips:	08
3. One Problem from Genetics	05
4. One Problem from Evolution	05
5. Certified practical record	05
6. Album	03
7. Viva voce	02

**B.Sc. ZOOLOGY SYLLABUS UNDER CBCS**

**B.Sc. III Year**

**V - SEMESTER**

**Discipline Specific Course, Paper – V**

**[Code: BS504; Course Type DSC 2E]**

**Physiology and Biochemistry**

**Periods: 45**

**Max. Marks: 40**

**UNIT – I Physiology**

**(15 Periods)**

**1.1 Digestion**

- 1.1.1 Digestion definition and extra and intracellular digestion.
- 1.1.2 Digestion of Carbohydrates, Proteins, Lipids and Cellulose.
- 1.1.3 Absorption and Assimilation of digested food; role of Gastrointestinal hormones in digestion

**1.2 Respiration**

- 1.2.1 Definition of Respiration and Respiratory mechanisms – External, Internal and cellular.
- 1.2.2 Respiratory Pigments; Transport of oxygen, Oxygen dissociation curves. Bohr's effect.
- 1.2.3 Transport of CO<sub>2</sub> – Chloride shift; Regulation of respiration – nervous and chemical

**1.5.1 Circulation**

- 1.3.1 Types of circulation - Open and Closed circulation
- 1.3.2 Structure of Mammalian Heart, Types of hearts – Neurogenic and Myogenic; Heart function – Conduction and regulation of heart beat.
- 1.3.3 Regulation of Heart rate – Tachycardia and Bradycardia; Blood Clotting mechanism

**1.4. Excretion**

- 1.4.1 Classification of Animals on the basis of excretory products- Ammonotelic, Uricotelic, Ureotelic
- 1.4.2 Structure and function of Nephron.
- 1.4.3 Urine formation, Counter current mechanism.

**UNIT – II Physiology**

**(15 periods)**

**2.1. Muscle Contraction**

- 2.1.1 Types of Muscles
- 2.1.2 Ultra structure of skeletal muscle fibre
- 2.1.3 Sliding Filament theory, muscle contraction mechanism and energetics.

## B.Sc. ZOOLOGY SYLLABUS UNDER CBCS

### 2.2. Nerve Impulse

- 2.2.1 Structure of Neuron
- 2.2.2 Nerve impulse - Resting potential and Action potential and Conduction of Nerve impulse
- 2.2.3 Synapse, types of synapses and Synaptic transmission.

### 2.3. Endocrine System

- 3.3.1 Endocrine glands - Structure, secretions and functions of Pituitary, Thyroid, Parathyroid, Adrenal glands and Pancreas
- 3.3.2 Hormone action and concept of Secondary messengers
- 3.3.3 Male and Female Hormones, Hormonal control of Menstrual cycle in humans.

## UNIT – III Physiology and Biochemistry

(15 periods)

### 3.1. Homeostasis and Enzymes

- 3.1.1 Concept of Homeostasis.
- 3.1.2 Mechanism of Homeostasis.
- 3.1.3 Osmoregulation - Water and ionic regulation by freshwater, brackish water and marine animals
- 3.1.4 Enzymes: Definition, Classification, Inhibition and Regulation

### 3.2. Biomolecules and Metabolism

- 3.2.1. Carbohydrates: Classification and function of Carbohydrates
- 3.2.2. Carbohydrate metabolism - Glycolysis, Krebs cycle, , Electron transport and oxidative phosphorylation.
- 3.2.3 Proteins: Classification of proteins based on functions and Chemical nature
- 3.2.4 Protein Metabolism - Transamination, Deamination and Urea Cycle
- 3.2.5 Lipids: Classification of Lipids
- 3.2.6. Lipid Metabolism - Fatty acid synthesis and Fatty acid oxidation.

### Suggested readings

**Gerard J. Tortora and Sandra Reynolds Garbowski** *Principles of Anatomy and Physiology*, Tenth Ed., John Wiley & Sons

**Arthur C. Guyton MD**, *A Text Book of Medical Physiology*, Eleventh ed., John E. Hall, Harcourt Asia Ltd.

**William F. Ganong**, *A Review of Medical Physiology*, 22 ed, McGraw Hill, 2005

**Sherwood, Klandrof, Yanc**, *Animal Physiology*, Thompson Brooks/Coole, 2005.

**Sherwood, Klandrof, Yanc**, *Human Physiology*, Thompson Brooks/Coole, 2005.

**Knut Schmidt-Nielson**, *Animal Physiology*, 5th ed, Cambridge Low Price Edition.

**Roger Eckert and Randal**, *Animal Physiology*, 4th ed, Freeman Co, New York.

**Singh. H.R**, *Text Book of Animal Physiology and Biochemistry*

**Nagabhushanam** , *Comparative Animal Physiology*

**Veer Bal Rastogi**, *Text Book of Animal Physiology*

**B.Sc. ZOOLOGY SYLLABUS UNDER CBCS**

**B.Sc. III Year PRACTICAL SYLLABUS  
V - SEMESTER**

**Discipline Specific Course, Paper – V  
[Code: BS504; Course Type DSC 2E]  
Physiology and Biochemistry**

**Periods: 30**

**Max. Marks: 40**

1. Qualitative tests for identification of carbohydrates, proteins and lipids.
  2. Qualitative tests for identification of ammonia, urea and uric acid (Nitrogenous excretory products)
  3. Effect of pH and Temperature on salivary amylase activity.
  4. Study of permanent histological sections of Mammalian Endocrine glands - pituitary, thyroid, pancreas, adrenal gland.
  5. Estimation of Haemoglobin by Sahlis method.
  6. Estimation of total protein by Lowry's method.
  7. Estimation of unit Oxygen consumption of fish with reference to body weight.
- **Laboratory Record work shall be submitted at the time of practical examination**
  - **Computer aided techniques should be adopted as per UGC guide lines.**

**Suggested manuals**

**Tortora, G.J. and Derrickson, B.H. (2009).** *Principles of Anatomy and Physiology*, XII Edition, John Wiley & Sons, Inc.

**Widmaier, E.P., Raff, H. and Strang, K.T. (2008)** *Vander's Human Physiology*, XI Edition., McGraw Hill

**Guyton, A.C. and Hall, J.E. (2011).** *Textbook of Medical Physiology*, XII Edition, Harcourt Asia Pvt. Ltd/ W.B. Saunders Company

**Berg, J. M., Tymoczko, J. L. and Stryer, L. (2006).** *Biochemistry*. VI Edition. W.H Freeman and Co.

**Nelson, D. L., Cox, M. M. and Lehninger, A.L. (2009).** *Principles of Biochemistry*. IV Edition. W.H. Freeman and Co.

**Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2009).** *Harper's Illustrated Biochemistry*. XXVIII Edition. Lange Medical Books/Mc Graw3Hill.

**B.Sc. ZOOLOGY SYLLABUS UNDER CBCS**

**B.Sc. III Year PRACTICAL MODEL PAPER  
V - SEMESTER**

**Discipline Specific Course, Paper – V  
[Code: BS504; Course Type DSC 2E]  
Physiology and Biochemistry**

**Time:2 Hrs.**

**Max. Marks: 40**

1. Identification, labeled diagram and salient features of spots: (05 spots)	10
2. Estimation of .....from Biochemistry	06
3. Identification/Study of.....from Physiology	06
4. Qualitative Test	06
5. Project Work	05
6. Certified practical record	05
7. Viva voce	02

**B.Sc. ZOOLOGY SYLLABUS UNDER CBCS**

**B.Sc. III Year**

**VI – SEMESTER**

**Discipline Specific Elective, Paper – VI**

**[Code: BS507; Course Type DSE 2E]**

**Applied Zoology**

**Periods: 45**

**Max. Marks: 40**

**UNIT – I**

**(15 Periods)**

**1. Aquaculture and Sericulture**

- 1.1 Types of Fisheries; Fresh Water Fish and Prawn culture
- 1.2 Fresh water fishing gears and crafts; Induced Breeding.
- 1.3 Hatchery design and Management of fish and prawn; Transportation of fish and prawn seed.
- 1.4 Preservation, Processing and By-products of fishes.
- 1.5 Fish Diseases and control measures
- 1.6 Life cycle of *Bombyx mori*
- 1.7 Structure of silk gland and secretion of silk
- 1.8 Silkworm rearing technology.
- 1.9 Spinning, harvesting and storage of cocoons.
- 1.10 Silk worm Pests and Diseases: Uzi fly; Protozoan, Viral, Fungal and Bacterial; Control and prevention.
- 1.11 Prospects of Sericulture in India

**UNIT – II**

**(15 Periods)**

**2. Apiculture and Vermiculture**

- 2.1 Selection of Bee Species for Apiculture.
- 2.2 Bee Keeping Equipment.
- 2.3 Methods of Extraction of Honey (Indigenous and Modern).
- 2.4 Bee Diseases and Enemies.
- 2.5 Products of Apiculture Industry and its Uses (Honey, Bees Wax).
- 2.6 Introduction of Vermiculture and Vermicomposting.
- 2.7 Vermiculture techniques.
- 2.8 Bedding, Essential parameters for Vermiculture and Management
- 2.9 Methods of Harvesting (Manual & Mechanical).
- 2.10 Economic Importance of Vermiculture.

**UNIT – III**

**(15 Periods)**

**3. Poultry Farming & Animal Husbandry**

- 3.1 Classification of Fowls based on their use – Broilers and Commercial layers.
- 3.2 Principles of poultry breeding, Management of breeding stock and broilers, Processing and preservation of eggs.
- 3.3 Poultry diseases - Viral, Bacterial, Fungal, Protozoan

## B.Sc. ZOOLOGY SYLLABUS UNDER CBCS

- 3.4 Management of a modern Poultry Farm, progressive plans to promote Poultry as a Self-Employment venture
- 3.5 Dairy farm and its management
- 3.6 Animal Husbandry – Introduction, Preservation of semen, artificial insemination of cattle, Induction of early puberty and synchronization of estrus in cattle

### Suggested Readings

1. **Prost, P. J. (1962).** *Apiculture*. Oxford and IBH, New Delhi.
2. **Bisht. D.S.,** *Apiculture*, ICAR Publication.
3. **Singh S.,** *Beekeeping in India*, Indian council of Agricultural Research, New Delhi.
4. **Ullal S.R. and Narasimhanna, M.N.** Handbook of Practical Sericulture: CSB, Bangalore
5. **Jolly. M. S.** Appropriate Sericultural Techniques; Ed., Director, CSR & TI, Mysore.
6. Handbook of Silkworm Rearing: Agriculture and Technical Manual-1, Fuzi Pub. Co.
7. **Narasimhanna, M. N.** Manual of Silkworm Egg Production,, CSB, Bangalore 1988.
8. **Wupang—Chun and Chen Da-Chung,** Silkworm Rearing,, Pub. By FAO, Rome 1988.
9. **Sengupta, K.** A Guide for Bivoltine Sericulture; Director, CSR & TI, Mysore 1989.
10. **Krishnaswamy, S.** Improved Method of Rearing Young age silkworm; CSB, Bangalore, 1986.
11. **Jhingran. V.G.** Fish and fisheries in India.,
12. **Khanna. S.S,** An introduction to fishes
13. **Santanam, B. et al,** A manual of freshwater aquaculture,
14. **Boyd. C.E. & Tucker.C.S,** Pond aquaculture water quality management,
15. **Biswas.K.P,** Fish and prawn diseases,
16. **Hafez, E. S. E. (1962).** *Reproduction in Farm Animals*. Lea & Fabiger Publisher
17. **Dunham R.A. (2004).** *Aquaculture and Fisheries Biotechnology Genetic Approaches*. CABI
18. **Pedigo, L.P. (2002).** *Entomology and Pest Management*, Prentice Hall.
19. **Lee,** Earthworm Ecology
20. **Stevenson,** Biology of Earthworms
21. **Ranganathan L.S,** Vermicomposting technology- soil health to human health



**B.Sc. ZOOLOGY SYLLABUS UNDER CBCS**

**B.Sc. III Year PRACTICAL SYLLABUS  
VI – SEMESTER**

**Discipline Specific Elective, Paper – VI  
[Code: BS507; Course Type DSE 2E]  
Applied Zoology**

**Periods: 30**

**Max. Marks: 40**

1. Identification and study of important cultivable and edible fishes - Any five
  2. Identification and study of important cultivable and edible crustaceans - Any five
  3. Identification different larvae of silk worm- Using specimens / pictures
  4. Identification of mulberry and non mulberry silkworms
  5. Mounting of mouth parts of adult silk worm and silk gland of larva
  6. Estimation of quality of milk from different dairy farm units – specific gravity, fat content, pH viscosity.
  7. Identification of purity of Honey in different samples
  8. Field visits to a Vermiculture / Sericulture / fisheries / apiculture / poultry / dairy farm-submission of any 3 Reports
- **Laboratory Record work shall be submitted at the time of practical examination**
  - **Computer aided techniques should be adopted as per UGC guide lines.**

**B.Sc. ZOOLOGY SYLLABUS UNDER CBCS**

**B.Sc. III Year PRACTICAL MODEL PAPER**

**VI – SEMESTER**

**Discipline Specific Elective, Paper – VI**

**[Code: BS507; Course Type DSE 2E]**

**Applied Zoology**

**Time: 2 Hrs.**

**Max. Marks: 40**

1. Identification, labeled diagram and salient features of spots: - (05 spots)	10
2. Identification	06
3. Field trip reports (3)	12
4. Project Work	04
5. Certified practical record	04
6. Viva voce	04

**B.Sc. ZOOLOGY SYLLABUS UNDER CBCS**

**B.Sc. III Year  
VI - SEMESTER**

**Discipline Specific Elective, Paper – VI  
[Code: BS507; Course Type DSE 2E]  
Entomology**

**Periods: 45**

**Max. Marks: 40**

**UNIT – I: Basics of Entomology**

**(15 Periods)**

- 1.1. Definition, scope and importance of Entomology.
- 1.2. Insect classification and their distinctive characters.
- 1.3. Insect External morphology- Head, Thorax, and Abdomen.
- 1.4. Insect Internal Morphology – Digestive, Respiratory, Circulatory, Excretory, Nervous, and Reproductive systems.
- 1.5. Insect growth and development.

**UNIT – II: Insect vectors and pests.**

**(15 Periods)**

- 2.1. Introduction and history of medical entomology
- 2.2. Vectors of public health importance – Mosquitoes, Housefly, Sand fly, Lice & Bedbugs
- 2.3. Vector-borne diseases- (Malaria, Dengue, Filariasis) and their control measures.
- 2.4. Role of pests in Agriculture.
- 2.5. Crop Pests and their control measures

**UNIT – III: Beneficial Insects and Harmful Insects**

**(15 Periods)**

- 3.1. Apiculture.
- 3.2. Lac culture.
- 3.3. Sericulture.
- 3.4. Social life of Insects.
- 3.5. Venomous Insects.

**Practicals:**

1. Identification and study of house hold Insects - Cockroach, Silver fish, Crickets
2. Identification and study of important Insect vectors – Mosquitoes, House fly, Head lice.
3. Mounting of mouth parts of mosquitoes.
4. Identification different larvae of silk worm- Using specimens / pictures.
5. Field visits to a Sericulture/ apiculture farm and submission of report.

**References**

1. Text Book of Applied Entomology Vol. I & II by K. P. Srivastava
2. General Applied Entomology by B V David and T N Anathkrishnan
3. Destructive and Useful Insects by C. L. Metcalf
4. A text book of Entomology by Mathur and Upadhyay

**B.Sc. ZOOLOGY SYLLABUS UNDER CBCS**

**B.Sc. III Year  
V – SEMESTER**

**Discipline Specific Elective, Paper – VI  
[Code: BS507; Course Type DSE 2E]  
SERICULTURE**

**Periods: 45**

**Max. Marks: 40**

**UNIT – I – Introduction of Sericulture**

**(15 Periods)**

- 1.1 History of Sericulture and Present status of sericulture industry in India.
- 1.2 Sericulture as Agro-industry - Perspectives and prospects of Sericulture in India.
- 1.3 Geographical distribution of various species and economic races of silkworms - mulberry, tasar, eri and muga silkworm.
- 1.4 Types of silkworm host plants and their systematic position.
- 1.5 Morphology and anatomy of Silk glands

**UNIT – II – Biology and diseases of Silkworms**

**(15 Periods)**

- 2.1 Life cycle, External morphology and biology of mulberry silkworm.
- 2.2 Internal morphology of Silkworm – Digestive, Respiratory, Nervous, Excretory, and Reproductive systems.
- 2.3 Influence of biotic and a biotic factor on the incidence of diseases.
- 2.4 Diseases of *Bombyx mori* and *Philosamia ricini* —Viral, bacterial protozoan and fungal. Preventive and control measures.
- 2.5 Insect and vertebrate Pests of silkworm and their management.

**UNIT – III – Silkworm Rearing**

**(15 Periods)**

- 3.1. Silkworm rearing house and rearing appliances.
- 3.2. Feeding and Rearing methods of mulberry silk worms.
- 3.3. Mounting and harvesting of mulberry silk cocoons.
- 3.4. Properties and composition of silk.
- 3.5. Commercial characters of cocoons and price fixation.

**Practicals:**

1. Identification of different types of silkworms.
2. Morphology of egg larva, pupa and adult of different silkworm types.
3. Life history of different silkworm types.
4. Dissection of digestive system and salivary gland of silkworm larva.
6. Dissection of the nervous system of larva silkworm.
7. Rearing appliances
8. Sex differentiation of Larva, Pupa and Adult silkworms
9. Calculation of Shell Ratio.

## B.Sc. ZOOLOGY SYLLABUS UNDER CBCS

### References:

1. Handbook of Practical Sericulture : Ullal, S.R. and Narasimhanna, M.N. (1987), Central Silk Board Publication, Bangalore.
2. FAO Manuals on Sericulture : Anonymous (1972), Vol. I-IV
3. Sericulture for Rural Development : Hanumappa (1978), Himalaya Publication,
4. The Silkworm, an Important Laboratory Tool : Tazima, Y. (1978), Kodansha Publications, Tokyo.
5. Control of Silkworm Reproduction, Development and Sex : Strunnikov, V.A. (1983), MIR Publications, Moscow.
6. Sericulture in India Sarkar, D.C. (1988), CSB, Bangalore.
7. Silkworm Rearing : Wupang—Chun and Chen Da-Chung (1988), Pub. By FAO.
8. Handbook of Silkworm Rearing : Anonymous (1972), Agriculture and Technical Manual-1, Fuzi Pub. Co. Ltd., Tokyo, Japan.
9. Improved Method of Rearing Young age silkworm : Krishnaswamy (1986), CSB Publication, Bangalore.

**B.Sc. ZOOLOGY SYLLABUS UNDER CBCS**

**B.Sc. III Year**

**V- SEMESTER**

**Discipline Specific Course, Paper – VII**

**[Code: BS604; Course Type DSC 2F]**

**Immunology and Animal Biotechnology**

**Periods: 45**

**Max. Marks: 40**

**UNIT – I Immunology – Basic concepts; antigens and antibodies**

**(15 Periods)**

- 1.1 Basic concepts of immunology.
- 1.2 Cells of immune system
- 1.3 Primary and secondary Organs of immune system
- 1.4 Types of Immunity – Innate and acquired
- 1.5 Basic properties of antigens
- 1.6 Structure, function and types of an antibody.
- 1.7 B and T cell epitopes, haptens, adjuvants.
- 1.8 Antigen-antibody reactions,
- 1.9 T-Cell and B-Cell activation
- 1.10 Monoclonal antibodies and their production

**UNIT – II Working of an Immune system; Immune system in health and disease**

**(15 Periods)**

- 2.1 Structure and functions of major histocompatibility complex.
- 2.2 Basic properties and functions of Cytokines, Interferons and complement proteins
- 2.3 Humoral and Cell mediated immunity.
- 2.4 Types of hyper sensitivity.
- 2.5 Concepts of autoimmunity and immunodeficiency.
- 2.6 Introduction to Vaccines and types of Vaccines

**UNIT – III Animal Biotechnology and Genetically modified organisms**

**(15 Periods)**

- 3.1 Concept and Scope of Animal Biotechnology.
- 3.2 Cloning vectors - Plasmids, Cosmids, Lambda bacteriophage, YAC
- 3.3 Cloning- Cloning methods (Cell, Animal and Gene cloning)
- 3.4 Animal Cell culture - Equipment and materials for animal cell culture; applications of cell culture techniques
- 3.5 Recombinant DNA technology and its applications
- 3.6 Transgenesis – Methods of Transgenesis.
- 3.7 Production of Transgenic animals and Application of Transgenic animals in Biotechnology.
- 3.8 Stem cells –types and their applications

**Suggested Readings**

**Arthur C. Guyton MD**, *A Text Book of Medical Physiology*, Eleventh ed., John E. Hall, Harcourt Asia Ltd.

**William F. Ganong**, *A Review of Medical Physiology*, 22 ed, McGraw Hill, 2005

**Sherwood, Klandrof, Yanc**, *Human Physiology*, Thompson Brooks/Coole, 2005.

**Knut Schmidt-Nielson**, *Animal Physiology*, 5th ed, Cambridge Low Price Edition.

**Richard A. Glodsby, Thomas J Kind, Barbara A. Osborne, Janis Kuby**, *Immunology*, 5th ed, Freeman and Co. New York

**Ivan Roitt**, *Immunology*, 4th ed, Johanthan Brostoff, Moshy, London.

**Thomas C. Chung**, *General Parasitology*, Hardcourt Brace and Co ltd. Asia. New Delhi.

**Gerard D. Schmidt and Larry S Roberts**, *Foundations of Parasitology*, McGraw Hill

**Kindt, T. J., Goldsby, R. A., Osborne, B. A., Kuby, J. (2006)**. VI Edition. *Immunology*. W.H. Freeman and Company.

**Delves, P. J., Martin, S. J., Burton, D. R., Roitt, I.M. (2006)**. XI Edition. *Roitt's Essential Immunology*, Blackwell Publishing.

**B.Sc. ZOOLOGY SYLLABUS UNDER CBCS**

**B.Sc. III Year PRACTICAL SYLLABUS  
V- SEMESTER**

**Discipline Specific Course, Paper – VII  
[Code: BS604; Course Type DSC 2F]  
Immunology and Animal Biotechnology**

**Periods: 30**

**Max. Marks: 40**

**I. Immunology**

1. Identification of Blood groups
2. Histological study of spleen, thymus and lymph nodes (through prepared slides)
3. Enumeration of RBC & WBC from a given blood sample
4. Enumeration of Differential count of WBC from a given blood sample
5. Demonstration of
  - a. ELISA
  - b. Immuno-electrophoresis
6. Identification of Autoimmune disease through charts.

**II. Animal Biotechnology**

1. Study the following techniques through photographs / virtual lab
  - a. Southern blotting
  - b. Western blotting
  - c. DNA sequencing (Sanger's method)
  - d. DNA finger printing
  - e. Identification of Vectors
  - f. Identification of Transgenic animals
2. PCR demonstration /virtual lab

- **Laboratory Record work shall be submitted at the time of practical examination**
- **Computer aided techniques should be adopted as per UGC guide lines.**

**Suggested manuals**

**Kindt, T. J., Goldsby, R.A., Osborne, B. A. and Kuby, J (2006).** Immunology, VI Edition. W.H. Freeman and Company.

**David, M., Jonathan, B., David, R. B. and Ivan R. (2006).** Immunology, VII Edition, Mosby, Elsevier Publication.

**Abbas, K. Abul and Lichtman H. Andrew (2003.)** Cellular and Molecular Immunology. V Edition. Saunders Publication.



**B.Sc. ZOOLOGY SYLLABUS UNDER CBCS**

**B.Sc. III Year PRACTICAL MODEL PAPER  
V- SEMESTER**

**Discipline Specific Course, Paper – VII  
[Code: BS604; Course Type DSC 2F]  
Immunology and Animal Biotechnology**

**Time: 2 Hrs.**

**Max. Marks: 40**

1. Identification, labeled diagram and salient features of spots: (05 spots)	10
2. Identification/Determination from Immunology	06
3. Identification/Study the technique from Anima Biotechnology	06
4. Demonstration of a technique	06
5. Project Work	05
6. Certified practical record	05
7. Viva voce	02

**B.Sc. ZOOLOGY SYLLABUS UNDER CBCS**

**B.Sc. III Year**

**VI - SEMESTER**

**Discipline Specific Elective, Paper – VIII**

**[Code: BS607; Course Type DSE 2F]**

**AQUATIC BIOLOGY**

**Periods: 45**

**Max. Marks: 40**

**UNIT – I Aquatic Biomes**

**(15 periods)**

- 1.1 Brief introduction of the aquatic biomes
- 1.2 Freshwater ecosystem (lakes, wetlands, streams and rivers),
- 1.3 Estuaries, intertidal zones,
- 1.4 Oceanic pelagic zone, marine benthic zone.
- 1.5 Coral reefs

**UNIT – II Fresh Water Biology and Marine Biology**

**(15 periods)**

- 2.1 Lakes: Origin and classification of lakes
- 2.2 Lake as an Ecosystem, Lake morphometry
- 2.3 Physico-chemical Characteristics of fresh water bodies: Light, Temperature, Thermal stratification, Dissolved Solids, Carbonate, Bicarbonates, Phosphates and Nitrates, Turbidity: dissolved gases (Oxygen, Carbon dioxide).
- 2.4 Nutrient Cycles and Lakes- Nitrogen, Sulphur and Phosphorous.
- 2.5 Streams: Different stages of stream development, Physico-chemical environment, adaptation of hill-stream fishes.
- 2.6 Salinity and density of sea water; Continental shelf; Adaptation of deep sea organisms; Sea weeds.

**UNIT – III Management of Aquatic Resources**

**(15 periods)**

- 3.1 Aquatic pollution - Causes of pollution: Agricultural, Industrial, Sewage, Thermal and Oil spills,
- 3.2 Eutrophication
- 3.3 Management and conservation
- 3.4 Water pollution acts of India
- 3.5 Sewage treatment and water quality assessment - BOD and COD.

**B.Sc. ZOOLOGY SYLLABUS UNDER CBCS**

**B.Sc. III Year PRACTICAL SYLLABUS  
VI - SEMESTER**

**Discipline Specific Elective, Paper – VIII  
[Code: BS607; Course Type DSE 2F]  
AQUATIC BIOLOGY**

**Periods: 30**

**Max. Marks: 40**

**PRACTICAL**

1. Study of the topography of a lake
2. Physico-Chemical and biological analysis of a lake  
Physico-Chemical analysis of water - O<sub>2</sub>, CO<sub>2</sub>, BOD, COD  
Biological– Zooplanktons – Identification and population density of Zooplanktons of a lake
3. Determination of - Turbidity / transparency, Dissolved Oxygen, Free Carbon dioxide, Alkalinity (carbonates & bicarbonates) in water collected from a nearby lake / water body.
4. Instruments used in limnology (secchi disc, van dorn bottle, conductivity meter, Turbidity meter, PONAR grab sampler) and their significance.
5. A Project Report on a visit to a Sewage treatment plant / Marine bio-reserve/Fisheries Institutes.

**Suggested Readings**

1. Ananthakrishnan : Bioresources Ecology 3<sup>rd</sup> Edition
2. Goldman – Limnology, 2nd Edition
3. Odum and Barrett – Fundamentals of Ecology, 5th Edition\
4. Pawlowski: Physicochemical Methods for water and Wastewater Treatment, 1st Edition
5. Wetzel: Limnology, 3rd edition
6. Trivedi and Goyal: Chemical and biological methods for water pollution studies  
Welch: Limnology Vols.I-II

**B.Sc. ZOOLOGY SYLLABUS UNDER CBCS**

**B.Sc. III Year  
VI - SEMESTER**

**Discipline Specific Elective, Paper – VIII  
[Code: BS607; Course Type DSE 2F]  
Public Health and Hygiene**

**Periods: 45**

**Max. Marks: 40**

**UNIT – I Nutrition, Environment and Health**

**(15 Periods)**

- 1.1 Classification of foods - Carbohydrates, proteins, lipids, vitamins and minerals
- 1.2 Balanced diet and malnutrition.
- 1.3 Nutritional deficiencies and disorders- Carbohydrates, proteins, lipids, vitamins and minerals.
- 1.4 Environment and health Impact assessment: concept, steps and applications.
- 1.5 Occupational, Industrial, agricultural and urban Health-Exposure at work place, urban areas, industrial workers, farmers and agricultural labourers, Health workers and health disorders and diseases.
- 1.6 Environmental pollution and associated Health hazards
- 1.7 Water borne diseases; Air borne diseases

**UNIT-II Communicable and Non-Communicable diseases**

**(15 Periods)**

- 2.1 Causes, Symptoms, Diagnosis, Treatment and Prevention of Communicable diseases - Malaria, Filaria, Measles, Polio, Chicken pox, Rabies, Plague, Leprosy, Tuberculosis and AIDS.
- 2.2 Causes, Symptoms, Diagnosis, Treatment and Prevention of Non-Communicable diseases - Hypertension, Coronary Heart diseases, Stroke, Diabetes, Obesity and Mental ill-health.

**UNIT-III Health Education in India**

**(15 periods)**

- 3.1 Health care legislation in India – termination of pregnancy act, Maternity benefit act, Transplantation of human organs act, Child Labour act, Biomedical waste act, ESI act.
- 3.2 WHO Programmes – Government and Voluntary Organizations and their health services
- 3.3 First Aid and Health awareness, personal health care record maintenance.

**Suggested Readings**

1. Park and Park, 1995: Text Book of Preventive and Social Medicine – Banarsidas Bhanot Publ. Jodhpur – India.
2. Public Health at the Crossroads Achievements and Prospects. Robert Beaglehole and Ruth
3. Bonita 2nd Edition Cambridge University Press 3. Maxcy Rosenau Last Public Health &
4. Preventive Medicine, Fourteenth Edition Ed RobertWallace, MD, et al. 4.
5. Epidemiology and Management for Health Care: Sathe, P.V. Sathe, A.P., PopularPrakashan,
6. Mumbai, 1991. 5.
7. International Public Health: Diseases, Programs, Systems, and Policies by
8. MichaelMerson, Robert E Black, Anne J Mills Jones and Bartlett Publishers. 6.

**B.Sc. ZOOLOGY SYLLABUS UNDER CBCS**

**B.Sc. III Year PRACTICAL SYLLABUS  
VI - SEMESTER**

**Discipline Specific Elective, Paper – VIII  
[Code: BS607; Course Type DSE 2F]  
Public Health and Hygiene**

**Periods: 30**

**Max. Marks: 40**

1. Medical fitness– Determine the following:  
BMI, Blood Pressure, Cholesterol (LDL, HDL) Hemoglobin  
Complete Blood Picture; Complete urine examination
  2. Qualitative identification of carbohydrates, Lipids, vitamins, lipids and minerals,
  3. Estimation of fat content and tests milk adulteration.
  4. Qualitative and quantitative survey methods in public health sciences.
  5. Identification of parasitic stages of malaria and filaria through permanent slides
  6. Estimation of blood glucose level in a normal and diabetic persons.
  7. Project report on Epidemiological survey, different diseases such as  
Malaria; Chicken gunya; AIDS, Diarrhoea
  8. Epidemiological survey of a slum area to identify the diseases due to poor sanitation and  
contaminated drinking water.
  9. Visit to a community water purification and treatment plant.
  10. Visit to an industry to study occupational health hazard and safety of industrial workers  
(sugar/milk dairy/textile/cement).
  11. Visit to agricultural fields to study occupational health of farmers and agricultural laborers.
- **Laboratory Record work shall be submitted at the time of practical examination**
  - **Computer aided techniques should be adopted as per UGC guide lines.**

**B.Sc. ZOOLOGY SYLLABUS UNDER CBCS**

**B.Sc. III Year PRACTICAL MODEL PAPER  
VI - SEMESTER**

**Discipline Specific Elective, Paper – VIII  
[Code: BS607; Course Type DSE 2F]  
Public Health and Hygiene**

**Time: 2 Hrs.**

**Max. Marks: 40**

- |   |  |    |
|---|--|----|
| 1 | Epidemiological survey report of a slum area health status | 10 |
| 2 | Estimation of ----- from food or water or milk             | 10 |
| 3 | Project work   | 10 |
| 4 | Certified practical record                                 | 05 |
| 5 | Viva voce  | 05 |

**B.Sc. ZOOLOGY SYLLABUS UNDER CBCS**

**B.Sc. III Year**

**VI - SEMESTER**

**Discipline Specific Elective, Paper – VIII**

**[Code: BS607; Course Type DSE 2F]**

**Poultry Science**

**Periods: 45**

**Max. Marks: 40**

**Unit -I: Poultry Nutrition and Physiology**

**15 hours**

- 1.1 Essential amino acids, proteins, fatty acids, vitamins and minerals their inter-relationships.
- 1.2 Functional regulation of digestion, absorption and metabolism of nutrients.
- 1.3 Feed formulation for different species and groups
- 1.4 Different systems of feeding wet mash, dry mash, crumble and pellet feeding. Feed Passage rate in G.I. tract in relation to digestion and absorption efficiency;
- 1.5 Characteristics features of endocrine glands. Endocrine control and variable factors influencing growth process

**Unit II: Poultry Products technology**

**15 hours**

- 2.1 Structure, chemical composition and nutritive value of egg.
- 2.2 Various measures of egg quality. Shell, albumen and yolk quality assessment.
- 2.3 Factors influencing egg quality traits. Mechanism of deterioration of egg quality.
- 2.4 Different methods of preservation of table eggs and their relative merits and demerits.
- 2.5 Physical, chemicals, microbial and organoleptic evaluation of meat quality

**Unit III: Poultry Health Management**

**15 hours**

- 3.1 Common diseases of poultry – bacterial, viral, fungal, protozoan, parasitic and other emerging diseases of poultry, their prevention, control and treatment.
- 3.2 Metabolic and nutrient deficiency diseases and disorders.
- 3.3 Vaccination programmes and Deworming programmes.
- 3.4 Control of coccidiosis, worms, ectoparasites and flies. Medication procedures.
- 3.5 Cleaning and disinfection of poultry houses. Drinking water sanitation

**Practical**

1. Estimation of amino acids, proteins and fatty acids in feed
2. Virtual demonstration of endocrine glands and their influence on growth of poultry
3. Estimation of albumen and yolk quantity in eggs
4. Estimation of calcium in egg shell.
5. Estimation of carotenes, cholesterol and peroxides in meat of chicken.

C.B.C.S PATTERN SYLLABUS FROM 2019 ONWARDS.  
B.A., B.SC., B.COM & B.B.A 1<sup>ST</sup> SEMESTER TELUGU (11th LANGUAGE)

Unit.No. I ప్రాచీన కవిత్వం

1. శకుంతలోపాఖ్యానం - నన్నయ
2. గౌడగూచి కథ - పాల్కురికిసోమన
3. సంపరణునితపస్సు - అద్దంకిగంగాధరకవి.

Unit.No. II ఆధునిక కవిత్వం

1. కాసులు - గురజాడ అప్పారావు
2. రాజు - కవి - గుర్రంజాషువా
3. గంగిరెద్దు - పల్లదుర్గయ్య
4. జయభేరి - శ్రీశ్రీ

Unit.No. III ఉపవాచకం

రుద్రమదేవి (నవల) - ఒద్దిరాజుసోదరులు

Unit.No. IV వ్యాకరణం

పర్యాయ పదాలు , నానార్థాలు, సంధులు సమాసాలు, తెలుగు వాక్యం

పాఠ్యగ్రంథం: తెలుగు అకాడమీ వారి సాహితీమంజీర

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C.B.C.S PATTERN SYLLABUS FROM 2019 ON WARDS.  
B.A., B.SC., B.COM & B.B.A 2nd SEMESTER TELUGU (11th LANGUAGE)

Unit.No.1 ప్రాచీన కవిత్వం

1. గజేంద్ర మోక్షం- పోతన
2. హనుమత్ సందేశం- మొల్ల
3. సుభాషితాలు-వినుగులకృణకవి

Unit.No.11 ఆధునిక కవిత్వం

1. స్నేహలతలేఖ-రాయప్రోలు సుబ్బారావు
2. అంతర్నాదం-దాశరథి
3. ప్రపంచపదులు-సి. నారాయణరెడ్డి
4. అల్పిదా-కౌముది

Unit.No.111 పచన విభాగం

1. యుగాంతం-నెల్లూరి తేశవస్వామి
2. ఎంకన్న-పి.యశోదారెడ్డి
3. మామిడిపండు-సురవరంప్రతాపరెడ్డి
4. మా డిరుపోయింది.-కృష్ణశాస్త్రి

Unit.No.1V ఛందస్సు

(ఉత్పలమాల, చంపకమాల, శార్వాలం, మత్తేభం, అటవెలది, తేటగీతి, ద్విపద, సీసం, కందం, ఉత్పాహం, తరళం, సగ్ధర, మహాసగ్ధర, ముత్యాలసరం)

పాఠ్యగ్రంథం: తెలుగు అకాడమీ వారి సాహితీమంజీర

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సూక్ష్మ  
E  
అక్షరం

**Proposed  
B.Sc. Botany Syllabus**

**Under Choice Based Credit System**

**2019-20**

**Meeting held with Heads & Chairperson,  
BOS of Six Conventional Universities  
on 15<sup>th</sup> June, 2019 at TSCHE-Hyderabad.**

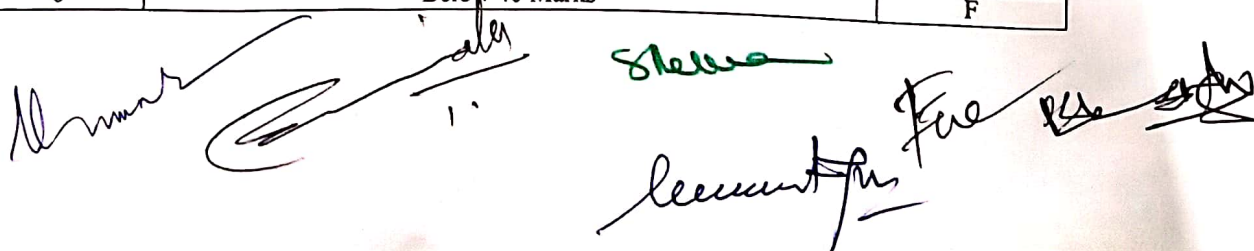
**Annexure – I (Credits)**  
**Proposed CBCS Scheme for B.Sc.**  
w.e.f 2019-20

Courses		Papers	Total Credits	Credits for each paper / Semester					
				B.Sc.					
				I	II	III	IV	V	VI
Core Courses DSC	Optional-1	4	20	5	5	5	5	-	-
	Optional-2	4	20	5	5	5	5	-	-
	Optional-3	4	20	5	5	5	5	-	-
Elective Courses DSE	Optional-1	2	10	-	-	-	-	5	5
	Optional-2	2	10	-	-	-	-	5	5
	Optional-3	2	10	-	-	-	-	5	5
Language	English(First Language)	5	20	4	4	3	3	3	3
	Second Language	5	20	4	4	3	3	3	3
Ability Enhancement Compulsory Course AECC	Environmental Science / Basic Computer Skills	1	2	2	-	-	-	-	-
	Basic Computer Skills / Environmental Science	1	2	-	2	-	-	-	-
Skill Enhancement Course SEC	SEC1	1	2	-	-	2	-	-	-
	SEC2	1	2	-	-	2	-	-	-
	SEC3	1	2	-	-	-	2	-	-
	SEC4	1	2	-	-	-	2	-	-
Generic Elective GE	Open Stream	1	4	-	-	-	-	4	-
Project Work/Optionals		1	4	-	-	-	-	-	4
Total Credits in each semester				25	25	25	25	25	25
Total Credits in UG				150					
Credits under Non-CGPA		NSS /NCC /sports / Extra curricular	6	Upto 6 (2 in each year)					
		Summer Internship	4	Upto 4 (2 in each, after I & II years)					

**Annexure II**

**Proposed New Grading System**

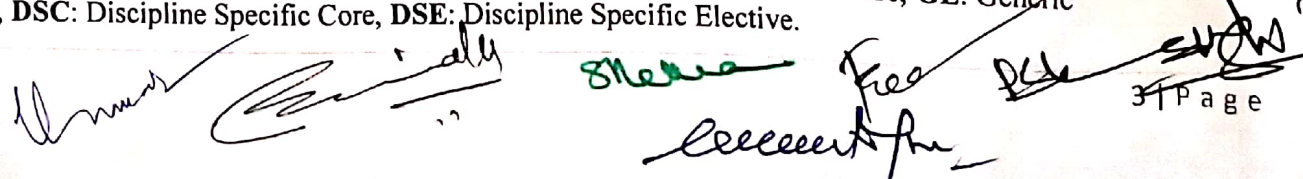
SGPA (SEMESTER GRADE POINT AVERAGE)			
S. No.	Grade Point	Range of marks	Grade Letter
1	10	Equal to and above 90 Marks	A+
2	9	More than or equal to 80 and less than 90 Marks	A
3	8	More than or equal to 70 and less than 80 Marks	B+
4	7	More than or equal to 60 and less than 70 Marks	B
5	6	More than or equal to 55 and less than 60 Marks	C+
6	5	More than or equal to 50 and less than 55 Marks	C
7	4	More than or equal to 40 and less than 50 Marks	D
8	0	Below 40 Marks	F



**TELANGANA STATE COUNCIL OF HIGHER EDUCATION**  
**PROPOSED CBCS COMMON CORE SCHEME FOR B.SC. COURSE**  
**OPTIONAL -1: BOTANY**

CODE	PAPER TITLE	Course Type	HPW	Credits
<b>FIRST YEAR SEMSTER - I</b>				
BS 104	PAPER-I : Microbial Diversity and Lower Plants	DSC-1A	4T+2P=6	4+1=5
<b>FIRST YEAR SEMSTER - II</b>				
BS 204	PAPER-II: Gymnosperms, Taxonomy of Angiosperms and Ecology	DSC-1B	4T+2P=6	4+1=5
<b>SECOND YEAR SEMSTER - III</b>				
BS 301	SEC-1: Nursery and Gardening	SEC-1	2	2
BS 302	SEC-2: Biofertilizers and Organic Farming	SEC-2	2	2
BS 304	PAPER-III: Plant Anatomy and Embryology	DSC-1C	4T+2P=6	4+1=5
<b>SECOND YEAR SEMSTER - IV</b>				
BS 401	SEC-3: Greenhouse Technology	SEC-3	2	2
BS 402	SEC-4: Mushroom Culture Technology	SEC-4	2	2
BS 404	PAPER-IV : Cell Biology, Genetics & Plant Physiology	DSC-1D	4T+2P=6	4+1=5
<b>THIRD YEAR SEMESTER - V</b>				
BS 501	GE-1: Industrial Microbiology	GE-1	4T	4
BS 502	DSE -1A: Biodiversity & Conservation DSE -1B: Economic Botany DSE -1C: Seed Technology	DSE-1A / DSE-1B / DSE-1C	4+2	4+1
<b>THIRD YEAR SEMESTER - VI</b>				
BS 601	DSE-3: Project (Group Projects)	PROJECT	4	4
BS 602	DSE -2A: Plant Molecular Biology DSE -2B: Tissue Culture and Biotechnology DSE -2C: Analytical Techniques in Plant Sciences	DSE-2A / DSE-2B / DSE-5E	4T+2P=6	4+1=5

AECC: Ability Enhancement Compulsory Course, SEC: Skill Enhancement Course, GE: Generic Elective, DSC: Discipline Specific Core, DSE: Discipline Specific Elective.





**B.Sc., BOTANY**  
**First Year, I -Semester**  
**Paper-I**  
**Microbial Diversity and Lower Plants**

DSC - 1A (4 hrs./week)

Credits- 4

Theory Syllabus

(60 hours)

(15 hours)

**UNIT - I**

- 1) **Bacteria:** Structure, nutrition, reproduction and economic importance. Brief account of Archaeobacteria, Actinomycetes and Mycoplasma with reference to little leaf of Brinjal and Papaya leaf curl
- 2) **Viruses:** Structure, replication and transmission; plant diseases caused by viruses and their control with reference to Tobacco Mosaic and Rice Tungro.
- 3) An outline of plant diseases of important crop plants caused by bacteria and their control with reference to Angular leaf spot of cotton and Bacterial blight of Rice.

(15 hours)

**UNIT-II**

- 1) General characters, structure, reproduction and classification of algae (Fritsch)
- 2) **Cyanobacteria:** General characters, cell structure their significance as biofertilizers with special reference to Oscillatoria, Nostoc and Anabaena.
- 3) Structure and reproduction of the following:  
Chlorophyceae- Volvox, Oedogonium and Chara.  
Phaeophyceae- Ectocarpus  
Rhodophyceae- Polysiphonia.

**UNIT-III**

(15 hours )

- 1) General characters and classification of fungi (Ainsworth).
- 2) Structure and reproduction of the following:
  - (a) Mastigimycotina- Albugo
  - (b) Zygomycotina- Mucor
  - (c) Ascomycotina- Saccharomyces and Penicillium.
  - (d) Basidiomycotina- Puccinia
  - (e) Deuteromycotina- Cercospora.
- 3) Economic importance of lichens

**UNIT-IV**

(15 hours )

- 1) **Bryophytes:** Structure, reproduction, life cycle and systematic position of Marchantia, Anthoceros and Polytrichum, Evolution of Sporophyte in Bryophytes.
- 2) **Pteridophytes:** Structure, reproduction, life cycle and systematic position of Rhynia, Lycopodium, Equisetum and Marsilea.
- 3) Stelar evolution, heterospory and seed habit in Pteridophytes.

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## References:

- 1) Alexopolous, J. and W. M. Charles. 1988. Introduction to Mycology. Wiley Eastern, New Delhi.
- 2) Mckane, L. and K. Judy. 1996. Microbiology – Essentials and Applications. McGraw Hill, New York.
- 3) Pandey, B. P. 2001. College Botany, Vol. I: Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. S. Chand & Company Ltd, New Delhi.
- 4) Pandey, B. P. 2007. Botany for Degree Students: Diversity of Microbes, Cryptogams, Cell Biology and Genetics. S. Chand & Company Ltd, New Delhi.
- 5) Sambamurthy, A. V. S. S. 2006. A Textbook of Plant Pathology. I. K. International Pvt. Ltd., New Delhi.
- 6) Sambamurthy, A. V. S. S. 2006. A Textbook of Algae. I. K. International Pvt. Ltd., New Delhi.
- 7) Sharma, O. P. 1992. Textbook of Thallophyta. McGraw Hill Publishing Co., New Delhi.
- 8) Thakur, A. K. and S. K. Bassi. 2008. A Textbook of Botany: Diversity of Microbes and Cryptogams. S. Chand & Company Ltd, New Delhi.
- 9) Vashishta, B. R., A. K. Sinha and V. P. Singh. 2008. Botany for Degree Students: Algae. S. Chand & Company Ltd, New Delhi.
- 10) Vashishta, B. R. 1990. Botany for Degree Students: Fungi, S. Chand & Company Ltd, New Delhi.
- 11) Dutta A.C. 2016. Botany for Degree Students. Oxford University Press.
- 12) Watson, E. V. 1974. The structure and life of Bryophytes, B. I. Publications, New Delhi.
- 13) Pandey, B. P. 2006. College Botany, Vol. II: Pteridophyta, Gymnosperms and Paleobotany. S. Chand & Company Ltd, New Delhi.
- 14) Vashishta, P. C., A. K. Sinha and Anil Kumar. 2006. Botany - Pteridophyta (Vascular Cryptogams). S. Chand & Company Ltd, New Delhi.
- 15) Pandey, B. P. 2001. College Botany, Vol. I: Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. S. Chand & Company Ltd, New Delhi.
- 16) Pandey, B. P. 2007. Botany for Degree Students: Diversity of Microbes, Cryptogams, Cell Biology and Genetics. S. Chand & Company Ltd, New Delhi.
- 17) Thakur, A. K. and S. K. Bassi. 2008. A Textbook of Botany: Diversity of Microbes and Cryptogams. S. Chand & Company Ltd, New Delhi.
- 18) Vashishta, B. R., A. K. Sinha and Adarsha Kumar. 2008. Botany for Degree Students: Bryophyta. S. Chand & Company Ltd, New Delhi.

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## Practical Syllabus

(45 hours)

1. Study of viruses and bacteria using electron micrographs (photographs).
2. Gram staining of Bacteria.
3. Study of symptoms of plant diseases caused by viruses, bacteria, Mycoplasma and fungi:  
Viruses: Tobacco mosaic  
Bacteria: Angular leaf spot of cotton and Rice tungro.  
Mycoplasma: Little leaf of Brinjal and Leaf curl of papaya  
Fungi: White rust on Crucifers, Rust on wheat & Tikka disease of Groundnut.
4. Vegetative and reproductive structures of the following taxa:  
Algae: Oscillatoria, Nostoc, Volvox, Oedogonium, Chara, Ectocarpus and Polysiphonia.  
Fungi: Albugo, Mucor, Saccharomyces, Penicillium, Puccinia and Cercospora
5. Section cutting of diseased material infected by Fungi and identification of pathogens as per theory syllabus. White rust of Crucifers, Rust on wheat & Tikka disease of Groundnut.
6. Lichens: Different types of thalli and their external morphology
7. Examination of important microbial, fungal and algal products:  
Biofertilizers, protein capsules, antibiotics, mushrooms, Agar-agar etc.
8. Field visits to places of algal / microbial / fungal interest (e.g. Mushroom cultivation, water bodies).
9. Study of Morphology (vegetative and reproductive structures) and anatomy of the following  
Bryophytes: Marchantia, Anthoceros and Polytrichum.
10. Study of Morphology (vegetative and reproductive structures) and anatomy of the following  
Pteridophytes: Lycopodium, Equisetum and Marsilea.
11. Study of Anatomical features of Lycopodium stem, Equisetum stem and Marsilea petiole & rhizome by preparing double stained permanent mounts.

## Practical Model Paper

Max. Marks: 25

Time : 3 hrs

1. Identify the given components 'A' & 'B' in the algal mixture .  
Describe with neat labeled diagrams & give reasons for the classifications. 2 X 2 = 4M
2. Classify the given bacterial culture 'D' using Gram – staining technique. 3M
3. Take a thin transverse section of given diseased material 'E'.  
Identify & describe the symptoms caused by the pathogen. 4M
4. Identify the given specimens 'F', 'G' & 'H' by giving reasons .  
(Fungal-1, Bacteria-1 & Viral-1) 3 X 1 = 3M
5. Comment on the given slides 'I' & 'J' (Algae-1, Fungi-1) 2 X 2 = 4M
6. Identify the given specimen 'K' & slide 'L' (Bryophytes & Pteridophytes ) 2 X 2 = 4M
7. Record 3M



# B.Sc., BOTANY

## First Year, II -Semester

### Paper-II Gymnosperms, Taxonomy of Angiosperms and Ecology

DSC-1B

Credits-4

#### Theory Syllabus

(60 hours)

#### UNIT-I

(15 hours)

- 1) Gymnosperms: General characters, structure, reproduction and classification (Sporne's). Distribution and economic importance of Gymnosperms.
- 2) Morphology of vegetative and reproductive parts, systematic position and life cycle of Pinus and Gnetum,
- 3) Geological time scale Introduction to Palaeobotany, Types of fossils and fossilization, Importance of fossils.

#### UNIT-II

(15 hours)

- 1) Introduction: Principles of plant systematics, Types of classification: Artificial, Natural and Phylogenetic; Systems of classification: Salient features and comparative account of Bentham & Hooker and Engler & Prantl classification systems. An introduction to Angiosperm Phylogeny Group (APG).
- 2) Current concepts in Angiosperm Taxonomy: Embryology in relation to taxonomy Cytotaxonomy, Chemotaxonomy and Numerical Taxonomy.
- 3) Nomenclature and Taxonomic resources: An introduction to ICN, Shenzhen code – a brief account. Herbarium: Concept, techniques and applications.

#### UNIT-III

(15 hours)

- 1) Systematic study and economic importance of plants belonging to the following families: Polypetalae Annonaceae, Capparidaceae, Rutaceae, Fabaceae (Faboideae/Papilionoideae, Caesalpinioideae, Mimosoideae), Cucurbitaceae
- 2) Gamopetalae: Apiaceae, Asteraceae, Asclepiadaceae, Lamiaceae, Monochalmydeae: Amaranthaceae, Euphorbiaceae
- 3) Monocotyledons: Orchidaceae, Poaceae and Zingiberaceae.

#### UNIT-IV

(15 hours)

1. Component of eco system, energy flow, food chain and food webs.
2. Plants and environment, ecological adaptations of plants, Hydrophytes, Xerophytes and Mesophytes
3. Plant Succession serial stages, modification of environment, climax formation with reference to Hydrosere and Xerosere.

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### References:

1. Watson, E. V. 1974. The structure and life of Bryophytes, B. I. Publications, New Delhi.
2. Pandey, B. P. 2006. College Botany, Vol. II: Pteridophyta, Gymnosperms and Paleobotany. S. Chand & Company Ltd, New Delhi.
3. Sporne, K. R. 1965. Morphology of Gymnosperms. Hutchinson Co., Ltd., London.
4. Vashishta, P. C., A. K. Sinha and Anil Kumar. 2006. Botany - Pteridophyta (Vascular Cryptogams). . Chand & Company Ltd, New Delhi.
5. Pandey, B. P. 2001. College Botany, Vol. I: Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. S. Chand & Company Ltd, New Delhi.
6. Pandey, B. P. 2007. Botany for Degree Students: Diversity of Microbes, Cryptogams, Cell Biology and Genetics. S. Chand & Company Ltd, New Delhi.
7. Thakur, A. K. and S. K. Bassi. 2008. A Textbook of Botany: Diversity of Microbes and Cryptogams. S. Chand & Company Ltd, New Delhi.
8. Vashishta, B. R., A. K. Sinha and Adarsha Kumar. 2008. Botany for Degree Students: Bryophyta. S. Chand & Company Ltd, New Delhi.
9. Vashishta, P. C., A. K. Sinha and Anil Kumar. 2006. Botany for Degree Students: Gymnosperms. Chand & Company Ltd, New Delhi.
10. Dutta A.C. 2016. Botany for Degree Students. Oxford University Press.
11. Pandey, B. P. 2007. Botany for Degree Students: Diversity of Seed Plants and their Systematics, Structure, Development and Reproduction in Flowering Plants. S. Chand & Company Ltd, New Delhi
12. Stace, C. A. 1989. Plant Taxonomy and Biostatistics (2nd Ed.). Edward Arnold, London.
13. Singh, G. 1999. Plant Systematics: Theory and Practice. Oxford and IBH, New Delhi.
14. Dutta A.C. 2016. Botany for Degree Students. Oxford University Press.
15. Davis, P. H. and V. H. Heywood. 1963. Principles of Angiosperm Taxonomy. Oliver and Boyd, London.
16. Heywood, V. H. 1965 . Plant Taxonomy. ELBS, London.
17. Heywood, V. H. and D. M. Moore (Eds). 1984. Current Concepts in Plant Taxonomy. Academic Press, London.
18. Jeffrey, C. 1982. An Introduction to Plant Taxonomy. Cambridge University Press, Cambridge. London.
19. Michael, S. 1996, Ecology, Oxford University Press, London
20. Odum, E.P. 1983. Basics of Ecology, Saunder's International Students Edition, Philadelphia.
21. Sharma P.D. 1989. Elements of Ecology, Rastogi Publications, Meerut

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**Practical Syllabus**

**(45 hours)**

1. Study of Morphology (vegetative and reproductive structures) of the following taxa:  
Gymnosperms - Pinus and Gnetum.
2. Study of Anatomical features of Pinus needle and Gnetum stem by preparing double stained permanent mounts.
3. Fossil forms using permanent slides / photographs: Cycadeoidea.  
Systematic study of locally available plants belonging to the families prescribed in theory Syllabus (Minimum of one plant representative for each family)
4. Study of morphological and anatomical characteristics of locally available plant species (Eichhornia, Hydrilla, Pistia, Nymphaea, Asparagus, Opuntia, Euphorbia melii)
5. Demonstration of herbarium techniques.
6. Candidate has to submit at least 30 herbarium sheets.

**Practical Model Paper**

**Time : 3 hrs**

**Max. Marks: 50**

- |  |           |
|--|-----------|
| 1. Prepare a mount of the given material ' A ' (Hydrophytes /Xerophytes)<br>Draw diagram & give reasons for identification.                | 8M        |
| 2. Prepare a double stained permanent mount of the given material ' B ' ( Gymnosperms )<br>Draw diagram & give reasons for identification. | 10M       |
| 3 . Identify the given specimens C & D (Gymnosperms /Xerophytes)   | 2 X 4 =8M |
| 4 . Identify the given slides E&F (Gymnosperms /Xerophytes)  | 2 X 4 =8M |
| 5. Technical description of the given plant twig ' A '   | 10M       |
| 6. Herbarium   | 3M        |
| 7. Record  | 3M        |

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**Telangana State Council of Higher Education, Govt. of Telangana B.Sc., CBCS Common  
Core Syllabi for all Universities in Telangana  
PROPOSED SCHEME FOR CHOICE BASED CREDIT SYSTEM IN  
B.Sc., Chemistry from 2019-2020**

**FIRST YEAR- SEMESTER I**

CODE	COURSE TITLE	COURSE TYPE	HPW	CREDITS
BS 101	Ability Enhancement Compulsory Course AECC-1	ES	2	2
BS 102	English	CC-1A	4	4
BS 103	Second language	CC-2A	4	4
BS 104	Optional I	DSC-1A	4T+3P=7	4+1=5
BS 105	Optional II	DSC-2A	4T+3P=7	4+1=5
BS 106	<b>Optional III- Chemistry - I</b>	DSC-3A	4T } = 7 3P	4 } = 5 1
	<b>Laboratory Course – I (Qualitative Analysis - Semi Micro Analysis of Mixtures)</b>			
	<b>Total Credits</b>		<b>31</b>	<b>25</b>

**FIRST YEAR- SEMSTER II**

BS 201	Ability Enhancement Compulsory Course AECC-2	BCS	2	2
BS 202	English	CC-1B	4	4
BS 203	Second language	CC-2B	4	4
BS 204	Optional I	DSC-1B	4T+3P=7	4+1=5
BS 205	Optional II	DSC-2B	4T+3P=7	4+1=5
BS 206	<b>Optional III- Chemistry - II</b>	DSC-3B	4T } = 7 3P	4 } = 5 1
	<b>Laboratory Course - II ( Quantitative Analysis – Titrations )</b>			
	<b>Total Credits</b>		<b>31</b>	<b>25</b>

**SECOND YEAR- SEMSTER III**

BS 301	i) Safety Rules in Chemistry Laboratory and Lab Reagents ii) Remedial methods for pollution, drinking water and Soil fertility	SEC-1 SEC-2	2 2	2 2
BS 302	English	CC-1C	3	3
BS 303	Second language	CC-2C	3	3
BS 304	Optional I	DSC-1C	4T+3P=7	4+1=5
BS 305	Optional II	DSC-2C	4T+3P=7	4+1=5
BS 306	<b>Optional III- Chemistry - III</b>	DSC-3C	4T } = 7 3P	4 } = 5 1
	<b>Laboratory Course - III (Synthesis of Organic compounds )</b>			
	<b>Total Credits</b>		<b>31</b>	<b>25</b>

**SECOND YEAR- SEMSTER IV**

BS 401	i) Materials and their Applications ii) Chemistry of Cosmetics and Food Processing	SEC-3 SEC-4	2 2	2 2
BS 402	English	CC-1D	3	3
BS 403	Second language	CC-2D	3	3
BS 404	Optional I	DSC-1D	4T+3P=7	4+1=5
BS 405	Optional II	DSC-2D	4T+3P=7	4+1=5
BS 406	<b>Optional III- Chemistry - IV</b>	DSC-3D	4T } = 7 3P	4 } = 5 1
	<b>Laboratory Course - IV (Qualitative Analysis of Organic Compounds)</b>			
	<b>Total Credits</b>		<b>31</b>	<b>25</b>

\* AECC: Ability Enhancement Compulsory Course, SEC: Skill Enhancement Course, DSC: Discipline Specific Course, GE: Generic Elective, ES: Environmental Science , BCS : Basic computer skills.

**B.Sc. I Yr CHEMISTRY**  
**SEMESTER WISE SYLLABUS**  
**SEMESTER I**  
**Paper – I**  
**Chemistry - I**

**Unit-I ( Inorganic Chemistry) 15 h (1 hr/week)**  
**S1- I-1. Chemical Bonding 8 h**

Ionic solids- lattice and solvation energy, solubility of ionic solids, Fajan's rule, polarity and polarizability of ions. VSPER Theory - Common hybridization-sp,  $sp^2$ ,  $sp^3$ ,  $sp^3d$ ,  $sp^3d^2$  and  $sp^3d^3$ , shapes of molecules. Molecular orbital theory: Shapes and sign convention of atomic orbitals. Modes of bonds. Criteria for orbital overlap. LCAO concept.  $\pi$  and  $\sigma$  overlapping. Concept of Types of molecular orbitals- bonding, antibonding and non bonding. MOED of homonuclear diatomics -  $H_2$ ,  $N_2$ ,  $O_2^-$ ,  $O_2^{2-}$ ,  $F_2$  (unhybridized diagrams only) and heteronuclear diatomics CO,  $CN^-$ , NO,  $NO^+$  and HF. Bond order, stability and magnetic properties.

**S1-I-2. P-Block Elements 1 7 h**

Group-13: Structure of diborane and higher Boranes ( $B_4H_{10}$  and  $B_5H_9$ ), Boron nitrogen compounds ( $B_3N_3H_6$  and BN), Lewis acid nature of  $BX_3$ .  
Group - 14: Carbides-Classification - ionic, covalent, interstitial - .Structures and reactivity. Industrial applications. Silicones - Classification - straight chain, cyclic and cross-linked.  
Group - 15: Nitrides - Classification - ionic, covalent and interstitial. Reactivity - hydrolysis. Reactions of hydrazine, hydroxyl amine, phosphazenes.

**Unit - II (Organic Chemistry) 15h(1 hr/week)**

**S1-O-1: Structural Theory in Organic Chemistry 5 h**

Bond polarization: Factors influencing the polarization of covalent bonds, electro negativity - inductive effect. Application of inductive effect (a) Basicity of amines (b) Acidity of carboxylic acids (c) Stability of carbonium ions. Resonance - Mesomeric effect, application to (a) acidity of phenol. (b) acidity of carboxylic acids and basicity of anilines. Stability of carbo cations, carbanions and free radicals. Hyper conjugation and its application to stability of carbonium ions, free radicals and alkenes.

**S1-O-2: Acyclic Hydrocarbons 6 h**

**Alkanes**- Methods of preparation: From Grignard reagent, Kolbe synthesis. Chemical reactivity - inert nature, free radical substitution, Halogenation example- reactivity, selectivity and orientation.

**Alkenes** - Preparation of alkenes (with mechanism) (a) by dehydration of alcohols (b) dehydrohalogenation of alkyl halides (c) by dehalogenation of 1,2 dihalides, Zaitsev's rule. Properties: Anti-addition of halogen and its mechanism. Addition of HX, Markonikov's rule, addition of  $H_2O$ , HOX,  $H_2SO_4$  with mechanism and addition of HBr in the presence of peroxide (anti - Markonikov's addition). Oxidation (cis - additions) - hydroxylation by  $KMnO_4$ ,  $OsO_4$ ,

anti addition- peracids (via epoxidation), hydroboration, ozonolysis – location of double bond. Dienes – Types of dienes, reactions of conjugated dienes – 1,2 and 1,4 addition of HBr to 1,3 – butadiene and Diels – Alder reaction.

**Alkynes**– Preparation by dehydrohalogenation of vicinal dihalides, dehalogenation of tetrahalides. Physical Properties: Chemical reactivity – electrophilic addition of  $X_2$ , HX,  $H_2O$  (tautomerism), Oxidation (formation of enediol, 1,2 diones and carboxylic acids) and reduction (Metal-ammonia reduction, catalytic hydrogenation).

### **Aromatic Hydrocarbons**

**4h**

Introduction to aromaticity: Huckel's rule – Benzene, Naphthalene and Anthracene. 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 - nitro, nitrile, carbonyl, carboxylic acid, sulphonic acid and halo groups.

### **Unit – III (Physical Chemistry)**

**15h(1 hr/week)**

#### **S1-P-1: Atomic structure and elementary quantum mechanics**

**3 h**

Black body radiation, heat capacities of solids, Rayleigh Jeans law, Planck's radiation law, photoelectric effect, Limitations of classical mechanics, Compton effect, de Broglie's hypothesis. Heisenberg's uncertainty principle.

#### **S1-P-2: Gaseous State**

**5 h**

Deviation of real gases from ideal behavior. van der Waals equation of state. Critical phenomenon. PV isotherms of real gases, continuity of state. Andrew's isotherms of  $CO_2$ . The van der Waal's equation and critical state. Derivation of relationship between critical constants and van der Waal's constants. The law of corresponding states, reduced equation of states. Joule Thomson effect and inversion temperature of a gas. Liquifaction of gases: i) Linde's method based on Joule Thomson effect ii) Claude's method based on adiabatic expansion of a gas.

#### **S1-P-3: Liquid State and Solutions**

**4 h**

##### **Liquid State**

Intermolecular forces, structure of liquids (qualitative description). Structural differences between solids, liquids and gases. Surface tension and its determination using stalagmometer. Viscosity of a liquid and determination of coefficient of viscosity using Ostwald viscometer. Effect of temperature on surface tension and coefficient of viscosity of a liquid (qualitative treatment only).

##### **Solutions**

**3 h**

Liquid - liquid mixtures, ideal liquid mixtures, Raoult's and Henry's laws. Non ideal systems. Azeotropes: HCl- $H_2O$  and  $C_2H_5OH - H_2O$  systems. Fractional distillation. Partially miscible liquids: Phenol – Water, Trimethyl amine – Water and Nicotine – Water systems.

## Unit - IV (General Chemistry)

15h(1 hr/week)

### S1-G-1. General Principles of Inorganic Qualitative Analysis

6 h

Anion analysis: Theory of sodium carbonate extract, classification and reactions of anions-  $CO_3^{2-}$ ,  $Cl^-$ ,  $Br^-$ ,  $SO_4^{2-}$ ,  $PO_4^{3-}$ ,  $BO_3^{3-}$ ,  $CH_3COO^-$ ,  $NO_3^-$ . Interfering ions. Cation Analysis: Principles involved - Solubility product, common ion effect, general discussion for the separation and identification of group I individual cations ( $Hg_2^{2+}$ ,  $Ag^+$ ,  $Pb^{2+}$ ) with flow chart and chemical equations. Principle involved in separation of group II & IV cations. General discussion for the separation and identification of group II ( $Hg^{2+}$ ,  $Pb^{2+}$ ,  $Bi^{3+}$ ,  $Cd^{2+}$ ,  $Sb^{3+}$ ), III ( $Al^{3+}$ ,  $Fe^{3+}$ ), IV ( $Mn^{2+}$ ,  $Zn^{2+}$ ) individual cations with flow chart and chemical equations. General discussion for the separation and identification of group V individual cations ( $Ba^{2+}$ ,  $Sr^{2+}$ ,  $Ca^{2+}$ ) with flow chart and chemical equations. Theory of flame test. Identification of Group VI cations ( $Mg^{2+}$ ,  $NH_4^+$ ).

### S1-G-2. Isomerism

5 h

**Isomerism:** Definition of isomers. Classification of isomers: Constitutional and Stereoisomers - definition and examples. Constitutional isomers: chain, functional and positional isomers. Stereoisomers: enantiomers and diastereomers – definitions and examples. Representation of stereoisomers – Wedge, Fischer projection, Sawhorse, Newmann formulae.

**Conformational analysis :** Classification of stereoisomers based on energy. Definition and examples Conformational and configurational isomers. Conformational analysis of ethane, n-butane, 1,2- dichloroethane, 2-chloroethanol .Cyclic compounds: Baeyer's strain theory, Conformational analysis of cyclohexane

Cis-trans isomerism: E-Z-Nomenclature

### S1-G-3: Solid state Chemistry

4 h

Laws of Crystallography: (i) Law of Constancy of interfacial angles (ii) Law of Symmetry-Symmetry elements in crystals (iii) Law of rationality of indices. Definition of space lattice, unit cell. Bravais Lattices and Seven Crystal systems (a brief review). X-ray diffraction by crystals; Derivation of Bragg's equation. Determination of structure of NaCl, KCl and CsCl (Bragg's method and Powder method).

## References

**General reference:** B.Sc I Year Chemistry : Semester I, Telugu Academy publication, Hyd

### Unit- I

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia Vishal Publications 1996.
2. Concise Inorganic Chemistry by J.D. Lee 3<sup>rd</sup> edn.
3. Basic Inorganic Chemistry by F.A.Cotton, G.Wilkinson and Paul.L. Gaus 3<sup>rd</sup> edn Wiley Publishers 2001. Chem.

- Inorganic Chemistry Principles of structure and reactivity by James E. Huhey, E.A. Keiter and R.L. Keiter 4<sup>th</sup> edn.
- Chemistry of the elements by N.N. Greenwood and A. Earnshaw Pergamon Press 1989.
- Inorganic Chemistry by Shriver and Atkins 3<sup>rd</sup> edn Oxford Press 1999.
- Textbook of Inorganic Chemistry by R Gopalan.

#### Unit- II

- Organic Chemistry by Morrison and Boyd.
- Organic Chemistry by Graham Solomons.
- Organic Chemistry by Bruce Yuranis Powla.
- Organic Chemistry by L. G. Wade Jr.
- Organic Chemistry by M. Jones, Jr
- Organic Chemistry by John McMurry.
- Organic Chemistry by Soni.
- General Organic chemistry by Sachin Kumar Ghosh.
- Organic Chemistry by C N Pillai

#### Unit III

- Principles of physical chemistry by Prutton and Marron.
- Text Book of Physical Chemistry by Soni and Dharmahara..
- Text Book of Physical Chemistry by Puri and Sharma.
- Text Book of Physical Chemistry by K. L. Kapoor.
- Physical Chemistry through problems by S.K. Dogra.
- Text Book of Physical Chemistry by R.P. Verma.
- Elements of Physical Chemistry by Lewis Glasstone.

#### Unit IV

- Qualitative analysis by Welcher and Hahn.
- Vogel's Qualitative Inorganic Analysis by Svehla.
- Text Book of Organic Chemistry by Morrison And Boyd.
- Text Book of Organic Chemistry by Graham Solomons.
- Text Book of Organic Chemistry by Bruce Yuranis Powla.
- Text Book of Organic Chemistry by Soni.
- Text Book of Physical Chemistry by Soni And Dharmahara..
- Text Book of Physical Chemistry by Puri And Sharma.
- Text Book of Physical Chemistry by K. L. Kapoor.

### Laboratory Course

45h (3 h / week)

#### Paper I - Qualitative Analysis - Semi micro analysis of mixtures

Analysis of two anions (one simple, one interfering) and two cations in the given mixture.

Anions:  $CO_3^{2-}$ ,  $SO_3^{2-}$ ,  $S^{2-}$ ,  $Cl^-$ ,  $Br^-$ ,  $I^-$ ,  $CH_3COO^-$ ,  $NO_3^-$ ,  $PO_4^{3-}$ ,  $BO_3^{3-}$ ,  $SO_4^{2-}$  . .

Cations:  $Hg_2^{2+}$ ,  $Ag^+$ ,  $Pb^{2+}$

$Hg^{2+}$ ,  $Pb^{2+}$ ,  $Bi^{3+}$ ,  $Cd^{2+}$ ,  $Cu^{2+}$ ,  $As^{3+/5+}$ ,  $Sb^{3+/5+}$ ,  $Sn^{2+/4+}$

$Al^{3+}$ ,  $Cr^{3+}$ ,  $Fe^{3+}$

$Zn^{2+}$ ,  $Ni^{2+}$ ,  $Co^{2+}$ ,  $Mn^{2+}$

$Ba^{2+}$ ,  $Sr^{2+}$ ,  $Ca^{2+}$

$Mg^{2+}$ ,  $NH_4^+$

**B.Sc I Yr CHEMISTRY**  
**SEMESTER WISE SYLLABUS**  
**SEMESTER II**  
**Paper – II**  
**Chemistry – II**

**Unit-I ( Inorganic Chemistry)**

**15 h (1 hr/week)**

**S2-I-1 P-block Elements -II**

**7 h**

**Oxides:** Types of oxides (a) Normal- acidic, basic amphoteric and neutral (b) Mixed (c) sub oxide d) peroxide e) superoxide. Structure of oxides of C, N, P, S and Cl - reactivity, thermal stability, hydrolysis.

**Oxy acids:** Structure and acidic nature of oxyacids of B, C, N, P, S, Cl and I. Redox properties of oxyacids of Nitrogen: HNO<sub>2</sub> (reaction with FeSO<sub>4</sub>, KMnO<sub>4</sub>, K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>), HNO<sub>3</sub> (reaction with H<sub>2</sub>S, Cu), HNO<sub>4</sub> (reaction with KBr, Aniline), H<sub>2</sub>N<sub>2</sub>O<sub>2</sub> (reaction with KMnO<sub>4</sub>). Redox properties of oxyacids of Phosphorus: H<sub>3</sub>PO<sub>2</sub> (reaction with HgCl<sub>2</sub>), H<sub>3</sub>PO<sub>3</sub> (reaction with AgNO<sub>3</sub>, CuSO<sub>4</sub>). Redox properties of oxyacids of Sulphur: H<sub>2</sub>SO<sub>3</sub> (reaction with KMnO<sub>4</sub>, K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>), H<sub>2</sub>SO<sub>4</sub> (reaction with Zn, Fe, Cu), H<sub>2</sub>S<sub>2</sub>O<sub>3</sub> (reaction with Cu, Au), H<sub>2</sub>SO<sub>5</sub> (reaction with KI, FeSO<sub>4</sub>), H<sub>2</sub>S<sub>2</sub>O<sub>8</sub> (reaction with FeSO<sub>4</sub>, KI). Redox properties of oxy acids of Chlorine.

**Interhalogens-** Classification- general preparation- structures of AB, AB<sub>3</sub>, AB<sub>5</sub> and AB<sub>7</sub> type and reactivity.

**Poly halides-** Definition and structure of ICl<sub>2</sub><sup>-</sup>, ICl<sub>4</sub><sup>-</sup> and I<sub>3</sub>.

**Pseudohalogens:** Comparison with halogens.

**S2-I-2: Chemistry of Zero group elements**

**2 h**

Isolation of noble gases, Structure, bonding and reactivity of Xenon compounds – Oxides, Halides and Oxy-halides. Clathrate compounds and Anomalous behavior of He (II)

**S2-I-3: Chemistry of d-block elements**

**6 h**

Characteristics of d-block elements with special reference to electronic configuration, variable valence, ability to form complexes, magnetic properties & catalytic properties. Stability of various oxidation states and standard reduction potentials. Comparative treatment of second and third transition series with their 3d analogues. Study of Ti, Cr and Cu triads. Titanium triad – electronic configuration and reactivity of +3 and +4 states – oxides and halides. Chromium triad – reactivity of +3 and +6 states. Copper triad – reactivity of +1, +2 and +3 states.

**Unit - II (Organic Chemistry)**

**15h(1 hr/week)**

**S2-O-1: Halogen compounds**

**4 h**

Classification: alkyl (primary, secondary, tertiary), aryl, aralkyl, allyl, vinyl, benzyl. Chemical reactivity - reduction, formation of RMgX, Nucleophilic substitution reactions – classification into S<sub>N</sub>1 and S<sub>N</sub>2. Mechanism and energy profile diagrams of S<sub>N</sub>1 and S<sub>N</sub>2 reactions. Stereochemistry of S<sub>N</sub>2 (Walden Inversion) 2-bromobutane, S<sub>N</sub>1 (Racemisation) 1-bromo-1-phenylpropane Structure and reactivity – Ease of hydrolysis - comparison of alkyl, vinyl, allyl, aryl, and benzyl halides.



## S2-O-2: Hydroxy compounds and ethers

6 h

**Alcohols:** Preparation: 1°, 2° and 3° alcohols using Grignard reagent, Reduction of Carbonyl compounds, carboxylic acids and esters. Physical properties: H-bonding, Boiling point and Solubility. Reactions with Sodium, HX/ZnCl<sub>2</sub> (Lucas reagent), esterification, oxidation with PCC, alk. KMnO<sub>4</sub>, acidic dichromates, conc. HNO<sub>3</sub> and Oppenauer oxidation (Mechanism).

**Phenols:** Preparation: (i) from diazonium salts of anilines, (ii) from benzene sulphonic acids and (iii) Cumene hydroperoxide .

Properties: Acidic nature, formation of phenoxide and reaction with R-X, electrophilic substitution; halogenations, Reimer Tiemann reaction (Mechanism), Kolbe reaction (Mechanism), Gattermann-Koch reaction, Azo-coupling reaction, Schotten-Boumann reaction, Houben-Hoesch condensation, .

**Ethers:** Nomenclature, preparation by (a) Williamson's synthesis (b) from alkenes by the action of conc. H<sub>2</sub>SO<sub>4</sub>. Physical properties – Absence of Hydrogen bonding, insoluble in water, low boiling point. Chemical properties – inert nature, action of conc. H<sub>2</sub>SO<sub>4</sub> and HI.

## S2-O-3 Carbonyl compounds

5 h

Preparation of aldehydes & ketones from acid chloride, 1,3-dithianes, nitriles and from carboxylic acids. Special methods of preparing aromatic aldehydes and ketones by (a) Oxidation of arenes (b) Hydrolysis of benzal halides Physical properties – absence of Hydrogen bonding. Reactivity of the carbonyl groups in aldehydes and ketones. Chemical reactivity: Addition of (a) NaHSO<sub>3</sub> (b) HCN (c) RMgX (d) NH<sub>3</sub> (e) RNH<sub>2</sub> (f) NH<sub>2</sub>OH (g) PhNHNH<sub>2</sub> (h) 2,4-DNP (Schiff bases). Addition of H<sub>2</sub>O to form hydrate, chloral hydrate (stable), addition of alcohols - hemiacetal and acetal formation. Cannizzaro reaction. Oxidation reactions – KMnO<sub>4</sub> oxidation and auto oxidation, reduction – catalytic hydrogenation, mechanism of Clemmenson's reduction, Wolff-kishner reduction, Meerwein-Ponndorf Verly reduction. Reduction with LAH, NaBH<sub>4</sub>.

## Unit - III (Physical Chemistry)

15h(1 hr/week)

### S2-P-1: Electrochemistry

15 h

Electrical transport – conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of specific and equivalent conductance with dilution. Migration of ions and Kohlrausch's law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law - its uses and limitations. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only). Transport number, definition and determination by Hittorf's method for attackable electrodes. Applications of conductivity measurements: Determination of degree of dissociation, determination of K<sub>a</sub> of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.

Electrolytic and Galvanic cells – reversible and irreversible cells, conventional representation of electrochemical cells. Electro motive force (EMF) of a cell and its measurement. Computation of EMF. Types of reversible electrodes- the gas electrode, metal-metal ion, metal-insoluble

salt and redox electrodes. 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. Applications of EMF measurements. Calculation of thermodynamic quantities of cell reactions (Gibbs free energy G, Helmholtz free energy and Equilibrium constant K). Determination of pH using hydrogen electrode, glass electrode and quinhydrone electrode. Solubility product of AgCl. Potentiometric titrations.

## **Unit – IV (General Chemistry)**

**15 h (1 hr/week)**

### **S2-G-1: Theory of Quantitative Analysis**

**6 h**

**Volumetric Analysis:** Introduction, standard solutions, indicators, end point, titration curves, Types of titrations: i) neutralization titration- principle, theory of acid base indicators, titration curves and selection of indicators- strong acid - strong base, strong acid –weak base, weak acid-strong base and weak acid –weak base. Theory of redox titrations - internal(KMnO<sub>4</sub>) and external indicators – use of diphenylamine and ferroin indicators. Theory of complexometric titrations – use of EBT, Murexide and Fast sulphone black indicators. Role of pH in complexometric titrations. Precipitation titrations – theory of adsorption indicators.

**Gravimetric analysis-** Introduction, nucleation, precipitation, growth of precipitate, filtration and washing, drying and incineration of precipitate, coprecipitation and post precipitation. Determination of Ni<sup>2+</sup>

### **S2-G-2: Stereoisomerism**

**5 h**

**Optical activity:** Definition, wave nature of light, plane polarised light, optical rotation and specific rotation, chiral centers. Chiral molecules: definition and criteria - absence of plane, center and S<sub>n</sub> axis of symmetry – asymmetric and dissymmetric molecules. Examples of asymmetric molecules (Glyceraldehyde, Lactic acid, Alanine) and dissymmetric molecules (trans-1,2-dichlorocyclopropane). Molecules with constitutionally symmetrical chiral carbons (Tartaric acid) Molecules with constitutionally unsymmetrical chiral carbons (2,3dibromopentane). D, L configuration – examples. R, S – configuration: Cahn-Ingold-Prelog rules, examples for asymmetric and dissymmetric molecules.

### **S2-G-3: Dilute Solutions & Colligative Properties**

**4 h**

Dilute Solutions, Colligative Properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination. Osmosis - laws of osmotic pressure, its measurement, determination of molecular weight from osmotic pressure. Elevation of boiling point and depression of freezing point. Derivation of relation between molecular weight and elevation in boiling point and depression in freezing point.

## References

**General reference:** B.Sc I Year Chemistry : Semester II, Telugu Academy publication, Hyd

### Unit I

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia Vishal Publications 1996.
2. Concise Inorganic Chemistry by J.D. Lee 3<sup>rd</sup> edn.
3. Basic Inorganic Chemistry by F.A.Cotton, G.Wilkinson and Paul.L. Gaus 3<sup>rd</sup> edn Wiley Publishers 2001.
4. Chemistry of the elements by N.N.Greenwood and A. Earnshaw Pergamon Press 1989.
5. Inorganic Chemistry by Shriver and Atkins 3<sup>rd</sup> edn Oxford Press 1999.
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7. Textbook of inorganic chemistry by R Gopalan.

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6. Organic Chemistry by John McMurry.
7. Organic Chemistry by Soni.
8. General Organic chemistry by Sachin Kumar Ghosh.
9. Organic Chemistry by C N pillai

### Unit III

1. Physical chemistry by P W Atkins
2. Principles of physical chemistry by Prutton and Marron.
3. Text Book of Physical Chemistry by Soni and Dharmahara.
4. Text Book of Physical Chemistry by Puri and Sharma
5. Text Book of Physical Chemistry by K. L. Kapoor
6. Physical Chemistry through problems by S.K. Dogra.
7. Elements of Physical Chemistry by Lewis and Glasstone.
8. Material science by Kakani & Kakani

### Unit IV

1. Vogel's Text Book of Quantitative Analysis by G.H.Jeffery, J.Bassett, J.Mendham and R.C. Denney 5<sup>th</sup> edn Addison Wesley Longman Inc. 1999.
2. Quantitative Analysis by Day and Underwood Prentice Hall (India) VI Edn..
3. Nano: The Essentials by T. Pradeep, McGraw-Hill Education.
4. Chemistry of nanomaterials: Synthesis, Properties and applications by CNR Rao et.al.
5. Nanostructured Materials and Nanotechnology, edited by Hari Singh Nalwa, Academic Press
6. Practical chemistry by V K Ahluwalia, Sunitha Dhingra and AdarshGulati.

## Laboratory Course

**45hrs (3 h / week)**

### Paper II- Quantitative Analysis

#### Acid - Base titrations

1. Estimation of Carbonate in Washing Soda.
2. Estimation of Bicarbonate in Baking Soda.
3. Estimation of Carbonate and Bicarbonate in the Mixture.

4. Estimation of Alkali content in Antacid using HCl.

5. Estimation of  $NH_4^+$  by back titration

### Redox Titrations

1. Determination of Fe(II) using  $K_2Cr_2O_7$

2. Determination of Fe(II) using  $KMnO_4$  with sodium oxalate as primary standard.

3. Determination of Cu(II) using  $Na_2S_2O_3$  with  $K_2Cr_2O_7$  as primary standard

### Complexometric Titrations

1. Estimation of  $Mg^{2+}$

2. Estimation of  $Cu^{2+}$

**B.Sc II Yr CHEMISTRY**  
**SEMESTER WISE SYLLABUS**  
**SEMESTER III**  
**Paper-III**  
**Chemistry - III**

## Unit-I (Inorganic Chemistry)

**15 h (1 hr/week)**

### S3-I-1: Chemistry of f-block elements:

**5 h**

Chemistry of Lanthanides: Position in periodic table, Electronic structure, oxidation state, ionic and atomic radii- lanthanide contraction- cause and consequences, anomalous behavior of post lanthanides-complexation- type of donor ligands preferred. Magnetic properties- paramagnetism. Colour and spectra, f-f transitions –occurrence and separation– ion exchange method, solvent extraction.

Chemistry of actinides- general features – electronic configuration, oxidation state, actinide contraction, colour and complex formation. Comparison with lanthanides.

### S3-I-2: Coordination Compounds-I

**6 h**

Simple inorganic molecules and coordination complexes. Nomenclature – IUPAC rules, 1. Coordination number, coordination geometries of metal ions, types of ligands. 2. Brief review of Werner's theory, Sidgwick's electronic interpretation and EAN rule and their limitations. (Valence bond theory (VBT) – postulates and application to (a) tetrahedral complexes  $[Ni(NH_3)_4]^{2+}$ ,  $[NiCl_4]^{2-}$  and  $[Ni(CO)_4]$  (b) Square planar complexes  $[Ni(CN)_4]^{2-}$ ,  $[Cu(NH_3)_4]^{2+}$ ,  $[PtCl_4]^{2-}$  (c) Octahedral complexes  $[Fe(CN)_6]^{4-}$ ,  $[Fe(CN)_6]^{3-}$ ,  $[FeF_6]^{4-}$ ,  $[Co(NH_3)_6]^{3+}$ ,  $[CoF_6]^{3-}$ . Limitations of VBT. 3. Isomerism in coordination compounds, stereo isomerism – (a) geometrical isomerism in (i) square planar meta I complexes of the type  $[MA_2B_2]$ ,  $[MA_2BC]$ ,  $[M(AB)_2]$ ,  $[MABCD]$ . (ii) Octahedral metal complexes of the type  $[MA_4B_2]$ ,  $[M(AA)_2B_2]$ ,  $[MA_3B_3]$  using suitable examples, (b) Optical isomerism in (i). tetrahedral complexes  $[MABCD]$ , (ii). Octahedral complexes  $[M(AA)_2B_2]$ ,  $[M(AA)_3]$  using suitable examples. Structural isomerism: ionization, linkage, coordination ligand isomerism using suitable examples.

**S3-I-3: Metal carbonyls and Organometallic Chemistry****4 h**

Metal carbonyls: 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.

Definition, nomenclature and classification of organometallic compounds. Methods of preparation, properties and applications of alkyl and aryl compounds of Li, Mg & Al.

**Unit - II (Organic Chemistry)****15h(1 hr/week)****S3-O-1: Carboxylic acids and derivatives****5 h**

Preparation: a) Hydrolysis of Nitriles, amides and esters. b) Carbonation of Grignard reagents. Special methods of preparation of Aromatic Acids - Oxidation of Arenes. Physical properties- hydrogen bonding, dimeric association,. Chemical properties – Reactions involving H, OH and COOH groups -salt formation, anhydride formation, Acid halide formation, Esterification (mechanism) & Amide formation. Reduction of acid to the corresponding primary alcohol - via ester or acid chloride. Degradation of carboxylic acids by Huns Diecker reaction, Schmidt reaction (Decarboxylation). Arndt – Eistert synthesis, Halogenation by Hell – Volhard - Zelensky reaction. Carboxylic acid Derivatives – Hydrolysis and Amonolysis of acid halides, Acid anhydrides and esters (mechanism of ester hydrolysis by base and acid). Hydrolysis and dehydration of amides.

**S3-O-2: Nitrohydrocarbons****3 h**

Preparation of Nitroalkanes. Reactivity - halogenation, reaction with  $\text{HNO}_2$  (Nitrous acid), Nef reaction, reduction. Aromatic Nitrohydrocarbons: Preparation of Nitrobenzene by Nitration. Physical properties, chemical reactivity –Reduction of Nitrobenzenes in different media.

**S3-O-3: Amines, Cyanides and Isocyanides****7 h**

Amines: classification into 1<sup>o</sup>, 2<sup>o</sup>, 3<sup>o</sup> Amines and Quarternary ammonium compounds. Preparative methods – Ammonolysis of alkyl halides, Gabriel synthesis, Hoffman's bromamide reaction (mechanism). Reduction of Amides and Schmidt reaction. Physical properties. Use of amine salts as phase transfer catalysts. Chemical Properties: a) Alkylation b) Acylation c) Carbylamine reaction d) Hinsberg separation. Reaction with Nitrous acid of 1<sup>o</sup>, 2<sup>o</sup>, 3<sup>o</sup> (Aliphatic and aromatic amines). Electrophilic substitutions of Aromatic amines – Bromination and Nitration, oxidation of aryl and 3<sup>o</sup> Amines, diazotisation. Diazonium salts: Preparation with mechanism. Synthetic importance – a) Replacement of diazonium group by – OH, X (Cl)- Sandmeyer and Gatterman reaction, by fluorine (Schiemann's reaction), by iodine, CN, NO<sub>2</sub>, H and aryl groups. Coupling Reaction of diazonium salts. i) with phenols ii) with anilines. Reduction to phenyl hydrazines.

**Cyanides and isocyanides:** Structure. Preparation of cyanides from a) Alkyl halides b) from amides c) from aldoximes. Preparation of isocyanides from Alkyl halides and Amines. Properties of cyanides and isocyanides, a) hydrolysis b) addition of Grignard reagent iii)

reduction iv) oxidation.

### **Unit III (Physical Chemistry)**

**15 h (1 hr/week)**

#### **S3-P-1: Thermodynamics –I**

**10 h**

A brief review of - Energy, work and heat units, mechanical equivalent of heat, definition of system, surroundings. First law of thermodynamics statement- various forms mathematical expression. Thermodynamic quantities- extensive properties and intensive properties, state function and path functions. Energy as a state function and exact differential. Work of expansion and heat absorbed as path function.

Expression for work of expansion, sign convention problems on first law. Heat changes at constant pressure and heat changes at constant volume. Enthalpy. Heat capacities at constant pressure and constant volume. Derivation of  $C_p - C_v = R$ . Isothermal adiabatic processes. Reversible and irreversible processes. Reversible change and maximum work. Derivation of expression for maximum work for isothermal reversible process. Problems. Internal energy of an ideal gas. Joules experiment. Joule-Thompson coefficient. Adiabatic changes in ideal gas, derivation of equation,  $PV^\gamma = \text{constant}$ . P-V curves for isothermal and adiabatic processes. Heat of a reaction at constant volume and at constant pressure, relation between  $\Delta H$  and  $\Delta V$ .

Variation of heat of reaction with temperature. Kirchhoff's equation and problems. Limitations of first law and need for second law. Statement of second law of thermodynamics. Cyclic process. Heat engine, Carnot's theorem, Carnot's cycle. Derivation of efficiency of heat engine. Problems. Thermodynamic scale of temperature.

#### **S3-P-2: Thermodynamics-II**

**5 h**

Entropy: Definition from Carnot's cycle. Entropy as a state function. Entropy as a measure of disorder. Sign of entropy change for spontaneous and non-spontaneous processes & equilibrium processes. Entropy changes in i). Reversible isothermal process, ii). Reversible adiabatic process, iii). Phase change, iv). Reversible change of state of an ideal gas. Problems. Entropy of mixing of ideal gases. Free energy Gibb's function (G) and Helmholtz's function (A) as thermodynamic quantities. Concept of maximum work and network  $\Delta G$  as Criteria for spontaneity. Derivation of equation  $\Delta G = \Delta H - T\Delta S$ . Significance of the equation. Gibbs equations and Maxwell relations. Variation of G with P, V and T.

### **Unit – IV (General Chemistry)**

**15 h (1 hr/week)**

#### **S3-G-1 Evaluation of analytical data**

**4 h**

Significant figures, accuracy and precision. Errors-classification of errors- determinate and indeterminate errors, absolute and relative errors. Problems based on mean, median, range, standard deviation

#### **S3-G-2: Carbanions-I**

**5 h**

Introduction, acidic nature of  $\alpha$ -hydrogens and tautomerism in carbonyl compounds, nitro hydrocarbons, ethyl acetoacetate, diethyl malonate. Terminal alkynes. Stability of carbanions  
Reactions : Aldol reaction, Perkin reaction, Benzoin condensation, haloform reaction, conversion of smaller alkynes to higher alkynes.

### **S3-G-3: Phase Rule**

**6 h**

Statement and meaning of the terms – Phase, Component and Degrees of freedom, Gibb's Phase rule, phase equilibria of one component system – water system. Phase equilibria of two-component system – Solid-Liquid equilibria, simple eutectic –Pb-Ag system, desilverisation of lead. Solid solutions – compound with congruent melting point – Mg-Zn system and incongruent melting point – NaCl-H<sub>2</sub>O system.

### **References**

**General reference:** B.Sc II Year Chemistry : Semester III, Telugu Academy publication, Hyd  
**Unit- I**

1. Analytical chemistry by G. L. David Krupadanam, D. Vijaya Prasad, K. Varaprasada Rao, K.L.N. Reddy and C. Sudhakar
2. Principles of Inorganic Chemistry by Puri, Sharma and Kalia Vishal Publications(1996).
3. Concise Inorganic Chemistry by J.D. Lee 3<sup>rd</sup> edn Van Nostrand Reinhold Company(1977)
4. Basic Inorganic Chemistry by F.A.Cotton, G.Wilkinson and Paul.L. Gaus 3<sup>rd</sup> edn Wiley Publishers (2001).
5. Inorganic Chemistry Principles of structure and reactivity by James E.Huhey, E.A. Keiter and R.L. Keiter 4<sup>th</sup> edn. (2006)
6. Chemistry of the elements by N.N.Greenwood and A. Earnshaw Pergamon Press(1989).
7. Inorganic Chemistry by Shriver and Atkins 3<sup>rd</sup> edn Oxford Press (1999).
8. Textbook of Inorganic Chemistry by R Gopalan(Universities Press(2012)
9. College Practical chemistry by V K Ahluwalia, Sunitha Dhingra and Adarsh Gulati Universities Press (India) Limited(2012)

### **Unit- II**

1. Text book of organic chemistry by Soni. Sultan Chand & Sons; Twenty Ninth edition (2012)
2. General Organic chemistry by Sachin Kumar Ghosh. New Age Publishers Pvt Ltd (2008).
3. Text book of organic chemistry by Morrison and Boyd. Person(2009)
4. Text book of organic chemistry by Graham Solomons. Wiley(2015)
5. Text book of organic chemistry by Bruice Yuranis Powla. (2012)
6. Text book of organic chemistry by C N pillai CRC Press (2012)
7. Organic Chemistry by L. G. Wade Jr.
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9. Organic Chemistry by John McMurry.

### **Unit III**

1. Principles of physical chemistry by Prutton and Marron. The MacmillanCompany; 4<sup>th</sup> Edn.(1970)
2. Text Book of Physical Chemistry by Soni and Dharmahara. Sulthan Chand and Sons.(2011)
3. Text Book of Physical Chemistry by Puri and Sharma. S. Nagin chand and Co.(2017)
4. Text Book of Physical Chemistry by K. L. Kapoor. (2012)
5. Colloidal and surface chemistry , M. Satake, Y. Hayashi, Y.Mido, S.A.Iqbal and
6. M.S.sethi, Discovery Publishing Pvt.Ltd (2014)
7. Material science by Kakani & Kakani, New Age International(2016)
8. Physical Chemistry by Ira Levine (Author) McGraw-Hill Education; 6 edition (May 9, 2008)

### **Unit IV**

1. Text book of organic chemistry by Morrison and Boyd, Person(2009)

2. Text book of organic chemistry by Graham solomons, Wiley(2015)
3. Text book of organic chemistry by Sony, Sultan Chand & Sons; 29<sup>th</sup> edition (2012)
4. Text book of organic chemistry by Bruice yuranis Powla, (2012)
5. General Organic chemistry by Sachin kumar Ghosh, New Age Publishers Pvt Ltd (2008)

## Laboratory Course

### Paper III (Organic Synthesis)

45 h (3h/week)

#### 1. Synthesis of Organic compounds:

Acetylation: Acetylation of salicylic acid, Benzoylation of Aniline.

Aromatic electrophilic substitution: Nitration: Preparation of nitro benzene and m-dinitro benzene.

Halogenation: Preparation of p-bromo acetanilide, Preparation of 2,4,6-tribromo phenol

Oxidation: Preparation of benzoic acid from benzyl chloride.

Esterification: Preparation of n-butyl acetate from acetic acid.

Methylation: Preparation of - naphthyl methyl ether.

Condensation: Preparation of benzilidene aniline and Benzaldehyde and aniline.

Diazotisation: Azocoupling of  $\beta$ -Naphthol.

#### 2. Microwave assisted synthesis of Asprin – DEMO (demonstration only)



**B.Sc. II yr CHEMISTRY**  
**SEMESTER WISE SYLLABUS**  
**SEMESTER IV**  
**Paper-IV**  
**Chemistry - IV**

**Unit-I (Inorganic Chemistry) 15h (1 h/week)**

**S4-I-1: Coordination Compounds –II 11 h**

Crystal field theory (CFT)- Postulates of CFT, splitting patterns of d-orbitals in octahedral, tetrahedral, square planar with suitable examples. Crystalfield stabilization energies and its calculations for various d<sup>n</sup> configurations in octahedral complexes. High Spin Low Spin complexes. Colour and Magnetic properties of transition metal complexes. Calculations of magnetic moments spin only formula. Detection of complex formation - basic principles of various methods- change in chemical properties, solubility, colour, pH, conductivity, magnetic susceptibility.

Hard and soft acids bases (HSAB) - Classification, Pearson's concept of hardness and softness, application of HSAB principles – Stability of compounds / complexes, predicting the feasibility of reaction. Thermodynamic and kinetic stability of transition of metal complexes. Stability of metal complexes –stepwise and overall stability constant and their relationship and chelate effect determination of composition of complex by Job's method and mole ratio method.

Applications of coordination compounds: Applications of coordination compounds a) in quantitative and qualitative analysis with suitable examples b) in medicine for removal of toxic metal ions and cancer therapy c) in industry as catalysts polymerization – Ziegler Natta catalyst d) water softening.

**S4-I-2: Bioinorganic Chemistry 4 h**

Essential elements, biological significance of Na, K, Mg, Ca, Fe, Co, Ni, Cu, Zn and chloride (Cl<sup>-</sup>). Toxic metal ions As, Hg & Pb Oxygen transport and storage – structure of hemoglobin, binding and transport of oxygen. Fixation of CO<sub>2</sub> in photosynthesis- overview of light and dark reactions in photosynthesis. Structure of chlorophyll and coordination of magnesium. Electron transport in light reactions from water to NADP<sup>+</sup> (Z – scheme).

**Semester-IV**

**Unit - II (Organic Chemistry) 15h(1 hr/week)**

**S4-O-1: Carbohydrates 6 h**

Introduction: Classification and nomenclature. Monosaccharides: All discussion to be confined to (+) glucose as an example of aldo hexoses and (-) fructose as example of ketohexoses. Chemical properties and structural elucidation: Evidences for straight chain pentahydroxy aldehyde structure. Number of optically active, isomers possible for the structure, configuration

of glucose based on D-glyceraldehyde as primary standard (No proof for configuration is required). Evidence for cyclic structure of glucose (Pyranose structure, anomeric Carbon and anomers). Proof for the ring size (methylation, hydrolysis and oxidation reactions). (Haworth formula and chair conformational formula). Structure of fructose: Evidence of 2 – ketohexose structure. Same osazone formation from glucose and fructose, Hydrogen bonding in osazones, cyclic structure for fructose (Furanose structure, Haworth formula).

Inter Conversion of Monosaccharides: : Arabinose to D-glucose, D- mannose (kiliani – Fischer method). Epimers, Epimerisation- Lobry de bruyn van Ekenstein rearrangement. D-glucose to D-arabinose by Ruff's degradation. Aldohexose(+) (glucose) to ketohexose (-) (fructose) and Ketohexose(Fructose) to aldohexose (Glucose).

#### **S4-O-2: Amino acids and proteins**

**5 h**

Classification. Methods of synthesis: General methods of synthesis of alpha amino acids (specific examples – Glycine, Alanine, Valine and Leucine) by following methods: a) From halogenated Carboxylic acid b) Malonic ester synthesis c) strecker's synthesis. Physical properties: Optical activity of naturally occurring amino acids. Zwitter ion structure – salt like character, definition of isoelectric point. Chemical properties: General reactions due to amino and carboxyl groups – Lactams from gamma and delta amino acids by heating peptide bond (amide linkage). Structure and nomenclature of peptides. Primary structure of proteins, di peptide synthesis

#### **S4-O-3: Heterocyclic Compounds**

**4 h**

Introduction and definition: 5 membered ring compounds with one hetero atom Ex. Furan. Thiophene and pyrrole. Importance of ring systems –Numbering. Aromatic character

Resonance structures: Explanation of feebly acidic character of pyrrole, electrophilic substitution, Halogenation, Nitration and Sulphonation. Reactivity of furan as 1,3-diene, Diels Alder reactions (one example). Sulphonation of thiophene purification of Benzene obtained from coal tar). Preparation of furan, Pyrrole and thiophene Paul-Knorr synthesis. Structure of pyridine, Basicity – Aromaticity – Comparison with pyrrole – preparation by Hantzsch method and properties – Reactivity towards Nucleophilic substitution reaction – chichibabin reaction.

### **Unit III (Physical Chemistry)**

**15h (1 hr/week)**

#### **S4-P-1: Chemical Kinetics**

**11 h**

Introduction to chemical kinetics, rate of reaction, variation of concentration with time, rate laws and rate constant. Specific reaction rate. Factors influencing reaction rates: effect of concentration of reactants, effect of temperature, effect of pressure, effect of reaction medium, effect of radiation, effect of catalyst with simple examples. Order of a reaction.

First order reaction, derivation of equation for rate constant. Characteristics of first order reaction. Units for rate constant. Half- life period, graph of first order reaction, Examples- Decomposition of  $H_2O_2$  and decomposition of oxalic acid, Problems.

Pseudo first order reaction, Hydrolysis of methyl acetate, inversion of cane sugar, problems. Second order reaction, derivation of expression for second order rate constant, examples-

Saponification of ester,  $2O_3 \rightarrow 3O_2$ ,  $C_2H_4 + H_2 \rightarrow C_2H_6$ . Characteristics of second order reaction, units for rate constants, half- life period and second order plots. Problems

#### **S4-P-2: Photochemistry**

**4 h**

Introduction to photochemical reactions, Difference between thermal and photochemical reactions, Laws of photo chemistry- Grotthus Draper law, Stark–Einstein’s Law of photochemical equivalence. Quantum yield. Examples of photo chemical reactions with different quantum yields. Photo chemical combinations of  $H_2-Cl_2$  and  $H_2-Br_2$  reactions, reasons for the high and low quantum yield. Problems based on quantum efficiency. Consequences of light absorption. Singlet and triplet states. Jablonski diagram. Explanation of internal conversion, inter- system crossing, phosphorescence, fluorescence.

### **Unit III (General Chemistry)**

**15h (1 hr/week)**

#### **S4-G-1: Theories of bonding in metals**

**4 h**

Valence bond theory, Explanation of metallic properties and its limitations, Free electron theory, thermal and electrical conductivity of metals, limitations, Band theory, formation of bands, explanation of conductors, semiconductors n-type and p-type, extrinsic & intrinsic semiconductors, and insulators.

#### **S4-G-2: Carbanions-II**

**5 h**

Mannich reaction , Michael addition and Knoevenagel condensation Synthetic applications of Aceto acetic ester. Acid hydrolysis and ketonic hydrolysis: Preparation of ketones, monocarboxylic acids and dicarboxylic acids Malonic ester– synthetic applications. Preparation of (i) substituted mono carboxylic acids and (ii) substituted dicarboxylic acids.

#### **S4-G-3: Colloids & Surface Chemistry**

**6 h**

Definition of colloids. Classification of colloids. Solids in liquids (sols): preparations and properties – Kinetic, Optical and Electrical stability of colloids. Protective action. Hardy–Schultz law, Gold number. Liquids in liquids (emulsions): Types of emulsions, preparation and emulsifier. Liquids in solids(gels): Classification, preparations and properties, General applications of colloids.

**Adsorption:**Types of adsorption. Factors influencing adsorption. Freundlich adsorption isotherm. Langmuir theory of unilayer adsorption isotherm. Applications.

### **References**

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2. Concise Inorganic Chemistry by J.D. Lee 3<sup>rd</sup> edn. Van Nostrand Reinhold Company(1977)
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7. Elements of Physical Chemistry by Lewis Glasstone. Macmillan (1966)
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5. Text book of organic chemistry by Morrison and Boyd, Person (2009)
6. Text book of organic chemistry by Graham solomons, Wiley (2015)
7. Fundamentals of organic synthesis and retrosynthetic analysis by Ratna Kumar Kar, CBA,(2014)
8. Organic synthesis by Dr. Jagadamba Singh and Dr. L.D.S. Yadav, Pragati Prakashan, 2010
7. Stereochemistry of organic compounds by D. Nasipuri, New Academic Science Limited, 2012
8. Organic chemistry by Clayden, Greeves, Warren and Wothers, Oxford University Press, 2001
9. Fundamentals of Asymmetric Synthesis by G. L. David Krupadanam, Universities, Press 2014

## Laboratory Course

### Paper IV-

#### **Qualitative Analysis of Organic Compounds: 45hrs (3 h/week)**

Qualitative analysis: Identification of organic compounds through the functional group analysis - ignition test, determination of melting points/boiling points, solubility test, functional group tests and preparation of suitable derivatives of the following: Carboxylic acids, phenols, amines, urea, thiourea, carbohydrates, aldehydes, ketones, amides, nitro hydrocarbons, ester and naphthalene.

**B.Sc. Chemistry II Year Semester-III**  
**Skill Enhancement Course- I (SEC-I) (2 Credits)**  
**Rules in Chemistry Laboratory and Lab Reagents**

**Unit I: Laboratory Safety Rules and Regulations** **15 h (1 hr/week)**

General rules and regulations for lab safety: Minimizing Risks of Hazards, Personal Protective Equipment (PPE) - Hair, Dressing for the Laboratory, Eye Protection, Eyewash fountain, Gloves, Laboratory Protocols, Labeling Chemicals, Careful reading of labels Prevention of Inhaling Harmful Chemicals, Guide to Chemical Hazards, Chemical Spills etc., Accidents use of fire extinguisher and first aid kit in the laboratory, safety symbols- Preparation of the charts by the students and display of charts in chemistry labs. Calibration of fractional weights, calibration of glass ware - burette, pipette, standard flask, Normality/Molarity and specific gravity of concentrated acids – Preparation of dilute solutions (Numerical problems). Precautions to be taken in the preparation of dilute acids and bases and bases. Preparation of stock solutions of salts with specific examples. Properties of primary standard salt and preparation of standard solution. Good laboratory practices-maintenance of observation book record.

**UNIT 2: Preparation of Lab Reagents** **15 h (1 hr/week)**

Preparation of indicators and use of indicators in volumetric analysis- acid base titrations, redox titrations, precipitation titrations and complexometric titrations. Role of an indicator in detecting end point (Phenolphthalein, Methyl orange, Methyl-red, Potassium Chromate, Diphenylamine, EBT, Murexide, etc). Preparation of buffers – pH 10 ammonical buffer and acetate buffer solutions. Preparation of commonly used reagents : Ammonium hydroxide solution, Ammonium molybdate reagent, Ammonium hydrogen phosphate solution, Bayer's reagent, Benedict's solution, Bromine water, Dimethyl glyoxime reagent, 2,4-Dinitrophenyl hydrazine reagent, Eriochrome black-T reagent Fehling solution, Ferric chloride solution, Ferrous sulphate solution, Iodine solution, Molisch's reagent, Nessler's reagent, Neutral FeCl<sub>3</sub>, Schiff's reagent, Silver nitrate solution, Sodium carbonate solution , Sodium hydroxide (Caustic soda) solution, Starch solution, Tollen's reagent. (reference work and submission of assignments). Charts preparation depicting course content.

**RECOMMENDED BOOKS**

1. Vogel's Text Book of Quantitative Chemical Analysis, 5th edition.
2. Vogel's Text Book of macro and semimicro qualitative inorganic analysis. G. Svehla, 5th edition.
3. Chemistry Reagent Manual Prepared by Chemistry Department, SGTB Khalsa College under DBT's Star College Scheme, University of Delhi ( Available: online)
4. American Chemical Society Safety in Academic Chemistry Laboratories 8th edition.

**[Course objectives (CO)]:** To improve the skills of students in the application of theory and practical knowledge. To fill the gap between theory and practicals. To train the students in understanding laboratory safety rules and to improve the skills in preparation of laboratory reagents]

**B.Sc. Chemistry II Year**  
**Semester III**  
**Skill Enhancement Course- II (SEC –II) (2 Credits)**  
**REMEDIAL METHODS FOR POLLUTION, DRINKING WATER AND SOIL**  
**FERTILITY STANDARDS**

**UNIT I: Remedial Methods for Pollution Prevention and control of air pollution** **15 h (1 hr/week)**

Ozone hole-causes and harm due to ozone depletion. The effect of CFC's in Ozone depletion and their replacements. Global Warming and Greenhouse Effect Precautions to control global warming. Deleterious effect of pollutants - Endangered Monuments- acid rain. Precautions to protect monuments. Sources of Radiation pollution - Chernobyl accident and its Consequences. Radiation effect by the usage of cell phones and protection tips. Deleterious effects of cell phone towers and health hazards.

Sources of water pollution-(i). Pollution due to pesticides and inorganic chemicals, (ii). Thermal pollution (iii). Ground water pollution (iv). Eutrophication.

Methods for control of water pollution and water recycling. Dumping of plastics in rivers & oceans and their effect on aquatic life. Determination of (i) Dissolved Oxygen and (ii) Chemical Oxygen Demand in polluted water - Illustration through charts (or) demonstration of experiments. Sources of soil pollution (i). Plastic bags, (ii). Industrial and (iii). Agricultural sources. Control of soil pollution. Environmental laws in India. Environmental benefits of planting trees.

**UNIT II: Drinking Water and Soil Fertility Standards and Analysis** **15 h (1 hr/week)**

**Water Quality and Common Treatments for Private Drinking Water Systems:** Drinking Water Standards-Primary Drinking Water Standards : Inorganics, Organics and Volatile Organic Chemicals. Secondary Drinking Water Standards-Inorganics and Physical Problems. Water Testing, Mineral Analysis, Microbiological Tests, Pesticide and Other Organic Chemical Tests. Principle involved in Water Treatment Techniques. (i) Reverse osmosis (ii) Disinfection methods such as chlorination, ultraviolet light, ozonation etc (iii) Chemical oxidation and (iv) Ion exchange (water softeners). Visit to nearby drinking water plants and interaction at sites.

**Introduction to Soil Chemistry-** Basic Concepts. Effect of pH on nutrient availability. Macronutrients and their effect on plants -Carbon, Hydrogen, Oxygen, Nitrogen and Phosphorus other macronutrients-Calcium, Magnesium and Sulfur. Micronutrients and their effect on plants. Boron ( $B_4O_7^{2-}$ ), Copper ( $Cu^{2+}$ ), Iron ( $Fe^{2+}$ ,  $Fe^{3+}$ ) Manganese ( $Mn^{2+}$ ) Molybdenum ( $MoO_4^{2-}$ ) Zinc ( $Zn^{2+}$ ) Cobalt ( $Co^{2+}$ ) Chlorine ( $Cl^-$ ) and Others. Determination of soil nitrogen by Kjeldahl method- Illustration through charts (Or) demonstration of experiment. Visit to nearby agricultural farms and interaction with farmers. Discussion with farmers on the use of Soil Analysis Kits.

## References

1. A Text book for 'Remedial methods for pollution, drinking water and soil fertility standards', First Edition, Authors: Dr Mudvath Ravi, Gopu Srinivas, Putta Venkat Reddy, Vuradi Ravi Kumar, Battini Ushaiah, ISBN No. 978-93-5311-183-0.
2. Remedial methods for pollution, drinking water and soil fertility standards, Author: Dr G. Vanjatha.
3. Remedial methods for pollution, drinking water and soil fertility standards, Telugu version, Authors: Dr N. Yogi Babu, Dr. G. Vanajatha, M. Srilatha.
4. Environmental Pollution, [download.nos.org/333courseE/10.pdf](http://download.nos.org/333courseE/10.pdf)
5. CFC Replacements, [butane.chem.uiuc.edu/pshapley/Environmental/L21/3.html](http://butane.chem.uiuc.edu/pshapley/Environmental/L21/3.html)
6. Effects of Acid Rain on Buildings [www.air-quality.org.uk/12.php](http://www.air-quality.org.uk/12.php)
7. Acid Rain Effects - Buildings - Chemistry [chemistry.elmhurst.edu/vchembook/196buildings.html](http://chemistry.elmhurst.edu/vchembook/196buildings.html)
8. How to protect national heritage - ways to protect monuments [www.youthkiawaaz.com/2011/03/how-to-protect-national-heritage/](http://www.youthkiawaaz.com/2011/03/how-to-protect-national-heritage/).
9. Chernobyl nuclear power plant accident - NRC [www.nrc.gov/reading-rm/doc-collections/fact-sheets/chernobyl-bg.pdf](http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/chernobyl-bg.pdf)
10. Side-effects of harmful radiation from mobile phones and towers [pib.nic.in/newsite/printrelease.aspx?relid=116304](http://pib.nic.in/newsite/printrelease.aspx?relid=116304)
11. Cell Phone Radiation Protection - Highly Effective Tips <https://www.electricsense.com/775/how-to-protect-yourself-from-cell-phone-radiation/>
12. Chemical Waste That Impact on Aquatic Life or Water Quality [blog.idrenvironmental.com/chemical-waste-that-impact-on-aquatic-life-or-waterquality](http://blog.idrenvironmental.com/chemical-waste-that-impact-on-aquatic-life-or-waterquality)
13. Trees and Your Environment - Clean Air Gardening [www.cleanairgardening.com/plantingtrees](http://www.cleanairgardening.com/plantingtrees)
14. water quality and common treatments for private drinking water . [extension.uga.edu/publications/detail.html?number=b939](http://extension.uga.edu/publications/detail.html?number=b939)
15. Soil chemistry <https://casfs.ucsc.edu/about/publications/Teaching-Organic-Farming/PDFdownloads/2.2-soil-chemistry.pdf>
16. Soil Analysis-Determination of Available Nitrogen ... - Amrita Virtual Lab [vlab.amrita.edu/?sub=2&brch=294&sim=1551&cnt=1](http://vlab.amrita.edu/?sub=2&brch=294&sim=1551&cnt=1)
17. Determination of dissolved oxygen (DO) [www.cutm.ac.in/pdf/env%20engg%20lab%20manual.pdf](http://www.cutm.ac.in/pdf/env%20engg%20lab%20manual.pdf)
18. Determination of chemical oxygen demand of wastewater [www.pharmaguideline.com](http://www.pharmaguideline.com) › quality control › test

**B.Sc. Chemistry II Year**  
**Semester - IV**  
**Skill Enhancement Course- III (SEC - III) (2 Credits)**  
**Materials and their Applications**

**Unit – I: Types of Materials**

**15 h (1 hr/week)**

Introduction: Materials and their importance. Classification of Materials, Advanced materials and their need. Types of Materials: Metals, ceramics, polymers and composites; Nature of bonding (Type of bond present). Types and applications of metal alloys: Classification- ferrous and non-ferrous alloys. Ferrous alloys -types and their applications. Non-ferrous alloys – Cu, Al, Ti alloys, their applications and super alloys.

Field Work- Collection of Metal Alloy Samples.

Types and Applications of Ceramics: Classification of Ceramics based on their application- glasses, clay products, refractories, abrasives, cements, and advanced ceramics. Glasses: Compositions and Characteristics of Some of the Common Commercial Glasses; Properties and applications of glass ceramics - preparation of charts depicting various types of glass and their use. Clay products: Structural clay products and the white wares. Refractories: Compositions of four Common Ceramic Refractory Materials, fireclay, silica, basic refractories ex. MgO and special refractories ex. Alumina and Zirconia Cements: Classification, preparation of cement and the setting process; quick setting cements; applications.

Field Work-Visit to industries and collection of samples of materials

**Unit – II: Types of Polymers and Applications**

**15 h (1 hr/week)**

Classification of Polymeric materials based on application: Coatings, adhesives, films, foams with examples Polymer Additives: Fillers, Plasticizers, Stabilizers, Colorants, Flame Retardants with examples.

Advanced Materials: Types of advanced materials - semiconductors, bio-compatible materials, smart materials, advanced polymeric materials and nano-engineered materials. Biocompatible materials: Definition. Materials used as biomaterials and their properties. Metals and alloys used in bone and joint replacement. Filling and restoration materials – dental cements, dental amalgams, dental adhesives.

Field Work- Visit to Dental Clinics and interaction with Doctors regarding materials used in Dental treatments.

Smart materials: Shape memory alloys- definition and examples (Ni-Ti alloys, Cu based alloys), applications. Conducting polymers: - Introduction, Electrically conducting polymers and their uses (polyaniline, polypyrrole, polyacetylene and polythiophene).

**References**

1. William D. Callister Materials Science and Engineering An Introduction, John Wiley & Sons, Inc, 2006.
2. Material science by Kakani and Kakani.
3. Sujata V., Bhat., —Biomaterials‡, Narosa Publication House, New Delhi, 2002.
4. M. V. Gandhi and B. S. Thompson, —Smart Materials and Structures‡, Chapman and Hall, London, First Edition, 1992.
5. Duerig, T. W., Melton, K. N, Stockel, D. and Wayman, C.M., —Engineering aspects of Shapememory Alloys‡, Butterworth – Heinemann, 1990.
6. Conducting Polymers, Fundamentals and Applications A Practical Approach Authors: Chandrasekhar, Prasanna Ashwin-Ushas Corp., Inc. Kluwer Academic Publishers. Boston



**B.Sc. Chemistry II Year Semester IV**  
**Skill Enhancement Course- IV (SEC - IV) (2 Credits)**  
**Chemistry of Cosmetics and Food Processing**

**Unit-I: Chemistry of Cosmetics and Perfumes**

A general study including preparation and uses of the following: Hair dye, hair spray, shampoo, sunscreen lotions, lipsticks, talcum powder, nail enamel, creams (cold, vanishing and shaving creams), antiperspirants and artificial flavours. Essential oils and their importance in cosmetic industries with reference to eugenol, geraniol, sandalwood oil, eucalyptus, 2-phenyl ethyl alcohol. Demonstration experiments or illustration of experimental procedures through charts for the preparation of talcum powder, shampoo and vanishing cream. Analysis of deodorants and antiperspirant - Aluminum, Zinc, Boric acid, Chloride and Sulphide.

**Unit-II: Food Processing and Food Adulteration**

Food processing: Introduction, methods for food processing, additives and preservatives. Food processing- impact on nutrition, analysis of calcium in milk by complexometric titration, spectrophotometric analysis of iron in foods, Spectrophotometric identification and determination of caffeine and benzoic acid in soft drinks. Field Work -Visit to Food Industries. Food adulteration: Adulterants in some common food items and their identification: Pulses, chilli powder, turmeric powder, milk, honey, spices, food grains and wheat flour, coffee powder, tea leaves, vegetable oil, ghee, ice creams, tomato sauce. Field Work-Collection of adulterated food samples, demonstration of a minimum of five experiments for testing adulterants in food items.

**References**

1. E. Stocchi: Industrial Chemistry, Vol -I, Ellis Horwood Ltd. UK.
2. P.C. Jain, M. Jain: Engineering Chemistry, Dhanpat Rai & Sons, Delhi
3. Sharma, B.K. & Gaur, H. Industrial Chemistry, Goel Publishing House, Meerut (1996).
4. Rameen Devi, Food Processing and Impact on Nutrition, Sc J Agric Vet Sci., AugSep 2015; 2(4A):304-311.
5. W.A. Poucher, Perfumes, Cosmetics and Soaps (1993).
6. Srilakshmi, Food Science. Edition: 3rd (2004). 7. Lillian Hoagland Meyer, Food chemistry (2008).
8. Handbook of Analysis and Quality Control for Fruit and Vegetable Products, S. Ranganna, Tata McGraw-Hill Education, 1986 – Food.
9. Fundamental concepts of applied chemistry J.C Ghosh, S. Chand and Co, Ltd, New Delhi.
10. Applied Chemistry K .Bhagavathi Sundhar, MJP publishers.



**Department of English  
Mahatma Gandhi University**

**Course Structure under the Reorganized CBCS (with effect from AY 2019-20)**

**Subject: English (First Language)**

**B.A./ B.Sc./B.Com. and other UG Courses**

**Course Objectives**

The 20-credit, six-semester course seeks to enhance the English language skills of undergraduate students by

- Strengthening their grammar and vocabulary
- Improving their reading and writing skills
- Enhancing their listening and speaking skills
- Imparting to them important life skills and human values
- Encouraging them to think creatively and critically
- Exposing them to a variety of content-rich texts
- Expanding their emotional intelligence
- Developing gender sensitivity among them.

**Course Outcomes**

On successful completion of the 20-credit, six-semester course, an undergraduate student will be able to

- Read, understand, interpret a variety of written texts
- Undertake guided and extended writing using appropriate vocabulary and correct grammar
- Listen with comprehension and speak with confidence in both formal and informal contexts with reasonable fluency and acceptable pronunciation
- Become employable with requisite professional skills, ethics and values.

**Credits, Syllabus, and Instructional Hours**

Semester	Number of Credits	Number of Units	Instruction (Clock hours per week)
I	4	4	4
II	4	4	4
III	3	3	3
IV	3	3	3
V	3	3	3
VI	3	3	3
<b>Total</b>	<b>20</b>	<b>20</b>	<b>20</b>



**Reorganized CBCS  
(With effect from AY 2019-20)**

**Subject: English (First Language)**

**Semesters I & II**

Course Code:

Instruction: 4 clock hours per week

Credits: 4

Continuous Assessment: 20 Marks

University Examination: 80 Marks

Duration of University Examination: 3 Hours

**Course Structure**

Four equal units per semester integrating English language learning with ethics, values, and skill development.

The syllabus will include, but is not limited to, the following components:

<b>Units</b>	<b>Components</b>
<b>I</b>	<b>Reading and Vocabulary</b> Passages for language enrichment and personality development (including comprehension, interpretation, creative critical thinking, and empathy)
<b>II</b>	
<b>III</b>	<b>Writing and Grammar</b> (including Spelling and Punctuation) Guided writing, Sequencing, Paragraph, Descriptive writing, Dialogue writing, Note taking, Note making, Letter writing; Parts of speech, Tenses, Articles
<b>IV</b>	
<b>V</b>	
<b>VI</b>	<b>Listening and Speaking</b> (including Conversation and Pronunciation) Self-introduction, Situation and Function-based conversations; English Speech Sounds (Vowels and Consonants)
<b>VII</b>	
<b>VIII</b>	<b>Soft Skills and Values</b> Inculcating self-confidence, and effecting desirable attitudinal and behavioural changes.



## Semesters III - VI

Course Code:

Credits: 3 per semester

Instruction: 3 clock hours per week

Continuous Assessment: 20 Marks

University Examination: 80 Marks

Duration of University Examination: 3 Hours

### Course Structure

Three equal units per semester integrating English language learning with ethics, values, and skill development.

**Two units (one each in Sem V and VI) will be designed to inculcate gender sensitivity. Appropriate course material will be prepared.**

The syllabus will include, but is not limited to, the following components:

Unit	Components
I	<b>Reading:</b> Fictional and Non-Fictional Prose, Poetry, and Drama for Comprehension, Interpretation, Literary Appreciation, Societal Awareness, Gender Sensitivity, Ecological Awareness, Constitutional Values.
II	
III	
IV	<b>Writing:</b> Process writing, Script writing, Personal Diary/journal writing, Essay Writing (different kinds), Report Writing (different kinds), CV Writing, Review/ Article Writing.
V	
VI	
VII	<b>Grammar:</b> Prepositions, Voice, Connectives, Reported Speech, Conditionals, Common Errors, Concord, Determiners, Degrees of comparison, Relative clauses, Framing questions, Transformation of sentences.
VIII	
IX	
X	<b>Vocabulary:</b> Synonyms, Antonyms, Anagrams, Acronyms, Rhyming words, Picture vocabulary, Indianisms, British-American English, Phrasal Verbs, Idioms, Technical Vocabulary, Commonly Confused Words.
XI	
XII	

In addition, the proposed syllabus of Semesters III-VI will impart, as in Semesters I and II, either directly or through the use of authentic materials, **communication skills** (formal and informal conversation skills, debating skills, interview skills etc), **study skills** (reference skills, library skills etc), **social skills** (politeness, patience, participation, cooperation, sharing etc), **soft skills** (such as negotiation, team work, decision making, beating the odds, dealing with failure etc), and **values** (such as honesty, empathy, fortitude, selflessness etc).



**DEPARTMENT OF ENGLISH  
MAHATMA GANDHI UNIVERSITY  
NALGONDA**

**CBCS GENERAL ENGLISH SYLLABUS STRUCTURE FOR U.G. I YEAR**

*Prescribed General English Text Book for I Year (Sem -I & Sem -II) for B.A /B. Sc /B.Com and all other U.G. Courses*

*Title: English for Enhanced Competence Published by Orient Black swan*

*Editors: Prof. Sumita Roy, Prof. A. Karunakar and K. ArunaPriya*

**SEMESTER - I**

<b>UNIT - I(SHORT FICTION)</b>	TEXT	<b>The Eyes are not Here - by Ruskin Bond</b>
	Pronunciation	Consonant Sounds
	Grammar	Nouns
	Vocabulary	Roots
	Spelling	Pick out the words which are wrongly spelt and correct them.
	Punctuation	Capitalization
	Conversation + Role Play	Introducing yourself in a formal or social context to the strangers
	Reading Passage	Historical place: Chayasomeshwaralayam (Nalgonda)
	Writing	Guided writing/expansion
	Soft Skills	Motivation and goal setting
	Value Orientation	Well begun is half done
<b>UNIT - II (PROSE)</b>	Text	<b>“Work Brings Solace” -Wings Of Fire - A.P.J. Abdul Kalam</b>
	Pronunciation	Vowel :Monophthongs
	Grammar	Pronoun
	Vocabulary	Prefix and suffix
	Spelling	Use ‘Un’ or ‘dis’ to complete the antonyms
	Punctuation	Capitalization
	Conversation + Role play	Starting a conversation/controlling a conversation
	Reading Passage	An important event of Telangana history: Telangana Formation Day
	Writing	Sequencing
	Soft skills	Self confidence
	Value Orientation	Doubt is the beginning of wisdom

<b>UNIT - III (POETRY)</b>	Text	<b>Bangle Sellers – Sarojini Naidu</b>
	Pronunciation	Vowel Diphthongs
	Grammar	Helping verbs
	Vocabulary	Homophones, homonyms, homographs
	Spelling	Complete the words using 'tion' on 'sion'
	Punctuation	Comma and full stop
	Conversation + role play	Describing your college and course of study
	Reading passage	A popular Telangana festival: Bathukamma Festival
	Writing	Paragraph/descriptive writing
	Soft skills	Body language/nonverbal communication
	Value orientation	Actions speak louder than words
<b>UNIT - IV (DRAMA)</b>	Text	<b>Merchant of Venice Act IV Scene –I William Shakespeare</b>
	Pronunciation	Varied pronunciation of some letters of the Alphabet
	Grammar	Main verbs and tenses
	Vocabulary	Collocation
	Spelling	Complete the following spellings using 'tion' or 'ment'
	Punctuation	Question mark and exclamation mark
	Conversation + Role play	Leaving a message on the answering machine/ making an appointment on telephone
	Reading Passage	A famous tourist attraction in Nalgonda :Nagarjunsagar, Nalgonda
	Writing	Dialogue
	Soft skills	Inter personal skills
	Value Orientation	Faith will move mountains
<b>SEMESTER - II</b>		
<b>UNIT - I (FICTION AND SHORT FICTION)</b>	Text	<b>The Open Window – H.H.Munro (saki)</b>
	Pronunciation	Plosives
	Grammar	Nonfinite verbs
	Vocabulary	Simile and metaphor
	Spelling	Complete the following using 'ei' or 'ie'
	Punctuation	Semi colon
	Conversation + Role play	Asking for advice/ asking for information

	Reading Passage	Yagagirigutta: famous pilgrim place in Nalgonda				
	Writing	Note Taking and Note Making				
	Soft skills	Time Management				
	Value Orientation	Time and tide wait for no one				
<b>UNIT - II (PROSE)</b>	Text	<b>The voice of Humanity – Rabindranath Tagore</b>				
	Pronunciation	Fricatives				
	Grammar	Adjectives				
	Vocabulary	Oxymoron and Hyperbole				
	Spelling	Complete the following with ‘able’ or ‘ible’				
	Punctuation	Colon and Long dash				
	Conversation + Role play	Making a request/ accepting or refusing the request				
	Reading Passage	Rural Telangana: Devarakonda Fort history				
	Writing	Informal letter				
	Soft skills	Leadership skills				
	Value Orientation	‘The pen is mightier than the sword’				
<b>UNIT - III (POETRY)</b>	Text	<b>If- by Rudyard Kipling</b>				
	Pronunciation	Affricates and Nasals				
	Grammar	Articles				
	Vocabulary	Portmanteau words and loan words				
	Spelling	Complete the following spellings using one of the following suffixes: ‘-ic’, ‘-ive’, ‘-ity’, ‘-al’, ‘-ance’, ‘-ence’				
	Punctuation	Hyphen and Long dash				
	Conversation + Role play	Conducting a meeting/seeking opinion of the team members				
	Reading Passage	Cultural Identity of Telangana:Telangana Ballads				
	Writing	Formal letter				
	Soft skills	Stress management				
	Value Orientation	Practice makes one perfect				
<b>UNIT - IV (DRAMA)</b>	Text	<b>Riders to the Sea by J.M.Synge</b>				
	Pronunciation	Lateral, frictionless continuants, semi vowels				
	Grammar	Adverbs				
	Vocabulary	palindromes				
	Spelling	Complete the spellings in the following table <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>Noun</td> <td>Verb</td> <td>Adjective</td> <td>Adverb</td> </tr> </table>	Noun	Verb	Adjective	Adverb
Noun	Verb	Adjective	Adverb			
	Punctuation	Inverted commas				

	Conversation + Role play	Appearing for a job interview/conducting a job interview
	Reading Passage	Handicrafts of Telangana : Pochampally
	Writing	Business letter
	Soft skills	Etiquette and Grooming
	Value Orientation	Necessarily is the Mother of invention



**Testing Pattern in the Reorganized CBCS  
(With effect from AY 2019-20)**

**Subject: English (First Language)**

B.A. /B.Sc. /B.Com. and other U.G. Courses

**Semesters I & II**

I Internal Assessment: 20 marks

II End-Semester Exam: 80 marks

- Section I: 6 short answer Qs to be set. 4 to be answered.  
4 x 5 marks each = 20 marks
- Section II: 4 long answer Qs with internal choice to be set.  
4 x 15 marks each = 60 marks

**Note:** Questions should cover all units:

- In Section I, Q 1 to be based on Unit I, Q 2 on Unit II and so on.

In Section II, Q 7 A & B to be based on Unit I, Q 8 A & B to be based on Unit II and so on.



## Paper AEC1 (b): ENVIRONMENTAL SCIENCE

**Hours Per Week:** 2

**Exam Hours:** 1 ½

**Credits:** 2

**Marks:** 40U+10I

*Objective: to understand the importance of Environment, biodiversity, Environmental pollution.*

### **UNIT - I : ECOSYSTEM, BIODIVERSITY & NATURAL RESOURCES :**

1. Definition, Scope & Importance of Environmental Studies.
2. Structure of Ecosystem – Abiotic & Biotic components Producers, Consumers, Decomposers, Food chains, Food webs, Ecological pyramids)
3. Function of an Ecosystem :Energy flow in the Ecosystem (Single channel energy flow model)
4. Definition of Biodiversity , Genetic, Species & Ecosystem diversity , Hot-spots of Biodiversity, Threats to Biodiversity , Conservation of Biodiversity (Insitu & Exsitu )
5. Renewable & Non – renewable resources, Brief account of Forest , Mineral & Energy (Solar Energy & Geothermal Energy) resources
6. Water Conservation, Rain water harvesting & Watershed management.

### **UNIT – II : ENVIRONMENTAL POLLUTION , GLOBAL ISSUES & LEGISLATION :**

**(15  
hrs.)**

1. Causes, Effects & Control measures of Air Pollution, Water Pollution
2. Solid Waste Management
3. Global Warming & Ozone layer depletion.
4. Ill – effects of Fire- works
5. Disaster management – floods, earthquakes & cyclones
6. Environmental legislation :-  
(a) Wild life Protection Act (b) Forest Act (c) Water Act (d) Air Act
7. Human Rights
8. Women and Child welfare
9. Role of Information technology in environment and human health

### **FIELD STUDY:**

Pond Ecosystem  
Forest Ecosystem

**(5 hrs.)**

### **SUGGESTED BOOKS :**

1. Environmental Studies - from crisis to cure – by R. Rajagopalan (Third edition) Oxford University Press.
2. Text book of Environmental Studies for undergraduate courses (second edition) by Erach Bharucha
3. A text book of Environmental Studies by Dr.D.K.Asthana and Dr. Meera Asthana
4. Environmental Studies (2019), R Venkateswara Rao, HPH



**MAHATMA GANDHI UNIVERSITY  
NALGONDA  
CHOICE BASED CREDIT SYSTEM (CBCS)  
(With Effect from Academic Year 2016 -17)**

**U.G. I year Semester-II - (B.Sc/B.A./B.Com)**

**Gender Sensitization**

**AECC-2 – Total 2 Credits**

**UNIT – I (Theory) – 1 Credit– 1 Hour of Instruction per Week**

1. Gender : Definition, Nature and Evolution, Culture, Tradition, Historicity.
2. Gender Spectrum: Biological, Sociological, Psychological Conditioning.
3. Gender based division of labour-domestic work and use value.
4. Gender, Human Rights and Parity (parallel progress of both genders).

**UNIT – II (Practical Activity) 1 Credit – 2 Hours of Activity per Week**

Group discussion, Presentation, Role play, Survey, Case studies, Group project based on following issues:

- Respect and Co-existence
- Social, Biological, Psychological, Political, Economic, Cultural, Health Issues.
- Domestic Violence, Eve-Teasing, Sexual Harassment.
- Real Life Experience of Gender Interaction.
- Print and Electronic Media and Gender Inequalities.
- Contemporary Challenges.

**Book:** "Towards a World of Equals: A Bilingual Textbook on Gender" published by Telugu Akademi