

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

Handwritten signatures and notes:
M. Ganesha
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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
FIRST YEAR SEMESTER - I				
BS 104	PAPER-I : Microbial Diversity and Lower Plants	DSC-1A	4T+2P=6	4+1=5
FIRST YEAR SEMESTER - II				
BS 204	PAPER-II: Gymnosperms, Taxonomy of Angiosperms and Ecology	DSC-1B	4T+2P=6	4+1=5
SECOND YEAR SEMESTER - III				
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
SECOND YEAR SEMESTER - IV				
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
THIRD YEAR SEMESTER - V				
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
THIRD YEAR SEMESTER - VI				
BS 601	DSE-3: Project	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.


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**Minutes of the meeting of Board of Studies in Botany for Under Graduate courses, held in the
Department of Botany, University college of Science, Osmania University.**

The Board of studies meeting for Under Graduate course has been held on 12.03.2020 in the Department of Botany, University college of Science, Osmania University.

The following members have attended the meeting:

1. Prof. P. Kamalakar
Chairman, Board of Studies in Botany,
Osmania University, Hyderabad.
2. Prof. S. K. Mahmood
Head, Department of Botany,
Osmania University, Hyderabad.
3. Dr. Rama Devi
Dept. of Botany, University College of Science,
Osmania University, Hyderabad.
4. Dr. B. Rajani
Dept. of Botany, University College of Science,
Osmania University, Hyderabad.
5. Dr. Ameena
Department of Botany,
University College for Women,
Koti, Hyderabad.
6. Dr. K. Shailaja
Dept. of Botany, University College of Science,
Osmania University, Hyderabad.
7. Dr. Sushma
Department of Botany,
University College for Women,
Koti, Hyderabad.
8. Dr. A. Vijaya Bhaskar Reddy
Dept. of Botany, Nizam College,
Basheerbagh, Hyderabad.
9. Dr. B. Kiran kumar
Dept. of Botany, University College of Science,
Osmania University, Hyderabad.


**CHAIRMAN
B.O.S. IN BOTANY
O. U. HYD.**






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10. Dr. K. Varaprasad
Dept of Botany, Government City College, Hyderabad.

11. Dr. M. Aruna
Dept. of Botany, Telangana University,
Nizambad.

12. Dr. M. Vanaja
Pr. Scientist, Central Research Institute for Dryland Agriculture,
Santoshnagar, Hyderabad.

Minutes of the Meeting:

1. The meeting was conducted to discuss and revise the syllabus of B.Sc. CBCS II and III Year, including four semesters.
2. Optional subject, Botany - Syllabus has been revised following TSCHE Proposed CBCS Scheme and UGC Guidelines, for Under Graduate Courses, to be implemented from the Academic year, 2019-20.
3. II and III Year semester wise course under Choice Based Credit System (CBCS) has been designed with four Discipline specific Core (DSC) Papers, four Skill Enhancement Course (SEC) Papers, Six Discipline Specific Electives (DSE) (out of six, two Papers have to be selected), One Generic Elective (GE) and One Project/Dissertation.
4. Two more DSC papers, one per Semester, from III - Semester to IV - Semester Plant Anatomy and Embryology (DSC-1C: Semester-III) and Cell Biology, Genetics and Plant Physiology (DSC-1D: Semester-IV) were prepared. Each core will carry 5 Credits, theory (4 credits) and practicals (1 credit). The Syllabus for each paper is added with a list of suggested books to refer followed by theory and practical Model question papers. Teaching hours per will be 60 Hours (60 Lectures) for theory and 30 Hours (2 hours per class) for practical classes.
5. Syllabus for Six DSE papers Ecology and Biodiversity (DSE -1A), Economic Botany (DSE -1B) DSE -1C: Seed Technology (DSE -1C) in Semester -V and Genetics and Molecular Biology (DSE-2A), Tissue Culture and Biotechnology (DSE -2B) Analytical Techniques in Plant Sciences (DSE-2C) in Semester -VI are placed in Third year, three in each semester, V & VI. Out of three electives only one has to be chosen per semester. The Discipline specific elective papers carry 5 credits, theory (4 credits) and practicals (1 credit) like the core papers.
6. Practical syllabi were also revised to be in association with theory. Each Practical paper, 2 hours per week pertained to 1 credit.
7. Syllabus for four papers of skill enhancement course (SEC), designed. Two SECs in III - Semester, another two in IV-Semesters will carry 2 credits per paper. Revised SECs, Nursery and Gardening (SEC-1) and Biofertilizers and Organic Farming (SEC-2) are placed in III-Semester, followed by Greenhouse Technology (SEC-3) and Mushroom Culture Technology (SEC-IV) in IV-Semester.

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8. Syllabus for Generic elective, Industrial Microbiology (GE-1) has been designed for V-Semester. One GE paper carries 4 credits (Theory only).
9. PROJECT WORK: Introducing Research Component in Under-Graduate Courses Project work/Dissertation is considered as a special course involving application of knowledge in solving / analyzing /exploring a real life situation / difficult problem. Project / Dissertation work should be given in view of local application subject knowledge. The Project / Dissertation work would be of 4 credits.
10. Choice based selection of project and group wise allotment of students to teaching faculty is indispensable.
11. Offered project work may vary from college to college depending upon the infrastructural facilities and may differ yearly. Project will involve experimental / field work and the student will have to do this in the time after their regular theory and practical classes.
12. The final evaluation of the project work will be through a committee involving internal and external examiners.
13. The members discussed thoroughly and prepared the syllabus for B.Sc. Botany - II & III Year, compatible to the revised Core and Elective paper titles with respect to TSCHE Scheme.
14. The changes suggested by the members of BOS committee, senior faculty and Subject experts were incorporated in the syllabus, following UGC Guidelines.
15. It is resolved to approve the revised syllabi of all the papers of 2nd and 3rd year, (Semester-III, IV, V and VI) Botany (Optional-1) to be implemented for the B.Sc. Batch 2019-22.

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B. (Kishor) SP
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B.Sc. BOTANY
II Year: Semester-III
Paper – III: Plant Anatomy and Embryology

DSC - 1C

Credits- 4

Theory Syllabus

(60 hours)

UNIT – I

(18h)

1. Meristems: Types, histological organization of shoot and root apices and theories.
2. Tissues and Tissue Systems: Simple, complex and special tissues.
3. Leaf: Ontogeny, diversity of internal structure; stomata and epidermal outgrowths.
4. General account of adaptations in xerophytes and hydrophytes.

UNIT - II

(16h)

5. Stem and root anatomy: Vascular cambium - Formation and function.
6. Anomalous secondary growth of Stem - *Achyranthes*, *Boerhaavia*, *Bignonia*, *Dracaena*;
Root- *Beta vulgaris*
7. Wood structure: General account. Study of local timbers – Teak (*Tectona grandis*),
Rosewood (*Dalbergia latifolia*), Red sanders (*Pterocarpus santalinus*), Nallamaddi
(*Terminalia tomentosa*) and Neem (*Azadirachta indica*).

UNIT – III

(10h)

8. History and importance of Embryology.
9. Anther structure, Microsporogenesis and development of male gametophyte.
10. Ovule structure and types; Megasporogenesis; types and development of female gametophyte.

UNIT-IV

(16h)

11. Pollen morphology, pollination and fertilization, Pollination Types, Pollen – pistil interaction,
Double fertilization.
12. Seed – structure appendages and dispersal mechanisms
13. Endosperm – Development and types. Embryo development and types; Polyembryony
and Apomixis - an outline.

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References:

1. Bhattacharya et. al. 2007. A textbook of Palynology, Central, New Delhi.
2. Bhojwani, S. S. and S. P. Bhatnagar. 2000. The Embryology of Angiosperms (4th Ed.), Vikas Publishing House, Delhi.
3. M.R.Saxena- A textbook of Palynology.
4. Vashista- A textbook of Anatomy.
5. P.K.K.Nair- A textbook of Palynology.
6. Esau, K. 1971. Anatomy of Seed Plants. John Wiley and Son, USA.
7. Johri, B. M. 1984. Embryology of Angiosperms. Springer-Verleg, Berlin.
8. Kapil, R. P. 1986. Pollination Biology. Inter India Publishers, New Delhi.
9. Maheswari, P. 1971. An Introduction to Embryology of Angiosperms. McGraw Hill Book Co., London.
10. Dutta A.C. 2016. Botany for Degree Students. Oxford University Press.

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B.Sc. BOTANY
II Year: Semester-III
Paper – III: Plant Anatomy and Embryology

DSC - 1C

Credits-1

Practical syllabus

(45 hours)

1. Demonstration of double staining technique.
2. Tissue organization in root and shoot apices using permanent slides
3. Preparation of double stained Permanent slides
Primary structure: Root - *Cicer, Canna*; Stem - *Tridax, Sorghum*
Secondary structure: Root - *Tridax* sp.; Stem - *Pongamia*
Anomalous secondary structure: Examples as given in theory syllabus.
4. Anatomy of Xerophyte (*Nerium* leaf); Hydrophyte (*Hydrilla* stem).
5. Stomatal types using epidermal peels.
6. Structure of anther and microsporogenesis using permanent slides.
7. Structure of pollen grains using whole mounts - *Hibiscus, Acacia* and Grass).
8. Pollen viability test using Evans Blue - *Hibiscus*
9. Study of ovule types and developmental stages of embryo sac.
10. Structure of endosperm (nuclear and cellular); Developmental stages of dicot and monocot embryos using permanent slides.

Practical Model Paper

Time: 3 hrs

Max. marks: 50

1. Identify the given material "A", Prepare a double stained permanent mount of transverse section of given the given material. 15M
2. Prepare a temporary mount of epidermal peel of the given leaf material "B" and identify the stomatal type. 7M
3. Conduct the pollen viability test "C" (OR) Isolate the embryo from the given material. 6M
4. Identify and describe the specimens / slides with well labeled diagrams
(a) Embryology - D (b) Palynology - E (c) Anatomy - F 3 X 4 = 12M
5. Record 5M
6. Viva 5M

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B. K. (Kishor)

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B.Sc. Botany
II Year: Semester-III
Skill Enhancement Course

SEC-1

(Credits - 2)

Nursery and Gardening

Lectures: 30

Unit-I

(15h)

1. Nursery: definition, objectives and scope and building up of infrastructure for nursery, planning and seasonal activities - Planting - direct seeding and transplants.
2. Seed: Structure and types - Seed dormancy; causes and methods of breaking dormancy - Seed storage: Seed banks, factors affecting seed viability, genetic erosion - Seed production technology - seed testing and certification.
3. Vegetative propagation: air-layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting medium and planting of cuttings - Hardening of plants - green house - mist chamber, shed root, shade house and glass house.

Unit-II

(15h)

4. Gardening: definition, objectives and scope - different types of gardening - landscape and home gardening - parks and its components - plant materials and design - computer applications in landscaping - Gardening operations: soil laying, manuring, watering, management of pests and diseases and harvesting.
5. Sowing/raising of seeds and seedlings - Transplanting of seedlings - Study of cultivation of different vegetables: cabbage, brinjal, lady's finger, onion, garlic, tomatoes, and carrots - Storage and marketing procedures.
6. Features of a garden: Garden wall, Fencing, biofencing, Steps, Hedge, Edging, Lawn, Flower beds, Shrubbery, Borders, Water garden. Some Famous gardens of India. Cultivation of Important cut flowers: Carnation, Aster, Chrysanthemum, Dahlia, Gerbera, Gladiolous, Marigold, Rose, Lilium, Orchids.

* Field trip is essential.

Suggested Readings

1. Bose T.K. & Mukherjee, D., 1972, Gardening in India, Oxford & IBH Publishing Co., New Delhi.
2. Sandhu, M.K., 1989, Plant Propagation, Wile Eastern Ltd., Bangalore, Madras.
3. Kumar, N., 1997, Introduction to Horticulture, Rajalakshmi Publications, Nagercoil.
4. Edmond Musser & Andres, Fundamentals of Horticulture, McGraw Hill Book Co., New Delhi.
5. Agrawal, P.K. 1993, Hand Book of Seed Technology, Dept. of Agriculture and Cooperation, National Seed Corporation Ltd., New Delhi.
6. Janick Jules. 1979. Horticultural Science. (3rd Ed.), W.H. Freeman and Co., San Francisco, USA.

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B.Sc. Botany
II Year: Semester-III
Skill Enhancement Course

SEC-2

(Credits - 2)

Biofertilizers and Organic Farming (30h)

UNIT - I: (15h)

1. Manures and Biofertilizers: Types of fertilizers, manures. Manure composition. Manures for crop productivity.
2. Differences between fertilizers and biofertilizers: pH changes and water contamination.
3. Bacterial Biofertilizers: General account on the microbes used as biofertilizer.
4. Algal Biofertilizers: Associative effect of different microorganisms. *Azolla* and *Anabaena-azollae* association, nitrogen fixation, factors affecting growth, *Azolla* in rice cultivation.

UNIT - II: (15h)

5. Fungal Biofertilizers: Mycorrhizal association, types of mycorrhizal association, occurrence and distribution, phosphorus nutrition, growth and yield, colonization of VAM – isolation and inoculum production of VAM, and its influence on growth and yield of crop plants.
6. Organic Farming: Green manuring and organic fertilizers, Recycling of bio-degradable municipal, agricultural and industrial wastes, Biocompost making- types, method of vermicomposting, Panchakavya. Biological pest control (neem).

Suggested Readings

1. Dubey R.C. 2005. A Text book of Biotechnology. S.Chand & Co. New Delhi.
2. Kumaresan V. 2005. Biotechnology. Saras Publications. New Delhi.
3. John Jothi Prakash E. 2004. Outlines of Plant Biotechnology. Emkay Publication. New Delhi.
4. Sathe T.V. 2004. Vermiculture and Organic Farming. Daya Publishers. New Delhi.
5. Subha Rao N.S. 2000. Soil Microbiology, Oxford & IBH Publishers. New Delhi.
6. Vayas S.C, Vayas S. and Modi H.A. 1998. Bio-fertilizers and organic Farming Akta Prakashan. Nadiad.

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B.Sc. BOTANY
II YEAR: Semester-IV

Paper IV: Cell Biology, Genetics and Plant Physiology

DSC-1D

Credits-4

Theory Syllabus

(60 hours)

UNIT I:

(15h)

1. Plant cell envelopes: Ultra structure of cell wall, Models of membrane structure, structure and functions of Semi permeable Plasma membrane.
2. Cell Organelles: Structure and semiautonomous nature of Mitochondria and Chloroplast.
3. Nucleus: Ultra structure, types and functions of DNA & RNA. Mitochondrial DNA & Plastid DNA and Plasmids.
4. Chromosomes: Morphology, organization of DNA in a chromosome, Euchromatin and Heterochromatin, Karyotype. Special types of chromosomes: Lampbrush and Polytene chromosomes.
5. Cell division: Cell and its regulation; mitosis, meiosis and their significance

UNIT – II:

(15 hours)

6. Mendelism: History, Principles of inheritance, Chromosome theory of inheritance, Autosomes and sex chromosomes, Incomplete dominance and Co-dominance. Multiple alleles, Lethal alleles, Epistasis, Recessive and Dominant traits, Polygenic inheritance.
7. Linkage and crossing over, Recombination frequency, two factor and three factor crosses; Interference and coincidence. Numericals based on gene mapping; Sex Linkage.
8. Variation in chromosome number and structure: Deletion, Duplication, Inversion, Translocation, Position effect, Euploidy and Aneuploidy
9. Gene mutations: Types of mutations; Molecular basis of Mutations; Mutagens-physical and chemical (Base analogs, deaminating, alkylating and intercalating agents);

Unit-III

(15h)

10. Plant -water Relations: Water potential, osmosis, osmotic and pressure potential, absorption and transport of water.
11. Mineral Nutrition: Essential micro & macro nutrients and symptoms of mineral deficiency.
12. Transpiration: Stomatal structure and movement.
13. Mechanism of phloem transport.
14. Enzymes: Nomenclature, properties, Classification and factors regulating enzyme activity.

UNIT- IV

(15h)

15. Photosynthesis: Photosynthetic pigments, Cyclic and Non-cyclic Photophosphorylation. Carbon assimilation pathways: C₃, C₄ and CAM.
16. Respiration: Aerobic and Anaerobic; Glycolysis, Krebs cycle and oxidative phosphorylation.
17. Nitrogen Metabolism: Biological nitrogen fixation.
18. Physiological role of Phytohormones: Auxins, gibberellins, cytokinins, ABA, ethylene and Brassinosteroids

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Reference:

1. Sharma, A. K. and A. Sharma. 1999. Plant Chromosomes: Analysis, Manipulation and Engineering. Harward Academic Publishers, Australia.
2. Shukla, R. S. and P. S. Chandel. 2007. Cytogenetics, Evolution, Biostatistics and Plant Breeding. S.Chand & Company Ltd., New Delhi.
3. Verma, P. S. and V. K. Agrawal. 2004. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand & Company Ltd., New Delhi. 1. Hopkins, W. G. 1995.
4. Introduction to Plant Physiology. John Wiley & Sons Inc., New York, USA
5. Gardner, E.J., Simmons, M.J., Snustad, D.P. (1991). Principles of Genetics, John Wiley & sons, India. 8th edition.
6. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics, John Wiley & Sons Inc., India. 5th edition.
7. Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics. Benjamin Cummings, U.S.A. 10th edition.
8. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10th edition.
9. Watson J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M., Losick, R. (2007). Molecular Biology of the Gene, Pearson Benjamin Cummings, CSHL Press, New York, U.S.A. 6th edition.
10. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley and Sons Inc., U.S.A. 5th edition.
11. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. Benjamin Cummings. U.S.A. 9th edition.
12. Russell, P. J. (2010). iGenetics- A Molecular Approach. Benjamin Cummings, U.S.A. 3rd edition.
13. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10th edition.
14. Jain, J.L., S. Jain and Nitin Jain. 2008. Fundamentals of Biochemistry. S. Chand & Company Ltd., New Delhi.
15. Pandey, B. P. 2007. Botany for Degree Students: Plant Physiology, Biochemistry, Biotechnology, Ecology and Utilization of Plants. S. Chand & Company Ltd., New Delhi.
16. Salisbury, F. B. and C. W. Ross. 1992. Plant Physiology. 4th edn. (India Edition), Wordsworth, Thomson Learning Inc., USA.
17. Taiz, L. and E. Zeiger. 1998. Plant Physiology (2nd Ed.). Sinauer Associates, Inc., Publishers, Massachusetts, USA.
18. Dutta A.C. 2016. Botany for Degree Students. Oxford University Press.

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B.Sc. BOTANY
II YEAR: Semester-IV

Paper IV: Cell Biology, Genetics and Plant Physiology

DSC-1D

Credits-1

Practical Syllabus

(60 hours)

1. Demonstration of cytochemical methods: Fixation of plant material and nuclear staining for mitotic and meiotic studies.
2. Study of various stages of mitosis using cytological preparation of Onion root tips.
3. Study of ultra structure of cell organelles using photographs.
Chloroplast, Mitochondria, Nucleus,
4. Study of Special types of Chromosomes (Polytene chromosome and Lampbrush chromosomes- Permanent slide)
5. Mendel's laws through seed ratios. Laboratory exercises in probability and chi-square analysis.
6. Chromosome mapping using test cross data.
7. Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1, 9:3:4)
8. Determination of osmotic potential of vascular sap by Plasmolytic method using leaves of *Rheodiscolor / Tradescantia*.
9. Determination of rate of transpiration using Cobalt chloride method
10. Determination of stomatal frequency using leaf epidermal peelings / impressions
11. Determination of amylase activity using potato tubers by titration method
12. Separation of chloroplast pigments using paper chromatography technique
13. Estimation of protein by Biurette method
14. Mineral deficiency symptoms of Micro and Macro nutrients

Practical Model Question Paper

Time: 3 hrs

Max. marks: 50

1. Prepare a cytological slide of given material "A" and identify & describe any two stages with well labeled diagrams. (12M)
2. Genetics problem (10M)
3. Physiology Experiment (12M)
4. Identify and Comment on A & B (2x3 =6M)
 - A. Micronutrient / Macronutrients Deficiency symptoms
 - B. Cell organelles / Special type of Chromosomes
5. Record (5M)
6. Viva (5M)

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B.Sc. BOTANY
II Year: Semester-IV
Skill Enhancement Course

SEC-3

Credits-2

Greenhouse Technology **(30h)**

UNIT – I

(15h)

1. Introduction; scope – classification of greenhouses – construction of greenhouse- heating unit – cooling unit – environmental control (light and temperature).
2. Net- poly houses- low cost green houses. Root media for greenhouses
3. Fertilizers: Organic and inorganic, liquid fertilizers, application of fertilizers.
4. Water in the Greenhouses: Irrigation system in green houses – misting, Drip irrigation- micro irrigation, water quality, water sanitation.

UNIT – II

(15h)

5. Plant Protection in Greenhouses: Diseases of greenhouse plants (bacterial, fungal, nematodes and viral diseases)
6. Management of pest and diseases – integrated pest management.
7. Applications of Greenhouse Technology: Importance of greenhouse technology. Micropropagation and greenhouse planting of tissue culture transplants
8. Advantages and disadvantages of greenhouse technology. Seed production, cut flower gardening.

Suggested Readings

1. Dubey R.C. 2006. A text book of Biotechnology. S.Chand and Company. New Delhi.
2. Sheela V.L. 2011. Horticulture. MJP Publishers. Chennai,
3. Prasad S., Kumar U. 2012. Green House Management for Horticultural Crops. Agrobios India.
4. Pant V. and Nelson. 1991. Green House Operation and Management. Bali Publication. New Delhi.
5. Introduction to soil science: <http://www.agrimoon.com/wpcontent/uploads/Introduction-to-soil-science.pdf>
6. Greenhouse applications: http://www.lindegas.com/en/products_and_supply/fumigants/carbon_dioxide_in_agriculture/greenhouse_applications/index.html
7. Role of greenhouse technology in agricultural engineering:

Sushama *Alruna* *Blau* *K. Shailesh* *M. Bang* *B. Kishore* *Juan*

B.Sc. BOTANY
II Year: Semester-IV
Skill Enhancement Course

SEC-4

(Credits 2)

Mushroom Culture Technology

Lectures: 30

UNIT-I

(15h)

1. Introduction & history. Medicinal value of edible mushrooms; Poisonous mushrooms. Types of edible mushrooms available in India - *Volvariella volvacea*, *Pleurotus citrinopileatus*, *Agaricus bisporus*.
2. Cultivation Technology: Infrastructure; substrates (locally available) Polythene bag, vessels, Inoculation hook, inoculation loop, low cost stove, sieves, culture rack, mushroom unit (Thatched house) water sprayer, tray, small polythene bag.
3. Pure culture: Medium, sterilization, preparation of spawn, multiplication. Mushroom bed preparation - paddy straw, sugarcane trash, maize straw, banana leaves.
4. Factors affecting the mushroom bed preparation - Low cost technology, Composting technology in mushroom production.

UNIT-II

(15h)

5. Storage: Short-term storage (Refrigeration - upto 24 hours) Long term Storage (canning, pickles, papads), drying, storage in salt solutions.
6. Nutritional value of Mushrooms: Proteins - amino acids, mineral elements nutrition - Carbohydrates, Crude fibre content - Vitamins.
7. Food Preparation: Types of foods prepared from mushroom. Research Centres - National level and Regional level. Cost benefit ratio - Marketing in India and abroad, Export Value.

Suggested Readings

1. Marimuthu, T. Krishnamoorthy, A.S. Sivaprakasam, K. and Jayarajan. R (1991) Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
2. Swaminathan, M. (1990) Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.
3. Tewari, Pankaj Kapoor, S.C., (1988). Mushroom cultivation, Mittal Publications, Delhi.
4. Nita Bahl (1984-1988) Hand book of Mushrooms, II Edition, Vol. I & Vol. II.

K. Shailja
M. Anand

B. Krishna

Sudhanshu

B.Sc. BOTANY

Skill Enhancement Course (SEC)

Time : 2 hrs

Max. Marks: 40

Theory - Model Question Paper

Draw well-labeled diagrams wherever necessary

I. Write short answer of the following

6 X 4 = 24M

1. Unit-I
2. Unit-I
3. Unit-I
4. Unit-II
5. Unit-II
6. Unit-II

II. Essay Questions:

2 X 8 = 16M

7. a. Unit-I
(OR)
b. Unit-I
8. a. Unit-II
(OR)
b. Unit-II

* Internal Exam carries 10 Marks

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Sushama
M. D. Gupta
Blau
B. Kishore
15/12/18

B.Sc. BOTANY
Discipline Specific Core (DSC)

Time :3 hrs

Max. Marks: 80

Theory - Model Question Paper

Draw well-labeled diagrams wherever necessary

I. Write short answer of the following

8 X 4 = 32M

1. Unit-I
2. Unit-I
3. Unit-II
4. Unit-II
5. Unit-III
6. Unit-III
7. Unit-IV
8. Unit-IV

II. Essay Questions:

4X 12 = 48M

9. a. Unit-I
(OR)
b. Unit-I
10. a. Unit-II
(OR)
b. Unit-II
11. a. Unit-III
(OR)
b. Unit-III
12. a. Unit-IV
(OR)
b. Unit-IV

* Internal Exam carries 20 Marks

Singhania
Jain
M. Gupta

K. Singh

B. Singh

Blaw

B.Sc. BOTANY
III Year: Semester-V
Paper-1A: Biodiversity & Conservation

DSE-1A

Credits-4

Theory Syllabus

(60 hours)

Unit - I:

(15h)

1. Plant diversity and its scope: Genetic diversity, Species diversity, Plant diversity at the ecosystem level, Agrobiodiversity and cultivated plant taxa, wild taxa.
2. Values and uses of Biodiversity: Ethical and aesthetic values, Precautionary principle, Methodologies for valuation, Uses of plants, Uses of microbes.

Unit-II:

(15h)

3. Loss of Biodiversity: Loss of genetic diversity, Loss of species diversity, Loss of ecosystem diversity, Loss of agrobiodiversity, Projected scenario for biodiversity loss.
4. Management of Plant Biodiversity: Organizations associated with biodiversity, management-Methodology for execution-IUCN, UNEP, UNESCO, WWF, NBPGR.
5. Biodiversity legislation and conservation, Biodiversity information management and communication.

Unit-III:

(15h)

6. Conservation of Biodiversity: Conservation of genetic diversity, species diversity and ecosystem Diversity
7. Principles of conservation - *In situ* and *Ex situ* conservation. Sacred groove, Botanical garden, Biosphere reserves, Sanctuaries, National parks (*In situ*) and Tissue culture, Gene / seed / pollen banks and Cryopreservation (*Ex situ*).

Unit-IV:

(15h)

8. Role of plants in relation to Human Welfare; Importance of forestry their utilization and commercial aspects, Avenue trees, Ornamental plants of India.
9. Alcoholic beverages through ages. Fruits and nuts, Important fruit crops and their commercial importance. Wood and its uses.

References:

1. Krishnamurthy, K.V. (2004). An Advanced Text Book of Biodiversity - Principles and Practices. Oxford and IBH Publications Co. Pvt. Ltd. New Delhi
2. Bharucha, E. 2005. Textbook of Environmental Studies for Undergraduate Courses. Universities Press (India) Private Limited, Hyderabad.
3. Odum, E. P. 1983. Basics of Ecology. Saunder's International Students Edition, Philadelphia.
4. Sharma, P. D. 1989. Elements of Ecology. Rastogi Publications, Meerut.

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M. B. Gupta, S. Chandra, B. K. Singh, K. S. Nair, B. Law, K. S. Nair, go.

B.Sc. BOTANY
III Year: Semester-V
Paper-1A: Biodiversity & Conservation

DSE-1A

Credits-I

Practical Syllabus

(30 hours)

1. Study on local biodiversity: Herbs, shrubs and trees; Seasonal, Annual, biennial and perennial plants.
2. Study of morphological characteristics of plant communities: Hydrophytes (*Eichhornia*, *Hydrilla*, *Pistia*, *Nymphaea*, *Vallisneria*), Xerophytes: (*Asparagus*, *Opuntia*, *Euphorbia milii*, *Casuarina*, *Calotropis*).
3. Assessment of biodiversity
 - i) Avenue trees: *Pongamia pinnata*, *Butea monosperma*, *Spathodea* sp., *Delonix regia*, *Jacaranda mimosifolia*, *Cassia fistula*, *Mimusops elengi*, *Acacia leucophloea*, and *Albizia lebbek*.
 - ii) Ornamental Plants: Any five locally available ornamental plants.
 - iii) Timber Value: *Acacia nilotica*, *Tectona grandis* and *Azadirachta indica*
 - iv) Fruits: *Mangifera indica* (Mango), *Ziziphus mauritiana*, *Psidium guajava* (Guava), *Annona squamosa*
 - v) Nuts: *Anacardium occidentale* (Cashew), *Terminalia catappa* (Badam)
 - vi) Beverages: *Madhuca indica*, *Camellia sinensis* (Tea), *Coffea arabica* (Coffee), *Borassus flabellifer* (Toddy palm) and *Caryota urens*
 - vii) Medicinal value: *Catharanthus roseus*, *Tinospora cordifolia* and *Phyllanthus emblica*, *Ocimum* sp., and *Azadirachta indica*
4. Field trip: Collection of plants from the field, identification and preparation of Herbarium.

Practical Model Question Paper

3 Hours

50 Marks

1. Identify and describe Biodiversity value of a) Medicinal b) Timber c) Fruit. 3x4=12M
2. Any two available ornamental plants and their uses. 2x3=06M
3. Comment on the specimens A, B & C 3x3=09M
4. Identify and describe Biodiversity value of the given slides D & E (Hydrophytes & Xerophytes) 2x4=08M
5. Field trip Herbarium. 05M
6. Record 05M
7. Viva 05M

Sushama

K. S. Nair

B. K. Srinivas

Blas

M. D. Srinivas

B.Sc. BOTANY
III Year: Semester-V
Paper-1B: Tissue Culture and Biotechnology

DSE-1B

Credits-4

Theory Syllabus

(60 hours)

UNIT – I:

(15 hours)

1. Tissue culture: Introduction, sterilization procedures, explants, culture media - composition and preparation; Nutrient and hormone requirements, Micropropagation.
2. Organ culture: Totipotency, Vegetative Organs-Root, Shoot, Leaf culture
Reproductive Organs-Anther, Ovule, Embryo culture
3. Callus culture and isolation and fusion of protoplast culture
4. Organogenesis, Embryogenesis (somatic and zygotic).

UNIT- II:

(15 hours)

5. Applications of tissue culture: Production of pathogen free plants and stress resistant plants, somaclonal variants and synthetic seeds.
6. Induction of hairy roots and its applications in production of secondary metabolites.
7. Haploidy and triploids, Cryopreservation and Germplasm Conservation.
8. Somatic hybrids and Cybrids.

UNIT- III:

(15 hours)

9. Biotechnology: Introduction, history, scope and applications.
10. rDNA technology: Basic aspect of gene cloning, Enzymes used in gene cloning-Restriction enzymes, Ligases, Polymerases.
11. Gene cloning: Recombinant DNA, Bacterial Transformation and selection of recombinant clones, vectors- cloning vehicles (Plasmid, Cosmids, Bacteriophages, & Phasmids; Eukaryotic Vectors (YAC) Gene Construct; Applications of rDNA technology.

UNIT - IV:

(15 hours)

12. Gene Libraries: construction of genomic and cDNA libraries, colony hybridization; Probes- oligonucleotide, Polymerase Chain Reaction (PCR) and its applications.
13. Methods of gene transfer- Agrobacterium-mediated, Direct gene transfer by Electroporation, Microinjection, Microprojectile bombardment; Selection of transgenics-selectable marker and reporter genes.
14. Application of transgenics in improvement of crop productivity and quality traits. Pest resistant transgenic crops (Bt-cotton & Bt-brinjal); herbicide resistant plants (Roundup Ready soybean); crops with quality traits (Flavr Savr tomato, Golden rice).

Sushama
Arjun
K. Shailgo.
M. Dweep
B. Kumbhar
Blaw

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References:

1. Balasubramanian, D., C. F. A. Bryce, K. Dharmalingam, J. Green and K. Jayaraman. 2004.
2. Biotechnology. Universities Press (India) Private Limited, Hyderabad.
3. Channarayappa. 2007. Molecular Biotechnology – Principles and Practices. Universities Press (India) Private Limited, Hyderabad.
4. Chawala, H. S. 2002. Introduction to Plant Biotechnology. Oxford & IBH Publishing Company, New Delhi.
5. Dubey, R. C. 2001. A Textbook of Biotechnology. S. Chand & Company Ltd., New Delhi
6. Edmond, J. B., T. L. Senn, F. S. Adrews and R. J. Halfacre. 1977.
7. Jha, T.B. and B. Ghosh. 2005. Plant Tissue Culture – Basic and Applied. Universities Press (India). Private Limited, Hyderabad..
8. Ramawat, K. G. 2008. Plant Biotechnology. S. Chand & Company Ltd., New Delhi.
9. Salisbury, F. B. and C. W. Ross. 1992. Plant Physiology. 4th edn. (India Edition), Wordsworth, Thomson Learning Inc., USA.
10. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
12. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.
13. Bhojwani, S.S. and Bhatnagar, S.P. (2011). The Embryology of Angiosperms. Vikas Publication House Pvt. Ltd., New Delhi. 5th edition.
14. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley and Sons, U.K. 5th edition.
15. Stewart, C.N. Jr. (2008). Plant Biotechnology & Genetics: Principles, Techniques and Applications. John Wiley & Sons Inc. U.S.A.

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B.Sc. BOTANY
III Year: Semester-V
Paper-1B: Tissue Culture and Biotechnology

DSE-1B

Credits-1

Practical Syllabus

30 Hours

Major Experiments

1. Isolation of plant DNA. (Tomato)
2. Production of synthetic seeds /Encapsulation of embryo
3. Preparation of plant tissue culture medium - MS medium
4. Isolation of protoplasts.

Minor Experiments

1. Callus induction
2. Demonstration of Micropropagation/multiple shoots
3. Anther culture
4. PCR –Demonstration
5. Study of biotechnology products: Samples of antibiotics and vaccines
6. Photographs of Gene transfer methods.
7. Instruments used in Biotechnology lab- Autoclave, Laminar air flow, Hot air oven and Incubator.
8. Demonstration of In-vitro sterilization and inoculation methods using leaf and nodal explants of tobacco, Datura, Brassica etc.

Spotting

1. Study of anther, embryo and endosperm culture, micropropagation, somatic embryogenesis & artificial seeds through photographs.
2. Study of methods of gene transfer through photographs: Agrobacterium-mediated, direct gene transfer by electroporation, microinjection, microprojectile bombardment.
4. Study of steps of genetic engineering for production of Bt cotton, Golden rice, Flavr Savr tomato through photographs.
5. Restriction digestion and gel electrophoresis of plasmid DNA.

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Sushama, Anurag, M. G. Deshpande, K. K. Mailgo, B. K. G. (circled), J. S. (circled)

Practical Model Question Paper

3 Hours

Max. Marks: 50

1. Major Experiment (18 marks)
Isolation of DNA
(OR)
Production of synthetic seeds / Encapsulation of embryo
2. Minor Experiment (10 marks)
Callus / Micropropagation / Multiple shoots
3. Spotters (3x4=12 marks)
 - A. Vaccines
 - B. Antibiotics
 - C. Gene transfer methods / instruments
4. Record (5 marks)
5. Viva (5 marks)

Sushama *Arundh*
M. Gurep *K. Shaitgo* *Arundh*
Arundh *B. Gurep* *Arundh*

B.Sc. BOTANY
III YEAR: Semester-V
Paper-1C: Seed Technology

DSE – 1C

Credits-4

Theory Syllabus

(60 hours)

UNIT-I

(15h)

1. Seed: Structure and types.
2. Seed development in cultivated plants, seed quality concept, importance of genetic purity of seed. Hybrid seed production and Heterocyst.
3. Cross pollination, Emasculation, role of pollinators and their management.
4. Collection and storage of pollen for artificial pollination.

UNIT-II

(15h)

5. Seed germination: Internal and external factors affecting germination.
6. Physiological processes during seed germination; seed respiration, breakdown and mobilization of stored seed reserves.
7. Seed dormancy: Types, causes and methods of breaking dormancy. Role of Phytochrome.

UNIT-III

(15h)

8. Cultural practices and harvesting of Seed: Isolation, Sowing, Cultural practices, harvesting and threshing of the following crops: a) Rice b) Cotton c) Sunflower
9. Seed treatment to control seed borne disease –General account
10. Seed testing- Procedures of seed testing, seed testing laboratories and importance of seed testing.

UNIT-IV

(15h)

11. Seed viability, factors affecting seed viability and genetic erosion.
12. Seed storage: Long term and short term storage. Orthodox and recalcitrant seeds. Packing of seeds – Principles, practices, bagging and labelling.
13. Seed banks- National, International and Millennium seed banks.
14. Seed certification- History, Seed certification agency, Indian millennium, general and specific seed certification standard.

Sushama

M. Gupta

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K. Shailgo

revised

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B. Kishore

Juni

Reference:

1. Agrawal, P. K. 1993. Hand Book of Seed Technology. Dept. of Agriculture and Cooperation. National Seed Corporation Ltd., New Delhi
2. Balasubramanian, D., C. F. A. Bryce, K. Dharmalingam, J. Green and K. Jayaraman. 2004. Biotechnology. Universities Press (India) Private Limited, Hyderabad.
3. Bedell, Y. E. Seed Science and Technology. Indian Forest Species. Allied Publishers Limited, New Delhi.
4. Channarayappa. 2007. Molecular Biotechnology – Principles and Practices. Universities Press (India) Private Limited, Hyderabad.
5. Chawala, H. S. 2002. Introduction to Plant Biotechnology. Oxford & IBH Publishing Company, New Delhi.
6. Dubey, R. C. 2001. A Textbook of Biotechnology. S. Chand & Company Ltd., New Delhi
7. Edmond, J. B., T. L. Senn, F. S. Adrews and R. J. Halfacre. 1977..
8. Hartman, H. T. and D. E. Kestler. 1976. Plant Propagation: Principles and Practices. Prentice & Hall of India, New Delhi.
9. Jha, T.B. and B. Ghosh. 2005. Plant Tissue Culture – Basic and Applied. Universities Press (India) Private Limited, Hyderabad..
10. Ramawat, K. G. 2008. Plant Biotechnology. S. Chand & Company Ltd., New Delhi.
11. Salisbury, F. B. and C. W. Ross. 1992. Plant Physiology. 4th edn. (India Edition), Wordsworth, Thomson Learning Inc., USA..
12. Tiwari, G. N. and R. K. Goal. Green House Technology – Fundamentals, Design, Modelling and Application. Narosa Publishing House, New Delhi.
13. Tunwar, N. S. and S. V. Singh. 1988. Indian Minimum Seed Certification Standards. The Central Seed Certification Board, Govt. of India, New Delhi.
14. Agrawal PK & Dadlani M. (Eds.). 1992. Techniques in Seed Science and Technology. South Asian Publ.
15. Baskin CC & Baskin JM. 1998. Seeds: Ecology, Biogeography and Evolution of Dormancy and Germination. Academic Press. Basra AS. 2006. Handbook of Seed Science and Technology. Food Product Press.
16. Bench ALR & Sanchez RA. 2004. Handbook of Seed Physiology. Food Product Press. Bewley JD & Black M. 1982. Physiology and Biochemistry of Seeds in Relation to Germination. Vols. I, II. Springer Verlag.
17. Bewley JD & Black M. 1985. Seed: Physiology of Seed Development and Germination. Plenum Press.
18. Copeland LO & Mc Donald MB. 1995. Principles of Seed Science and Technology. 3rd Ed. Chapman & Hall.
19. Khan AA. 1977. Physiology and Biochemistry of Seed Dormancy and Germination. North Holland Co.
20. Kigel J & Galili G. (Eds.). Seed Development and Germination. Marcel Dekker.
21. Murray DR. 1984. Seed Physiology. Vols. I, II. Academic Press. Sadasivam S & Manickam A. 1996. Biochemical Methods. 2nd Ed. New Age.

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B.Sc. BOTANY
III YEAR: Semester-V
Paper-1C: Seed Technology

DSE – 1C

Credits-1

Practical syllabus

(30 hours)

Major Experiment

1. Testing of seed viability using 2, 3, 5-triphenyl tetrazolium chloride (TTC).
2. Estimation of amylase activity of germinating seeds (Qualitatively).
3. Demonstration of seed dressing using fungicides to control seed borne diseases.
4. Demonstration of seed dressing using Biofertilizers (BGA) to enrich nutrient supply.

Minor Experiments

5. Emasculation, bagging of flower for hybrid seed production.
6. Dissection of Dicot embryo (bean) and Monocot embryo (maize).
7. Pollen viability test using Evan's blue staining (Hibiscus).
8. Harvesting and Importance of following seeds:
 - a) Rice
 - b) Maize
 - c) Cotton
 - d) Groundnut and
 - e) Sunflower.
9. Methods to break Seed dormancy
10. Study visits to research institutes, seed tests and certification laboratories and Places, seed banks.

Practical Model Question Paper

3 Hours

Max. marks: 50

1. Major Experiment. (16 marks)
 - a) Estimation of amylase activity in germinating seeds.
(OR)
 - b) Seed viability test by triphenyl tetrazolium chloride (TTC)
2. Minor Experiment. (12 marks)
 - a) Dissection of Dicot / Monocot embryo
(OR)
 - b) Methods to break Seed dormancy / Seed dressing.
3. Spotters (3x4=12 marks)
 - A. Emasculation / Bagging
 - B. Germination of seeds.
 - C. Importance of following seeds: rice, cotton and sunflower.
4. Record (5 marks)
5. Viva (5 marks)

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B.Sc. BOTANY
III YEAR: Semester-V
Generic Elective (GE)

GE-1

(Credits: 4)

Industrial Microbiology

Lectures: 60

Unit I

(15h)

1. Scope of microbes in industry and environment
2. Bioreactors/Fermenters and fermentation processes
3. Solid-state and liquid-state (stationary and submerged) fermentations; Batch and continuous fermentations.
4. Components of a typical bioreactor, Types of bioreactors-laboratory, pilot scale and production fermenters.

Unit II

(15h)

5. Constantly stirred tank fermenter, tower fermenter, fixed bed and fluidized bed bioreactors and air-lift fermenter. A visit to any educational institute/ industry to see an industrial fermenter, and other downstream processing operations.
6. Microbial production of industrial products: Microorganisms involved, media, fermentation conditions, downstream processing and uses;
7. Filtration, centrifugation, cell disruption, solvent extraction, precipitation and ultrafiltration, lyophilization, spray drying.
8. Hands on microbial fermentations for the production and estimation (qualitative and quantitative) of Enzyme: amylase or lipase activity, Organic acid (citric acid or glutamic acid), alcohol (Ethanol) and antibiotic (Penicillin).

Unit III

(15h)

9. Microbial enzymes of industrial interest and enzyme immobilization
10. Microorganisms for industrial applications and hands on screening microorganisms for casein hydrolysis; starch hydrolysis; cellulose hydrolysis.
11. Methods of immobilization, advantages and applications of immobilization, large scale applications of immobilized enzymes (glucose isomerase and penicillin acetylase).
12. Microbes and quality of environment. Distribution of microbes in air; Isolation of microorganisms from soil, air and water.

Unit IV:

(15h)

13. Microbial flora of water. Water pollution, role of microbes in sewage and domestic waste water treatment systems.
14. Determination of BOD, COD, TDS and TOC of water samples; Microorganisms as indicators of water quality, check coliform and fecal coliform in water samples.
15. Microbes in agriculture and remediation of contaminated soils.
16. Biological fixation; Mycorrhizae; Bioremediation of contaminated soils. Isolation of root nodulating bacteria, arbuscular mycorrhizal colonization in plant roots.

Handwritten signatures and notes:
Sushama
B.P. Chauhan
K. Shalga
M. Gupta
B. Kishore
10

Suggested Readings

1. Pelzar, M.J. Jr., Chen E.C. S., Krieg, N.R. (2010). Microbiology: An application based approach. Tata McGraw Hill Education Pvt. Ltd., Delhi.
2. Tortora, G.J., Funke, B.R., Case, C.L. (2007). Microbiology. Pearson Benjamin Cummings, San Francisco, U.S.A. 9th edition.

Dr. [Signature]
Sushama K. Thairgi
M. Anand
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B.Sc. Botany
III Year: Semester-VI
Paper-2A: Plant Molecular Biology

DSE-2A

Credits -4

Theory syllabus

Lectures: 60

Unit-I: (15 hours)

1. Nucleic acids: Carriers of genetic information, types of genetic material, DNA as the carrier of genetic information.
2. Structures of DNA: Salient features and Types of DNA, Organization of DNA in Prokaryotes. Mitochondrial and chloroplast DNA.
3. Structure of RNA: Structure and Types of RNA's (mRNA, rRNA and tRNA).

Unit-II (15 hours)

4. Nucleosome, Chromatin structure - Euchromatin, Heterochromatin; Constitutive and Facultative heterochromatin.
5. Replication of DNA: Chemistry of DNA synthesis, general principles, Semi-conservative replication of DNA, replication of linear ds-DNA, replication of the 5' end of linear chromosome.
6. Central dogma and genetic code: Central Dogma (Adaptor hypothesis and discovery of mRNA template), salient features of Genetic code.

Unit-III: (15 hours)

7. Mechanism of Transcription: Transcription in prokaryotes and eukaryotes; Split genes-concept of introns and exons, removal of introns, eukaryotic mRNA processing (5' cap, 3' polyA tail).
8. RNA editing and mRNA transport.

Unit-IV: (15 hours)

9. Translation in prokaryotes: Ribosome structure and assembly, mRNA; Charging of tRNA, aminoacyl tRNA synthetases; Various steps in protein synthesis, proteins involved in initiation, elongation and termination of polypeptides; Fidelity of translation.
10. Transcriptional regulation in prokaryotes, Regulation of lactose metabolism (Lac operon) and tryptophan (Trp operon) synthesis in E.coli.

Sushama Kumar
Arjun
M. Dinesh
K. Shailja
B. Kiran
Blau

B.Sc. Botany
III Year: Semester-VI
Paper-2A: Plant Molecular Biology

DSE-2A

Credits -1

Practical Syllabus

1. Isolation of genomic DNA from E.Coli.
2. DNA isolation from cauliflower head / tomato fruit.
3. DNA estimation by diphenylamine reagent/UV Spectrophotometry.
4. Study of DNA replication mechanisms through photographs (Rolling circle, Theta replication and semi-discontinuous replication).
5. Study of structures of prokaryotic RNA polymerase and eukaryotic RNA polymerase II through photographs.
6. Photographs establishing nucleic acid as genetic material (Messelson and Stahl's, Avery et al, Griffith's, Hershey & Chase's and Fraenkel & Conrat's experiments)
7. Study of the following through photographs: Assembly of Spliceosome machinery; Splicing mechanism in group I & group II introns; Ribozyme and Alternative splicing.
8. Estimation of size of a DNA fragment after electrophoresis using DNA markers (through photographs).

Practical Exam - Model Paper

Time: 3 Hours

Max. Marks: 50

I. Experiments

- | | |
|---------------------|-----|
| 1. Major Experiment | 15M |
| 2. Minor Experiment | 10M |

II. Spotters

4X3=12M

- A)
- B)
- C)
- D)

III. Identify and describe the photograph

3M

IV. Viva

5M

V. Record

5M

Subhame
Aneer
M. Bhaag
Alumant

Reshale
B. Krishna
Blaw

B.Sc. Botany
III Year: Semester-VI
Paper-2B: Economic Botany

DSE-2B

Credits-4

Theory Syllabus

60 hours

UNIT - I

1. Origin of Cultivated Plants: Major plants introduction, Crop domestication and examples of crops / varieties
2. Vegetables: Nutritional and Commercial values of root crops, leafy and fruit vegetables.
3. Millets: Nutrient significance of Sorghum, Finger millet, Pearl millet, Foxtail millet.
4. Cereals: Rice, Wheat and maize - Origin, morphology and uses.

UNIT - II

5. Legumes: General account, importance to man and ecosystem.
6. Fruits and nuts: Commercial and nutritional value of South Indian fruits. Cashew nut, Almond and Walnut.
7. Sugars & Starches: Morphology and processing of sugarcane, products and by-products of sugarcane industry. Potato – morphology, propagation & uses.
8. Spices: Listing of important spices, part used, economic importance with special reference to fennel, saffron, clove and black pepper

UNIT - III

9. Beverages: Tea, Coffee (morphology, processing & uses)
10. Edible oils & Fats: General description, extraction, uses and health implications of groundnut, sunflower, coconut, linseed, and mustard.
11. Essential Oils: General account, extraction methods, comparison with fatty oils & their uses.
12. Natural Rubber: Para-rubber - tapping, processing and uses.

UNIT - IV

13. Drug-yielding plants: Therapeutic and habit-forming drugs with special reference to Cinchona, Digitalis, Papaver and Cannabis.
14. Tobacco processing, uses and health hazards
15. Timber plants: General account with special reference to teak and pine
16. Fibres: Classification based on the origin of fibres, extraction methods and uses of Cotton and Jute.

Suggested Readings

1. Kochhar, S.L. (2012). Economic Botany in Tropics, MacMillan & Co. New Delhi, India.
2. Wickens, G.E. (2001). Economic Botany: Principles & Practices. Kluwer Academic Publishers, The Netherlands.
3. Chrispeels, M.J. and Sadava, D.E. (2003). Plants, Genes and Agriculture. Jones & Bartlett Publishers.
4. B.P. Pandey (2007). Economic Botany, S. Chand & Company Ltd. New Delhi. 17/e.

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Subhanshu
M. Banerjee
K. Shailgo.
B. K. Choudhary
B.P.P.

B.Sc. Botany
III Year: Semester-VI
Paper-2B: Economic Botany

DSE-2B

Credits-1

Practical Syllabus

30 hours

1. Study of economically important plants: Wheat, Gram, Soybean, Black pepper, Clove Tea and Cotton through specimens, sections and microchemical tests.
2. Identification and study on nutrient values of locally available vegetables, millets and cereals.
3. Study on nutrient values and commercial status of Cashew nut, Almond and Walnut.
4. Uses and health implications of groundnut, sunflower, coconut, linseed and Brassica.
5. Identification of starch granules.
6. Quantitative estimation and comparative study of proteins in millets and cereals.
7. Collection of economically important plants / vegetable plants and preparation of Herbarium.

Practical Exam - Model Paper

Time: 3 Hours

Max. Marks: 50

I. Experiments	
A) Protein test (Major Experiment)	12M
B) Starch granules (Minor Experiment)	6M
II. Spotters	4X3=12M
C) Leafy / Fruity Vegetables,	
D) Fruits / Spices,	
E) Medicinal Plants / Beverages,	
F) Wood / Timber / Fiber	
III. Herbarium	10M
IV. Viva	5M
V. Record	5M

Sushama *K. Shaila* *M. Banu* *B. Kishor*
Jyoti *M. Banu* *B. Kishor*

B.Sc. Botany
III Year: Semester-VI
Paper-2C: Analytical Techniques in Plant Sciences

DSE-2C

Credits - 4

Theory Syllabus

Lectures: 60

Unit I:

1. Imaging and related techniques: Principles of microscopy; Light microscopy; Fluorescence microscopy; Confocal microscopy.
2. Use of fluorochromes: Fluorescence-activated cell sorting (FACS); Applications of fluorescence microscopy: Chromosome banding, FISH, chromosome painting.
3. Transmission and Scanning electron microscopy - sample preparation for electron microscopy, cryofixation, negative staining, shadow casting, freeze fracture, freeze etching.

Unit II:

4. Cell fractionation: Centrifugation: Differential and density gradient centrifugation, sucrose density gradient, CsCl₂ gradient, analytical centrifugation, ultracentrifugation, marker enzymes.
5. Radioisotopes: Use in biological research, auto-radiography, pulse chase experiment.
6. Spectrophotometry: Principle and its application in biological research.

Unit III:

7. Chromatography: Principle; Paper chromatography; Column chromatography, TLC, GLC, HPLC, Ionexchange chromatography; Molecular sieve chromatography; Affinity chromatography.
8. Characterization of proteins and nucleic acids: Mass spectrometry; X-ray diffraction; X-ray crystallography; Characterization of proteins and nucleic acids;
9. Electrophoresis: PAGE, SDS-PAGE

Unit IV:

10. Biostatistics: Statistics, data, population, samples, parameters;
11. Representation of Data: Tabular, Graphical; Measures of central tendency;
12. Arithmetic mean, mode, median; Measures of dispersion: Range, mean deviation, variation, standard deviation; Chi-square test for goodness of fit.

Handwritten signatures and initials:
A. Kumar
S. Kumar
M. Banerjee
K. Chaitanya
B. Kishore
B. Kishore
B. Kishore

Suggested Readings

1. Plummer, D.T. (1996). An Introduction to Practical Biochemistry. Tata McGrawHill Publishing Co. Ltd. New Delhi. 3rd edition.
2. Ruzin, S.E. (1999). Plant Microtechnique and Microscopy, Oxford University Press, New York. U.S.A.
3. Ausubel, F., Brent, R., Kingston, R. E., Moore, D.D., Seidman, J.G., Smith, J.A., Struhl, K. (1995). Short Protocols in Molecular Biology. John Wiley & Sons. 3rd edition.
4. Zar, J.H. (2012). Biostatistical Analysis. Pearson Publication. U.S.A. 4th edition.

B.Sc. Botany
III Year: Semester-VI
Paper-2C: Analytical Techniques in Plant Sciences

DSE-2C

Credits - 1

Practical Syllabus

Lectures: 30

1. Study of Blotting techniques: Southern, Northern and Western, DNA fingerprinting, DNA sequencing, PCR through photographs.
2. Demonstration of ELISA.
3. To separate nitrogenous bases by paper chromatography.
4. To separate sugars by thin layer chromatography.
5. Isolation of chloroplasts by differential centrifugation.
6. To separate chloroplast pigments by column chromatography.
7. To estimate protein concentration through Lowry's methods.
8. To separate proteins using PAGE.
9. To separate DNA (marker) using PAGE.
10. Study of different microscopic techniques using photographs/micrographs (freeze fracture, freeze etching, negative staining, positive staining, fluorescence and FISH).
11. Preparation of permanent slides (double staining).

Sushama

M. G. S.

V. S.

K. S. S.

~~revised~~

B. S. S.

Blau

Practical Exam - Model Paper

Time: 3 Hours

Max. Marks: 50

I. Experiments

A. Major Experiment 12M

B. Minor Experiment 8M

II. Permanent slide preparation 8M

III. Spotters 4X3=12M

C)

D)

E)

F)

IV. Viva 5M

V. Record 5M

Sushama

M. Gupta

Arman

K. S. Nalga

~~Neeraj~~

~~Hy~~

B. Kishore

Blau

Jane

B.Sc. Botany
Theory Model Question Paper

Discipline Specific Elective (DSE)
&
Generic Elective (GE)

Time :3 hrs

Max. Marks: 80

Draw well-labeled diagrams wherever necessary

I. Write short answer of the following

8 X 4 = 32M

1. Unit-I
2. Unit-I
3. Unit-II
4. Unit-II
5. Unit-III
6. Unit-III
7. Unit-IV
8. Unit-IV

II. Essay Questions:

4X 12 = 48M

9. a. Unit-I
(OR)
b. Unit-I
10. a. Unit-II
(OR)
b. Unit-II
11. a. Unit-III
(OR)
b. Unit-III
12. a. Unit-IV
(OR)
b. Unit-IV

* Internal Exam carries 20 Marks

Sushome
Jane
M. Ganesh

B. C. Singh
K. Shalpa
Blau

B.Sc. Botany
III Year: Semester-VI
Project / Dissertation Work

Credits – 4

Project work/Dissertation is considered as a special course involving application of knowledge in solving / analyzing /exploring a real life situation / difficult problem. The Project/Dissertation work will be of 4 credits. Studied subject specific project work can be handled, with a view to develop creative thinking, team spirit and skill. The project work at preliminary level should be assigned to students, in groups.

Project report in the form of dissertation is prepared and submitted by the students. It will be evaluated by the External and Internal Examiners. Head of the Department will chair the evaluation panel and proceedings of viva voce. It carries a maximum of 100 marks.

Project guidelines:

1. Understand the subject broadly.
2. Choose a topic of interest.
3. Refer to the books & interact with subject specific experts.
4. Try to understand the basic principles of Living organisms followed by Plants, with the help of Physics, Chemistry and Statistics.
5. Select the topic applicable locally to know the importance of the subject in daily life. Preferably choose, vegetation around the institution, around home, agricultural crops, vegetable markets and nearby relevant industries.
6. Put together, latest technology and methods, basic knowledge on selected theme, Importance / need, locally applicable.
7. Summarize three years knowledge on the subject, go through Skill enhancement course, correlate to real life and choose the project work.
8. Laboratory facilities, books to refer and faculty with research experience are essential to handle Project.
9. Analyze your Data and Draw a Conclusion
10. Communicate the Results
11. Work division among the group members should be followed
12. Maximum number of students in a group should not exceed 5.

Project Examination

Max. Marks: 100

1. Project Report	75 M
3. Seminar Presentation	25 M

Sushama K. Meilkar
M. Ganesha
Dr. ...

(Handwritten signatures and initials)

B. G. ...
Arun

20



DEPARTMENT OF ZOOLOGY
UNIVERSITY COLLEGE OF SCIENCE
OSMANIA UNIVERSITY

No. 310 /Zool/2020

Date: 22.07.2020

To,
The Dean,
Faculty of Science,
Osmania University,
Hyderabad – 07.

Sub: CBCS UG Course – submission of the approved syllabus of II & III year 2019-20 – Reg.

Ref: Your office Lr. No. 2927/DFSc/OU/2020, dt. 10.02.2020.

Sir,

With reference to above cited, I am herewith submitting the syllabus of II & III year B.Sc. Zoology syllabi of the academic year 2019-20 onwards, under CBCS pattern (both hard and softy copy) for your perusal and necessary action.

Thanking you,

Yours Sincerely,

(PROF. S. JITHENDER KUMAR NAIK)
Chairman, Board of Studies in Zoology

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

Encl [As above]



CBCS SYLLABUS FOR 2019-2020
UNDER GRADUATE DEGREE COURSE
DEPARTMENT OF ZOOLOGY
UNIVERSITY COLLEGE OF SCIENCE
OSMANIA UNIVERSITY
HYDERABAD

Department of Zoology (46 credits)

Structured syllabus under CBCS for 2019-20 onwards to under graduate course

I. Discipline core course: (5 credits each) (I, II, III, IV Semester)

1. Animal Diversity – Invertebrates
2. Animal Diversity – Vertebrates
3. Animal Physiology and Animal Behaviour
4. Cell Biology, Genetics, and Developmental Biology

II. Discipline specific Elective: (5 credits each – any one paper in V Semester and VI Semester)

1. Physiological Chemistry and Endocrinology
2. Immunology and Animal Biotechnology
3. Laboratory Animals Maintenance and Applications
4. Fisheries
5. Limnology
6. Ecology, Zoogeography and Evolution

III. Skill enhancement course: (2 credits) 2 paper in III Semester and 2 papers in IV Semester)

1. Sericulture
2. Apiculture
3. Public health and hygiene
4. Medical diagnostics
5. Poultry and Animal husbandry
6. Vermiculture
7. Vector biology
8. Biomaterial from Animal Source
9. Aquaculture
10. Aquarium Fish Keeping

IV. Generic elective (Open stream) – (4 credit only in V Semester)

1. Preventive Medicine
2. Integrated Pest Management

V. Project/optional paper (4 credit only in VI Semester) In case of not opting project

1. Tools and Techniques in Biology


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

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS 2019-20
CURRICULUM FOR ZOOLOGY
IN UNDER GRADUATE DEGREE PROGRAMME
CBCS SYLLABUS SCHEDULE 2019-20
Osmania University

Year	Semester	Paper		Title of the Paper	No. of Credits	Exam Hrs.	Max. Marks		
							I.A	End Exam	Total
I	I	Paper - I	Core-I Theory	Animal Diversity- Invertebrates	4	2	20	80	100
			Core-I Practical	Animal Diversity- Invertebrates	1	2	10	40	50
	II	Paper – II	Core-II Theory	Animal Diversity- Vertebrates	4	2	20	80	100
			Core-II Practical	Animal Diversity- Vertebrates	1	2	10	40	50
II	III	Paper – III	Core-III Theory	Animal Physiology and Animal Behaviour	4	2	20	80	100
			Core-III Practical	Animal Physiology and Animal Behaviour	1	2	10	40	50
			SEC-1	Sericulture / Apiculture	2	2	10	40	50
			SEC-2	Public Health and Hygiene/ Medical Diagnostics	2	2	10	40	50
	IV	Paper - IV	Core-IV Theory	Cell Biology, Genetics, and Developmental Biology	4	2	20	80	100
			Core-IV Practical	Cell Biology, Genetics, and Developmental Biology	1	2	10	40	50
			SEC-3	Poultry and Animal Husbandry/ Vermiculture/ Vector Biology	2	2	10	40	50
			SEC-4	Biomaterials from Animals sources / Aquaculture/ Aquarium Fish Keeping	2	2	10	40	50
III	V	Paper - V	DSE-I Theory	Physiological Chemistry and Endocrinology/ Laboratory Animals Maintenance and Applications / Immunology and Animal Biotechnology	4	2	20	80	100
			DSE -I Practical	Physiological Chemistry and Endocrinology/ Laboratory Animals Maintenance and Applications / Immunology and Animal Biotechnology	1	2	10	40	50
			GE – I Theory	Preventive Medicine / Integrated Pest Management	4	2	20	80	100
	VI	Paper - VI	DSE-II Theory	Fisheries / Limnology / Ecology, Zoogeography and Evolution	4	2	20	80	100
			DSE-II Practical	Fisheries / Limnology / Ecology, Zoogeography and Evolution	1	2	10	40	50
			Project / Tools and Techniques in Biology		4	2	20	80	100
					46	36	260	1040	1300

DSC – Discipline Specific Core; DSE – Discipline Specific Elective; SEC – Skill enhancement Course; GE- Generic Elective (Open streams)

*Practical one credit equal to 3 hours of instruction

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS 2019-20

B.Sc. ZOOLOGY I YEAR
SEMESTER-I
CORE PAPER – I
ANIMAL DIVERSITY – INVERTEBRATES

Instructions: 4 hr per week

No. of period: 60

No. of credits: 4

UNIT – I : (15 Periods)

1.1 Protozoa.

- 1.1.1 General characters and classification of Protozoa upto order levels with examples
- 1.1.2 Type study – *Elphidium*
- 1.1.3 Locomotion and Reproduction in Protozoa.
- 1.1.4 Epidemiology of Protozoan diseases - Amoebiasis; Giardiasis; Leishmaniasis and Malaria.

1.2 Porifera

- 1.2.1. General characters and classification of Porifera upto order levels with examples
- 1.2.2 Type study – *Sycon*
- 1.2.3 Canal system in sponges and Spicules.

UNIT – II: (15 Periods)

2.1. Cnidaria

- 2.1.1 General characters and classification of Cnidaria upto order levels with examples
- 2.1.2 Type study - *Obelia*
- 2.1.3 Polymorphism in Siphonophora
- 2.1.4 Corals and coral reef formation

2.2 Platyhelminthes

- 2.2.1 General characters
- 2.2.2 Classification of Platyhelminthes up to classes with examples
- 2.2.3 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 Coelomoducts 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 Crustacean larvae
- 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

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 I YEAR
ZOOLOGY PRACTICAL SYLLABUS FOR I SEMESTER
CORE PAPER – I
ANIMAL DIVERSITY – INVERTEBRATES

Instructions: 3hr per week

No. of credits: 1

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*, *Chaetopteurs*, *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

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 I YEAR
SEMESTER-II
CORE PAPER – II
ANIMAL DIVERSITY- VERTEBRATES

Instructions: 4 hr per week

No. of period: 60

No. of credits: 4

UNIT – I:

1.1 Hemichordata

(15 Periods)

1.1.1 General characters

1.1.2 Classification of Hemichordata up to classes with examples

1.1.3 *Balanoglossus* - Structure and affinities

1.2. Urochordata, Cephalochordata, Cyclostomata

1.2.1. Salient features of Urochordata

1.2.2. Retrogressive metamorphosis and its significance in Urochordata

1.2.3. Salient features and affinities of Cephalochordata

1.2.4. General characters of Cyclostomata

1.2.5. Comparison of the *Petromyzon* and *Myxine*

1.2.6. General characters and classification of Chordata upto orders with examples.

UNIT – II:

2.1. Pisces

(15 Periods)

2.1.1. General characters of Fishes

2.1.2. Classification of fishes up to order level with examples

2.1.3. *Scoliodon* – Respiratory, Circulatory and Nervous system.

2.1.4. Types of Scales and types of Fins

2.2. Amphibia

2.2.1. General characters of Amphibians

2.2.2. Classification of Amphibians up to orders with examples.

2.2.3. *Rana tigrina* - Respiratory, Circulatory and Nervous system.

2.2.4. Parental care in amphibian; neoteny and paedogenesis.

UNIT – III :

3.1 Reptilia

(15 Periods)

3.1.1. General characters of Reptilia

3.1.2. Classification of Reptilia up to orders with examples

3.1.3. *Calotes* – Respiratory system, Circulatory and Nervous system.

3.1.4. Temporal fosse in reptiles and its evolutionary importance

3.1.5. Distinguished characters of Poisonous and Non poisonous snakes.

3.2. 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 Nervous system.

3.1.4. Migration in Birds

3.1.5. Flight adaptation in Birds

UNIT – IV :

(15 Periods)

4.1. Mammalia

- 4.1.1. General characters of Mammalia
- 4.1.2. Classification of Mammalia up to orders with examples
- 4.1.3. Rabbit –Digestive, Respiratory, Circulatory and Nervous system.
- 4.1.4. Dentition in mammals.
- 4.1.5. Aquatic adaptations in Mammals.

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.

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS 2019-20

B.Sc. ZOOLOGY I YEAR
ZOOLOGY PRACTICAL SYLLABUS FOR II SEMESTER
ZOOLOGY - CORE PAPER - II
ANIMAL DIVERSITY- VERTEBRATES

Instructions: 3hr per week

No. of credits: 1

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

1. **Hemichordata:** *Balanoglossus*, *Tornaria* larva
2. **Protochordata:** *Amphioxus*, *Amphioxus* T.S. through pharynx
3. **Cyclostomata:** *Petromyzon*, *Myxine*, *Ammocoetus* larva
4. **Pisces:** *Sphyrna Pristis*, *Torpedo*, *Channa*, *Pleuronectes*, *Hippocampus*, *Exocoetus*, *Echieneis*, *Labeo*, *Catla*, *Clarius*, *Auguilla*, *Protopterus*, Scales: Placoid, Cycloid, Ctenoid
5. **Amphibia:** *Ichthyophis*, *Amblystoma*, *Siren*, *Hyla*, *Rachophous*, *Bufo*, *Rana*, Axolotal larva
6. **Reptilia :** *Draco*, *Chamaeleon*, *Gecko*, *Uromastix*, *Vipera russelli*, *Naja*, *Bungarus*, *Enhydrina*, *Typhlops*, *Testudo*, *Trionyx*, *Crocodilus*, *Ptyas*.
7. **Aves:** *Archaeopteryx*, *Passer*, *Psittacula*, *Bubo*, *Alcedo*, *Columba*, *Corvus*, *Pavo*; Collection and study of different types of feathers: Quill, Contour, Filoplume, Down
8. **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

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 2019-20

B.Sc. ZOOLOGY II YEAR

SEMESTER-III

CORE PAPER – III: ANIMAL PHYSIOLOGY AND ANIMAL BEHAVIOUR

Instructions: 4 hr per week

No. of period: 60

No. of credits: 4

UNIT – I:

(15 periods)

1.1 Digestion

1.1.1 Enzymes: Definition, classification, inhibition, regulation.

1.1.2 Digestion of carbohydrates, proteins, lipids and cellulose

1.1.3 Absorption, assimilation of digested food

1.1.4 Role of gastrointestinal hormones in digestion

1.2 Excretion

1.2.1 Classification of animals on the basis of excretory products: Ammonotelic, Uricotelic and Ureotelic

1.2.2 Structure and function of nephron

1.2.3 Urine formation counter current mechanism

1.3 Osmoregulation

1.3.1 Water and ionic regulation by fresh water

1.3.2 Brackish water and marine water animals

UNIT – II:

(15 periods)

2.1 Homeostasis

2.1.1 Concept of homeostasis

2.1.2 Mechanism of homeostasis

2.2 Respiration

2.2.1 Definition of respiration, respiratory mechanism, external, internal and cellular Respiration

2.2.2 Respiratory pigments, transport of oxygen, oxygen dissociation curves, Bohr's effect, transport of carbon dioxide, chloride shift

2.2.3 Regulation of respiration: nervous and chemical mechanism

2.3 Circulation

2.3.1 Types of circulation: open and closed: Structure of mammalian heart

2.3.2 Types of hearts: neurogenic and myogenic

2.3.3 Heart functions, conduction and regulation of heartbeat, regulation of heart rate

2.3.4 Tachycardia, bradycardia: blood clotting mechanism

UNIT – III:

(15 periods)

3.1 Muscle contraction

3.1.1 Types of muscles

3.1.2 Ultrastructure of skeletal muscle fibre

3.1.3 Sliding filament theory of muscle contraction mechanism and energetics

3.1.4 Twitch tetanus summation, Treppe fatigue

3.2 Nerves

3.2.1 Structure of neuron

3.2.2 Resting potential, threshold potential, action potential, conduction of nerve impulse

3.2.3 Transmission of nerve impulse

3.2.4 Synapse, synaptic transmission neurotransmitters EPSP, IPSP

3.3 Endocrine systems

- 3.3.1 Endocrine glands- Structure, secretion, function 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 human beings

UNIT – IV:

(15 periods)

4.1 Animal behaviour

- 4.1.1 Types of behaviour and acquired instinctive behaviour
- 4.1.2 Behaviour taxes, reflexes tropisms

4.2 Learning and memory

- 4.2.1 Types of learning, trial and error learning imprinting, habituation,
- 4.2.2 **Conditioning:** classical conditioning, instrumental conditioning, examples of conditioning, Pavlov's experiment

4.3 Social behaviour and communication:

- 4.3.1 Colonial existence of bees and termites, pheromones

4.4 Biological rhythms

- 4.4.1 Biological clocks, circadian rhythms, circumlunar rhythms, circannual rhythms

Suggested readings

1. **Gerard J. Tortora and Sandra Reynolds Garbowski** *Principles of Anatomy and Physiology*, Tenth Ed., John Wiley & Sons
2. **Arthur C. Guyton MD**, *A Text Book of Medical Physiology*, Eleventh ed., John E. Hall, Harcourt Asia Ltd.
3. **William F. Ganong**, *A Review of Medical Physiology*, 22 ed, McGraw Hill, 2005
4. **Sherwood, Klandrof, Yanc**, *Animal Physiology*, Thompson Brooks/Coole, 2005.
5. **Sherwood, Klandrof, Yanc**, *Human Physiology*, Thompson Brooks/Coole, 2005.
6. **Knut Schmidt-Nielson**, *Animal Physiology*, 5th ed, Cambridge Low Price Edition.
7. **Roger Eckert and Randal**, *Animal Physiology*, 4th ed, Freeman Co, New York.
8. **Singh. H.R**, *Text Book of Animal Physiology and Biochemistry*
9. **Nagabhushanam**, *Comparative Animal Physiology*
10. **Veer Bal Rastogi**, *Text Book of Animal Physiology*

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS 2019-20

**B.Sc. ZOOLOGY PRACTICAL SYLLABUS
SEMESTER-III**

CORE PAPER – III: ANIMAL PHYSIOLOGY AND ANIMAL BEHAVIOUR

Instructions: 3hr per week

No. of credits: 1

1. Qualitative test of identification of carbohydrates, proteins and lipids.
 2. Qualitative test of identification of ammonia, urea, uric acid (nitrogenous excretory products).
 3. Zonation of gut in cockroaches.
 4. Effect of pH and temperature on salivary amylase activity.
 5. Study of permanent histological sections of mammalian endocrine glands: pituitary, thyroid, pancreas, adrenal glands.
 6. Estimation of haemoglobin by Sahil's method.
 7. Estimation of blood clotting time.
 8. Estimation of total protein by Biuret's method.
 9. Estimation of unit metabolism of fish.
- Laboratory record work shall be submitted at the time of practical examinations.
 - Computer – aided techniques shall be adopted as per UGC guidelines.

B.Sc. ZOOLOGY II Year
SEMESTER- III
PAPER-III (SEC – I): SERICULTURE

Instructions: 2hr per week

No. of period: 30

No. of credits: 2

UNIT- I:

(15 Periods)

- 1.1 History and economic importance of sericulture – types of silkworm – Mulberry and non-Mulberry (Tassar, Eri and Muga).
- 1.2 Systematic position of Bombyx and Life Cycle - Morphology of silk gland.
- 1.3 Horticulture – mulberry cultivation – Environmental conditions for mulberry cultivation – soil, climatic factors, preparation of land.
- 1.4 Intercultivation – pruning methods – harvesting
- 1.5 Diseases and pests of mulberry and control methods.

UNIT- II:

(15 Periods)

- 2.1 Silkworm rearing – general principles of silkworm rearing – primary requisite for successful rearing.
- 2.2 Feeding of silkworm, bed cleaning, sparing, moulting, late age silkworms – Moulting and harvesting economics of silkworm.
- 2.3 Diseases and pests of silkworm.
- 2.4 Reeling –reeling appliances and process of reeling cocoons.
- 2.5 Sericulture as cottage industry.

References:

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

B.Sc. ZOOLOGY II Year
SEMESTER- III
PAPER-III (SEC – I): SERICULTURE

Instructions: 2hr per week

No. of period: 30

No. of credits: 2

UNIT- I:

(15 Periods)

- 1.1 History and economic importance of sericulture – types of silkworm – Mulberry and non-Mulberry (Tassar, Eri and Muga).
- 1.2 Systematic position of Bombyx and Life Cycle - Morphology of silk gland.
- 1.3 Horticulture – mulberry cultivation – Environmental conditions for mulberry cultivation – soil, climatic factors, preparation of land.
- 1.4 Intercultivation – pruning methods – harvesting
- 1.5 Diseases and pests of mulberry and control methods.

UNIT- II:

(15 Periods)

- 2.1 Silkworm rearing – general principles of silkworm rearing – primary requisite for successful rearing.
- 2.2 Feeding of silkworm, bed cleaning, sparing, moulting, late age silkworms – Moulting and harvesting economics of silkworm.
- 2.3 Diseases and pests of silkworm.
- 2.4 Reeling –reeling appliances and process of reeling cocoons.
- 2.5 Sericulture as cottage industry.

References:

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

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS 2019-20

**B.Sc. ZOOLOGY II YEAR
SEMESTER- III
PAPER-III (SEC – I): APICULTURE**

Instructions: 2hr per week

No. of period: 30

No. of credits: 2

UNIT-I: (15 Periods)

- 1.1 History, classification and present status of apiculture industry in India
- 1.2 Biology of honey bees and bee economy
- 1.3 Social organization of bee colony
- 1.4 Selection of bee species for apiculture
- 1.5 Bee rearing method: artificial Bee rearing (Apiary), Bee hives

UNIT-II: (15 Periods)

- 2.1 Products of apiculture industry and its use – honey; Bees wax; propalic
- 2.2 Methods of extraction of honey – indigenous and modern
- 2.3 Bee keeping equipment
- 2.4 Colony inspection and maintenance of the equipment
- 2.5 Bee diseases and enemies; control and preventive method

Suggested Reading:

1. Textbook of Applied Zoology, Telugu Academy.
2. Apiculture by Prost P.J. Oxford aro IBH, New Delhi
3. Apiculture by Bisht, ICAR publication

B.Sc. ZOOLOGY II YEAR
SEMESTER - III
PAPER-III (SEC – II): PUBLIC HEALTH AND HYGIENE

Instructions: 2hr per week

No. of period: 30

No. of credits: 2

UNIT – I: Nutrition, Environment and Health (15 Periods)

- 1.1 Classification of foods - Carbohydrates, proteins, lipids, vitamins and minerals
- 1.2 Nutritional deficiencies and disorders- Carbohydrates, proteins, lipids, vitamins and minerals.
- 1.3 Environment and health Impact assessment: concept, steps and applications.
- 1.4 Occupational, Industrial, agricultural and urban Health-Exposure at work place, urban areas, health disorders and diseases.
- 1.5 Environmental pollution and associated Health hazards

UNIT-II: Communicable and Non-Communicable diseases (15 Periods)

- 2.1 Causes, Symptoms, Diagnosis, Treatment and Prevention of Communicable diseases - Malaria, Filariasis, 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.
- 2.3 Water borne diseases: Cholera, E. coli, Hepatitis and Polio; Air borne diseases: Chickenpox, Influenza, Measles and Tuberculosis
- 2.4 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. First Aid and Health awareness, personal health care record maintenance.
- 2.5 WHO Programmes – Government and Voluntary Organizations and their health services

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 II YEAR
SEMESTER - III
PAPER-III (SEC – II): MEDICAL DIAGNOSTICS

Instructions: 2hr per week

No. of period: 30

No. of credits: 2

UNIT-I:

(15 Periods)

- 1.1 Introduction to medical diagnostic and its importance
- 1.2 Diagnostic methods used for analysis of Blood composition smear preparation. Differential leucocytes count (DLC). Cell counting-RBC, WBC platelet, ESR(Erythrocyte sedimentation Rate), PVC(Packed cell volume) Haemoglobin estimation, Bleeding clotting time. Blood grouping and Rh typing.
- 1.3 Bone marrow study, Haemopoiesis, Blood coagulation and anticoagulants, Blood banking blood transfusion.
- 1.4 Clinical biochemistry – blood glucose, serum protein, LFT(Liver Function Test) Lipid profile LDL, VDL, HDL, cholesterol, creatine kinase, LDH, SGPT, SGOT, Amylase, Bile pigments.
- 1.5 Histopathological techniques, Autopsy and Biopsy, FNAC technique

UNIT-II:

(15 Periods)

- 2.1 Urine analysis Physical chemical, microscopic dialysis analysis of body fluids (CSF Synovial fluid, pleural, pericardial, peritoneal Fluids). Sputum and faecal matter for infection.
- 2.2 Clinical diagnosis of diseases – bacterial (Tuberculosis and Typhoid) antibiotic sensitivity test, viral- hepatitis, AIDS, Polio, Protozoan Malaria, Amoebiasis, Helminthes- Ascaris, Taenia solium, Wucheria
- 2.3 Clinical diagnosis of non infection diseases – Diabetes, Hypertension, Asthama, Stroke, Arthritis, Heart attack, Cancer –benign, Malignant metastasis
- 2.4 Concept of Edema, Hyperaemia, Haemorrhage, Hemostasis, Thrombosis, Cellular responses – Hyperplasia, Hypertrapy, Metaplasia, Atrophy Necrosis, Apoptosis
- 2.5 Medical Imaging – X-ray, PET(Positron emission tomography), MRI (Magnetic Resonance Imaging), CT Scan ECG, EEG, Echo tests.

Suggested Readings:

1. Cheesebrough M., A Laboratory Manual for Rural Tropical Hospitals, A basis for training course.
2. Kania Mukherjee, Medical Laboratory Techniques Vol-I, II, III, . Tata MC Graw Hill Publishing company
3. Dr. K. N. Sachdev, Jaypee Brothers, (1988) Clinical Pathology and bacterial and medical publisher.
4. Ramnik Sood, Medical laboratory Techniques – Jaypee Brothers.
5. Prakash, G. Lab Manual on Blood Analysis and Medical Diagnostics, S. Chand and Co. Ltd.
6. Robbins and Cotran, Pathology-I Basis of Disease, VIII Edition, Saunders.
7. Guyton A.C. and Hall J. E textbook of Medical Physiology, saunders.
8. Park, K. Preventive and social medicine, B. B. Publishers.

B.Sc. ZOOLOGY II YEAR
SEMESTER - IV
CORE PAPER – IV:
CELL BIOLOGY, GENETICS & DEVELOPMENTAL BIOLOGY

Instructions: 4hr per week

No. of period: 60

No. of credits: 4

UNIT – I: (15 Periods)

1. Cell Biology

- 1.1. Ultrastructure of animal cell
- 1.2. Structure and functions of plasma membrane proteins.
- 1.3. Structure and functions of cell organelles –Endoplasmic reticulum, Golgi body, Ribosomes, Lysosomes, centrosomes, Mitochondria and Nucleus
- 1.4. Chromosomes – Structure, types, giant chromosomes
- 1.5. Cell Division - Mitosis, Meiosis; Cell cycle and its regulation.

UNIT – II: (15 Periods)

2. Molecular Biology

- 2.1 DNA (Deoxyribo Nucleic Acid) – Structure and RNA (Ribo Nucleic Acid) - Structure, types
- 2.2 DNA Replication
- 2.3 Protein Synthesis – Transcription and Translation
- 2.4 Gene Expression – Genetic Code; operon concept
- 2.5 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; Gene mutations- Induced versus Spontaneous mutations.
- 3.5 Inborn errors of metabolism.

UNIT – IV: (15 Periods)

4. Developmental Biology and Embryology

- 4.1 Gametogenesis (Spermatogenesis and Oogenesis) Fertilization; Types of eggs; Types of cleavages
- 4.2 Development of Frog up to formation of primary germ layers
- 4.3 Formation of Foetal membrane in chick embryo and their functions
- 4.4 Types and functions of Placenta in mammals
- 4.5 Regeneration in Turbellaria and Lizards

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.

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS 2019-20

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. **Gupta P.K., 'Genetics'**
8. Developmental Biology by **Beryl**
9. Developmental Biology **S. Gilbert**
10. Developmental Biology - patterns, problems and principles by **W. Saunders Jr.**

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS 2019-20

**B.Sc. ZOOLOGY II YEAR PRACTICAL SYLLABUS
SEMESTER - IV
CORE PAPER – IV
CELL BIOLOGY, GENETICS & DEVELOPMENTAL BIOLOGY**

Instructions: 3hr per week

No. of credits: 1

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. 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 **"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

1. Manual of laboratory experiments in cell biology Edward, G.
2. **Freeman & Bracegirdle**, An atlas of embryology

B.Sc. ZOOLOGY II YEAR
SEMESTER- IV
PAPER-IV(SEC-3): POULTRY AND ANIMAL HUSBANDRY

Instructions: 2hr per week

No. of period: 30

No. of credits: 2

UNIT -I: Poultry

(15 Periods)

- 1.1 Poultry – present status and future prospects
- 1.2 Methods of Housing – Housing of chicks in floor and cages, Housing growers in cages and floor, Housing of layers on floor and cages, slatted floor
- 1.3 Importance of nutrition in poultry production – Classification of food stuffs and their categorization into energy feeds, protein feeds, minerals and vitamins
- 1.4 Common diseases of poultry and their causative agents, symptoms and treatment
 - (i) Viral diseases – Ranikhet disease, Fowl pox, EDS-76 (Egg Drop Syndrome), infection of bursal disease (gumbolo disease)
 - (ii) Bacterial diseases – Coli bacillosis, Salmonellosis
 - (iii) Fungal diseases – Aspergillosis
 - (iv) Parasitic diseases – Tapeworm, Coccidiosis
- 1.5 Vaccination procedures for broilers, broiler breeders, commercial layers, turkey, duck breeders and commercial ducklings.

UNIT-II: Animal Husbandry

(15 Periods)

- 2.1 Introduction to dairy farming in India and its present and future prospects
- 2.2 Dairy farm- Water supply, Light, Ventilation, Drainage system, Maintenance of recycling of waster and hygienic conditions of farm
- 2.3 Study of general management practices of animals: Grooming, Drying off, control of bad habits, castration, deworming, trimming
- 2.4 Cattle and Buffalo management – Calf raising, management of pregnant, parturient, lactating and dry cows, buffalos and breeding bull, summer management of buffalo
- 2.5 Sheep and Goat management – Management of Lambs and kids, Management of pregnant, parturient and lactating doe, General management practices of pigs

Suggested Readings:

1. Poultry Science and practice – Nilotpal Ghosh, CBS publisher
2. Poultry production and Management - Jagadeesh Prasad, Kalyani publisher
3. A text book of Animal husbandry – C. C. Banjer Joe, IBH publishing
4. A text book of Animal husbandry – S. K. Kaushish, Kalyani publisher

B.Sc. ZOOLOGY II YEAR
SEMESTER- IV
PAPER-IV(SEC-3): VERMICULTURE

Instructions: 2hr per week

No. of period: 30

No. of credits: 2

UNIT-I:

(15 Periods)

- 1.1 Scope of vermi technology- Vermiculture and vermi composting – difference between vermiculture and vermi composting –
- 1.2 Earthworm diversity – Ecological groups of earthworms, biology of composting earthworms – *Eoisena foeitida*, *Eudrilus lugeniae*.
- 1.3 Soil – Physical, chemical and biological features
- 1.4 Organic waste sources – problems in traditional composting, vermi composting
- 1.5 Types small and large scale pit method, heap method.

UNIT-II:

(15 Periods)

- 2.1. Vermiculture techniques – vermi culture process – site selection - Selection and collection of species mono and poly culture
- 2.2. Essential parameters for vermi culture – bedding. Methods of harvesting worms general manual methods, self harvesting method, mechanical method
- 2.3. Nutritive value of vermi compost, storing and packing of compost
- 2.4. Applications of vermi composting in agricultural and horticultural practices
- 2.5. Economic of vermi culture, nationalized bank, NABARD support for vermi culture.

References:

1. Earthworm ecology by LEE
2. Biology of earthworm by Steven son
3. Vermicomposting tech – soil health to human health by Ranganathan L.S.

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS 2019-20

**B.Sc. ZOOLOGY III YEAR
SEMESTER - VI
PAPER – VI (SEC-III): VECTOR BIOLOGY**

Instructions: 2hr per week

No. of period: 30

No. of credits: 2

Unit-I: Vector Biology of Public Health Importance (15 Periods)

- 1.1 Introduction to vectors and vectors of human diseases – Public health nuisance.
- 1.2 Salient features and Life cycle of important Mosquito vector species – Anopheles, Aedes, Culex and Mansonia.
- 1.3 Salient features and life cycle of important other Dipteran vectors of public health Importance: Sandflies, Black flies, House flies and Myiasis causing flies.
- 1.4 Life cycle and public health importance of
-Fleas and lice
- 1.5 Life cycle and public health importance of
-Ticks and Mites.

Unit – II: Basic sanitation and Public Health (15 Periods)

- 2.1 Basic sanitation – Hygiene and personal protection – Human wastes and Health – Solid waste and Waste water management.
- 2.2 Distinguishing characters of different species of human malarial parasites Life cycle and host Parasite interactions.
- 2.3 Distinguishing characters of different species of human Filarial parasites Life cycle and host parasite interactions.
- 2.4 Distinguishing characters of different arboviral diseases and their mode of transmission.
- 2.5 Control Measures – Source reduction.

B.Sc. ZOOLOGY II YEAR
SEMESTER- IV
PAPER-IV(SEC-4:) BIOMATERIALS FROM ANIMALS SOURCES

Instructions: 2hr per week

No. of period: 30

No. of credits: 2

UNIT-I: Biomaterials Introduction (15 Periods)

- 1.1 Introduction classification, Chemistry and characterization to biomaterial, biocompatibility with medical devices
- 1.2 Types of biomaterials degradable and reabsorbable materials, hydro gels and natural materials
- 1.3 Metallic biomaterial , ceramic biomaterials, composite for biomedical applications
- 1.4 Biomaterials and its applications – muscular skeletal systems
- 1.5 Delivery of drugs: for tissue engineering and regenerative medicine

UNIT-II: Biomaterials and their applications (15 Periods)

- 2.1 Collagen Definition, Types of Collagen, Structure of Collagen, Collagen Sources from Animal Origin Such as Bovine, Porcine, Marine and Fishes; Applications in Pharmaceutical, Tissue Engineering and Biomedical Industries.
- 2.2 Introduction to silk biomaterials: Silk fibroin and silk sericin proteins, molecular structure. Properties of silk fibroin: mechanical strength and biocompatibility. Spider dragline silk structure and properties, production from glands, spinning mechanism, Chemical Composition and Applications.
- 2.3 Structural Properties, Isolation and Processing Methods, Conversion of Chitin to Chitosan, Chemical and Biological properties; Bio Medical Applications.
- 2.4 Physico Chemical Properties, Structure, Synthesis Methods, Mechanism of Action, Physiological Function, Wound and Skin Repairs, Receptors of Hyaluronic Acid and Biomedical Applications
- 2.5 Introduction, elastin- structure, properties, Production from Various Sources, Biological Function and Biomedical Applications

Suggested Readings:

1. Biomaterial science: An introduction to materials in medicine, Buddy D. Ratner, et. al., Elsevier academic press 3rd edition.
2. Biomaterial compositor by Luigi Ambroio 210 CRC press
3. Styata V. Bhat, Biomaterial 2nd edition, Naros Publishing House, New Delhi
4. Biological Materials Science, Biological Materials, Bioinspired Materials, and Biomaterials; Marc André Meyers, Po-Yu Chen.
5. Biomaterials, Medical Devices, and Combination Products; Biocompatibility Testing and Safety Assessment; Shayne Cox Gad, Samantha Gad-McDonald.
6. Biologically Responsive Biomaterials for Tissue Engineering. Iulian Antoniac.

B.Sc. ZOOLOGY II YEAR
SEMESTER – IV
PAPER-IV(SEC-4) – AQUACULTURE

Instructions: 2hr per week

No. of period: 30

No. of credits: 2

UNIT-I: Aquaculture systems

(15 Periods)

- 1.1 Concept of aquaculture. Culture systems: Freshwater culture: Prawn and fish culture in paddy fields; Brackish water culture; Mariculture: Culture of Oyster, Crab, Lobster, Mussel, Eels, aquatic weeds.
- 1.2 Definition and patterns of Composite fish culture in India. Techniques of composite culture. Culture of Catfishes and miscellaneous fishes.
- 1.3 Preparation and management of fish culture ponds: Nursery, Rearing, and Stocking ponds. Predatory and Weed fishes and their control using fish toxicants. Aquatic insects and their control.
- 1.4 Fertilization. Fish food organisms and their production. Supplementary feeding.
- 1.5 Transport of fish seed and Brood fish. Causes of mortality in transport. Methods for packaging and transport- Open and Closed systems. Use of chemicals, anesthetic drugs, antiseptics and antibiotics in live fish transport.

UNIT-II: Fish pathology and Technologies in Fisheries development

(15 Periods)

- 2.1 Parasitic and Non-parasitic diseases; Fungal infections, Protozoan diseases, Worm diseases.
- 2.2 Fish breeding: Natural and artificial. Harvesting: Fishing techniques, preservation and processing of fish.
- 2.3 Fresh water prawn culture - Introduction. Breeding characteristics. Juvenile prawn migration. Seasonal & regional distribution of seeds. Identification of juveniles. Controlled breeding. Culture: Monoculture and Mixed culture in ponds. Role of hard water in culture of *Macrobrachium* species. Fertilization and feeds.
- 2.4 Pearl culture: Introduction, Pearl producing mollusks, pearl formation, collection and rearing of oysters, insertion of nucleus, harvesting, composition and quality of pearl.
- 2.5 Recirculation technology, Geographic Information System (GIS) technology, use of Information and Communication Technology (ICT) in fishes: production aspects, marketing aspects.

References:

1. Jingran, V.G. (1983). Fish and fisheries of India, Hindustan pub. Corp., New Delhi.
2. Hute, M. and Kahn, H. (2000). Textbook of fish culture, Blackwell Scientific Publication, Australia.
3. Srinivasulu, M., Reddy, K.R.S. Rao, S. (1999). Text book of Aquaculture, Discovery Publishing House, New Delhi.
4. Yawn Mehta, Fisheries & Aquaculture Biotechnology (2011). Campus Books International, Prahalad street, Ansari Road, Durga Ganj, New Delhi.

B.Sc. ZOOLOGY II YEAR
SEMESTER – IV
PAPER-IV(SEC-4) – AQUARIUM FISH KEEPING

Instructions: 2hr per week

No. of period: 30

No. of credits: 2

UNIT- I: Designing and preparation of aquaria with all accessories (15 Periods)

- 1.1 Importance, history and scope of aquarium fish keeping as a Cottage Industry.
- 1.2 Aquarium fabrication- shape, size, volume, type of glass tank, cutting of glass, preparation of glass tank, strengthening and supporting of tank; aquarium floor setting- type and size of pebbles, gravels, granites used for bed setting and its advantages.
- 1.3 Filters-biological, chemical and mechanical. Aquarium accessories like aerators, decorative, lighting, heating and feeding trays.
- 1.4 Water quality management in aquarium systems-sources of water, temperature, pH, dissolved oxygen, carbon dioxide, ammonia, hardness, turbidity.
- 1.5 Aquarium plants: Uses of different varieties of submerged plants (tubers, rooted plants) and emerged plants.

UNIT- II: Biology, food & feeding and control of diseases of aquarium fishes (15 Periods)

- 2.1 Common characters and sexual dimorphism of common freshwater and marine exotic and indigenous species of aquarium fishes: Guppy, Molly, Sword tail, Gold fish, Angel fish, Blue morph, Anemone fish and Butterfly fish.
- 2.2 Food and feeding Use of live fish feed organisms (Artemia, Infusoria, Spirulina). Preparation and composition of formulated fish feed.
- 2.3 Brood stock management: Maintenance of breeding conditions- pH, temperature and sex ratio; Selective breeding and hybridization techniques, induced breeding, colour enhancement techniques.
- 2.4 Common diseases of aquarium fishes – their causative agents viz., virus, bacteria, fungi, protozoa and nematodes; symptoms, treatment and prophylactic measures.
- 2.5 Budget for setting up an Aquarium Fish Farm as a Cottage Industry.

References:

1. Hansen, J. (1979). Making your own aquarium. Bell and Hyman Ltd., London.
2. Axelord, H.R. (1967). Breeding aquarium fishes, T F H Publications.
3. Lovell, T. (1998). Nutrition and feeding of fish. Second Ed. Kluwer Academic publishers.
4. Mills, D. and Vevers, G. (1982). The Practical encyclopedia of fresh water, Tropical Aquarium fishes, Salamander Books Limited, London.
5. Brunner, G. (1973). Aquarium plants, T F H Publications Inc. Ltd., Hongkong.
6. Mills, D. (1981). Aquarium Fishes, Arco publishing.
7. Gahlawat, S.K., et. al. (2007). Manual of experimental Ichthyology, Daya publishing House, Delhi.
8. Talwar, P.K., and Jhingran, A.G. (1991). Inland fishes. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

B.Sc. ZOOLOGY III YEAR

SEMESTER – V

PAPER-V (DSE – I): PHYSIOLOGICAL CHEMISTRY AND ENDOCRINOLOGY

Instructions: 4hr per week

No. of period: 60

No. of credits: 4

UNIT-I: Biomolecules of Importance (15 Periods)

- 1.1 Types of biomolecules –Carbohydrates,Proteins ,Lipids,Nucleic acids and their significance in biological systems.
- 1.2 Classification of protein; Function of proteins based on their chemical nature
- 1.3 Protein metabolism: Transamination, deamination, urea cycle
- 1.4 Classification and function of carbohydrates
- 1.5 Carbohydrate metabolism: Glycolysis, Kreb's cycle, electron transport and oxidative phosphorylation

UNIT-II: Lipids and enzyme Classification (15 Periods)

- 2.1 Lipids: nomenclature and classification of lipids
- 2.2 Fatty acid synthesis and beta oxidation of lipids
- 2.3 Cholesterol synthesis and metabolism of steroidal hormones
- 2.4 Enzyme definition, nomenclature, classification and Enzyme kinetics, Lineweaver-Burk plot
- 2.5 Mechanism of enzymes: Action, enzyme inhibition, coenzymes

UNIT - III: Introduction to Endocrinology (15 Periods)

- 3.1 Concept and Scope of endocrinology; Hormones as chemical messengers.
- 3.2 Classification of hormones
- 3.3 Mechanism of action of aminoacid derivatives, peptide hormones and steroid hormones.
- 3.4 Positive feedback mechanism and Negative feedback control
- 3.5 Concept of internal environment and homeostasis.

UNIT - IV: Endocrine Glands and their Hormones (15 Periods)

- 4.1 Hypothalamus and its Hormones.
- 4.2 Structure, hormones and functions of Pituitary gland.
- 4.3 Structure, hormones and functions of Thyroid, Parathyroid, thymus
- 4.4 Structure, hormones and functions of Adrenal, Pancreas, Pineal,
- 4.5 Hormones and reproduction

REFERENCE BOOKS:

1. Text book of biochemistry
2. Text book of biochemistry
3. Text book of physiology and biochemistry
4. Text book of biochemistry
5. Molecular cell biology
6. Comparative Endocrinology of Invertebrates by Highman and Hill.
7. Comparative Vertebrate Endocrinology by P.J.Bentley, Cambridge Univ. Press
8. Text Book of Endocrinology by Turner and Bangnara (W.B.Sanders)
9. Essential Endocrinology by Joen Laycock and Peter Loise Oxford Univ. Press.
10. Text Book of Endocrinology by R.H.Williams (W.B.Saunders).

B.Sc. ZOOLOGY III Year PRACTICAL SYLLABUS
SEMESTER – V
PAPER-V (DSE – I): PHYSIOLOGICAL CHEMISTRY AND ENDOCRINOLOGY

Instructions: 3hr per week

No. of credits: 1

1. Identification of carbohydrates –Molisch test,Benedict's/Fehling's test,Iodine test,Barfoed's test.
 2. Identification of proteins-Biuret test,Sodium hydroxide test
 3. Identification of amino acids-Xanthoproteic test,Nin-hydrin test,Millon's test.
 4. Identification of lipids-Sudan-IV test.
 5. Histology of Endocrine glands, Pituitary, Thyroid, Parathyroid, Thymus, Adrenal Pancreas, Ovary & Testis, Uterus.
 6. Effect of Eye Stalk ablation on Blood Glucose levels in Crabs.
 7. Identification of Gonadotrophin in Human urine samples.
 8. Effect of Thyrosine and thiourea (antithyroid agent) on oxygen consumption in fish.
- Laboratory record work shall be submitted at the time of practical examinations
 - Computer-aided techniques shall be adopted as per UGC guidelines

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS 2019-20

B.Sc. III Year

SEMESTER-V,

Paper – V (DSE – I): LABORATORY ANIMALS MAINTENANCE AND APPLICATIONS

Instructions: 4hr per week

No. of period: 60

No. of credits: 4

UNIT I: Introduction to Laboratory Animals & Animal Care (15 Periods)

- 1.1 Laboratory Animals – Introduction; Species of Laboratory Animals; Laboratory Animals for Research; Genetically Modified Laboratory Animals
- 1.2 Animal Experimentations – Implications; Principles, Laboratory Animals and Models of Human Diseases, Results of Animal Experimentations
- 1.3 Animal Care – Animal Ethics; ethical theories – Virtue ethics, Humean Theory, Utilitarian Theory, Capabilities Theory, Persons Theory
- 1.4 Animal Care – Regulations and Policies; Prevention of Cruelty to Animal Act, 1960; Breeding of and Experiments on Animals (Control and Supervision) Rules, 2006
- 1.5 Animal Care – CPCSEA, Standard Operating Procedures (SOP) for IAEC; CPCSEA Guidelines for Laboratory Animal Facility

UNIT II: Maintenance, Quality Control & Welfare of Laboratory Animals (15 Periods)

- 2.1 Environment and Facilities of Laboratory Animals for Terrestrial Animals and Aquatic Animals
- 2.2 Nutrition and Animal Experimentation – Nutrients, energy, nutritional needs, animal feeds
- 2.3 Genetic Standardization of Laboratory Animals – Animal Breeding System; Inbred strains; Strains Made from Multiple Inbred Strains; F1 Hybrids, Outbred Strains and Closed Colonies; Genetic Quality Control
- 2.4 Microbiological Standardization of Laboratory Animals – Reasons, causes, zoonosis; Contamination sources and routes of transmission
- 2.5 Concept of Animal Welfare – Origin and Connotation; Concept of Stress, Pain, and Distress in Laboratory Animals; Humane End Points of Animal Experiments

UNIT III: Management & Husbandry of Laboratory Animals (15 Periods)

- 3.1 Management of Laboratory Animals – Introduction, Laboratory Animal Welfare and controversy of animal experimentation
- 3.2 Alternative Methods of Animal Experimentation - 3Rs Theory; Protocol of animal experimentation
- 3.3 Laboratory Management and Husbandry – Mice: general biological characteristics including anatomy and physiology; sexual differentiation, health features, cages and housing; husbandry and recording
- 3.4 Laboratory Management and Husbandry - Rats: general biological characteristics including anatomy and physiology; sexual differentiation, health features, cages and housing; husbandry and recording
- 3.5 Laboratory Management and Husbandry – Fishes; general biological characteristics including anatomy and physiology; health features, water system, water management, feeding

UNIT IV: Applications of Laboratory Animals (15 Periods)

- 4.1 Animal Models – Need, Classification and Selection of animal models
- 4.2 Animal Models – Types: Induced AM, Spontaneous AM, and Genetically Modified AM
- 4.3 Applications in biomedical research – systemic diseases, transplantation studies, studies on embryogenesis and developmental biology
- 4.4 Applications in behavioural research – neurological responses, behavioural changes, brain function, acclimatization studies
- 4.5 Applications in toxicology and drug research – safety testing of pesticides, medications, food additives; cosmetic testing; drug testing: metabolic tests, toxicology tests

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS 2019-20

B.Sc. III Year PRACTICAL SYLLABUS

SEMESTER-V, DSE – I

Paper – V

LABORATORY ANIMALS MAINTENANCE AND APPLICATIONS

Instructions: 3hr per week

No. of credits: 1

1. Mounting zooplanktons for microscopic viewing
2. Demonstration of microscopic drawings of zooplanktons
3. SDH or LDH activity using colorimeter
4. Demonstration of ELISA using kit
5. Measurements of soil characteristics – temperature, pH, humus content and moisture content
6. Measurement of physico-chemical parameters of water – temperature, pH, oxygen levels, alkalinity
7. Exercise on data collection, tabulation and preparation of graphs
8. Calculation of averages (mean, median, mode) and standard deviation
9. Calculation of difference in means using Student's t Test

- **Laboratory record work shall be submitted at the time of Practical Examination.**
- **Computer-aided teaching material too can be used for these experiments as per UGC guidelines**

B.Sc. ZOOLOGY III YEAR
SEMESTER-V

PAPER – V(DSE – I): IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY

Instructions: 4hr per week

No. of period: 60

No. of credits: 4

UNIT-I: Basics of Immune system (15 Periods)

- 1.1 Cells of the immune system and the lymphoid organs(Primary and secondary).
- 1.2 First line of defenses-physical and chemical barriers; second line of defenses- inflammation and phagocytosis.
- 1.3 Types of immunity-Inherent(Active and passive) and acquired immunity(Active and passive) Humoral and cell mediated immunity
- 1.4 Major histocompatibility complex (MHC)–structure and function of class I and class II proteins.
- 1.5 Significance of MHC in organ transplantation.MHC restriction

UNIT-II: Antibodies and Antigens and Immune system diseases (15 Periods)

- 2.1 Antibodies/immunoglobulins- structure, functions and classification, antibody diversity, Monoclonal antibodies and applications.
- 2.2 Antigens structure, antigenic determinants/epitopes, haptens, adjuvants and antigenicity.
- 2.3 Antigen-antibody reactions-agglutination, precipitation, opsonization, cytotoxicity
- 2.4 Hypersensitivity reactions
- 2.5 Autoimmunity and Immunodeficiency diseases.

UNIT – III: Animal Biotechnology and Genetically modified organisms (15 Periods)

- 3.1 Concept and Scope of Animal Biotechnology.
- 3.2 Recombinant DNA technology and its applications.
- 3.3 Cloning vectors - Plasmids, Cosmids and shuttle vectors; Cloning methods (Cell, Animal and Gene cloning).
- 3.4 Transgenesis – Methods of Transgenesis.
- 3.5 Production of Transgenic animals - sheep and fish.

UNIT –IV: Applications of Biotechnology (15 Periods)

- 4.1 In vitro fertilization and embryo transfer.
- 4.2 Hybridoma technology – concepts and applications.
- 4.3 Stem cells –types and their applications.
- 4.4 Biopesticides; *Bacillus thuringiensis* – mode of action of toxin.
- 4.5 Animal Bioreactors – concepts and applications.

Reference Books:

1. Text book of immunology-Ivan Riott
2. Text book of immunology-C.V.Rao
3. Text book of immunology-Nandini shetty
4. Text book of immunology-Kubey
5. Culture of Animal cells. R. Ian Freshney, Wiley Liss.
6. Biotechnology – S. Mitra.
7. Animal Cell culture – Practical Approach – Ed. John R W Masters, Oxford.
8. Biotechnology – B. D. Singh

B.Sc. ZOOLOGY III YEAR PRACTICAL SYLLABUS
SEMESTER-V
PAPER – V(DSE – I): IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY

Instructions: 3hr per week

No. of credits: 1

I. Immunology

1. Demonstration of agglutination(ABO-blood grouping/Widal test) using kit
2. Demonstration of precipitation(VDRL/RPR test)using kit
3. Radial immunodiffusion using kit.
4. Histology of lymphoid organs-Spleen, Thymus, Lymphnode, Bone marrow.

II. Animal Biotechnology

1. Study the following techniques through photographs / virtual lab

- a. Identification of Vectors
- b. Identification of Transgenic animals
- c. DNA sequencing (Sanger's method)
- d. DNA finger printing
- e. Southern blotting
- f. Western blotting

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.**

Reference Books:

1. A hand book of practical immunology-Ivan Riott
2. Animal Biotechnology – PK Gupta

B.Sc. ZOOLOGY III Year
SEMESTER – V
PAPER – V (GE-I): PREVENTIVE MEDICINE

Instructions: 4hr per week

No. of period: 60

No. of credits: 4

UNIT-I: -Man and Medicine: Health for all (15 Periods)

- 1.1. Antiquity medicine, types of medicine.
- 1.2. Dawn of scientific medicine, modern medicine – curative medicine, preventive medicine and social medicine.
- 1.3. Definition of health, dimensions of health – Physical, Mental, Social Spiritual, Emotional and Vocational health,
- 1.4. Determinants of health – Biological, Behavioural, Environmental, Socio-economic and Health services
- 1.5. Concept of well being – Standard of living, Level of living and quality of life.

UNIT-II: Principles of Epidemiology (15 Periods)

- 2.1. Definition of epidemiology, measurements in epidemiology- rates, ratio and proportion.
- 2.2. Epidemiologic methods- observational and experimental studies.
- 2.3. Uses of epidemiology and definitions of infectious disease epidemiology.
- 2.4. Dynamics of disease transmission – source and reservoirs.
- 2.5. Epidemiological triad, modes of disease transmission – direct and indirect.

UNIT-III: Concept of Disease causation (15 Periods)

- 3.1. Germ theory of Diseases
- 3.2. Disinfection- types of disinfection
- 3.3. Immunity- Active Immunity, Passive immunity, immunizing agents.
- 3.4. Nutrition and Health – Classification of foods; Nutritional requirements.
- 3.5. Screening of disease – uses of screening, types of screening.

UNIT-IV: Concepts of control & prevention (15 Periods)

- 4.1. Health care of the community – health care systems, levels of health care.
- 4.2. Modes of health interventions: Health Promotion, Specific Protection, Early Diagnosis and Treatment, Disability Limitations, and Rehabilitations.
- 4.3. Concepts of control - Monitoring and Surveillance.
- 4.4. Concepts of Prevention- Primary, Secondary & Tertiary.
- 4.5. Health programmes in India.

References:

1. Park's Textbook of Preventive and Social Medicine.

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS 2019-20

B.Sc. ZOOLOGY III YEAR

SEMESTER – V

PAPER – V (GE-I): INTEGRATED PEST MANAGEMENT

Instructions: 4 hr per week

No. of period: 60

No. of credits: 4

UNIT-I: Pest

(15 Periods)

- 1.1 Introduction, History and origin
- 1.2 Definition of pest and its ecology
- 1.3 Pest, population dynamics
- 1.4 Economic injury level (EIL), Economic threshold
- 1.5 Pest surveillance

UNIT-II: Integrated Pest Management

(15 Periods)

- 2.1 Concepts of IPM
- 2.2 Components of IPM
- 2.3 Major IPM strategies
- 2.4 Strategies for IPM Mechanical, Physical, Cultural and Biological

UNIT-III: Biological and Genetic Control

(15 Periods)

- 3.1 Introduction and Principle
- 3.2 Bio control agents
- 3.3 Parasitoids, predators and pathogens (NPV, Bacteria, fungi and nematodes)
- 3.4 Merits and demerits
- 3.5 Genetic Control – sterile insect technique; sterile insect release method

UNIT-IV: Chemical Control

(15 Periods)

- 4.1 Classification of insecticides
- 4.2 Insecticide adjuvant and formulation
- 4.3 Chemical control with reference to organo chloride, organophosphate carbamates
- 4.4 Synthetic pyrethroids; fumigants; pheromones legal or regulatory control- Quarantine acts

REFERENCES

1. K.P.Srivastava: A Text Book of applied Entomology Vol.i&ii. Kalyani Publishers New Delhi.
2. B.V.David and KumaraSwamy. Elements of Economic Entomology
3. B.V.David and KumaraSwamy. Elements of Economic Entomology
4. Pedigo, L.P. Entomology and Pest Management. Prentice-Hall, New Delhi
5. Pradhan, S. Insect Pests of Crops, National Book Trust, New Delhi
6. Agricultural Pests of India and South East Asia by Atloal A.S. Kalyani Publisher, New Delhi
7. Insect Pest of Crops by S. Pradhan, National Book Trust, New Delhi

Instructions: 4hr per week

No. of period: 60

No. of credits: 4

UNIT-I: Introduction to Fisheries, aquaculture systems, management practices (15 periods)

- 1.1 Introduction, definition, history, scope and significance of 'Fisheries'. Present status and prospects of Fisheries at global, national and local (state) level. Blue revolution.
- 1.2 Classification of Fisheries.
 - i) Fin fisheries & Shell fisheries;
 - ii) Capture fisheries & Culture fisheries;
 - iii) Freshwater (inland), Brackish water & Marine fisheries.
- 1.3 Aquaculture systems: Pond culture, pen culture, cage culture. Monoculture, composite culture, integrated culture systems.
- 1.4 Culture phases and management practices: Nursery, rearing and grow-out pond preparation. Liming, fertilization/manuring, and water quality management. Control of aquatic weeds, algal blooms, and weed fishes.
- 1.5 Traits of important cultivable finfish and shellfish: Indian major carps and Minor carps, Exotic carps, air breathing fishes, cold water fishes, fresh water prawns, mussels.

UNIT-II: Feeding, Breeding and hatchery management of finfish and shellfish (15 periods)

- 2.1 Bundh breeding: Concept; wet and dry bundhs; Collection and hatching of eggs.
- 2.2 Induced breeding: Environmental factors affecting spawning; Hypophysation of fishes; Fish pituitary gland: Structure, collection, preservation, and preparation of extract for injection, dosages and methods of injection, dosages and methods of injection.
- 2.3 Brood-stock management and transportation of brood fish. Synthetic hormones are used for induced breeding of carps.
- 2.4 Types of fish hatcheries: Traditional, Chinese, Glass jar, Modern controlled hatcheries. Breeding and hatchery management of *Penaeus monodon* and *Macrobrachium rosenbergii*.
- 2.5 Fish nutrition: Natural and supplementary feeding of cultivable finfish and shellfishes. Forms of feeds: Wet feeds, dry feeds, mashes, pelleted feeds, floating and sinking pellets.

UNIT-III: Limnology (15 periods)

- 3.1 Introduction to limnology, Inland water bodies: Characteristics and distribution of Ponds, Lakes, Reservoirs, Streams and Rivers.
- 3.2 Dynamics of lentic and lotic environments.
- 3.3 Major rivers and fresh water lakes of India. Origin, classification and morphometry of lakes.
- 3.4 Influence of physical and chemical conditions on living organisms in inland waters- Temperature, Light, pH, Turbidity, Thermal stratification, Dissolved Oxygen (DO), Alkalinity, Acidity, Hardness, BOD, COD etc.
- 3.5 Major groups of organisms in freshwater bodies: Planktons, Periphytons, Neustons, Nektons, Benthos, large aquatic plants etc. Ecological adaptations of freshwater fauna.

UNIT-IV: Productivity of lakes (15 periods)

- 4.1 Ecology of ponds and lakes (Lentic ecosystems) – Structure and dynamics – Energy flow.
- 4.2 Productivity of water bodies: Concept of productivity, primary, secondary and tertiary productivity. Factors affecting productivity. Classification of lakes based on productivity.
- 4.3 Laws of minimum and quantitative relationships in a standing crop.

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS 2019-20

- 4.4 Biotic potential and environmental resistance. Succession phenomenon and indices of productivity of lakes.
- 4.5 Eutrophication – causes, consequences and control mechanisms.

Reference Books:

1. Goldman CR. And Home AJ. 1983. Limnology. Mc Graw – Hill International Book Company.
2. Ruttner F. 1953. Fundamentals of Limnology. University of Toronto press, Toronto.
3. Welch PS, 1952. Limnology, 2nd Ed. Mc Graw-Hill Book Co., New York.
4. Golterman, HL. 1975. Physiological Limnology. Elsevier Publishing Co., Amsterdam
5. Cole GA. 1983. Text book of Limnology. C.V Mosby Company, St. Louis, Missouri, USA.
6. Wetzel RG. 1975. Limnology. W.B. Sanders Company, Philadelphia.

B.Sc. ZOOLOGY III YEAR PRACTICAL SYLLABUS
SEMESTER – VI
PAPER-VI (DSE-II): FISHERIES AND LIMNOLOGY

Instructions: 3hr per week

No. of credits: 1

1. Aquaculture production statistics – World, India, and Telangana state.
2. Aquaculture resources of the World, India, and Telangana state.
3. Histological studies of testis, ovary of fish.
4. Identification of important cultivable fresh water fishes-Indian major carps, exotic carps, mahaseers, trouts, tilapias, catfishes, murrel fish.
5. Removal of fish pituitary gland and preparation of pituitary gland extract.
6. Morphometry of lakes, ponds and streams.
7. Determination of physical and chemical characteristics of lotic and lentic water bodies: Temperature, transparency, turbidity, pH, electrical conductivity, salinity, total dissolved solids, dissolved oxygen, free carbondioxide, total alkalinity, total hardness, calcium, magnesium, inorganic nitrogen(ammonium and nitrate) and phosphorous.
8. Collection and identification of fresh water Phytoplankton.
9. Collection and identification of fresh water Zooplankton.
10. Estimation of primary productivity in fresh water bodies.
11. Field trip to local or nearby fisheries unit/fresh water body is to be conducted and certified field note book should be submitted at the time of practical examination.

References:

1. Ayyappan, S., 2011. Handbook of Fisheries and Aquaculture, ICAR Publications, New Delhi.
2. Rath, R.K., 2011. Freshwater Aquaculture, Scientific publications.
3. Santhanam, R., Sukumaran, N. and Natarajan, P. 1987. A manual of Aquaculture. Oxford-IBH, New Delhi.
4. Ramanathan, N. and Francis T., 1996. Manual on breeding and larval rearing of cultivable fishes, Fisheries College and Research Institute, Tuticorin.
5. Jhingran, V.G., Pullin, R.S.V., 1997. A hatchery manual for the Common, Chinese and Indian Major Carps. Asian Development Bank, International Centre for living Aquatic Resources Management, Philippines.

B.Sc. ZOOLOGY III YEAR
SEMESTER-VI

PAPER – VI (DSE-II): ECOLOGY, ZOOGEOGRAPHY AND EVOLUTION

Instructions: 4hr per week

No. of period: 60

No. of credits: 4

UNIT – I: (15 Periods)

1.1 Ecology - I

- 1.1 Ecosystem structure and functions. Types of Ecosystems – Aquatic and Terrestrial.
- 1.2 Biogeochemical cycles - Nitrogen, Carbon, Phosphorus and Water.
- 1.3 Energy flow in ecosystem.
- 1.4 Food chain, food web and ecological pyramids.
- 1.5 Animal Associations - Mutualism, commensalism, parasitism, competition, predation

UNIT – II: (15 Periods)

2.1 Ecology - I

- 2.1 Concept of Species, Population dynamics and Growth curves.
- 2.2 Community Structure and dynamics and Ecological Succession.
- 2.3 Ecological Adaptations.
- 2.4 Environmental Pollution – Sources, Effect and Control measures of Air, Water, Soil and Noise Pollution.
- 2.5 Wildlife conservation - National parks and Sanctuaries of India, Endangered species.

UNIT – III: (15 Periods)

3.1 Zoogeography

- 3.1 Zoogeographical regions – Palaearctic, Nearctic, Neotropical, Oriental, Australian and Ethiopian regions - their Climatic and faunal peculiarities
- 3.2 Wallace line, Discontinuous distribution
- 3.3 Continental Drift
- 3.4 Biodiversity and hotspots of Biodiversity in India.

UNIT – IV: (15 Periods)

4.1 Evolution

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

Suggested Readings:

1. M.P.Arora, 'Ecology' Himalaya Publishing company.
2. P.D.Sharma, 'Environmental Biology'.
3. P.R.Trivedi and Gurdeep Raj, 'Environmental Ecology'
4. Buddhadev Sarma and Tej Kumar, 'Indian Wildlife Threats and Preservation'
5. Chapman J.L. and Reiss M.J, 'Ecology Principles and Applications, Second Ed., Cambridge University Press, London.
7. Benny Joseph, 'Environmental Studies, TATA McGraw Hill Com., New Delhi.

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS 2019-20

8. **Eugene P. Odum**, *Fundamentals of Ecology* Third Ed., Nataraj Publishers, Dehradun.
9. **Veer Bala Rastogi**, "Ecology and Animal Distribution"
10. **P.K. Gupta**, "Text Book of Ecology and Environment"
11. **Bhatnagar and Bansal**, "Ecology and Wildlife biology"
12. **Ridley, M. (2004)**. *Evolution*. III Edition. Blackwell Publishing
13. **Douglas, J. Futuyma (1997)**. *Evolutionary Biology*. Sinauer Associates.
14. **Minkoff, E. (1983)**. *Evolutionary Biology*. Addison-Wesley.
15. **Jan M. Savage**. *Evolution*, 2nd ed, Oxford and IBH Publishing Co., New Delhi.

B.Sc. ZOOLOGY III YEAR PRACTICAL SYLLABUS
SEMESTER- VI
PAPER – VI (DSE-II): ECOLOGY, ZOOGEOGRAPHY AND EVOLUTION

Instructions: 1hr per week

No. of credits: 2

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

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

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

OPTIONAL PAPER IN PLACE OF THE PROJECT
B.Sc. ZOOLOGY III YEAR
SEMESTER - VI
PAPER – VI: TOOLS AND TECHNIQUES IN BIOLOGY

Instructions: 4hr per week

No. of period: 60

No. of credits: 4

UNIT- I: Microscopy Centrifugation (15 Periods)

- 1.1 Microscopy – Basic principle of microscopy, types of microscopes and their application
- 1.2 Histopathological techniques – principle and its applications
- 1.3 Centrifugation –Basic principle of centrifugation; Preparatory and analytical centrifugation techniques and its applications

UNIT- II: Separation techniques (15 Periods)

- 2.1 Colorimetry and Spectrophotometry – Basic principle of colorimetry and its applications, Basic principle of spectrophotometry, and applications.
- 2.2 Chromatography – Basic principle of chromatography; Types of chromatography techniques and their applications
- 2.3 Electrophoresis – Basic principle of electrophoresis and their applications

UNIT- III: Advanced techniques (15 Periods)

- 3.1 Immuno assay-Principle and applications of ELISA
- 3.2 PCR Techniques – DNA extraction and isolation; Principles and applications of PCR techniques
- 3.3 RIA and its applications

UNIT- IV: Statistical tools (15 Periods)

- 4.1 Data – Definition and types of data, Concept of variables; Summarising data: averages (mean, median, mode), dispersion (range, standard deviation, confidence limits);
- 4.2 Representing data – Arraying data, tabulation; graphical representation of data (histogram, bar graph, line graph, scatter plot, pie diagram)
- 4.3 Non-parametric tests –Chi Square test and Parametric tests –Correlation; Student's t-Test; Regression analysis

Reference Books

1. Gurumani, N. An Introduction to Biostatistics. MJP Publisher, Chennai
2. Gurumani, N. Research Methodology. MJP Publishers, Chennai
3. Tembhare, D.B. Techniques In Life Sciences, Himalaya Publishing House, Delhi


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

**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	Optional III- Chemistry - I	DSC-3A	4T } = 7 3P	4 } = 5 1
	Laboratory Course – I (Qualitative Analysis - Semi Micro Analysis of Mixtures)			
	Total Credits		31	25

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	Optional III- Chemistry - II	DSC-3B	4T } = 7 3P	4 } = 5 1
	Laboratory Course - II (Quantitative Analysis – Titrations)			
	Total Credits		31	25

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	Optional III- Chemistry - III	DSC-3C	4T } = 7 3P	4 } = 5 1
	Laboratory Course - III (Synthesis of Organic compounds)			
	Total Credits		31	25

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	Optional III- Chemistry - IV	DSC-3D	4T } = 7 3P	4 } = 5 1
	Laboratory Course - IV (Qualitative Analysis of Organic Compounds)			
	Total Credits		31	25

* 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. π and σ 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 3rd edn.
3. Basic Inorganic Chemistry by F.A.Cotton, G.Wilkinson and Paul.L. Gaus 3rd edn Wiley Publishers 2001. Chem.

- Inorganic Chemistry Principles of structure and reactivity by James E. Huhey, E.A. Keiter and R.L. Keiter 4th edn.
- Chemistry of the elements by N.N. Greenwood and A. Earnshaw Pergamon Press 1989.
- Inorganic Chemistry by Shriver and Atkins 3rd 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.
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- 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_2 (reaction with FeSO_4 , KMnO_4 , $\text{K}_2\text{Cr}_2\text{O}_7$), HNO_3 (reaction with H_2S , Cu), HNO_4 (reaction with KBr, Aniline), $\text{H}_2\text{N}_2\text{O}_2$ (reaction with KMnO_4). Redox properties of oxyacids of Phosphorus: H_3PO_2 (reaction with HgCl_2), H_3PO_3 (reaction with AgNO_3 , CuSO_4). Redox properties of oxyacids of Sulphur: H_2SO_3 (reaction with KMnO_4 , $\text{K}_2\text{Cr}_2\text{O}_7$), H_2SO_4 (reaction with Zn, Fe, Cu), $\text{H}_2\text{S}_2\text{O}_3$ (reaction with Cu, Au), H_2SO_5 (reaction with KI, FeSO_4), $\text{H}_2\text{S}_2\text{O}_8$ (reaction with FeSO_4 , KI). Redox properties of oxy acids of Chlorine.

Interhalogens- Classification- general preparation- structures of AB , AB_3 , AB_5 and AB_7 type and reactivity.

Poly halides- Definition and structure of ICl_2^- , ICl_4^- and I_3^- .

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 $\text{S}_{\text{N}}1$ and $\text{S}_{\text{N}}2$. Mechanism and energy profile diagrams of $\text{S}_{\text{N}}1$ and $\text{S}_{\text{N}}2$ reactions. Stereochemistry of $\text{S}_{\text{N}}2$ (Walden Inversion) 2-bromobutane, $\text{S}_{\text{N}}1$ (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/ZnCl₂ (Lucas reagent), esterification, oxidation with PCC, alk. KMnO₄, acidic dichromates, conc. HNO₃ 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. H₂SO₄. Physical properties – Absence of Hydrogen bonding, insoluble in water, low boiling point. Chemical properties – inert nature, action of conc. H₂SO₄ 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) NaHSO₃ (b) HCN (c) RMgX (d) NH₃ (e) RNH₂ (f) NH₂OH (g) PhNHNH₂ (h) 2,4-DNP (Schiff bases). Addition of H₂O to form hydrate, chloral hydrate (stable), addition of alcohols - hemiacetal and acetal formation. Cannizzaro reaction. Oxidation reactions – KMnO₄ oxidation and auto oxidation, reduction – catalytic hydrogenation, mechanism of Clemmenson's reduction, Wolff-kishner reduction, Meerwein-Ponndorf Verly reduction. Reduction with LAH, NaBH₄.

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_a 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(KMnO₄) 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 Ni²⁺

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_n 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 3rd edn.
3. Basic Inorganic Chemistry by F.A. Cotton, G. Wilkinson and Paul.L. Gaus 3rd edn Wiley Publishers 2001.
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7. Textbook of inorganic chemistry by R Gopalan.

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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 5th 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 Adarsh Gulati.

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 l 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 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^o, 2^o, 3^o 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^o, 2^o, 3^o (Aliphatic and aromatic amines). Electrophilic substitutions of Aromatic amines – Bromination and Nitration, oxidation of aryl and 3^o 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, NO₂, 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 ΔH and ΔV .

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 ΔG 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 α -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-H₂O 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 3rd edn Van Nostrand Reinhold Company(1977)
4. Basic Inorganic Chemistry by F.A.Cotton, G.Wilkinson and Paul.L. Gaus 3rd edn Wiley Publishers (2001).
5. Inorganic Chemistry Principles of structure and reactivity by James E.Huhey, E.A. Keiter and R.L. Keiter 4th edn. (2006)
6. Chemistry of the elements by N.N.Greenwood and A. Earnshaw Pergamon Press(1989).
7. Inorganic Chemistry by Shriver and Atkins 3rd 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.
8. Organic Chemistry by M. Jones, Jr
9. Organic Chemistry by John McMurry.

Unit III

1. Principles of physical chemistry by Prutton and Marron. The MacmillanCompany; 4th 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; 29th 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 β -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 dⁿ 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⁻). Toxic metal ions As, Hg & Pb Oxygen transport and storage – structure of hemoglobin, binding and transport of oxygen. Fixation of CO₂ 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⁺ (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 Hantsch 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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Unit- I

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia Vishal Publications (1996).
2. Concise Inorganic Chemistry by J.D. Lee 3rd edn. Van Nostrand Reinhold Company(1977)
3. Basic Inorganic Chemistry by F.A.Cotton, G.Wilkinson and Paul.L. Gaus 3rd edn Wiley Publishers (2001).
4. Inorganic Chemistry Principles of structure and reactivity by James E.Huhey, E.A. Keiter and R.L. Keiter 4th edn. (2006)
5. Chemistry of the elements by N.N.Greenwood and A. Earnshaw Pergamon Press(1989).
6. Inorganic Chemistry by Shriver and Atkins 3rd edn Oxford Press (1999).
7. Textbook of Inorganic Chemistry by R Gopalan, Universities Press,(2012)

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1. Text book of organic chemistry by Soni. Sultan Chand & Sons; Twenty Ninth edition (2012)
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3. Text book of organic chemistry by Morrison and Boyd. Person(2009)
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5. Text book of organic chemistry by Bruce Yuranis Powla. (2012)
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2. Text Book of Physical Chemistry by Soni and Dharmahara. Sulthan Chand & 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. Physical Chemistry through problems by S.K. Dogra. (2015)
6. Text Book of Physical Chemistry by R.P. Verma.
7. Elements of Physical Chemistry by Lewis Glasstone. Macmillan (1966)
8. Industrial Electrochemistry, D. Pletcher, Chapman & Hall, London, 1990

Unit IV

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia Vishal Publications(1996).
2. Concise Inorganic Chemistry by J.D. Lee 3rd edn. Van Nostrand Reinhold Company (1977)
3. Basic Inorganic Chemistry by F.A.Cotton, G.Wilkinson and Paul.L. Gaus 3rd edn Wiley Publishers (2001).
4. Inorganic Chemistry Principles of structure and reactivity by James E.Huhey, E.A. Keiter and R.L. Keiter 4th edn. (2006)
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 FeCl₃, 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
5. CFC Replacements, butane.chem.uiuc.edu/pshapley/Environmental/L21/3.html
6. Effects of Acid Rain on Buildings www.air-quality.org.uk/12.php
7. Acid Rain Effects - Buildings - Chemistry 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/.
9. Chernobyl nuclear power plant accident - NRC 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
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
13. Trees and Your Environment - Clean Air Gardening www.cleanairgardening.com/plantingtrees
14. water quality and common treatments for private drinking water . 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
17. Determination of dissolved oxygen (DO) www.cutm.ac.in/pdf/env%20engg%20lab%20manual.pdf
18. Determination of chemical oxygen demand of wastewater 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.