

MADURAI KAMARAJ UNIVERSITY

DIRECTORATE OF DISTANCE EDUCATION

DEPARTMENT OF CHEMISTRY

(With effect from the academic year 2020-2021 onwards)

Regulations, Scheme of Examinations and Syllabus for

BACHELOR OF SCIENCE IN CHEMISTRY

(SEMESTER PATTERN)

**MADURAI KAMARAJ UNIVERSITY
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**Regulations, Scheme of Examinations and Syllabus for Bachelor of Science in Chemistry
(semester pattern)**

About the Department

The Department of Chemistry in the Directorate of Distance Education of Madurai Kamaraj University was established in 2003. The department currently offers Post Graduate and Under Graduate programs in chemistry and Post Graduate Diploma in Pharmaceutical Chemistry.

I. Program Overview

The B.Sc. program in Chemistry at the Directorate stresses that chemistry is fundamental to the revolution taking place in science and technology. No educated person can realize the modern world without the basic knowledge in chemistry. So a course in chemistry will be a fascinating experience because it helps us understanding our nature. So the aim of the course is to impart basic skills and knowledge on the principles of all branches chemistry to cater to the need of society, scientific organizations and industries in the context of the developing needs of our Country by providing extensive coverage on the fundamental aspects of chemistry relating applications of chemistry to life systems. An undergraduate program is the essential qualification of Master's or post graduate degree.

Title and Duration: Bachelor of Science in Chemistry and Three years (6 Semesters)

II. Programme's Mission and Vision:

Vision:

To be a nodal centre for chemical education and research with social and ethical values.

Mission:

- Academic eminence in Science and Technology through dedication towards duty, commitment for research, novelty in learning/teaching and faith in ethics.
- Enable the students to develop into teachers, researchers, scientists or technologists with high ethical standards capable of creating, developing and managing global teaching skills and scientific industrial requirements.
- Realize and fulfill expectations of the society and industries by preparing the students with state of the art scientific resources.

(i). Chemistry is fundamental to the revolution taking place in science and technology. No educated person can realize the modern world without the basic knowledge in chemistry.

So a course in chemistry will be a fascinating experience because it helps us understanding our nature. So the aim of the course is to impart basic skills and knowledge on the principles of all branches chemistry to cater to the need of society, scientific organizations and industries in the context of the developing needs of our Country by providing extensive coverage on the fundamental aspects of chemistry relating applications of chemistry to life systems. Further,

- To ensure student centered learning environment
- To offer an excellent opportunity to explore knowledge for multidisciplinary opportunities.

(ii). Relevance of the programme with HEI's Mission and Goals:

- The programme is to extend higher education in different parts of the state/country and to provide access to different skill enhancing educational programmes at affordable cost to the underprivileged and needy and to facilitate lifelong learning to aspiring learners. The programme is designed specifically for in-service chemistry teachers and chemists who wish to enhance their teaching skills and analytical techniques. This course provides intensive practical training to develop, associate and apply various aspects of chemistry in life systems.
- The programme prepares the students to achieve success in competitive examinations and make developments of needs of their life.

(iii) Nature of prospective target group:

The programme offers opportunity to the students from rural, semi-urban and urban background, wishing to study chemistry but could not continue the education through regular mode due to various constraints. Also students may join this course to increase their employability in the area of scientific technology, chemical laboratories, clinical laboratories, health centres or even in R & D laboratories of chemical industries. The working persons may take this course for their vertical/ horizontal mobility in their work place and career upliftment.

(iv) Appropriateness of programme to be conducted in distance learning mode to acquire skills and competence:

Distance Education is more cost effective and can take place while continuing full-time employment. The programme is a tailor-made programme specially designed for the people/employees of chemistry related sectors. They can take the advantage of distance learning mode to increase their skills and competence in this particular field without disturbing their work schedule. The personal contact programmes (PCP) enable them getting their doubts clarified by the subject experts. Further, conduct of practical classes provide them hands-on experience and training on the chemical concepts that they have imbibed in the theory papers.

(v). Instructional Design:

The curriculum of the programme is adapted from the graduate chemistry course recommended by The UGC, India. The Curriculum has been designed and developed with

the subject experts and is approved by the Board of Studies of the University. The learners will have to complete the papers given in Annexure-I in three years. Details on course structure and syllabus can also be had from our website. The study material is Self-Learning (SLM) format, which is the essence of standard distance learning programs. Thus Institution has developed all materials in SLM format. Subject experts prepare the study materials on the specific guidelines laid down by the statutory body. Curriculum design and detailed syllabi is annexed as Annexure-II.

(vi). Procedure for admission:

Eligibility for admission - Higher Secondary (+2) pass with Chemistry as one of the subjects or any other equivalent examination accepted by the Syndicate, as equivalents thereto. Through Admission Notification published in leading news papers and through University website (www.mkuniversity.ac.in/dde).

Course duration: 3 Years. (6 Semesters)

Admission procedure: Centralised admission process is conducted by online mode at the Head quarters and at selected colleges approved centres of admission within four districts of our University's jurisdiction. Admission fee is collected through online payment gateway service.

(vii) Time Table for Personal Contact Program

The ODL Regulations insists between 30-36hours of contact classes per semester for programs offering practical courses.

One round is equivalent to 2 days; each day being 6 hours of contact time. Hence for a semester 4 to 5 months time may be available and one or two rounds of contact classes per month may be enough to achieve the required hours for covering all subjects. The following table demonstrates the time allotment for personal contact program (PCP) for the first round – I semester.

Day order / time	9.00-11.00	11.15-1.15	2.00-4.00
Day 1	Core I	Allied - I	Language - I
Day 2	Core I	NME-I	Language-II

Five rounds of laboratory classes may be scheduled accordingly to accommodate 60hrs approximately. Laboratory courses of B. Sc., chemistry may be conducted for 5 rounds @12 hours a round i.e. for 10 days to achieve the required hours. Laboratory sessions would be handled separately in the Chemistry Laboratory at the Directorate.

III. Scheme of Examinations:

Duration: 3 Hrs.; Maximum: 100 Marks; Passing Minimum: 40 Marks

IV. Evaluation: The evaluation system is maintained as per the norms of the semester examinations of the University. The examiners for evaluation are drawn from the panel of examiners available for the DDE disciplines in the semester mode.

The students will be assessed by

(a) Continuous Internal Evaluation; (b) End-of-semester evaluation.

(a) Continuous Internal Evaluation

Aiming to assess values, skills and knowledge imbibed by students, internal assessment is to be done by the concerned faculty-member by written assignments on the updated chemistry concepts. Time frame for completion of the coursework by students shall be fixed by the faculty members and the evaluation/assessment has to be done immediately by the faculty members. Allotted mark is 25.

(b) End-of-semester evaluation

This is to be carried out at the end of each semester and will aim to assess skills and knowledge acquired by students through class-room interaction and written assignments submitted by the students. Students will have to write examinations for 75 marks for theory and for 60 marks for practicals.

V. PATTERN OF EXAMINATIONS

A) Scheme for Internal Exam-Theory

Internal marks = Maximum 25 marks

Two Assignments - 12.5 marks each; **Total - 25 Marks**

B) Scheme for External Exam-Theory

External Examination – Maximum 75 marks; **Grand Total 100 marks**

Passing Minimum - Theory

1. 40% of the aggregate (Internal + External)
2. 27 marks out of 75 is the pass minimum for the External.

A) Scheme for Internal Exam - Practical

Internal marks = Maximum 40 marks

B) Scheme for External Exam - Practical

External Examination – Maximum 60 marks; **Grand Total 100 marks**

Passing Minimum - Practical

1. 40% of the aggregate (Internal + External)
2. 21 marks out of 60 is the pass minimum for the External

Note: There is no passing minimum for internal assessment marks.

VI. Description of Evaluation

This table lists all the components that make up the course assessment and their weightage. The column headed Qual. Mark indicates the percentage of marks that a student must have secured for declaring him as passed in that course.

Description of Program Evaluation	% Weightage	Qual. Mark
Internal - Theory Seminars & Writing Assignment	25%	No minimum
External -Theory 3 hour theory examinations	75%	27 marks
Internal - Practicals Skill in handling experiments	40%	No minimum
External-Practicals 3 hours laboratory examinations	60%	21 marks

For laboratory external examinations, total marks: 60

- Experimentation, procedure writing, calculations & report: 50 Marks
- Record Note writing: 10 Marks

VII. QUESTION PAPER PATTERN

Part – A

Ten questions (No choice) 10 x 1 = 10 marks
Two questions from each Unit (Objective type Multiple Choice questions)

Part – B

Five questions (either or type) 5 x 7 = 35 marks
One question from each unit

Part – C

Three questions out of five 3 x 10 = 30 marks
One question from each unit

ANNEXURE-I

PROGRAM STRUCTURE AND DESCRIPTION OF COURSES IN B.Sc. CHEMISTRY DEGREE (CBCS - SEMESTER PATTERN)

(With effect from the academic year 2021-2022 onwards)

Semester	Part	Course	Paper Title	Credits
I	I	Language-I Tamil/ Other Language	Language	3
	II	English-I	Language	3
	III	Core Course-I	General Chemistry-I	4
		Core practical-I	Volumetric Analysis	2
		Allied course –I	Mathematics-I or Zoology-I	4
	IV	Skill Based –I	Introduction to Chemistry Laboratory Techniques	2
		Skill Based-II	Sugar and Paper Industries	2
Value Education		Value Education	2	
TOTAL				22
II	I	Language-II Tamil/Other Language	Language	3
	II	English-II	Language	3
	III	Core Course-II	Organic Chemistry-I	4
		Core practical – II	Inorganic Semimicro Qualitative Analysis	2
		Allied course –I*	Mathematics-II or (Zoology-II)	5 or (4)
		Allied Practical –I	Zoology practical I	(1)
	IV	Skill Based –III	Perfumes and Cosmetics	2
		Skill Based-IV	Leather and Textile Chemistry	2
Environmental studies		Environmental studies	2	
TOTAL				23
III	I	Language-III Tamil/Other Language	Language	3
	II	English-III	Language	3
	III	Core Course-III	Physical Chemistry-I	4
		Core practical-III	Organic preparations & gravimetric Estimation	5
		Allied course –I	Mathematics-III or Zoology-III	4
		Allied course –II	Physics –I or Botany-I	4
TOTAL				23
IV	I	Language-IV Tamil /Other Language	Language	3
	II	English-IV	Language	3
		Core Course – IV	Inorganic Chemistry-I	4

	III	Core practical-IV	Organic Analysis & Estimation	5
		Allied course – I	Mathematics-IV or Zoology-IV	5 or (4)
		Allied Practical –I	Zoology practical - II	(1)
		Allied course –II	Physics –II or Botany-II	4
		Allied Practical –II	Physics practical I or Botany practical I	1
	IV	Extension activities	Science Communication Club	1
TOTAL				26
V	III	Core Course-V	Organic Chemistry-II	4
		Core Course-VI	Physical Chemistry-II	4
		Core Course-VII	Inorganic, Analytical & application of computers in Chemistry	4
		Core practical-V	Physical Chemistry Practicals	5
		Allied course – II	Physics –III or Botany-III	4
	IV	Skill Based-V	Nanotechnology and Green Chemistry	2
		Non-Major Elective-I	Ornamental Fish culture	2
TOTAL				25
VI	III	Core Course-VIII	Organic Chemistry-III	4
		Core Course- IX	Physical Chemistry-III	4
		Core Course- X	Applied Chemistry	4
		Allied course – II	Physics –IV or Botany-IV	4
		Allied Practical –II	Physics practical II or Botany practical II	1
	IV	Skill Based-VI	Medicinal Chemistry	2
		Non-major elective - II	Human Biology	2
TOTAL				21

- Part 1 Language 4 + Part 2 Language 4 = **08**;
- Core (Theory + Practical) 10+5 = **15**;
- Allied (Theory + Practical) 8+4 = **12**;
- Skill based = **06**;
- Value Education: **01**
- Non-major elective: **02**
- Extension activities: **01**
- Environmental studies: **01**
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Total papers 46 x 100 = 4600 marks.

Total credits = 140

ANNEXURE – II

**DETAILED SYLLABI – B. Sc. CHEMISTRY
(CBCS - SEMESTER PATTERN)**

(With effect from the academic year 2021-2022 onwards)

ANNEXURE II

DETAILED SYLLABI DETAILED SYLLABI – BSc CHEMISTRY (SEMESTER PATTERN)

(With effect from the academic year 2021-2022 onwards)

I SEMESTER CORE PAPER –I

GENERAL CHEMISTRY

Credits – 4 Max. Marks: 100

OBJECTIVES

1. To understand the atomic structure and various concepts regarding atomic structure.
2. To learn the periodic properties of elements and their classification.
3. To know the types of bonding in molecules
4. To understand the basic concepts in Organic chemistry
5. To learn about kinetic theory, gas laws and molecular velocities

UNIT 1: ATOMIC STRUCTURE AND PERIODIC TABLE

- a. Bohr atom model - Bohr-Sommerfeld Model, de Broglie dual nature of electrons - Heisenberg uncertainty principle - Schrodinger equation - significance of wave functions-quantum numbers - Pauli's exclusion principle - Hund's rule - sequence of energy levels (Aufbau principle).
- b. Modern periodic law: Long form periodic table. Periodicity in properties: Atomic and ionic radii - Ionization enthalpy - Electron affinity (electron gain enthalpy) – Electronegativity. Electronegativity scales: Pauling and Mullikan scales. Effective nuclear charge – Slater rule and its applications – Polarizing power. Diagonal relationship and anomalous behavior of first element in a group (basic idea only).
- c. Balancing of redox equations.(oxidation number method and electron method)

UNIT II: CHEMICAL BONDING I

- a. Introduction – Type of bonds – Octet rule and its limitations. Ionic Bond: Factors favoring the formation of ionic bonds - Lattice energy of ionic compounds - Born-Landé equation (derivation not expected) – Solvation enthalpy and solubility of ionic compounds – Born-Haber cycle and its applications – Properties of ionic compounds - Polarization of ions – Fajan's rule and its applications.
- b. Covalent Bond: Lewis theory. VSEPR theory: Postulates - Applications - Shapes of BeF_2 , BCl_3 , SnCl_2 , CCl_4 , NH_3 , H_2O , PF_5 -Valence Bond Theory- Coordinate bond. Hybridization: Definition and characteristics – sp , sp^2 , sp^3 , dsp^3 , sp^3d^2 hybridization and geometry with examples-. Limitations of VBT.

UNIT III: CHEMICAL BONDING II

- a. Molecular Orbital Theory – LCAO - Bonding and anti bonding molecular orbitals – Bond order and its significance. MO diagrams of homo nuclear and hetero nuclear diatomic molecules: H₂, He₂, N₂, O₂, F₂ and CO Comparison of VB and MO theories.
- b. Intermolecular Forces: Introduction. Hydrogen bond: Intra and inter molecular hydrogen bonds – Effect on physical properties. Induction forces and dispersion forces: Van der Waals forces, ion-dipole, dipole- dipole, ion-induced dipole, dipole- induced dipole and induced dipole-induced dipole interactions.

UNIT IV: FUNDAMENTALS OF ORGANIC CHEMISTRY AND ALKANES.

- a. Classification, trivial and IUPAC nomenclature of organic compounds
- b. Cleavage of bonds: homolysis and heterolysis
- c. Nucleophiles and electrophiles
- d. Inductive, electrometric, mesomeric, hyper conjugation and steric effect.
- e. Stability of reactive intermediates: carbocation, carbanion and free radical
- f. Hybridization in methane, ethylene and acetylene.
- g. Alkanes: Preparation : catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis
- h. Reactions: Halogenation (mechanism of free radical substitution), Aromatization.

UNIT V: KINETIC THEORY OF GASES

- a. Postulates of Kinetic Theory of Gases - derivation of Boyle law, Charles law and Avogadro's law from the kinetic gas equation – reason for deviation of real gases from ideal behavior, compressibility factor -Van der Waals equation of state for real gases. Boyle temperature -Law of corresponding states and reduced equation of state.
- b. Maxwell Boltzmann distribution laws of molecular velocities - equation-graphical representation – (derivation not required) - Temperature dependence of these distributions. Most probable, average and root mean square velocities – numerical problems-(no derivation). Collision number, collision frequency, collision diameter and mean free path of molecules. Viscosity of gases and effect of temperature and pressure on coefficient of viscosity (qualitative treatment only). Principle of equipartition energy.

TEXT BOOKS

TEXT BOOKS

1. Satya Prakash, Advanced Inorganic Chemistry, R.D.Madan, Volume 1, 5th Edition, S. Chand and Sons, New Delhi, 2012.
2. A. Bahl and B.S. Bahl, Advanced Organic Chemistry, 1st Multicolour Edition, S. Chand & Company, New Delhi, 2010.
3. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, 46th Edition, Vishal Publishing Company, New Delhi, 2013.

REFERENCE BOOKS

1. S. Glasstone and D.H. Lewis, Elements of Physical Chemistry, 2nd Edition, Macmillan & Company, UK, 1962.

2. I.L. Finar, Organic Chemistry Vol. I, 6th Edn, Pearson Education, New Delhi, 2014.

PRACTICAL - I VOLUMETRIC ANALYSIS

Credits –2 Max. Marks 100

OBJECTIVES

1. To enable the students to acquire the quantitative skills in volumetric analysis.
2. At the end of the course, the students should be able to plan experimental projects and execute them.

I ACIDIMETRY AND ALKALIMETRY

1. Estimation of HCl.
2. Estimation of oxalic acid.
3. Estimation of sodium carbonate
4. Estimation of sodium hydroxide

II REDOX TITRATIONS

A. PERMANGANOMETRY

1. Estimation of Ferrous ion
2. Estimation of oxalic acid

B. DICHROMETRY

1. Estimation of ferrous ion
2. Estimation of ferric ion using external indicator

III IODOMETRY AND IODIMETRY

1. Estimation of potassium dichromate
2. Estimation of potassium permanganate
3. Estimation of copper sulphate
4. Estimation of arsenious oxide

IV ARGENTIMETRY

1. Estimation of potassium chloride

V COMPLEXOMETRIC TITRATION

- a. Estimation of hardness of water using EDTA (demonstration only)

Scheme of evaluation (Max. marks 100)

Internal Assessment 40 Marks

Regularity	25 Marks
Observation Note	15 Marks
Total	40 Marks

External Examination: 60 Marks (3 hours)

Record Note Book	10 Marks
Procedure	15 Marks
Experiment	35 Marks
Total	60 Marks
< 3 %	35 Marks
3 - 4%	25 Marks
4- 5%	20 Marks

> 5%	10 Marks
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PART IV: SKILL BASED COURSE - I

INTRODUCTION TO CHEMISTRY LABORATORY TECHNIQUES

Credits – 2 Max. marks: 100

UNIT I: LABORATORY SAFETY

Handling of concentrated acids, bases and hazardous chemicals, Safety precautions, fire hazards, safety and first aid procedures for laboratory accidents - poisoning – universal antidote.

UNIT II: CONCENTRATION OF SOLUTIONS

Avogadro number – mole concept – atomic weight, molecular weight, equivalent weight – primary and secondary standards - normality, molarity, molality, weight percentage, volume percentage, dilution from stock solutions- problems.

UNIT III: BASIC PRINCIPLES OF QUANTITATIVE ANALYSIS

Condition for precipitation based on solubility and ionic product-titrimetry-principles of different acid-base titrations - indicators used in acid-base titrations- redox titrations (MnO_4^- only) – accuracy – error calculation in volumetric analysis –percentage error.

UNIT IV: INORGANIC QUALITATIVE ANALYSIS

Group separation of common cations –interfering and non-interfering anions – elimination of interfering anions – test for basic anions and cations - phosphate, nitrate, sulphate, carbonate, fluoride, oxalate, chloride, borate, lead, cadmium, copper, aluminium, iron, nickel, calcium, barium, strontium, ammonium(any one test for each).

UNIT V: BASICS OF ORGANIC ANALYSIS

Principle of distillation –Detection of elements – Lassaigne's test - nitrogen, sulphur, halogens
– estimation of nitrogen by Kjeldahl method – estimation of halogens by Carius method - qualitative tests to identify organic functional groups – aliphatic and aromatic, test for unsaturation, phenols, aldehydes, ketones, esters, carbohydrates, amines, amides, carboxylic acids (any one test for each).

REFERENCE BOOKS

1. Textbook of Organic Chemistry – P. L. Soni
2. Vogel's textbook of Practical Organic Chemistry
3. Inorganic Semi-micro Qualitative Analysis – V. V. Ramanujam
4. Elements of Analytical Chemistry – R. Gopalan, P.S. Subramanian, K. Rengarajan

PART IV: SKILL BASED COURSE - II

SUGAR & PAPER INDUSTRIES

Credits – 2 Max. marks: 100

UNIT I

Sugarcane and sugar Beet - manufacture of cane sugar - extraction of juice - concentration - separation of crystals - recovery of glucose from molasses defecation.

UNIT II

Sulphitation and carbonation - testing and estimation of sugar - double sulphitation process- preparation of bagasse- use of bagasse in paper and electricity production - list of important sugar industries in India.

UNIT III

Preparation of alcohol from molasses - preparation of absolute alcohol - manufacture of wine,beer, methylated spirit - power alcohol - estimation of number of hydroxyl groups.

UNIT IV

Introduction to pulp - raw materials for pulp production- mechanical pulping process - debarking - sulphate pulping - black liquor recovery - sulphite pulping - red liquor recovery (outline only).

UNIT V

Beating, refining, filling processes - sizing and bleaching agents, calendaring - list of important paper industries in India.

REFERENCE BOOK

1. Industrial Chemistry - B. K. Sharma (Goel Publishing House)

SEMESTER – I

NON MAJOR ELECTIVE – I

either FUNCTIONAL ENGLISH I or ORNAMENTAL FISH CULTURE

FUNCTIONAL ENGLISH I

Credits –4 Max. Marks: 100

To enable the students to have direct access to the functional aspects of English language.
To equip the students to learn language as a medium for communication and to enable them to interact with others.
To make them acquire communication skill.

Unit I - Speaking Skills

1. Introducing Yourself and to a stranger
2. Requesting
3. Apologizing
4. Expressing Likes/Dislikes/Hopes/Wishes and Regret
5. Exchanging Greetings and Taking Leave
6. Paying Compliments/Showing Appreciation and Responding
7. Seeking and Giving Advice and Making Suggestive
8. Talking about current affairs

Unit II - Communication Skills – I

Fundamentals of Communication Skills

1. Communication skills
2. Listening skills
3. Oral communication
4. Reading skill
5. Written communication skills
6. Instruction and transcoding

Unit III – Communication Skills – II

1. Interpersonal communication / Intropersonal
2. Employment communication
3. Barriers to communication
4. Communication
 - At the college
 - About the college
 - Outside the class
 - For business transaction?

Unit IV - Telephone Skills

1. Basic telephone skills
2. Effective telephone skills
3. Types of specialized telephone calls
4. Telephone etiquette
5. Telephone interview
6. Tips for telephone interview

Unit V Group Discussion

1. Group discussion as a selection process
2. Different kinds of Group Discussion
3. Structure of Group Discussion
4. Successful Group Discussion Techniques
5. Group Discussion – Do's and Dont's

Books recommended:

1. Spoken English – Part – I, A Foundation Course, Kamalesh Sadanond & Susheela Punitha Orient Black Swan
2. Spoken English – Part – II, A Foundation Course, Kamalesh Sadanond & Susheela Punitha Orient Black Swan
3. Spoken English – Jayashree Balan, Vijay Nicole

*******(OR)*******

PART – IV SEMESTER – I NON MAJOR ELECTIVE –1.

ORNAMENTAL FISH CULTURE (2 CREDITS)

OBJECTIVES

To identify common ornamental fishes and their characteristics

To know the art of fish keeping and setting up a fish tank

To understand the collection and preparation of live and prepared feed
To become familiar with breeding technique

To gain knowledge about the common diseases of ornamental fishes and their control

Unit -1

Identification of popular Ornamental fishes:

Siamese fighting fish, Gold fish, Rosy barb, Black molly, Guppy, Koi carp, Arowana and Angel fish.

Unit -2

Construction of fish tank:

Size and shape of fish tank, bottom settings, stocking of fish, planting with aquarium plants, Accessories of fish Tank - aerators, types of filters, nets, lights and hood.

Unit-3

Transport of fishes: Oxygen packing

Food and feeding: Culture of live food organisms- Micro worms, vinegar eel, tubifex.

Artificial feed - Pellet feed formulation.

Unit -4

Breeding methods:

Siamese fighting fish, Gold fish, Black molly, Guppy and sword tail.

Unit-5

Common diseases and treatment of ornamental fishes:

Nutritional diseases, Whitespot diseases, Fungal diseases, Bacterial diseases, Dropsy diseases and ecto-parasites.

TEXT BOOKS:

1. Jameson J.D., and Santhanam R., Manual of Ornamental Fishes and Farming Technologies, Fisheries College and Research Institute, Tamilnadu Veterinary and Animal Sciences, Tuticorin, 1996

REFERENCES:

1. Felix S., Sundaraj V., and Thilakar S., Manual of Tropical Fish Diseases Diagnosis, Tamilnadu Veterinary and Animal Sciences University, Chennai, 1999.
2. Ramanathan N., and Francis T., Manual of Breeding and Larval Rearing of Cultivable Fishes, Tamilnadu Veterinary and Animal Sciences University, Chennai, 1996.
3. Santhanam, R. Sukumaran, N. and Natarajan, P Oxford and IBH Publishing Copvt. New Delhi 1990.

II SEMESTER CORE PAPER –II ORGANIC CHEMISTRY - I

Credits –4 Max. Marks: 100

OBJECTIVES

1. To learn preparation and reactions of alkenes and alkynes
2. To study aromaticity and mechanism of certain reactions
3. To understand the chemistry of polynuclear hydrocarbons
4. To learn the preparation and reactions of halide based functional groups.
5. To learn the concept of stereochemistry

UNIT I: ALKENES AND ALKYNES

- a. Preparation of alkenes: dehydration of alcohols, dehydrohalogenation of alkyl halides, Saytzeff rules, partial dehydrogenation of alkynes. Reactions: addition of HX (Markownikoff rule and anti Markownikoff rule), ozonolysis, addition of halogen (mechanism of electrophilic addition), oxidation with Bayers' reagent, hydroboration.
- b. Dienes: conjugated, isolated and cumulative dienes with example, preparation from alkenes, reactions: Diels-Alder reaction and polymerization.
- c. Alkynes: preparation: Acetylene from CaC_2 , dehalogenation of tetra halides and Dehydro halogenation of vicinal-dihalides. Reactions: formation of acetylides, ozonolysis, oxidation reactions and addition of bromine.

UNIT II: AROMATIC HYDROCARBONS

- a. Aromaticity, Huckel's rule, Structure of benzene (M.O model)
- b. Preparation of benzene from phenol, acetylene and by decarboxylation. Reactions: Electrophilic substitution reaction- mechanism of nitration, sulphonation, halogenations, Friedel-Crafts alkylation and acylation
- c. Directive influence of substituents based on electronic effects.
- d. Preparation of toluene, xylene, and mesitylene

UNIT III: POLY NUCLEAR HYDROCARBONS, CYCLOALKANES AND CONFORMATION

- a. Preparations and reactions of biphenyl, naphthalene, anthracene and phenanthrene
- b. Cyclo alkanes: Preparation using Dickmann's method, Freund's method and reduction of hydrocarbons
- c. Bayer's strain theory and theory of strain less rings
- d. Conformational Analysis: Fischer, Saw-horse and Newman projection formula-Difference between configuration and conformation
- e. Conformational analysis of ethane, n-butane, 1,2-

ichloroethane, cyclohexane and mono substituted cyclohexane

UNIT IV: ALKYL AND ARYL HALIDES

- a. Alkyl halides: Preparation from alkenes and alcohols, Reactions: Types of nucleophilic Substitution reactions (S_N^1 , S_N^2 mechanism), hydrolysis, alkyl nitrate and nitroalkane- preparation, reaction with ammonia, elimination reactions (E_1 and E_2 mechanism).
- b. Aryl halides; Preparation from phenol, Sandmeyer's reaction, substitution by OH-Group (nucleophilic bimolecular mechanism) and by NH_2 group (Benzyne mechanism)
- c. Poly halogen derivatives: Preparation and applications of Westron and Freon

UNIT V: STEREO CHEMISTRY

- a. Geometrical Isomerism: Maleic acid and fumaric acids, aldoximes and ketoximes, Determination of configuration of geometrical isomers, E-Z notation.
- b. Optical activity, specific rotation, asymmetric centre, chirality, achiral molecules, Elements of symmetry, resolution of racemic mixtures, Walden inversion,
- c. Asymmetry synthesis, specification of R-S notations. Optically active compounds without asymmetric carbon atoms: Allenes, spiranes and biphenyl compounds

TEXT BOOKS

1. A. Bahl and B.S. Bahl, Advanced Organic Chemistry, 1st Multicolour Edition, S.Chand & Company, New Delhi, 2010.
2. S.C. Sharma and M.K. Jain, Modern Organic Chemistry, Vishal Publishing Company, New Delhi, 2014.
3. K.S. Tewari, N.K. Vishnoi and S.N. Mehrotra, A Textbook of Organic Chemistry, 2nd Edition, Vikas Publishing House (Pvt.) Ltd., New Delhi, 2004.

REFERENCE BOOKS

1. Jerry March, Advanced Organic Chemistry, 5th Edition, John Wiley and Sons, New York, 2004
2. I.L. Finar, Organic Chemistry Vol. I, 6th Edition, Pearson Education, New Delhi, 2014.
3. E.L. Eliel, Stereochemistry of Carbon Compounds, Tata McGraw Hill Publishing Company Ltd, New Delhi, 1992.

PART IV: SKILL BASED COURSE - III

PERFUMES AND COSMETICS

Credits –2 Max. marks: 100

UNIT I: NATURAL PERFUMES

Perfumes –plant and animal sources– examples –components of perfume – vehicle – characteristics of good vehicle -fixatives and its types, odoriferous compounds, extraction of essential oils by distillation, enfleurage and solvent extraction methods.

UNIT II: ARTIFICIAL PERFUMES AND FLAVORS

Preparation and uses of methyl anthranilate, methyl salicylate, methyl cinnamate, phenyl ethanol, citronellol, vanillin, coumarin and heliotrope.

UNIT III: COMPOSITION AND MANUFACTURE OF PERFUMERY COMPOUNDS

Rose and Jasmine – Composition and preparation of rose and jasmine perfumes – manufacture of fruit flavors – fruit syrup preparation and composition of apple and pineapple flavors.

UNIT IV: SOAPS AND DETERGENTS

Cleansing action of soap – differences between soap and detergents – ingredients of washing and bathing soap – TFM of bathing soap – composition of solid and liquid detergents – functions of ingredients in detergents.

UNIT V: COSMETICS AND PERSONAL HYGIENE PRODUCTS

Characteristics of good cosmetics – demerits of artificial cosmetics –basic composition of talcum powder – face cream – nail polish – hair dye – toothpaste – mouthwash (Composition only)

REFERENCE BOOKS

1. Industrial Chemistry – B. K Sharma
2. Textbook of cosmetics – Rajesh Kumar Nema, Kamal Singh Rathore, Balkrishna Dubey
3. Manufacture of perfumes, cosmetics, detergents –Gir Raj Prasad (from Small Industryresearch Institute)

PART IV: SKILL BASED COURSE -IV

LEATHER AND TEXTILE CHEMISTRY

Credits –2 Max. marks: 100

UNIT I: INTRODUCTION

Structure and composition of animal skin-Terminology involved in leather tanneries-chemistry of beam house processes-soaking, liming, unhairing, deliming, bating and pickling-preservation of animal skin-salt curing and brine curing.

UNIT II: MATERIALS AND METHODS OF TANNING

Vegetable tans- catechol tans- pyrogallol tans-vegetable tanning process and applications of vegetable tanned leather-Chrome tanning-chemicals used-method-type of leather obtained and its uses-aldehyde tanning- Artificial leather- Corfam-synthetic tans

UNIT III: POLLUTION AND TREATMENT OF TANNERY EFFLUENT

Various finishing process in tanneries – drying - bleaching - fat liquoring - dyeing- calendaring. Pollution caused by leather tanneries-Treatment of tannery effluents-primary, secondary and tertiary treatment.

UNIT IV: TEXTILE FIBRES

Classification of textile fibres - differences between cellulosic and synthetic fibres - identification of fibres by burning and solubility tests - chemical structure, physical and chemical properties of cotton, wool, silk - chemical structure - physical and chemical properties of cotton, wool, silk

UNIT V: BLEACHING, DYEING & FINISHING

Bleaching of cotton fabrics - peroxide bleaching - hypochlorite bleaching - dyeing of cotton with vat dyes -dyeing of wool with acid dyes - dyeing of polyester with disperse dyes - textilefinishing - mercerization - water repellent and waterproof finish.

REFERENCE BOOKS

1. Textile fibres - R. S.Prayag
2. Industrial Chemistry - B. K Sharma GOEL publishing
3. Technology and Textile Finishing - V. A. Shenai
4. Fundamental concepts of Applied Chemistry by Jayashree Ghosh, S. Chand & Company

PRACTICAL – II

INORGANIC SEMIMICRO QUALITATIVE ANALYSIS

Credits –2 Max. Marks 100

Objectives

1. To enable the students to develop analytical skills in inorganic qualitative analysis.
2. To appreciate the various colored chemical reactions of metal ions.

Semi micro qualitative analysis:

1. Training sessions for three classes: Mixture of anions containing an interfering anion and its elimination technique. Mixture of cations of simple radicals to familiarize with the inter group separation techniques.
2. Semi micro qualitative analysis of inorganic salt mixtures containing two anions (one interfering) and two cations.
3. Simple anions: carbonate, nitrate, sulphate, sulphide, sulphite, chloride and bromide.
4. Interfering anions: borate, fluoride, oxalate, phosphate, arsenite and chromate.
5. Cations:
 - a. Group I cations: lead
 - b. Group II cations: lead, copper, cadmium, bismuth, antimony and tin.
 - c. Group III cations: aluminium, ferrous, ferric and chromium.
 - d. Group IV cations: cobalt, nickel, manganese and zinc.
 - e. Group V cations: barium, strontium and calcium
 - f. Group VI cations: magnesium and ammonium.

Scheme of evaluation: (Max. Marks 100)

Internal Assessment 40 Marks

Regularity	25 Marks
Observation Note	15 Marks
Total	40 Marks

External Examination: 60 Marks (3 Hours)

Record Note Book	10 Marks
Reporting 4 ions with procedure 4 x 12.5	50 Marks

SEMESTER - II

PART IV

NON-MAJOR ELECTIVE - II

either FUNCTIONAL ENGLISH – II or HUMAN BIOLOGY

NON-MAJOR ELECTIVE - II

FUNCTIONAL ENGLISH - II

Credit: 2

Objective:

To enable the student to have direct access to functional aspects of English language.

To equip the students to learn language as a medium for communication and to enable him to interact with others.

To make him acquire the communication skill.

Unit I Notices, Agenda, Minutes and Meetings

1. Writing Notices
2. Writing Agenda
3. Writing Minutes, Memorandum

Unit II Business Communication

1. Characteristics of Business Communication
2. Business Correspondence
3. E Communication
4. Resume Writing

Unit III Interview Skills

1. FAQs
2. Frequently asks questions
3. Telephone Interview
4. Preparing for a Face-to-Face Interview
5. Interview Etiquette
6. Mock Interview

Unit IV Speeches, Presentation. Spell Check, Proof reading:

1. Art of Public Speaking
2. Welcome Address
3. Presidential Address
4. Chief Guests Address
5. Vote of Thanks

Unit V Non-verbal Communication and Editing Skills

1. Types of Non-Verbal Communication.
2. Editing Skills
3. Kinetics
4. Haptics
5. Proxemics
6. Para language
7. Sign language
8. Chronemics

Books Prescribed:

- Synergy Communication in English and Study Skills for Students of Commerce and Business Management
- Business Communication – Basic Concepts of skills Board of Editors, Orient Black Swan

Books recommended:

- Business Communication Basic Concepts and Skills, J. P. Parikh, Anshu Surve, Swarnabharati, ASNA Bahrainwakq, Orient Black Swan, Executive Communication
- Dr. A. Devaraj, Dr. K. S. Anthonysamy, Vijay Nicole Imprint Private Limited

*******(OR)*******

PART – IV SEMESTER – II NON MAJOR ELECTIVE –II.

HUMAN BIOLOGY (2 CREDITS)

Unit – I Human Embryology

Structure of Human sperm and ovum - Menstrual cycle – Menopause – Pregnancy - Parturition -Twins - Test tube Baby.

Unit – II Human Physiology

Respiration - Oxygen and Carbon di oxide transport; Blood: Blood Composition ; Structure and function of heart , Electrocardiogram (ECG), Blood pressure , Blood urea; Structure of kidney nephron - Formation of urine.

Unit – III Human Genetics

Sex determination in Man - Chromosomal abnormalities (Down, Turner’s, Klinefelter’s syndromes) - Human Blood groups.

Unit – IV Human health and Hygiene

Composition of food, Digestion and absorption of food, Balanced diet, Vitamin deficiencies, Calorie value of food, Malnutrition and Obesity.

Unit – V Human History

Human origin – Diversification, Biological and cultural evolution - Human future.

Text Book:

1. Developmental Biology Arumugam. N.,Saras Publications, Kottar, Nagercoil-2012.
2. Animal physiology- N. ArumugamSaras Publication Nagercoil-2011
3. Organic Evolution by. Arumugam N, Saras Publications Nagercoil-2009.
4. Mani, A., Narayanan, Fatima , D L.M., Selvaraj, A.M. and Arumugam, N.Immunology and Microbiology(2010), Saras Publication, Nagercoil.

Reference Books:

1. P.S.Verma and V.K. Agarwal- Animal physiology
2. Verma, P.S. and Agarwal V.K. 2005 Chordate Embryology S, Chand & CompanyLtd., New Delhi.
3. Dobzhansky, Evolution, Genetics and Man, Oxford and IBH Publishing Co., New Delhi.
4. Gordon S. Maleon et al., Animal Function –Principles and Adaptations. The Macmillan Company –Collier- Mamillan Ltd. Hen 5.. Hoar S.William- General,Comparative Physiology, Prentice Hall of Indian pvt ltd, New Delhi,
5. Philip H. Mitchel – A Text book of General Physiology, McGraw Hill

III SEMESTER CORE PAPER –III

PHYSICAL CHEMISTRY- I

Credits –4 Max. Marks: 100

OBJECTIVES

1. To understand the properties of matter
2. To know the structure and types of solids
3. To learn the characteristics and applications of colloids
4. To understand the principles of adsorption and catalysis
5. To learn about electrical conductance and ionic equilibria.

UNIT I: PROPERTIES OF MATTER

- a. Intermolecular forces in liquids-Trouton's rule and significance- Surface tension and Viscosity of a liquid and Effect of temperature on surface tension and coefficient of viscosity of a liquid (qualitative treatment only)
- b. Electrical properties: dipole moment -electrical polarization of dielectrics and polarisability –Applications of dipole moment studies - estimation of ionic character, calculation of bond moments, distinguishing geometrical isomers and o-, m-, p- isomers
- c. Magnetic properties: Magnetic permeability, specific susceptibility, atomic and molar susceptibilities – dia-, para- and ferromagnetism – measurement of susceptibility by Gouy's method

UNIT II: SOLID STATE

- a. Types of solids. Symmetry in crystals, unit cells, crystal systems, Bravais lattice types and identification of lattice planes. Laws of Crystallography - Law of constancy of interfacial angles, Law of rational indices. Miller indices.
- b. X-Ray diffraction by crystals, Bragg's law- determination of crystal structure – rotating crystal method- powder method- Structures of NaCl, KCl and CsCl (qualitative treatment only). Types of crystals-structure of diamond, graphite and ice. Frankel and Schotky defects in crystals.
- c. Liquid crystals – theory and applications.

UNIT III: COLLOIDAL STATE

- a. Colloids -Distinguishing characteristics of colloids, suspensions and solutions-Types of colloidal dispersions
- b. Optical properties-Tyndall effect– Kinetic properties – Brownian motion– Electrical properties–Helmholtz and diffuse double layers – electro kinetic or zeta potential – electrophoresis and its applications
- c. Coagulation – methods of coagulation – Hardy Schultz law – Hofmeister series - Protective colloids – protective action – gold number – applications- Emulsions – classification, preparation, identification Gels – preparation – properties (thixotropy, syneresis and imbibition)

UNIT IV: CATALYSIS AND ADSORPTION

- a. Catalysis- characteristics- - different types-homogeneous-heterogeneous-acid-

base catalysis-auto catalysis-theories of catalysis-intermediate compound formation theory and adsorption theory- kinetics of enzyme catalysis - Michaelis Menton equation. – applications of catalysis

- b. Adsorption-definition-adsorbent-adsorbate-examples-difference between adsorption and absorption- factors influencing adsorption of gases on solids- physisorption and chemisorptions- - Langmuir adsorption isotherm –Applications of adsorption.

UNIT V: IONIC EQUILIBRIA

- a. Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Kohlrausch law of independent migration of ions.
- b. Transference number and its experimental determination using Hittorf method. Ionic mobility.
- c. Applications of conductance measurements: determination of degree of ionization of weak electrolyte, solubility and solubility products of sparingly soluble salts, ionic product of water, hydrolysis constant of a salt.
- d. Debye Huckle Onsegar theory.
- e. Conductometric titrations (only acid- base).

TEXT BOOKS

1. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, 46th Edition, Vishal Publishing Company, New Delhi, 2013.
2. P.L. Soni, O.P. Dharmarha and U.N. Dash, Textbook of Physical Chemistry, 23rd Edition, Sultan Chand & Sons, New Delhi, 2011.

REFERENCE BOOKS

1. S. Glasstone and D.H. Lewis, Elements of Physical Chemistry, 2nd Edition, Macmillan & Company, UK, 1962.
2. W.J. Moore, Physical Chemistry, 5th Edition, Orient Longman, London, 1999.

SEMESTER III

PRACTICAL - III ORGANIC PREPARATIONS & GRAVIMETRIC ESTIMATION

Credits – 5 Max. Marks 100

OBJECTIVES

1. To enable the students to develop skills in quantitative estimation by gravimetric method
2. To learn the art of synthesizing organic compounds.

1. GRAVIMETRY

1. Estimation of lead as lead chromate
2. Estimation of barium as barium chromate
3. Estimation of calcium as calcium oxalate monohydrate
4. Estimation of nickel as Ni-DMG

2. ORGANIC PREPARATION

1. Nitration: picric acid from phenol
2. Bromination: p-bromoacetanilide from acetanilide
3. Hydrolysis: Aromatic acid from an ester/amide
4. Oxidation: Benzoic acid from benzaldehyde
5. Benzoylation of amine/phenols
6. Acetylation of amine/phenols

Scheme of evaluation (Max. marks 100)

Internal Assessment: 40 Marks

Regularity	25 Marks
Observation Note	15 Marks
Total	40 Marks

External Examination: 60 Marks (6 hours)

Record Note Book	10 marks		
Gravimetric estimation	30 Marks	Organic Preparation	20 Marks
Procedure	10 Marks	Procedure	6 Marks
Estimation	20 Marks	Crude sample	10 Marks
< 2 %	20 Marks	Recrystallized sample	4 Marks
2 -3%	15 Marks		
3- 4%	10 Marks		
> 4%	5 Marks		

SEMESTER IV

CORE PAPER –IV INORGANIC CHEMISTRY-I

Credits –4 Max. Marks: 100

OBJECTIVES

1. To understand the concept of nuclear chemistry and its applications
2. To learn the characteristics d and f-block elements
3. To understand the principles metallurgy
4. To know the properties and theories about coordination compounds
5. To learn about carbonyls, silicates and their applications

UNIT I: NUCLEAR CHEMISTRY

- a. Nuclear transmutations-Theory of Nuclear reactions- Comparison of nuclear and chemical reactions - subatomic particles, structure of the nucleus-shell model, liquid drop model; Forces in the nucleus-mesons
- b. Stability of nucleus-n/p ratio, mass defect and binding energy.
- c. Types of nuclear reactions-spallation- nuclear fission- theory of nuclear fission-chain reaction, critical mass-atom bomb- nuclear reactors-fast breeder reactors, fuels used in nuclear reactors, moderators, coolants; nuclear fusion- hydrogen bomb- nuclear reactors in India- Stellar energy
- d. Applications of radioactive isotopes in the field of medicine, agriculture, industry and elucidation of reaction mechanism

UNIT II: TRANSITION AND INNER TRANSITION ELEMENTS

- a. Transition Metals: General characteristics: Metallic character, oxidation states, size, density, melting points, boiling points, ionization energy, color, magnetic properties, reducing properties, catalytic properties, non-stoichiometric compounds, complex formation and alloy formation. Difference between first row and other two rows. Preparation, properties, structure and uses of KMnO_4 and $\text{K}_2\text{Cr}_2\text{O}_7$.
- b. Lanthanides: Electronic configuration and general characteristics – Occurrence of lanthanides – Isolation of lanthanides from monazite sand - Separation by ion-exchange method. Lanthanide contraction: Causes and consequences. Industrial importance of lanthanides.
- c. Actinides: Electronic configuration and general characteristics – Comparison with lanthanides

UNIT III: METALLURGY

- a. Occurrence of metals based on standard electrode potential – Concentration of ores – Calcination and roasting - Reduction to free metal – Electrometallurgy – Hydrometallurgy.
- b. Refining of metals: Electrolytic refining, ion exchange method, zone refining, vapour phase refining and oxidative refining
- c. Ellingham diagrams for metal oxides-Extractive metallurgy of Al, Fe, Ni, Cu & Ti.

- d. Alloys: Definition- Composition and uses of German silver, brass, bronze, gunmetal and alnico.

UNIT IV: COORDINATION CHEMISTRY

- a. Introduction - Types of ligands – Anionic, cationic and neutral complexes – IUPAC nomenclature -Structural and stereo isomerism in coordination compounds.
- b. Bonding theories- Werner's theory and Sidgwick's concept of coordination – EAN rule -Valence bond theory - Geometries of coordination numbers 4 and 6 – Limitations of VBT. Crystal field theory - Splitting of *d*-orbitals in octahedral, tetrahedral, tetragonal and square planar complexes –Factors affecting crystal field splitting - CFSE of low spin and high spin octahedral complexes - Spectrochemical series - Explanation of geometry, magnetism and colour - Merits and demerits of Crystal field theory.

UNIT V: METAL CARBONYLS, CARBIDES, INTERCALATION COMPOUNDS AND SILICATES

- a. Bonding and structure of Fe, Co, Ni and Cr carbonyls
- b. Metal Carbides –types-preparation and applications.
- c. Intercalation compounds of graphite-preparation-properties and uses
- d. Silicates-types-structure-mica, beryl, clay, zeolite and quartz

TEXT BOOKS

1. B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, 31st Edition, Milestone Publishers and Distributors, New Delhi, 2013.
2. Satya Prakash, Advanced Inorganic Chemistry, R.D.Madan, Volume 1, 5th Edition, S.Chand and Sons, New Delhi, 2012.
3. R. Gopalan, Text book of Inorganic Chemistry, Universities Press India Ltd., Hyderabad, 2012.
4. C.N.R. Rao, Understanding Chemistry, Universities Press India Ltd., Hyderabad, 2011.

REFERENCE BOOKS

1. J.E. Huheey, E.A. Keitler and R.L. Keitler, Inorganic Chemistry – Principles of Structure and Reactivity, 4th Edition, Pearson Education, New Delhi, 2013
2. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, 6th Edition, WileyIndia Pvt.Ltd., New Delhi, 2009 (Reprint).

SEMESTER IV
PRACTICAL - IV
ORGANIC ANALYSIS AND ESTIMATION

Credits – 5 Max. Marks 100

Objectives

1. To enable the students to develop analytical skills in organic qualitative analysis
2. At the end of the course, the students should be able to plan the experimental projects and execute them.

1. Organic Analysis

- a. Identification of acidic, basic, phenolic, and neutral organic substances.
- b. Detection of N, S and halogens.
- c. Test for aliphatic and aromatic nature of substances.
- d. Test for saturation and unsaturation.
- e. Identification of functional groups: i) Carboxylic acids ii) Phenols iii) Aldehydes iv) Ketones v) Esters vi) Carbohydrates vii) Amines viii) Amides ix) Halogen compounds
- f. Preparation of derivatives for the functional groups.

2. Organic Estimation

- a) Estimation of aniline b) Estimation of phenol c) Estimation of glucose

Scheme of evaluation (Max. marks 100) Internal Assessment: 40 Marks

Regularity	25 Marks
Observation Note	15 Marks
Total	40 Marks

External Examination: 60 Marks (6 hours)

Record Note Book	10 marks		
Organic Estimation	25 Marks	Organic Analysis	25 Marks
Procedure	10 Marks	Elements present	8 Marks
Estimation	15 Marks	Aliphatic/aromatic	4 Marks
< 2 %	15 Marks	Saturated/unsatd.	4 Marks
2 -3%	12 Marks	Functional group	6 Marks
3- 4%	10 Marks	Derivative /color reaction	3 Marks
> 4%	5 Marks		

V SEMESTER CORE PAPER –V ORGANIC CHEMISTRY - II

Credits –4 Max. Marks: 100

OBJECTIVES

1. To study the preparation and reactions of hydroxyl compounds
2. To learn the chemistry of ethers, aldehydes and ketones
3. To understand the chemistry of carboxylic acids
4. To know the properties and structure of carbohydrates
5. To learn about nitrogen containing compounds.

UNIT I: HYDROXY COMPOUNDS

- a. Alcohols: Preparation of alcohols from Grignard reagent, by reduction of carbonyl compounds, by ester hydrolysis, and by hydroboration - Reactions: with metals, HX, dehydration, oxidation reactions.
- b. Phenols: Classification and nomenclature, Preparation: From sulphonic acids and Diazonium salts. Reactions: Acidity, effect of substituents on the acidity of phenol - Reimer-Tiemann reaction, Electrophilic Substitution reactions: Nitration, halogenation, sulphonation - Hoesch reaction, Kolbe reaction, Schotten-Baumann reaction.
- c. Preparation and properties of Naphthols and alizarin

UNIT II: ETHERS, ALDHYDES AND KETONES

- a. Aliphatic and aromatic ethers: Preparation by Williamson's synthesis (mechanism), Reactions: cleavage by acids.
- b. Aliphatic and aromatic aldehydes and ketones: Preparation from acid chloride and nitrile, Reactions: with HCN, ROH, and Iodoform test
- c. Mechanism of Cannizzaro, Perkins, Claisen, Benzoin condensation, Knoevenagel MPV reduction.
- d. Preparation and uses of Cinnamaldehyde and Vanillin.
- e. Keto-enol tautomerism (Acid and base catalyzed mechanism)

UNIT III: CARBOXYLIC ACIDS

- a. Carboxylic acids (aliphatic and aromatic): Preparation: from carbonyl compounds, hydroxyl compound and cyanide. Reactions: decarboxylation, substitution in alkyl group of aliphatic and aromatic acids.
- b. Effect of substitution on acidity of aromatic acids
- c. Preparation of oxalic, malonic, succinic, glutaric, adipic and phthalic acids.
- d. Preparation of cinnamic acid, coumarin, salicylic acid, anthranilic acid and mandelic acid.

UNIT IV: DERIVATIVES OF ACIDS AND CARBOHYDRATES

- a. Preparation of acid chloride, anhydride, ester and amides from acids.

Reactions:

Acidic and alkaline hydrolysis of ester (mechanism) and trans esterification

- b. Carbohydrates: Classification, Glucose and Fructose (open chain and cyclic Structure), ascending and descending in monosaccharide, Muto Rotation, Structure of disaccharides- sucrose and maltose - Polysaccharides - starch and cellulose (structure only).

UNIT V: NITROGEN CONTAINING ORGANIC COMPOUNDS

- a. Aliphatic and aromatic Nitro compounds: Preparation by nitration, Reactions: reduction by chemical and electrolytic methods.
- b. Synthesis o-,m-,and p- dinitro benzenes and trinitro benzenes
- c. Amines(aliphatic and aromatic): Preparation from alkyl halides ,Preparation of primary, secondary and tertiary amines, Preparation of aniline and benzylamine , Reactions: effects of substituents on the basic character of amines, reactions in aniline and benzylamine
- d. Preparation and synthetic applications of benzene diazonium chloride
- e. Preparation and properties of naphthylamines.

TEXT BOOKS

1. A. Bahl and B.S. Bahl, Advanced Organic Chemistry, 1st Multicolour Edition, S.Chand &Company, New Delhi, 2010.
2. S.C. Sharma and M.K. Jain, Modern Organic Chemistry, Vishal Publishing Company, New Delhi, 2014.
3. K.S. Tewari, N.K. Vishnoi and S.N. Mehrotra, A Textbook of Organic Chemistry, 2nd Edition, Vikas Publishing House (Pvt.) Ltd., New Delhi, 2004.

REFERENCE BOOKS

1. Jerry March, Advanced Organic Chemistry, 5th Edition, John Wiley and Sons, New York, 2004
2. I.L. Finar, Organic Chemistry Vol. I, 6th Edition, Pearson Education, New Delhi, 2014.
3. R.T. Morrison, R.N. Boyd, Organic Chemistry, 7th Ed, Pearson Education, New Delhi, 2013

CORE PAPER –VI

PHYSICAL CHEMISTRY - II

Credits –4 Max. marks: 100

OBJECTIVES

1. To learn the first law of thermodynamics and its applications
2. To understand second law of thermodynamics, entropy and free energy
3. To know the concept of thermodynamic equilibria
4. To understand phase rule and its applications to various systems
5. To learn the fundamentals of group theory and its applications

UNIT I: FIRST LAW OF THERMODYNAMICS AND ITS APPLICATIONS

- a. System-surrounding-Intensive and extensive variables; state and path functions; isolated, closed and open systems-zeroth law of thermodynamics
- b. First law of thermodynamics-mathematical form- Heat capacity, relation between C_p and C_v . Isothermal process: Change in internal energy, work done, $W(\text{rev})$ and $W(\text{irrev})$. Adiabatic process: work done, and entropy changes. - Application of the laws of thermodynamics to real (van der Waals) gases: Isothermal process- Work done, change in internal energy, heat absorbed. Adiabatic process: Work done
- c. Joule- Thomson effect-derivation of Joule- Thomson coefficient for ideal gases and real gases, inversion temperatures.
- d. Variation of enthalpy change of reaction with temperature (Kirchoff's equation). - Hess's law of constant heat of summation- Bond energy and heat of reaction

UNIT II: SECOND LAW OF THERMODYNAMICS AND ITS APPLICATIONS

- a. Second law of thermodynamics: Limitations of first law and the need for the second law. Formulation of the second law of thermodynamics on the basis of Carnot cycle-various statements of the second law of thermodynamics- Carnot theorem-Thermodynamic principle of the working of refrigerator
- b. Concept of entropy- entropy changes for physical transformations- entropy and probability.
- c. Free Energy Functions: Gibbs and Helmholtz energy; variation of S , G and A with T , V and P - Gibbs-Helmholtz equation; Maxwell relations; thermodynamic equation of state. Criteria of spontaneity. Changes in S , G and A as criteria for spontaneous process
- d. Partial molar properties- Chemical potential-variation of chemical potential with temperature and pressure-Gibbs -Duhem equation

UNIT III: THERMODYNAMICS OF EQUILIBRIUM PROCESSES

- a. Law of mass action. Various forms of equilibrium constants. Relationships between K_p and K_c ; Vant Hoff isotherm. Vant Hoff isochore. Le-Chatelier-Braun principle: Formation of ammonia.
- b. *Third Law*: Statement of third law, concept of residual entropy, calculation of absolute entropy of molecules.- Nernst heat theorem
- c. Colligative properties- relative lowering of vapour pressure-Raoult's law-thermodynamic derivation of relationship between relative lowering of vapour pressure and (i)osmotic pressure, (ii)elevation of boiling point,(iii) depression in freezing point - Abnormal behavior of solutions of electrolytes

UNIT IV: PHASE EQUILIBRIA

- a. Phase Rule: Concepts of phase, component and degrees of freedom, with examples.Gibb's phase rule - derivation.

- b. One-component system: Phase diagrams: Water and sulphur systems.
- c. Two component system: (i) Simple eutectic: Lead-silver system- Formation of compound with congruent melting point: Ferric chloride – water system.
- d. Clapeyron and Clausius-Clapeyron equations and their applications to equilibria in phase transitions. (solid – liquid, liquid – vapour, solid – vapour)

UNIT V: GROUP THEORY

- a. Symmetry and importance of symmetry aspects -Symmetry elements and various associated symmetry operations-Definitions and examples
- b. Mathematical group – properties of a group – construction of group multiplication table (GMT) for H₂O and NH₃ – Abelian and non -Abelian groups-point groups-
- c. C_{nv}, C_{nh} and D_{nh}- symmetry present with examples – matrix representation of symmetry operations E, C_n, σ , S_n and i.

TEXT BOOKS

1. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, 46th Edition, Vishal Publishing Company, New Delhi, 2013.
2. P.L. Soni, O.P. Dharmarha and U.N. Dash, Textbook of Physical Chemistry, 23rd Edition, Sultan Chand & Sons, New Delhi, 2011
3. J. Rajaram and J.C. Kuriacose, Chemical Thermodynamics, Pearson Education, New Delhi, 2013.
4. Gurdeep Raj, Advanced Physical Chemistry, 35th Edn, Goel Publishing House, Meerut, 2009.
5. S. Swarnalakshmi, T. Saroja, R. M. Ezhilarasi, A simple Approach to Group Theory in Chemistry, University Press, 2008.
6. A. K. Mukherjee. B. C. Ghosh, Group Theory in Chemistry, University Press, 2018

REFERENCE BOOKS

1. S. Glasstone and D.H. Lewis, Elements of Physical Chemistry, 2nd Edition, Macmillan & Company, UK, 1962.
2. W.J. Moore, Physical Chemistry, 5th Edition, Orient Longman, London, 1999.
3. R.P. Rastogi and R.R. Misra, An Introduction to Chemical Thermodynamics, 6th Edition, Vikas Publishing House Pvt. Ltd., Noida, 2002.

CORE PAPER –VII

INORGANIC, ANALYTICAL & APPLICATION OF COMPUTERS IN CHEMISTRY

Credits –4 Max. Marks: 100

OBJECTIVES

1. To know the various theories of acids and bases
2. To learn the fundamentals of bioinorganic chemistry
3. To understand the importance of inorganic polymers
4. To study the analytical techniques
5. To learn the C language and its applications

UNIT I: ACIDS- BASE CONCEPTS AND NON- AQUEOUS SOLVENTS

- a. Arrhenius concept- Bronsted Lowry concept – Conjugate acid base pairs-relative strength of acid – base pair- Lux Flood concept- auto ionization concept – Lewis concept – leveling and differentiating effects – Usanovich concept – Hard and Soft acids – Applications of HSAB principle
- b. Non-aqueous solvents – classification – reactions in liquid ammonia – precipitation reaction – acid – base reaction – protolysis - ammonolysis

UNIT II: BIOINORGANIC CHEMISTRY

- a. Metallo porphyrins - Porphyrins – Chlorophyll – vitamin B₁₂ - Metal ions in biological system – Trace and bulk metal ions – Hemoglobin and myoglobin (elementary idea of structure and oxygen binding mechanism) – Chlorophyll and photosynthesis (mechanism not expected) - Sodium–potassium pump
- b. Biochemistry of Ca, Zn and Co - Toxicity of metal ions (Pb, Hg and As).
- c. Anticancer drugs: *Cis*-platin, oxaliplatin and carboplatin – Structure and significance.

UNIT III: INORGANIC POLYMERS

- a. General properties of inorganic polymers – glass transition temperature
- b. Various types of silicones, preparation, properties and uses of silicones
- c. Sulphur based polymers – polymeric sulphur – polymeric sulphur nitride – preparation, properties and uses

UNIT IV: ANALYTICAL CHEMISTRY

- a. Introduction – Definition – Classification - Principles and applications of column chromatography, thin layer chromatography, paper chromatography, ion exchange chromatography, - R_f values
- b. Analytical chemistry in consumer protection – detection of adulterants in milk, oils, ghee, coffee powder, chilly powder and pulses – sweeteners – preservatives – flavors– colorants – pesticide residue in food.

- c. Precision – Accuracy – absolute and relative error – classification of errors – confidence limit – students Q-test – rejection of experimental data – sources and elimination of errors – significant errors and computation

UNIT V: APPLICATIONS OF ‘C’ LANGUAGE IN CHEMISTRY

- a. Important features of C – structure of C program – character set of C language – key words - constants in C program – identifiers – variables and data types – operators in aC program
- b. C programs for chemistry – calculation of energy of a photon – calculation of rate constant of a zero order reaction – calculation of half-life period of a first order reaction – calculation of rms speed of a molecule – calculation of entropy change for a phase transition - calculation of molarity, molality and normality of a solution

TEXT BOOKS

1. B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, 31st Edition, Milestone Publishers and Distributors, New Delhi, 2013.
2. Satya Prakash, Advanced Inorganic Chemistry, R.D.Madan, Volume 1, 5th Edition, S.Chand and Sons, New Delhi, 2012.
3. R. Gopalan, Text book of Inorganic Chemistry, Universities Press India Ltd., Hyderabad, 2012.
4. Computers for Chemist by Pundir–Bansal, Pragathi Prakashan, 12th edn, 2016

REFERENCE BOOKS

1. Jeffrey A. Lee, The Scientific Endeavor: A Primer on Scientific Principles and Practice, Pearson Education, 1999.
2. M.C. Day and J. Selbin, Theoretical Inorganic Chemistry, East West Press, New Delhi, 2002
3. D.A. Skoog, D.M. West, F.J. Holler and S.R. Crouch, Fundamentals of Analytical Chemistry, 8th Edition, Brooks/Cole, Thomson Learning, Inc., USA, 2004.
4. J.E. Huheey, E.A. Keitler and R.L. Keitler, Inorganic Chemistry – Principles of Structure and Reactivity, 4th Edition, Pearson Education, New Delhi, 2013

SEMESTER V PRACTICAL - V
PHYSICAL CHEMISTRY EXPERIMENTS

Credits –5 Max. Marks 100

OBJECTIVES

1. To apply the principles of physical chemistry and do some experiments
2. At the end of the course, the students should be able to plan the experimental projects and execute them.

1. **Rast Method**- Determination of cryoscopic constant (K_f) of solid solvent using a solute of known molecular mass. Determination of molecular mass of the solute using a solvent of known cryoscopic constant (K_f).
Solid solvents: Naphthalene, biphenyl, camphor. Solutes: Naphthalene, biphenyl, 1,4 dichlorobenzene, diphenylamine, acetanilide, benzophenone
2. **Transition Temperature** - Determination of molal transition point depression constant (K_t) of salt hydrate using solute of known molecular mass. Determination of molecular mass of the solute using a solvent of known molal transition point depression constant (K_t). Salt hydrates: $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$, $\text{CH}_3\text{COONa} \cdot 3\text{H}_2\text{O}$. Solutes: Urea, Glucose
3. **Phase Equilibria** - Construction of phase diagram & determination of eutectic composition and eutectic temperature. Naphthalene-biphenyl system, Naphthalene-diphenylamine system, Biphenyl–diphenylamine system. Naphthalene – m-dinitrobenzene system
4. **Critical solution temperature** –Determination of CST of phenol-water system- Influence of NaCl impurity on miscibility temperature of phenol–water system and determination of concentration of given NaCl solution
5. **Thermochemistry** – Heat of solution – potassium dichromate – ammonium oxalate – oxalic acid
6. **Kinetics** – Determination of relative strength of acids by acid catalysed hydrolysis of ester – inversion of cane sugar
7. **Potentiometric titration** – (i) KMnO_4 Vs Fe SO_4 (ii) $\text{K}_2\text{Cr}_2\text{O}_7$ Vs Fe SO_4
8. **Conductometric titration**
9. **Partition Coefficient Experiment**
10. **Viscosity** – Determination of composition of unknown mixture

Scheme of evaluation (Max. marks 100)

Internal Assessment 40 Marks

External Examination: 60 Marks (6 hours)

Regularity	25Marks
Observation Note	5 Marks
Total	40 Marks

Record note	10 Marks
Ability to complete the experiment	30 Marks
Graph/calculation	10 Marks
Tabulation	5 Marks
Result	5 Marks

PART IV: SKILL BASED COURSE - V

NANOTECHNOLOGY AND GREEN CHEMISTRY

Credits –2 Max. marks: 100

Unit I: INTRODUCTION TO NANO MATERIALS

Definition of nano sized material – origin of nano technology - difference in properties between bulk and nano materials - Dimension based classification of nano materials - 0D, 1D, 2D, 3D

Unit II: PROPERTIES AND SYNTHESIS OF NANO MATERIALS

Magnetic and electrical properties of nano materials - synthesis of nano materials - basics of bottom-up and top down approach - PVD, CVD, Sol-gel, wet chemical synthesis only.

Unit III: APPLICATIONS OF NANO TECHNOLOGY

Quantum dots - fabrication - applications - CNT - synthesis and applications - application of nano materials in nano medicines and pollution control - Principle of Scanning electron microscope.

Unit IV: INTRODUCTION TO GREEN CHEMISTRY

Green chemistry and its significance- Difference between conventional chemistry and green chemistry techniques - twelve principles of green chemistry - atom economy - prevention and recycling of byproducts - limitations of green chemical techniques.

Unit V: GREEN SYNTHESIS TECHNIQUES

Green solvents, - synthesis involving basic principles of green chemistry - synthesis of adipic acid, methyl methacrylate, paracetamol – microwave assisted reactions in water- Hofmann Elimination, Hydrolysis of benzamide, Ultrasound assisted esterification - Cannizaro reaction.

REFERENCE BOOKS

1. Textbook of Nanoscience and Nanotechnology - BS Murthy P Shankar, BaldevRaj, BBRath, and James Murday - Orient Blackswan Private Limited - New Delhi
2. An Introduction to Nanomaterials and Nanoscience A. Das - CBS Publications
3. Nanoscience and Nanotechnology: Fundamentals of Frontiers - Shubra Singh M.S.Ramachandra Rao
4. A Textbook of Nanoscience and Nanotechnology - T. Pradeep
5. New Trends in Green Chemistry - V.K. Ahluwalia & M.R. Kidwai, Anamalaya Publishers.
6. An Introduction to Green Chemistry - V.Kumar, Vishal Publishing Co.,
7. Green Chemistry: Greener Alternatives to Synthetic Organic Transformations - V.K. Ahluwalia
8. Environmental Chemistry - B.K.Sharma, GOEL Publishing House.

VI SEMESTER

CORE PAPER –VIII ORGANIC CHEMISTRY-III

Credits –4 Max. Marks 100

OBJECTIVES

1. To learn the chemistry of heterocyclic compounds and alkaloids
2. To understand the concept of proteins nucleic acids and terpenes
3. To study the chemistry of dyes and know the applications of synthetic reagents
4. To learn the properties of sulphur containing compounds and the mechanism of molecular rearrangements
5. To study the application of spectral techniques to organic molecules

UNIT I: HETEROCYCLIC COMPOUNDS AND ALKALOIDS

- a. Heterocyclic compounds: Classification - preparation and reactions of thiophene, furan, pyrrole, pyridine, quinoine and isoquinoline.
- b. Alkaloids: Definition- occurrence and extraction of alkaloids, classification of alkaloids, structure elucidation and synthesis of the following alkaloids - conine, piperine and nicotine.

UNIT II: PROTEINS, NUCLEIC ACID AND TERPENES

- a. Preparation of amino acids using Gabriel's phthalimide synthesis, Zwitter ion
- b. Classification and colour reactions of proteins- primary, secondary, tertiary and Quarternary structure of proteins (an elementary idea only).
- c. Nucleic acids, nucleosides, nucleotides, RNA and DNA (an elementary idea about their Structure.)
- d. Terpenes: Classification, occurrence and isolation- general properties- isoprene rule – synthesis and structural elucidation of citral, geranial, menthol and terpeniol.

UNIT III: DYES AND SOME SYNTHETIC REAGENTS

- a. Dyes: Theory of colour and constitution, classification of dyes on the basis of their structure and applications. Preparation of malachite green, rosaniline, phenolphthalein, fluorescein, indico, alizarin, methyl orange and congo red.
- b. Synthetic applications of Grignard reagents, LiAlH_4 and SeO_2 .
- c. Synthetic applications of acetoacetic ester and malonic ester.

UNIT IV: SULPHUR CONTAINING ORGANIC COMPOUNDS AND MOLECULARREARRANGEMENTS.

- Thioalcohols and thioethers: Preparation of thiols from alcohol, and its oxidation reactions - Preparation of sulphanol and mustard gas.
- Aromatic sulphonic acids: Preparation, reactions of benzene sulphonic acids.

Preparation and uses of saccharin, choloramine-T and dichloramine-T

- Molecular rearrangements: Detailed mechanisms of the following: pinacol-pinacolone , Hofmann, Curtius, benzil-benzilic acid ,Claisen , Beckmann, benzidene,and Fries rearrangement

UNIT V: PRINIPLES AND APPLICATIONS OF SPECTROSCOPY

- UV-VIS. spectroscopy: Types of electronic transitions , absorption laws , bathochromic shift and hypsochromic shift , hyperchromic and hypochromic effect , applications of UV to organic compounds, Woodward-Fieser rules-calculation of (λ_{max}) for conjugated dienes
- IR spectroscopy: Instrumentation- Modes of vibration, overtone and combination of bonds, applications of IR to organic compounds-finger print region, study of hydrogenbond.
- NMR spectroscopy: Introduction- chemical shift – shielding and deshielding effects
- factors affecting the chemical shift- solvent used, splitting of signals- NMR spectra of ethanol, benzaldehyde ,isopropyl alcohol and mesitylene

TEXT BOOKS

- A. Bahl and B.S. Bahl, Advanced Organic Chemistry, 1st Multicolour Edition, S.Chand &Company, New Delhi, 2010.
- S.C. Sharma and M.K. Jain, Modern Organic Chemistry, Vishal Publishing Company,NewDelhi, 2014.
- K.S. Tewari, N.K. Vishnoi and S.N. Mehrotra, A Textbook of Organic Chemistry, 2ndEdition, Vikas Publishing House (Pvt.) Ltd., New Delhi, 2004.

REFERENCE BOOKS

- I.L. Finar, Organic Chemistry Vol. II, 5th Edition, Pearson Education, New Delhi,2013.
- R.M. Silverstein and F.X. Webster, Spectrometric Identification of Organic Compounds, 6th Edition, John Wiley and Sons, New York, 2004.
- Y.R. Sharma, Elementary Organic Spectroscopy, 4th Edition, S. Chand & CompanyLtd., New Delhi, 1012 (Reprint)
- P.S. Kalsi, Organic Reactions, Stereochemistry and Mechanism, 4th Edition, New AgeInternational Publishers, New Delhi, 2006.

CORE PAPER –IX PHYSICAL CHEMISTRY - III

Credits –4 Max. Marks 100

OBJECTIVES

1. To learn about rate, order and theories of reaction rate
2. To understand principles of various types of spectroscopy
3. To know the concept of thermodynamics of ideal solutions
4. To understand about emf and electrochemical cells
5. To learn the fundamentals of photochemistry

UNIT I: CHEMICAL KINETICS

- a. Rate- order- rate law- rate constants- Simple reactions involving zero, first, second and third – order reactions. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction.
- b. Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants). Half-life of a reaction.
- c. General methods for determination of order of a reaction.
- d. Concept of activation energy and its calculation from Arrhenius equation.
- e. Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only). Lindeman hypothesis.

UNIT II: SPECTROSCOPY

- a. Introduction - Distinguishing (i) emission and absorption spectra (ii) atomic and molecular spectra – regions of e.m. spectrum in terms of wave length – conversion to wave number, frequency and energy
- b. Pure rotational spectroscopy -Definitions of rigid rotors,- derivation of equation for moment of inertia, I- equation for rotational energy levels –rotation constant (B) – rotational selection rules - calculation of inter atomic distance
- c. Pure vibrational spectroscopy - normal modes in CO₂ and H₂O– potential energy versus displacement diagram for HCl –zero point energy – vibrational selection rules– vibration spectrum of an ideal harmonic oscillator – calculation of force constant – meaning of fundamental vibrational transitions, hot bands and overtone spectroscopy
- d. Raman spectroscopy- Stokes and anti stokes lines-Comparison with IR
- e. Electronic spectroscopy–Franck Condon principle
- f. Principle of NMR-Chemical Shift- Principle of EPR –hyperfine splitting of H⁺ ion

UNIT III: SOLUTIONS

- a. Thermodynamics of ideal solutions: Ideal solutions and Raoult's law, deviations from Raoult's law – non-ideal solutions. Vapour pressure-composition and temperature composition curves of ideal and non-ideal solutions.

- b. Distillation of solutions. Lever rule. Azeotropes. Partial miscibility of liquids: Critical solution temperature; effect of impurity on partial miscibility of liquids. Immiscibility of liquids- Principle of steam distillation.
- c. Nernst distribution law and its applications.

UNIT IV: ELECTRO CHEMICAL CELLS

- a. Reversible and irreversible cells. Concept of EMF of a cell. Measurement of EMF of a cell. Nernst equation and its importance.
- b. Types of electrodes. Standard electrode potential. Electrochemical series.
- c. Thermodynamics of a reversible cell, calculation of thermodynamic properties: $\Delta G, \Delta H$ and ΔS from EMF data. Calculation of equilibrium constant from EMF data.
- d. Concentration cells with transference and without transference. Liquid junction potential and salt bridge.
- e. pH determination using hydrogen electrode and quinhydrone electrode.
- f. Potentiometric titrations -qualitative treatment (acid-base and oxidation-reduction only).
- g. Commercial cells: Dry cell, lead storage, alkali (Na-S) and H_2-O_2 fuel cells-lithium ion battery.

UNIT V: PHOTOCHEMISTRY

- a. Introduction - Difference between thermal and photochemical processes - Beer Lambert's law. Laws of photochemistry: Grothus-Draper law and Stark-Einstein's law of photochemical equivalence. Quantum yield and its explanation and determination
- b. Photosynthesis - Kinetics of Photochemical reaction of hydrogen-chlorine and hydrogen-bromine reactions.
- c. Photophysical processes: Jablonski diagram - Fluorescence - Phosphorescence. Non-radiative processes: Internal conversion and inter system crossing.
- d. Photosensitization - Chemiluminescence and bioluminescence - Chemistry of vision.

TEXT BOOKS

1. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, 46th Edition, Vishal Publishing Company, New Delhi, 2013.
2. P.L. Soni, O.P. Dharmarha and U.N. Dash, Textbook of Physical Chemistry, 23rd Edition, Sultan Chand & Sons, New Delhi, 2011.
3. R.L. Madan, G. D. Tuli, Physical Chemistry, S. Chand, Revised edition, 2014

REFERENCE BOOKS

1. S. Glasstone and D.H. Lewis, Elements of Physical Chemistry, 2nd Edition, Macmillan & Company, UK, 1962.
2. P.W. Atkins, Physical Chemistry, 8th Edition, Oxford University Press, New Delhi, 2006.
3. P.W. Atkins, J.D. Paula Elements of Physical Chemistry, Oxford Univer. Press, 2017

CORE PAPER –X APPLIED CHEMISTRY

Credits –4 Max. Marks 100

OBJECTIVES

1. To learn about the analysis and treatment of waste water
2. To understand the various fuels and their applications
3. To learn about match industry
4. To understand about silicate industry
5. To learn the fundamentals of polymer chemistry

UNIT I: WATER AND SEWAGE TREATMENT

- a. Water Quality analysis - chemical and physical analysis of water, Quality parameter Seawater as a source of Drinking water - Electro Dialysis method, Reverse osmosis method for purification of water.
- b. Sewage Treatment -Municipal Waste water - Sewage treatment - Aerobic and Anaerobic processes.

UNIT II: FUELS AND COMBUSTION

- a. Fuels - Definition , Characteristics of a good fuel , Calorific value , Coal , Varieties of coal , liquid Fuels Gaseous fuels - Preparation and specific uses of producer gas, Water gas, LPG and gobar gas. Advantages and disadvantages of solid, liquid and gaseous Fuels.
- b. Rocket fuels - classification of solid propellants , Liquid propellants mono - bipropellants).- Combustion - Spontaneous ignition temperature (SIT) - combustion calculation.

UNIT III: MATCH INDUSTRY

- a. Raw materials - Types of matches - Composition of match head striking surface manufacture of safety matches - Pyrotechnics - Colored matches.
- b. Pyrotechnics and explosives , Classification of explosives, Requirements and classification of a good explosives TNT, RDX , Picric acid, Gun powder , Ammonium nitrate.

UNIT IV: SILICATE INDUSTRY AND INDUSTRIAL COATINGS

- a. Silicate industry- Cement, Glass and Gypsum, Rawmaterials and Manufacture of cement, Glass.
- b. Industrial Coatings- protective coatings, Metallic coatings, non-metallic coatings, Inorganic coatings, organic coatings, - Paints - composition of paints , pigments - lacquers - Varnishes.

UNIT V: POLYMER CHEMISTRY AND RUBBER

- a. Polymer chemistry - Types of polymerization - Addition and condensation polymerization - properties of polymers – structure and uses of polyurethane-polyester-polymethyl methacrylate- plastics, classification of plastics. Difference between thermo plastics of thermo setting plastics - Applications of plastics in industry.
- b. Rubber: Natural Rubber — preparation from latex- defects of natural rubber,

vulcanization of rubber, synthetic rubber preparation and application of Neoprene, Buna – S, Thiokol.(specific uses only)

TEXT BOOKS

1. R. Gopalan. P. S. Subramanian and K. Rengarajan. Elements of Analytical Chemistry, Sultan Company (2008).
2. B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, 31st Edition, Milestone Publishers and Distributors, New Delhi, 2013.

REFERENCE BOOKS

1. A text book of quantitative inorganic analysis, Arthur Vogel. Latest Edition 2006.
2. R. D. Madan. Advanced inorganic chemistry Latest Edition 2006.
3. B.K. Sharma (Goel Publishing House) Latest Edition 2006
4. I.L. Finar, Organic Chemistry Vol. I, 6th Edition, Pearson Education, New Delhi, 2014.

PART IV: SKILL BASED COURSE- VI

MEDICINAL CHEMISTRY

Credits –2 Max. Marks 100

OBJECTIVES

1. To learn about method of analysis of blood and urine
2. To understand vitamins, hormones and enzymes
3. To know the various types of drugs
4. To learn about diabetes and AIDS
5. To know the medicinal values of some plants

UNIT I

Health and Biochemical Analysis: Definition of health - WHO standard - Biochemical analysis of urine and serum. Blood: Composition, grouping and Rh factor - Blood transfusion

UNIT II

Vitamins (name, classification, source, function and deficiency diseases) - Enzymes (classification, characteristics, function and examples) – Hormones (classification, organ of secretion and functions)

UNIT III

Drugs & Pharmaceuticals: Drug discovery, design and development; Basic Retrosynthetic approach. Definition, example and structure the following classes of drugs: analgesics agents, antipyretic agents, anti-inflammatory agents (Aspirin, paracetamol, Ibuprofen); antibiotics (Chloramphenicol); antibacterial and antifungal agents (Sulphonamides; Sulphanethoxazol, Sulphacetamide, Trimethoprim); antiviral agents (Acyclovir), Central Nervous System agents (Phenobarbital,

Diazepam), Cardiovascular (Glyceryl trinitrate), antilaprosy (Dapsone),

UNIT IV

Diabetes and Hypoglycemic drugs: Introduction, Types and control of diabetics; Insulin; oral hypoglycemic drugs; sulphonyl urea; biguanide drugs. AIDS – General symptoms of AIDS- prevention treatment

UNIT V

Indian Medicinal Plants: Kizhanelli, Hibiscus, Adathodai, Thuduvalai, Thulasi, Brahmi, Aloe Vera and Neem plant (major chemical constituents and medicinal uses). Essential Oils: Extraction by steam distillation – Source and medicinal uses of eucalyptus oil, Sandalwoodoil and lemon grass oil.

REFERENCE BOOKS

1. Guyton and Hall, Textbook of Medical Physiology, 12th Edition, Saunders, US, 2010.
2. B.L. Oser, Hawk's Physiological Chemistry, Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 1979.
3. Gurdeep R. Chatwal, Synthetic Drugs, Himalaya Publishing House, Bombay, 1995.
4. Jayashree Ghosh, A Textbook of Pharmaceutical Chemistry, 3rd Edition, S. Chand and Company Ltd., New Delhi, 1999.
5. S.C Rastogi, Biochemistry, 2nd Edition, Tata McGraw Hill Publishing Co., ND 2007

PART - V EXTENSION ACTIVITIES

SCIENCE COMMUNICATION CLUB

Objectives

- To understand the characteristics and importance of Science
- To understand the methods of Science and its application in societal problems
- To develop Scientific Awareness and Scientific Temper
- To understand the necessities of Science Communication to the Society
- To develop skill among the members on Science Communication

Paper - 1

Unit -1 Science- Characteristics- Methods of Science-Differentiating from Pseudo Science and Nan Science

Unit -2 Science Communication-Objectives and need for science communication Scientific Awareness and Scientific Temper

Unit - 3 Science and Society- Relationship of Science, Technology and Society-Uses of Science and Misuse of Science

Unit - 4 Sources of Scientific Information-Scientists, Laboratories, Universities and Academic Institution

Unit - 5 Science Communicating Organizations- Objectives, Methods and Achievements, NISCAIR Vigyan Prasar, State Council for Science and Technology Communication

Paper - II

Unit - 1 Science through Print Media-Science News-Nature of Science News and its value- Science writing (each member is motivated to write an article/ science bits)

Unit - 2 Science through Audio-Visual Media- Nature of communication and Content of Communication-Radio Programme- Television Programme (Visit to a Radio Station/ writing for a radio/ TV programme)

Unit - 3 Science through art and culture - Science Songs, Skits, Drama, Folk Arts (To motivate the student to write in cultural format)

Unit - 4 Science Communication of activities of People Science Movements-Objectives, methods and achievements-Eg. Tamil Nadu Science Forum (TNSF), Kerala Shastra Shitya Parishat (KSSP) Green Peace Movement and such other organizations (Inviting an activist to report/ visit to such organization)

Unit - 5 Celebrations of Science and Scientists Days-Importance, theme and formats National Science Day, World Environment Day, World Health Day, Einstein Day. Submission of report on the activities of the Club

References:

1. Peter Broks, Understanding Popular Science, Open University Press, England, 2006.
2. Mohan Sundara Rajan. *Popular science in mass media*, Allied Publishers, 1985.
3. Luisa Massarani and Ildeu de Castro Moreira. Popularisation of science: Historical Perspectives and permanent dilemmas, *Quark* 32: 73-751, 2004.
4. Science communication in India: perspectives and challenges - <http://www.scidev.net/en/opinions/science-communicatipn-in-irtdiat-perspectives-and-c.html>

VALUE EDUCATION

SEMESTER – VI

Total marks: 100 & 2 Credits

Objectives

To impart citizenship values among the student To make them awareness of civil rights
To familiarities the students with basic features of Indian constitution

Unit I. Values and Individual

Values meaning – the significance of values – classification of values –needs of value education – values and the individual – self-discipline, self-confidence, self-initiative, empathy, compassion, forgiveness, honesty and courage.

Unit II. Values of Religion and Society

Karma yoga in Hinduism – love and justice in Christianity – brotherhood in Islam, compassion in Buddhism – ahimsa in Jainism and courage in Sikhism – need for religious harmony- Definition of society – democracy – secularism –socialism –gender justice – human rights – socio political awareness – social integration – social justice.

Unit III. Professional values &Role of social institutions in value formation

Definition – accountability –willingness to learn – team sprit- competence development – honesty – transparency – respecting others – democratic functioning –integrity and commitment.

Role of family – peer group – society – educational institutions – role models and mass media in value formation.

Unit IV: Constitutional Values and Fundamental Rights

Constitutional Values: Sovereignty – Socialism - Secularism – Democracy – Republic – Justice – Liberty – Equality – Fraternity - Dignity of the individual - Unity and integrity of the Nation - International peace and a just international order.

Fundamental rights: Right to equality - Right to freedom - Right against exploitation - Right to freedom of religion - Cultural and educational rights - Right to constitutional remedies.

Unit V: Directive Principles of State Policy and Fundamental Duties

Directive Principles of State Policy: Meaning and Classification – Policies relating to economic and social Principles –Policies relating Gandhian Principles - Policies Relating to International Peace and Security – Policies relating to Universalisation of Education, Child Labour and Status of Women

Fundamental Duties: Abiding and respecting the Constitution, its ideals and institutions - cherishing and following the noble ideals that inspired our national struggle for freedom – upholding and protecting the sovereignty, unity and integrity of India - defending the country – promoting the harmony and the spirit of common brotherhood and dignity of women - valuing and preserving the heritage of our composite culture - protecting and improving the natural environments - developing the scientific temper, humanism and the spirit of inquiry - safeguarding public property - serving towards excellence in all spheres of individual and collective activity - providing opportunities for education.

Reference Books:

1. M.G.Chitakra: Education and Human Values, A.P.H.Publishing Corporation, New Delhi, 2003
2. Chakravarthy, S.K.: Values and ethics for Organizations: Theory and Practice, OxfordUniversity Press, NewDelhi , 1999.
3. Satchidananda, M.K.: Ethics, Education, Indian Unity and Culture, AjanthaPublications, Delhi, 1991
4. Das, M.S. & Gupta, V.K. : Social Values among Young adults: A changing Scenario, M.D. Publications, New Delhi, 1995
5. Bandiste, D.D.: Humanist Values: A Source Book, B.R. Publishing Corporation, Delhi,1999
6. Ruhela, S.P. : Human Values and education, Sterling Publications, New Delhi, 1986
7. Kaul, G.N.: Values and Education in Independent Indian, Associated Publishers, Mumbai, 1975
8. NCERT, Education in Values, New Delhi, 1992 Swami Budhananda (1983) How toBuild Character A
9. Primer : Ramakrishna Mission, New Delhi
10. A Cultural Heritage of India (4 Vols.), Bharatiya Vidya
11. Basu DD, 2015. Introduction to the Constitution of India, Gurgoan:Lexis Nexis
12. NCERT, 2006, Indian Constitution at work, New Delhi:NCERT
13. Subash C. Kashyap, Citizen & the Constitution, New Delhi: Publication Division, Ministry of Information and Broadcasting, 2015
14. Y.V. Chandra Chudh, The Basics of Indian Constitution, New Delhi: Publication Division, Ministry of Information and Broadcasting, 2015

Web Documents

National Open School Materials: Senior Secondary level Political Science Lessons
Module 2: Aspects of Indian constitution

Lesson 5: preamble and salient features of the constitution of India Available in
<http://download.nos.org/srsec317newE/317EL5.pdf> Lesson 6: Fundamental rights

Available in <http://download.nos.org/srsec317newE/317EL6.pdf>

Lesson 7: Directive principles of State Policy and Fundamental Duties Available in
<http://download.nos.org/srsec317newE/317EL7.pdf>

Methodology:

The each mentioned value may be taught through parables, new analysis, role play, group discussion, debates, case studies, peer-team discussion and field work

Evaluation Pattern (Internal 25 Marks & External 75 Marks)

Scheme of Internal Assessment		Scheme of End semester Exam
Assignment - 10 marks		Part A – Descriptive Type – 100 words each (5 x 6 = 30 Marks)
Seminar / Group Discussion - 15 marks		Part B – Descriptive & Analytical Type – 250 words each (3 x 15 = 45 Marks)
Total	25 marks	75 marks

ANCILLARY PAPERS

ANCILLARY MATHEMATICS

(For B. Sc Physics and B. Sc Chemistry Courses)

ANCILLARY MATHEMATICS - I

Objectives:

1. To learn the applications of differentiation.
2. To solve differential equations
3. To learn partial differential equations
4. To know the applications of differential equations.

UNIT I

Differentiation: n^{th} – derivatives and Leibnitz Theorem. Curvature – Center of Curvature - Radius of curvature – Circle of curvature.

UNIT II

Integration: Reduction formula – Double integrals - Evaluation of Double Integrals – Triple integrals.

UNIT III

Equations of the first order and higher degree - Linear equations with constant co-efficients – Methods of finding complementary functions – Methods of finding particular integrals.

UNIT IV

Formations of partial differential equations – First order partial differential equations – Methods of solving first order PDE – Some standard forms.

UNIT V

Orthogonal trajectories - Growth and decay - Continuous compound interest - The Braachistochrone Problem - Simple electric circuit - Falling bodies - SHM - Simple pendulum

Text Books:

1. Dr. S. Arumugam & Issac, Calculus, New Gamma Publishing House, June 2014.
2. Dr. S. Arumugam & Isaac, Differential Equations and Applications, NewGamma Publishing House, July 2014.

Reference Books:

1. T. K. M. Pillai and S. Narayanan, Calculus, Volume III, S. Viswanathan Publishing Company, 2012.
2. Shanthi Narayan, Dr. P. K. Mittal, Differential Calculus, S. Chand Publishing Company Ltd., 2005.

ANCILLARY MATHEMATICS - II

Objectives:

1. To explore trigonometry as a tool in solving problems.
2. To learn vector differentiation and vector integration.

UNIT I: Relation between roots and coefficients - Matrices: Characteristic Equation of a Matrix –Eigen Values and Eigen Vectors.

UNIT II: Trigonometry: Hyperbolic functions – Inverse hyperbolic Functions – Logarithm of Complex numbers.

UNIT III: Sphere – Standard equation – Tangent Line and Tangent Plane – Section of a Sphere.

UNIT IV: Vector Differentiation – Gradient – Divergence - Curl and their Properties – Solenoidal -Irrotational Vectors - Directional Derivative.

UNIT V: Vector Integration – Line Integrals – Surface Integrals.

Text Books:

1. S. Arumugam & Issac, Trigonometry, New Gamma Publishing House, November 2017.
2. S. Arumugam & Issac, Analytical Geometry 3D and Vector Calculus, New Gamma Publishing House, January 2017.

Reference Books:

1. T. K. M. Pillai and S. Narayanan, Analytical Geometry, S. Viswanathan Publishing Company, 2012.
2. P. Durai pandian and others, Analytical Geometry 3-Dimension, Emerald Publishers, 1998.

ANCILLARY MATHEMATICS - III

Objectives:

1. To know the need and importance of statistical analysis in their major subjects

UNIT I

Moments - Measures of Skewness – Karl Pearson’s Coefficient of Skewness – Bowley’s Coefficient of Skewness – Measures of Kurtosis.

UNIT II

Correlation – Rank correlation – Regression.

UNIT III

Interpolation – Finite differences – Newton’s Formula (Problems only) – Lagrange’s formula (Problems only).

UNIT IV

Theory of attributes: Consistency of a data.

UNIT V

Index numbers – Consumer index numbers – Conversion of chain base index number to the fixed base index number and conversely.

Text Book:

Dr. S. Arumugam and Prof. Thangapandi Issac, Statistics, New Gamma PublishingHouse, July 2016.

Reference Books:

- 1.T. Veerarajan, Fundamentals of Mathematical Statistics, YesDee PublishingPrivate Ltd, 2017.
- 2.B. L. Agarwal, Basic Statistics, New Age International Publishers, 6th Edition.

ANCILLARY MATHEMATICS - IV

Objectives:

- 1.To introduce the fundamental concepts of LPP.
- 2.To develop the skills in decision making
- 3.To equip the students in solving real time problems.

UNIT I

Linear Programming Problems: Formulation of LPP – Mathematical formulation of LPP – Solution of LPP – Graphical Method.

UNIT II

Simplex Method – Big-M method.

UNIT III

Duality in LPP.

UNIT IV

Transportation Problem: Mathematical formulation TP – Degeneracy of TP

UNIT V

Assignment Problems: Mathematical formulation of AP – Solution to AP – Sequencing: Processing n jobs in two machines – Processing n jobs in m machines.

Text Book:

Dr. S. Arumugam and Prof. Thangapandi Issac, Linear Programming, New Gamma Publishing House, March 2015.

Unit I: Chapter 3 – Sections 1, 2, 3 and 4

Unit II: Chapter 3 - Sections 5 and 6 Unit III: Chapter 3 - Section 9

Unit IV: Chapter 4

Unit V: Chapter 5 and Chapter 6 - Sections 1 and 2.

Reference Books:

1. Dr. S. Arumugam and Prof. Thangapandi Issac, Linear Programming, New Gamma Publishing House, March 2015.
2. Kanti Swarup, P. K. Gupta, Manmohan, Operations Research, Sultan Chand & Sons, New Delhi, 1978.

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ZOOLOGY ANCILLARY -I

SEMESTER - I

INVERTEBRATA (4 Credits)

Objectives

To study the levels of organization and outline classification of animals.

To know the salient features and examples of invertebrate phyla.

To understand the biology and parasitic adaptations of invertebrates.

To trace the economic importance of invertebrate groups.

To study the method of oyster culture.

Unit – I Taxonomy and Protozoa

1. Types of classification and nomenclature
2. General characters of Phylum Protozoa
3. **Amoeba - Type study**-Externals, Nutrition, Locomotion, excretion and reproduction
4. **Plasmodium**: Life history, transmission, prevention and control.

Unit – II Porifera and Coelenterata

1. General characters of **Phylum Porifera and Coelenterata**.
2. **Obelia - Type study**-Structural organization of Obelia colony, Medusa and Life cycle of Obelia (Metagenesis)
3. Canal system and spicules of Sponges

Unit - III Helminthes

1. General characters of **Platyhelminthes and Nematoda**.
2. **Fasciola** - Type study- External characters, Excretion, Reproduction and Development (Life cycle).
3. **Wuchereria**: Life history, transmission, prevention and control
4. Parasitic adaptations of helminthes worms

Unit - IV Annelida and Arthropoda

1. General characters of Annelida and Arthropoda.
2. **Earth worm** - Type study. External characters, Digestive system, nervous system, Excretion, Reproduction and development
3. i) pest of Paddy - Tryporyza, Leptocorisa,
ii) pest of coconut - *Oryctes rhinoceros* and *Nephantis*.

Unit - V Mollusca and Echinodermata

1. General characters of Mollusca and Echinodermata.
2. **Star fish** – Type Study -External Morphology, Digestive System, and Water vascular System, Bipinnaria larva and its significance
3. **Pearl Culture:** Structure of Pearl oyster-formation of pearl-types of culture
4. **Oyster Culture:** Structure of edible oyster-types of culture and its food value

TEXT BOOKS:

1. A Text Book of Invertebrata – Arumugam. N et al., 2017, SARAs Publication, Kottar, Nagercoil.
2. Invertebrate Zoology – Jordan. E.L. and Verma. P.S., 2010 (Reprint), S. Chand and Company Ltd., Ram Nagar, New Delhi.

REFERENCE BOOKS:

1. Manual of Zoology, Vol. I (Invertebrata), EkambaranathaAyyar.M and T.N. Ananthkrishnan, 2003 (Reprint), Viswanathan Printers and Publishers Pvt. Ltd., Chennai.
2. Invertebrate Zoology: A functional Evolutionary Approach, 7th Edition, Edward E. Ruppert, Richard S. Fox and Robert D. Barnes, 2003, Brooks – Publisher Pvt. Ltd., UnitedStates.
3. Modern Text Book of Zoology Invertebrates, 11th Edition, Kotpal. R.L., 2014, Rastogi Publications, Meerut, India.
4. Biology of the Invertebrates, 7th Edition, Jan A Pechenik, 2014, McGraw-Hill Education, India.
5. Invertebrates, 3rd Edition, Richard C. Brusca, Wendy Moore, Stephen M. Shuster, 2016, Sinauer Associates, Oxford University Press, UK.

SEMESTER - II ANCILLARY ZOOLOGY-II PART – III

CHORDATA (4 Credits)

OBJECTIVES:

- To gain knowledge about the classification and general characters of vertebrates.
- To understand the structure and function of various systems in animals.
- To acquire knowledge on identifying the poisonous and non-poisonous snakes.
- To study the adaptations of birds and mammals.

Unit - I: Phylum Prochordates and Chordata

1. General characters of Phylum Chordata and classification upto class level
2. General characters of prochordates- Salient features of Hemichordata / Urochordata /Cephalochordata with one example each.

3. **Amphioxus** - Type Study - External features, Mode of feeding, Digestive system, excretory system and Reproductive system.
4. Affinities of prochordates

Unit - II: Pisces and Amphibia

1. General characters of Class Pisces and Amphibia.
2. **Shark** - Type study. External features, Digestive system, Respiratory system, structure of Brain,
3. Accessory respiratory organs in fishes
4. Parental care in amphibian

Unit - III: Reptilia

1. General characters of Class Reptilia. .
2. Identification of poisonous and non - poisonous snakes.
3. Biting mechanism of poisonous snake, Venoms of snake, first - aid and treatment for snake bite.
4. Extinction of dinosaurs-Classification of dinosaurs-causes of extinction

Unit: V: Aves

1. General characters of Class Aves.
2. Modification of beak and feet.
3. Migration of birds.
4. Flight adaptations in birds.

Unit - V: Mammalia

1. General characters of Class Mammalia.
2. **Rabbit** - Type study - Digestive system, Respiratory system, Brain and eye and excretory system.
3. Dentition in mammals.
4. Adaptations of aquatic mammals.

TEXT BOOKS:

1. A Text Book of Chordata – Arumugam. N *et al.*, 2017, Saras Publication, Kottar, Nagercoil.
2. Chordate Zoology – Jordan. E.L. and Verma. P.S., 2011, S. Chand and Company Ltd., Ram Nagar, New Delhi.

REFERENCE BOOKS:

1. A Manual of Zoology, Ekambaranatha Ayyar. M and T.N. Ananthkrishnan, 2003 (Reprint), Viswanathan Printers and Publishers Pvt. Ltd., Chennai.
2. Modern Text Book of Zoology vertebrates, Kotpal. R.L., 2009, Rastogi Publications,

Meerut, India.

3. Vertebrate Life, 9th Edition, Harvey Pough. F, Christine Janis, Heiser. J.B., 2013, Benjamin-Cummings Publishing House, San Francisco.
4. Comparative Vertebrate Zoology, Hyman. L.H., McGraw Hill Co., New York.

ANCILLARY ZOOLOGY -III PART – III SEMESTER - III

Microbiology, Cell biology, Genetics, Molecular biology, and Biotechnology

OBJECTIVES:

- To gain knowledge about the bacterial and viral structure and diseases
- To understand the structure and function of various cell organells.
- To acquire knowledge on sex linked inheritance in man
- To study the biotech applications.

Unit - I Microbiology

1. Structure of a prokaryotic cell (E.Coli).
2. Structure of T4 Phage.
3. Morphology of Bacteria i) coccus type: - Micrococcus, Diplococcus, Streptococcus, and Staphylococcus. ii) Bacillus type: - Micro bacillus, Diplobacillus, Streptobacillus, and Staphylobacillus. iii) Spirochetes, and iv) Comma shaped.
4. Bacterial and Viral disease - Gonorrhoea and AIDS (Pathogenesis, Symptoms, Prevention, and Control).

Unit – II Cell biology

Structure and functions of the following cell components:

1. Cell membrane
2. Mitochondria
3. Endoplasmic reticulum and Ribosomes
4. Golgi body

Unit – III Genetics

1. Mendel's Laws – Mono and Dihybrid crosses.
2. Linkage and Crossing over
3. Multiple Allele and polygene inheritance
4. Sex linked inheritance in Man

Unit – IV Molecular biology

1. Structure and functions of DNA.
2. Structure and functions of RNAs(t RNA, m RNA, and r RNA).
3. DNA replication.
4. Protein synthesis.

Unit – V Biotechnology

1. Recombinant DNA -Construction and applications
2. Stem Cell Culture- Methods and applications
3. Transgenic animals-Methods and applications
4. DNA finger printing-Methods and applications

Text Books:

1. Cell and Molecular Biology Arumugam.N, Saras Publications, Kottar, Nagercoil-2011
2. Biotechnology Kumaresan. V, Saras Publications, Nagercoil-2010

References Books:

1. De Robertis, E.D.P. and E.M.F. De Robertis 1987. Cell and Molecular Biology.
2. Power, C.B., 1989. Essentials of Cytology. Himalaya Publishing House.
3. Mani, A., Narayanan, Fatima, D L.M., Selvaraj, A.M. and Arumugam, N. Immunology and Microbiology (2010), Saras Publication, Nagercoil.
4. Genetics, Meyyan R.P. Saras Publication Nagercoil. 2008.
5. Principles of Genetics (VIII Edition) by Eldon John Gardener, Michael J. Simmons, D. Peter Snustad (2006) Published by John Wiley & Sons Inc., Canada. (2005 Reprint)
6. Text book of Biotechnology. Dubey, R.C. 2008. Chand & co., New Delhi.
7. Biotechnology B.D. Singh. 2008 Kalyani Publishers Ludhiana.

ANCILLARY ZOOLOGY-IV

PART - III

SEMESTER - IV

Developmental biology, Biochemistry, Physiology, Immunology, and Evolution

OBJECTIVES:

- To gain knowledge about the test tube babies
- To understand the function of various metabolic cycles.
- To acquire knowledge on kidney function
- To study the human evolution.

Unit - I: Developmental biology

1. Structure of sperm and ovum in Frog.
2. Fertilization, Blastulation and Gastrulation in Frog.
3. Placentation in Mammals-Formation, Classification and functions
4. Test tube baby methods

Unit - II: Biochemistry

1. Classification and structure of Carbohydrates. (Mono, Di, Polysaccharides with one example each).
2. Classification and structure of proteins with examples (primary, secondary, tertiary, and quaternary structure).
3. Classification and Structure of Lipids with examples.
4. Metabolism: Glycogenesis, Glycolysis, Deamination and Transamination-Beta oxidation

Unit - III: Physiology (Human)

1. Digestion of Carbohydrates, Protein, and Lipids.
2. Mechanism of respiration and Transport of gases
3. Structure of Nephron and Formation of urine
4. Structure of Neuron and conduction of impulse

Unit - IV: Immunology.

1. Types of Immunity (Innate and Acquired immunity).
2. Lymphoid organs. (Primary and secondary)
3. Immunoglobulin – Types and structure.
4. Antigen – antibody reactions.

Unit - V: Evolution

1. Lamarckism and De veries theory of Mutation.
2. Darwin's theory and Modern synthetic theory.
4. Speciation – Allopathic and Sympatric.
5. Human Evolution-Fossils and Genomic studies only.

Text Books:

1. Developmental Biology Arumugam. N.,Saras Publications, Kottar, Nagercoil-2012.
2. Animal physiology- N. ArumugamSaras Publication Nagercoil-2011
3. Organic Evolution by. Arumugam N, Saras Publications Nagercoil-2009.
4. Mani, A., Narayanan, Fatima , D L.M., Selvaraj, A.M. and Arumugam, N.Immunology and Microbiology(2010), Saras Publication, Nagercoil.

References Books:

1. P.S.Verma and V.K. Agarwal- Animal physiology

2. Verma, P.S. and Agarwal V.K. 2005 Chordate Embryology S,Chand&CompanyLtd., New Delhi.
3. Dobzhansky, Evolution, Genetics and Man, Oxford and IBH Publishing Co., NewDelhi.
4. Gordon S. Maleon et al., Animal Function –Principles and Adaptations. The Macmillan Company –collier- Mamillan Ltd. Hen 5.. Hoar S.William- General,Comparative Physiology, Prentice Hall of India Pvt Ltd, New Delhi
5. Philip H. Mitchel – A Text book of General Physiology, McGraw Hill Book

ANCILLARY ZOOLOGY

SEMESTER – II

INVERTEBRATA AND CHORDATA

PRACTICAL – I (1 CREDIT)

1. Identifying the virtual specimen exposed in monitor / dissect the virtual specimen and label it and comment on it with suitable diagram.

- (1) Cockroach (2) Earthworm (3) Calotes

2. SPOTTERS

A. Classify giving reasons:

- 1) Paramecium
- 2) Taenia solium
- 3) Penaeus
- 4) Sea star
- 5) Amphioxus
- 6) Calotes
- 7) Pigeon
- 8) Rabbit

B. raw Labeled Sketch :

- 1) Obelia Colony
- 2) Taenia Solium – Scolex
- 3) Frog – Pectoral girdle
- 4) Calotes – Brain
- 5) Snake – Poison apparatus
- 6) Pigeon – Quill feather
- 7) Rabbit – Dentition

C. Biological significance :

- 1) Obelia Medusa
- 2) Balanoglossus
- 3) Honey bee
- 4) Culex mosquito
- 5) Earth worm
- 6) Kangaroo

D. Write descriptive notes :

- 1) Paramecium – conjugation only
- 2) Gold fish
- 3) Sea horse
- 4) Peripatus
- 5) Owl
- 6) Bat

3. Identification of fauna and report submission

4. Record

ANCILLARY ZOOLOGY PART - III SEMESTER - IV PRACTICAL - II

**Microbiology, Cell biology, Genetics, Molecular biology, and Biotechnology,
Developmental biology, Biochemistry, Physiology, Immunology, and Evolution**

List of practicals:

1. Simple staining of non- pathogenic bacteria and observe the morphological structure.
2. Preparation of Onion root tip and observe the Mitotic stages.
3. Mendelian Monohybrid ratio with beads.
4. Self observation and recording of some common Mendelian traits.
5. Quantitative test for ammonia, urea, and uric acid.
6. Quantitative test for Carbohydrates, protein, and lipid.
7. Antigen – antibody reaction (in blood grouping)

List of Spotters:

1. Different morphological appearance of Bacteria.
2. Mitochondria, Golgi body, Endoplasmic reticulum, Lysosome and Ribosome.
3. Mitotic stages identification.
4. Meiotic stages identification.
5. Mendelian traits in Human population.
6. DNA – Model / paper cutting.
7. t RNA – Model / paper cutting.
8. Following stages of Frog embryo: i) Egg, ii) Sperm, iii) Blastula, iv) Gastrula.
9. Frog embryo – Section through optic cup.
10. Sheep placenta.
11. Paper cutting of zebra neck growth to explain Lamarckism.

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ANCILLARY PHYSICS - I SEMESTER – III
CREDIT – 4

PAPER I : MECHANICS, PROPERTIES OF MATTERS AND SOUND

Unit I:

Forces in nature – Central forces – Gravitational and electromagnetic – Conservative and Non-Conservative forces – Examples – Nuclear force – Friction – Angle of friction – Motion of bodies along an inclined plane – Work done by a force – Work done by a varying force – Expression for Kinetic energy – Expression for potential energy – Power.

Unit II:

Angular velocity – Normal acceleration (no derivation) – Centrifugal and Centripetal forces – Torque and angular acceleration – Work and power in rotational motion – Angular momentum – K.E of rotation – Moment of Inertia – Laws of parallel and Perpendicular axes theorems – M.I of circular ring, Circular Disc, Solid sphere, hollow sphere and cylinder.

Unit III:

Kepler's laws of planetary motion – Laws of Gravitation – Boy's method for G – Compound pendulum – Expression for period – Experiment to find g - Variation of g with latitude, altitude and depth – Artificial Satellites.

Unit IV:

Elastic moduli – Poisson's ration – beams – Expression for bending moment – Determination of Young's modulus by uniform and non-uniform bending – I section girders. Torsion – Expression for couple per unit twist - Work done in twisting – Torsional pendulum
– Derivation Poiseuille's formula (analytical method) – Bernoulli's theorem – Proof of Application – Venturimeter – Pitot tube.

Unit V:

Simple harmonic motions – Progressive Waves Properties – Composition of Two S.H.M and beats stationary waves – Properties – Melde's experiments for the frequency of electrically maintained tuning fork – Transverse and longitudinal modes - Acoustics – Ultrasonic – Properties and Application.

Reference Books

1. Mechanics by D.S. Mathur – S. Chand & Co., 2008.
2. Properties of matter by Brijlal & N. Subramanyam 2004, S. Chand.
3. A Text Book of Soud by Brijlal & N. Subramanyam, S. Chand &Co 2004.
4. University Physics by Sears Zemansky and Gound, 6th edition (Narosa PublishingHouse, Chennai 1996)

ANCILLARY PHYSICS – II

SEMESTER – IV PAPER-II THERMAL PHYSICS

CREDIT – 4

Unit I:

Expansion of Crystals – Determination of α by air wedge method – Expansion of anisotropic solids – solids of low expansivity and their uses – anomalous expansion of water – thermostats. Isolated and adiabatic changes – Derivation of equation for both C_v , and C_p of a gas – relation between them – experimental determination of C_v , by Joly's method- Determination of C_p by Regnault's method.

Unit II:

Lee's disc method for conductivity of bad conductor – air and cardboard / ebonite – analogy between heat flow and electric current Weidman – Franz law – Convection in atmosphere – lap rate – stability of atmosphere – green house effect – atmospheric pollution.

Unit III:

Radiation – Stefan's law – determination of Stefan's constant by filament heating method – solar constant measurement water flow Pyrheliometer – temperature of the Sun – Solar spectrum- energy distribution in black body spectrum – Planck's law (no derivation) – derivation of Wien's and Rayleigh Jeans laws from Planck's law.

Unit IV:

Kinetic theory of gases – Mean free Path – transport phenomena – diffusion – viscosity and thermal conductivity – Maxwell's law of distribution of molecular speed – experimental verification – degree of freedom – Boltzmann's law of equipartition of energy – calculation of C_p for monatomic and diatomic gases.

Unit V:

Thermodynamics – Carnot's theorem – Derivation of Efficiency – Second law of thermodynamics – entropy – changes of entropy in Carnot's Cycle – Change of entropy in conversion of ice into steam – Joule – Kelvin effect – simple theory of Porous – Plug experiment adiabatic – diamagnetism – Curie's law Giauque's Methods Superconductivity.

Reference Books

1. Heat and Thermodynamics by Brijlal & N. Subramanyam – S. Chand & Co.2004.
2. Ancillary Physics Vol.II, A. Ubald Raj & Jose Robin, Indira Publications, 2002.

ANCILLARY PHYSICS – III

SEMESTER–V PAPER-III ELECTRICITY AND ELECTRONICS

CREDIT – 4

Unit I:

Gaus's law – proof – Applications – Field due to a charged sphere and an infinite plane sheet – Field near a charged conducting cylinder – Coulomb's theorem – Electric potential – Relation between potential and field – Capacitors – Expression for C of parallel plate spherical (outer sphere earthed) and cylindrical capacitors – Energy of charged capacitor -loss of energy due to sharing of charges.

Unit II:

Kirchhoff's laws – application of wheatstone's network – sensitiveness of bridge – Carey Foster Bridge – Measurement of resistance and temperature – Coefficient of resistance – principle of potentiometer – Calibration of ammeter and voltmeter – low and high range – measurement of resistance using potentiometer.

Unit III:

Torque on a current loop – mirror galvanometer, dead beat and ballistic – Current sensitiveness – voltage sensitiveness I B.G. theory – damping correction – experiments for charge sensitiveness – comparison of emf's and comparison of capacitors. Electro motive force generated in a coil rotating in a uniform magnetic field – R.M.S and mean values – LCR circuit – impedances - Series and Parallel resonant circuits – Power factor – Wattless current – Choke.

Unit IV:

Junction diodes – Forward and Reverse bias – Diode characteristics – Types of diodes – (LED and Zener) Bridge rectifier using junction – II filter – Transistors-Characteristics (CE modes only) – Biasing and action of a single transistor (CE) amplifier – Frequency response Hartley oscillator – Modulation (qualitative study) – Op-Amp and its characteristics – virtual earth – voltage amplifier in inverting mode - Op-Amp as adder and Subtractor.

Unit V:

Binary number system – reason for using binary numbers – binary to decimal and decimal to binary conversions – addition and subtraction of binary numbers. Logic circuits – Boolean algebra – De Morgan's theorem – OR, AND, NOT, NOR and NAND Gates – NOR and NAND gates as universal building blocks – Ex-Or gates.

Reference Books:

1. Solid State Electronics - B.L. Theraja S. Chand 2003.
2. Electricity and Magnetism - Brijlal & N. Subramanyam, S. Chand 2007.

ANCILLARY PHYSICS – IV

SEMESTER– VI PAPER-IV

CREDIT – 4

OPTICS, SPECTROSCOPY AND MODERN PHYSICS

Unit I:

Deviation produced by thin lens – Focal length of two thin lenses in and out of contact - Cardinal points – Refraction through a thin prism – Dispersion – Dispersive power combination of thin prisms to produce (a) deviation without dispersion and (b) dispersion without deviation – Direct vision spectroscope – Chromatic aberration in lenses and its removal – Spherical aberration and its removal – Aplanatic surfaces – Oil immersion objective Theory of primary and secondary rainbows.

Unit II:

Interference in thin films – Air wedge – Newton's rings (Reflected beam only) – Determination of wavelength – Jamin's Interferometer, principle and use. Diffraction; Theory of plane transmission grating (Normal incidence only) – Experiment to determine wavelengths.

Unit III:

Double refraction – Nicol prisms, constructions, action and uses – QWP and HWP – Optical activity (No theory) – Biot's laws – Specific rotator power – Half shade polarimeter – Determination of Specific rotator power – Fiber optics – Light propagation in fibers – Fiber optic communication system.

Unit IV:

Infra red radiations, Production, properties and uses – Ultra violet radiations sources, properties and uses. Quantum theory – Plank's quantum theory – Raman Effect – Simple theory Experimental study (Wood's apparatus) Application. Photo electricity – Laws of photo electricity – Einstein's equation Photocells and their uses, photo emissive, photoconductive and photo voltaic cells.

Unit V:

De Broglie's theory – Electron diffraction – G.P. Thomson's experiment. Michelson – Morley experiment – Significance of the negative results – Postulates of special theory of relativity – Lorentz transformation equations (No Derivation) – Length Contraction – Time dilation – Variation of mass with velocity and Mass – Energy relation (Simple derivation)

Reference Books:

1. A text book of Optics by Brijlal & N. Subramanyam, S.Chand 2002.
2. Optics and Spectroscopy by R. Murugesan, Vivekananda Press, Madurai 2004.

SEMESTER IV

ANCILLARY PHYSICS PRACTICAL – I CREDIT – 1

LIST OF PRACTICALS

Any 14 Experiments

1. Young's Modulus - Uniform bending – Pin & Microscope
2. Young's Modulus - Non-Uniform bending – Scale & Telescope
3. Acceleration due to gravity - Compound Pendulum
4. Determination of G and M. I - Torsion Pendulum
5. Verification of laws - Sonometer
6. Frequency of fork - Melde's Apparatus
7. Calibration of low range voltmeter - Potentiometer
8. Calibration of ammeter - Potentiometer
9. Resistance and specific resistance - Potentiometer
10. Comparison of capacities - Spot Galvanometer
11. Comparison of EMF's - Spot Galvanometer
12. Resistance and resistivity - Carey Foster Bridge
13. Refractive index of prism - Spectrometer
14. Thermal conductivity of bad conductor - Lee's Disc
15. Viscosity of liquid - Stoke's method
16. Comparison of viscosity - Ostwald's Viscometer

SEMESTER VI

ANCILLARY PHYSICS PRACTICAL – II

CREDIT – 1

Any 14 Experiments

1. Thickness of wire - Air Wedge
2. Radius of curvature - Newton's Rings
3. Determination of N and λ - Spectrometer/Grating(Normal incidence)
4. Dispersive power of a prism - Spectrometer
5. Transistor characteristics - Common Emitter
6. Bridge Rectifier along with π Filter
7. Single Stage Amplifier - Transistor
8. Frequency of oscillation - Hartley Oscillator
9. Verification of Truth table - Logic gates (AND,OR,NOT) discrete component
10. Verification of Truth table - Logic gates (NAND,NOR) discrete component
11. Static characteristics - Zener diode
12. Adder and subtractor - Op-Amp
13. Comparison of capacities - De Sauty's Bridge

14. Determination of L and Q - LCR Series Resonance circuit
15. Determination of L and Q - LCR parallel Resonance circuit
16. Voltage and current sensitivity - Mirror galvanometer

BOTANY ANCILLARY SYLLABUS

THEROY PAPERS

Semester III	: Paper – I - Plant Diversity
Semester IV	: Paper – II Plant Ecology & Applied Botany
Semester V	: Paper – III Taxonomy, Embryology of Angiosperms & Medicinal Botany
Semester VI	: Paper – IV Plant Physiology & Horticulture

PRACTICAL PAPERS

Semester I&II	: Practical- I	-
Paper I & II Semester III&IV	:	
Practical-II	-	Paper III & IV

SYLLABUS

Ancillary Botany Theory Paper 1

Plant Diversity

(Algae, Fungi, Bryophytes, Pteridophytes and Gynosperms)

Objectives:

- Understand the basics & general characters of various groups of lower plants
- Study the Structure and life cycle of lower plants
- Impart knowledge on the economic importance of lower plants

Unit I: Algae

Introduction, general characters & economic importance of Algae; Structure and life cycle of **Oscillatoria, Oedogonium, Sargassum**

Unit II: Fungi

Introduction, general characters & economic importance of Fungi; Structure and life cycle of **Aspergillus & Puccinia**.

Unit III: Bryophytes

Introduction, general characters & economic importance of Bryophytes Structure

and life cycle of **Funaria**.

Unit IV: Pteridophytes

Introduction, general characters & economic importance of Pteridophytes
Structure and life cycle of **Selaginella**

Unit V: Gymnosperm

Introduction, general characters & economic importance of Gymnosperm
Structure and life cycle of **Pinus**.

References

1. Chopra, R.N. and Kumara, P.K. (1988). *Biology of Bryophytes*. Wiley Eastern Ltd., New Delhi.
2. Rashid, A. (1998). *An Introduction to Bryophyta*. Vikas Publishing House (P) Ltd., New Delhi.
3. Sharma, O.P. (1990). *Textbook of Pteridophyta*. MacMillan India Ltd., New Delhi.
4. Sharma, O.P. (1997). *Gymnosperms*. Pragati Prakashan, Meerut.
5. Smith, G.M. (1955). *Cryptogamic Botany Vol. II Bryophytes and Pteridophytes* (2Edn.). Tata McGraw-Hill Publishing Co., New Delhi.
6. Vashishta, B.R., Sinha, A.K. and Singh, V.P. (2008) *Botany for Degree Students: Algae*. S. Chand & Company Ltd., New Delhi.
7. Vashishta, B.R. (1990). *Botany for Degree Students: Fungi*. S. Chand & Company Ltd., New Delhi. 8.

Activities:

- Visit to Kanyakumari, Rameswaram and CMFRI – Mandapabam for Algal study & submit the report.
- To visit nearby Field & Hill stations (like, Alagar Hills, Ooty, Kodaikanal, Munnar, Kurangani etc.) to see the habitat of Bryophytes, Pteridophytes and Gymnosperms & submit the report.
- To visit nearby TNAU departments to see mushroom cultivation, tissue culture laboratory, bio-fertilizer production, to learn vegetative cutting methods like layerage, grafting etc., & submit the report.

ANCILLARY BOTANY

Theory Paper-2

PLANT ECOLOGY & APPLIED BOTANY

Objectives:

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

- Understand the concept of Plant Ecology, Plant adaptations, Vegetation of TamilNadu.
- Learn the techniques of Mushroom Cultivation and Plant Tissue Culture
- Know biofertilizers, mycorrhiza and organic farming

Unit I: Plant Ecology

Introduction, concept & terminology; Plant adaptations – morphological, anatomical & physiological adaptations of hydrophytes, xerophytes, halophytes; Vegetation of Tamilnadu; Methods of studying vegetation – quadrat.

Applied Botany

Unit II: Mushroom Cultivation

Introduction, nutritive value, importance; cultivation of white button mushroom (*Agaricus* sp.) – spawn preparation - preservation of mushroom.

Unit III: Plant Tissue Culture

Introduction, basic requirements for tissue culture laboratory, basic tissue culture techniques & applications of plant tissue culture.

Unit IV: Biofertilizers

Biofertilizers – Definition, kinds of microbes as biofertilizers, Rhizobium-legume Symbiotic association, Mycorrhiza – VAM association.

Unit V: Organic Farming

Methods of compost preparation & Biodiesel production from *Jatropha*.

References

1. Kumar, H.D. (1992). *Modern Concepts of Ecology* (7th Edn.). Vikas Publishing Co., New Delhi.
2. Arumugam, N. (1994). *Concepts of Ecology* (Environmental Biology). Saras Publications, Nagercoil, Tamilnadu.
3. Alice, D., Muthusamy and Yesuraja, M. (1999). *Mushroom Culture*. Agricultural College, Research Institute Publications, Madurai. 3.
4. Marimuthu, T. (1991). *Oyster Mushroom*. Department of Plant Pathology, TamilNadu Agricultural University, Coimbatore.
5. Nita Bhal (2000). *Handbook on Mushrooms Vol. I and II* (2nd Ed.). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
6. Pathak, V.N. and Yadav, N. (1998). *Mushroom Production and Processing Technology*. Agrobios, Jodhpur.
7. Tripathi, D.P. 2005. *Mushroom Cultivation*. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
8. Kalyan Kumar De. (1997). *Plant Tissue culture*. New central Book Agency, Calcutta.
9. Kumar, H.D. (1991). *A Textbook on Biotechnology*. East west press, New Delhi.
10. Parihar, P. (2014). *A Textbook of Biotechnology*. Argobios Publications, Jodhpur
11. Purohit, S.S. (2003). *Agricultural Biotechnology*. Agrobios Publications, Jodhpur.
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Ancillary Botany Theory Paper-3

Taxonomy, Embryology of Angiosperms & Medicinal Botany

Objectives:

On successful completion of the course the students will be able to

- Know systems of classifications, merits and demerits.
- Understand the systematic of the selected families of the flowering plants with their economic importance.
- Learn the medicinal important plants with their systematic treatment.
- Understand the key aspects of embryology of Angiosperms

Unit I:

Introduction to basic morphology – Bentham and Hooker classification – Merits and demerits.

Unit II:

A detailed study of the following families with their economic importance –

Annonaceae, Rutaceae, and Ceasalpinaceae,

Unit III:

A detailed study of the following families with their economic importance –

Asclepiadaceae, Lamiaceae, Euphorbiaceae & Poaceae

Unit IV:

Medicinal Botany: Study the systematic position, common names, description of individual plant, Morphology of useful part and curative properties of following plants:

Aegle marmelos, *Azadirachta indica*, *Ocimum sanctum*, *Coriandrum sativum*
Phyllanthus niruri and *Gloriosa superba*

Unit V:

Embryology – Structure and development of anther, microsporogenesis & male gametophyte

- Structure, development of ovule & megasporogenesis, female gametophyte (*Polygonum* type of embryo sac development), Fertilization, Structure of embryo – Dicot and Monocot.

References

1. Agarwal, O.P. (2014). *Organic Chemistry Natural Products, Vol. II*. Krishna Prakashan Media (P) Ltd., Meerut
2. Bhojwani, S.S. and Bhatnagar, S.P. (2000). *The Embryology of Angiosperms* (4th Edition). Vikas Publishing House (P) Ltd., UBS Publisher's Distributors, New Delhi.
3. Chopra, R.N., Badhuvar, R.L. and Gosh, G. (1965). *Poisonous Plants of India*. CSIR Publications, New Delhi.
4. Chopra, R.N., Chopra, I.C., Handa, K.L. and Kapur, L.D. (1994). *Indigenous Drugs of*

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9. Pandey, B.P. (1997). *Taxonomy of Angiosperms*. S. Chand & Company Pvt. Ltd., New Delhi.
10. Sharma. O.P. (2007). *Plant Taxonomy*. Tata McGraw–Hill Publishing Co., New Delhi.
11. Somasundaram, S. (1997). *Medicinal Botany (Maruthuva Thavaraviyal)* (Tamil Medium Book). Elangovan Publishers, Tirunelveli.
12. Srivastava, A.K. (2006). *Medicinal Plants*. International Book distributors, Dehradun.

Ancillary Botany Theory Paper- 4 Plant Physiology & Horticulture

Objectives:

On successful completion of the course the students will be able to

- Understand the metabolic activities of plants
- learn the horticultural practices, tools and manures.
- relate the kitchen garden and ornamental garden.
- study the importance of horticultural crops and their propagation methods

Plant Physiology Unit I:

Absorption of Water - imbibition, diffusion, osmosis, plasmolysis, site of absorption, mechanism – active & passive & factors; Ascent of Sap -path and mechanism; Transpiration (Water Loss) - types, functions, mechanism & factors; Photosynthesis- Structure of chloroplast, Mechanism - Light and Dark reaction (C_3 & C_4 cycle only) & factors.

Unit II:

Respiration- Structure of Mitochondria, Mechanisms of respiration - Glycolysis and Krebs' cycle, Electron transport system & factors. Plant Growth Regulators – Auxins, Gibberellins, Cytokinins, Abscisic acid and Ethylene

Horticulture Unit III:

Introduction, Basic requirements, kinds of manures, Methods of vegetative Propagations, Cuttage, Layerage and Graftage.

Unit IV:

Planning and Layout of Kitchen Gardening & Orchard; Indoor gardening & Hanging pots.

Unit V: Bonsai, Rockery and Methods of storage of Fruits.

References

1. Jain, V.K. (1990). *Fundamentals of Plant Physiology*. S. Chand & Co., New Delhi.
2. Pandey, S.N. (1991). *Plant Physiology*. Vikas Publishing House (P) Ltd., New Delhi.
3. Kumar, N. (1997). *Introduction to Horticulture*. Rajalakshmi Publications, Nagercoil.
4. Edmond, J.B., Musser, A.M. and Andrews, F.S. (1951). *Fundamentals of Horticulture*. McGraw-Hill Book Company, Inc., New York.

Note : Field visit to TNAU department to see horticultural practices, Bonsai, Rockery, Orchards maintenance.

B.Sc., chemistry Ancillary Botany Syllabus PRACTICAL - I IV Semester

Plant diversity, Plant Ecology and Applied Botany Syllabus

1. Micro preparation of plants mentioned in plant diversity part of the syllabus.
2. Section cuttings and submission of slides-Selaginella and Pinus.
3. Spotters – Identification of specimens or slides from Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms include in the syllabus.
4. Section cutting and mounting plant materials of ecological importance (Such as Nerium, Bryophyllum, Nymphaea, leaves and other available materials)
5. Maintenance of observation notebook and submission of the same during practical examination. B.Sc., Botany Ancillary Practical (Question Pattern)

Paper I Plant diversity, Plant Ecology & Applied Botany

Time : 3 Hrs Max. Marks : 100

1. Take T.S. of specimen A. Identify, draw labeled sketch giving reasons. Submit slide for valuation 10 Marks
2. Make suitable micro preparation of B and C. Identify, draw labeled sketches giving reason. Submit slides for valuation. 2 x 10 = 20 Marks
3. Identify, draw sketches and write notes on spotters D, E, F, G, H, I, U and K.
8 x 5 = 40 Marks
4. Comment on the ecological adaptations of the plant L and M 2 x 5 = 10 Marks
5. Observation note book = 20 Marks

(Note : Scale down to 60 marks)

Key for Botany Ancillary Practical – I

1. A- Angiosperm material - Stem, leaf of Hydrophytes or Xerophytes prescribed in the syllabus (Slide = 5, Diagram = 2 Description = 3)
2. (B & C) Vegetative. Materials from plant diversity (Pteridophyte and gymnosperm) for each material (Slide = 5, Diagram = 2, Description = 3)
3. E, F and G, H, I – [Permanent slides or museum specimens of Algae, Fungi,

Bryophytes, Pteridophytes and Gymnosperms]. J & K – Applied Botany (for each one Identification = 1, Diagram=2 and Description = 2)

4. L & M – Xerophytes or Hydrophyte or a mangrove plant or plant part [Identification = 1, diagram = 2, Description=2]
5. Observation note book – 20 marks

B.Sc., chemistry Ancillary Botany

PRACTICAL –II SYLLABUS

IV SEMESTER

Paper II – Taxonomy, Embryology of angiosperms, Medicinal Botany, Plant physiology and Horticulture

1. To make dissections using dissection microscope of the floral parts of angiospermic plants and to make drawing to bring out the salient feature [floral diagram also expected] to learn to mount the floral parts on a given slide.
2. To assign the given plants to its natural order giving reasons.
3. To describe plants in technical terms.
4. Identification of medicinal plants and record their morphological features.
5. Identification of sections of anther and ovule.
6. Propagation methods of horticulture plants – Cuttage, Layerage and Graftage.
7. Demonstration of techniques of Horticulture.
8. To describe simple setups in plant physiology (Evolution of oxygen – photosynthesis, Light screen experiment, Mohl's half leaf experiment.)
9. To maintain an observation notebook and to submit it for external valuation.

(Question Pattern)

Time : 3 hours

Max. Marks : 100

1. Refer specimen A to its family giving reasons. 10 Marks
2. Describe B in Technical terms. Draw labeled sketches including L.S of flower. Submit L.S. of the flower for valuation. 15 Marks
3. Identify and write notes on Botanical name, common name and medicinal value of C, D, E & F (No sketches required) 4 x 5 = 20 Marks
4. Identify and write notes on G. 5 Marks
5. Demonstrate the Horticultural technique (any one method) assigned to you [H] and write the procedure for the same. 10 Marks
6. Identify and write note on I, J & K 3 x 5 = 15 Marks
7. Comment on the physiology set up L 5 Marks
8. Observation notebook. 20 Marks

Total = 100 marks (Note : Scale down to 60 marks)

Key and Scheme of valuation:

1. A- Angiosperm materials of any family prescribed in the syllabus. As a whole = 10 marks
2. B – Any Angiosperm specimen. (Included in the syllabus) (Description- 5, L.S-2, other diagrams – 5, Floral diagram – 2, Floral formula – 1) 15 marks
3. C, D, E & F – Medicinal plants prescribed in the syllabus. (Botanical and common names 1 +1, Note – 3) 4 x 5 = 20 marks
4. G. Embryology slides section of Anther and Ovule (Description – 3, Diagram – 2) 5 marks
5. Horticulture – (Demonstration – 5, Procedure – 5) 10 marks
6. I and J – Horticulture, K – Physiology. (Identification – 1, Diagram – 2, Notes – 2) 3x 5 = 15 marks
7. Any Physiological setup (Identification – 1, Diagram – 2, Notes – 2) 5 marks
8. Observation note book 20 marks

SEMESTER – V
ENVIRONMENTAL STUDIES FOR ALL U.G. COURSES

(2 CREDITS)
OBJECTIVES

- To create awareness on Environment, ecosystem, energy flow, food chain, food web and Biogeochemical cycles
- To understand the sustainable agriculture and exploitative human activity in polluting the environment locally and globally
- To provide awareness about issues relating to drinking and driving, Road safety rules and Traffic signals
- To create awareness on disasters through intensive public education
- To create awareness on village adoption towards clean, green infrastructure, education, health, drinking water supply, etc

Unit I. Earth and its Environment

a) Earth formation and Evolution of Earth over time – Structure of earth and its components : Atmosphere, Lithosphere, Hydrosphere and Biosphere

b) Resources – Renewable and Non- renewable resources.

Unit II. Ecology and Ecosystem concepts

a) Ecology definition – ecosystem – definition – structure and function –energy flow- food chain and food web – one example for an ecosystem

b) Biogeochemical cycles – Nitrogen, Carbon, Phosphorous, Water

Unit III. Biodiversity and India

a) Introduction- definition- values of biodiversity- threats to biodiversity- conservation of biodiversity

b) Biodiversity of India – as a mega diversity nation-bio-geographical distribution – hot spots of biodiversity- national biodiversity conservation board and its function.

Unit IV. Pollution and Global Issues

- a) Definition, causes, effects and control measures of air, water, soil, marine, noise, thermal and nuclear pollution.
- b) Global issues: Global warming and Ozone layer depletion.

Unit V. Development and disaster management

- a) Sustainable Development - sustainable agriculture – organic farming, irrigation – water harvesting and waste recycling – cyber waste and management.
- b) Disaster management – Flood and Drought – Earthquake and Tsunami – Landslides and Avalanches – Cyclones and Hurricanes – Precautions, Warnings rescue and Rehabilitation.
- c) Road safety rules – Traffic signals – Conduct of road safety awareness programme.
- d) Role of the Colleges, Teachers and Students in village adoption towards clean, green and make in villages in various aspects.

Text Books

1. Arumugam, N, 2016, Concepts of Ecology. Saras publication, Nagercoil

Reference Books

1. Odum E.P., 1971, Fundamentals of ecology, W.B. Saunders Company, London.
2. Verma and Agarwal, 2003, Principles of Ecology, S.Chand& Company. New Delhi,
3. Ecology for Environmental science. Biosphere- Anderson J.M. 1981
4. Water pollution and Management- C.K.Varshney, 1984
5. Environmental Biology- P.D.Sharma, 2005
6. Natural disaster-A guide for relief workers- JAC Adliyatmasadhana Kendra.
7. Disaster planning- the preservation of life and property, Foster,H.D
8. India Disaster report: towards a policy initiative, Parasuraman.s, 2000
9. Disaster Management, Mukesh Kapoor, 2009
10. Textbook of Highway and Traffic Engineering,Saxena S.C, 2005
11. Road safety management issues and perspectives, Prabha shastri ranade, 2010
12. Safety and Disaster Management, O.P. Dutta, 2014. Methods, Techniques, Recent Approach, Major Events & Exist Framework Hazardous Material
13. The Indian Ocean Tsunami: The Global Response to a Natural Disaster By Pradyumna P. Karan, Shanmugam P. Subbiah, 2011
14. Village Adoption & Development Programme guidelines, 2016, National Institute of Rural Development & Panchayati Raj (NIRD&PR) Ministry of Rural Development, GoI Rajendranagar Hyderabad – 500030

Websites where study materials, video lessons and text books can be downloaded:

<https://ocw.mit.edu/courses/chemistry> study.com/academy/course/general-chemistry-course.html
www.youtube.com/watch?v=k3rRr19J2F4
www.openculture.com/chemistry-free-courses study.com/online_chemistry_class.html
www.collegeopentextbooks.org/textbook-listings/textbooks-by-subject/chemistry
<https://www.examrace.com/CSIR/CSIR-Free-Study-Material/CSIR-Chemical-Sciences>
<https://www.university.youth4work.com> › Study-Material
www.sparknotes.com › SparkNotes
